CONFERENCE PROCEEDINGS BOOK



6th INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES

APRIL 9-16, 2024 / Lisbon, PORTUGAL

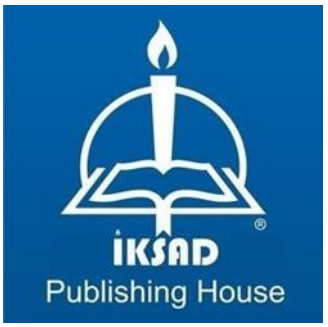
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6th INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES



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6th INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES

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APRIL 9-16, 2024 / Lisbon, PORTUGAL

PROCEEDINGS BOOK
(Abstracts & Full Texts)

EDITORS

Prof. Dr. Mehmet Fırat BARAN
Assoc. Prof. Dr. Arzu ALTUNTAŞ
Assoc. Prof. Dr. Seyithan SEYDOŞOĞLU

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6th INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES

EVALUATION PROCESS and POLICIES

All applications have undergone double blind peer review process. In addition, each paper was accepted and the process of publishing in the book was carried out through editorial oversight. The published papers were presented and discussed at the meeting.

Full texts and abstracts published in accordance with the Symposium Policy have been prepared in accordance with ethical rules and APA standards. Authors of all papers are both ethically and legally responsible.

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TOTAL ACCEPTED ARTICLES: 306

The Number of Accepted Papers from Türkiye: 200
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6th INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES

/

APRIL 9-16, 2024

Lisbon, PORTUGAL

SYMPOSIUM SCHEDULE

6th INTERNATIONAL CONFERENCE ON GLOBAL PRACTICE OF MULTIDISCIPLINARY SCIENTIFIC STUDIES

April 09-16, 2024 / Lisbon, Portugal

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- To be able to attend a meeting online, login via **https://zoom.us/join** site, enter ID "Meeting ID or Personal Link Name" and solidify the session.
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CONGRESS LANGUAGES: English and All Turkish Dialects

Face to Face / İbis Lisboa Malhoa

11.04.2024	HALL-1
LISBON LOCAL TIME $18^{00} : 21^{00}$	

HEAD OF SESSION: Prof. Dr. Kagan GUNCE

Authors	Affiliation	Presentation title
Leman Üstündağ	*Bandirma Onyedi Eylul University*	Proverbs Expressıon with Kinetic Typographyabstract
Mustafa Deniz Türkoğlu Merve Uysal	*Haliç University*	On the Existence of Concircular Transformation on Non-Riemannian Manifolds
Zehra Funda Akbulut Soner Guler	*Van Yuzuncu Yıl University*	Sustainability in Concrete: Exploring the Benefits of Pozzolanic Cementitious Materials
Zehra Funda Akbulut Soner Guler Faruk Osmanoğlu Mehmet Rıza Kavanç	*Van Yuzuncu Yıl University*	Assessing the Role and Significance of Colored Concrete in Modern Construction Practices
Nasirov Azimidin Normamatovich	*Tashkent International University of Kimyo*	French and the Image of Amir Temur Interpretations in Uzbek Literature (in the example of the novels of Marcel Brion and Muhammad Ali)
Botirov Azizbek Mirzakarimovich	*Tashkent International University of Kimyo*	Students in the Process of Independent Education Forming Knowledge Skills
Rakhimov Akmal Akbarovich	*Tashkent International University of Kimyo*	Information in the Process of Electronic Education Methods of Ensuring Security
Yashchenko Ganna	*National Forestry University of Ukraine*	Public Administration Decisions in the Conditions of Military and Humanitarian Crises
Senem Akkoç Eyüp Başaran	*Süleyman Demirel University*	Synthesis, Spectral Characterization and Antiproliferative Activity of a Novel Thymol-Linked Imino Compound
Eyüp Başaran Senem Akkoç	*Süleyman Demirel University*	A Novel Fluorine-Containing Hydrazone Compound: Synthesis, Structural and in Vitro Cytotoxic Activity Studies
Nurhan Doğan	*Afyonkarahisar Health Sciences University*	Project Implementation Course the Role of the Scientific Research Methodology in Determining the Self-Efficacy Level
Nurhan Doğan İsmet Doğan	*Afyonkarahisar Health Sciences University*	Suicide Mortality Trends in Children, Adolescents And Young Adults in Turkey
Kağan Günçe	*Eastern Mediterranean University*	Conservation of Vernacular Architecture in Rural Settlements with Tourism: A Case Study from Northern Cyprus
Islam Safa Kaya	*Kırıkkale University*	Criminal Jurisdiction for International Crimes Committed on the High Seas
Ali Cengiz	*Kırıkkale University*	Application of International Law of War
Yusuf Sert	*Yozgat Bozok University*	2,4-Dihydro-1h-Cyclopenta[B]Indol-3-One: Frontier Molecular Orbbital Analysis
Yusuf Sert	*Yozgat Bozok University*	2-(2,6-Dioxopiperidin-3-Yl)-5-Fluoroisoindoline-1,3-Dione: Molecular Docking and Mep Analysis
Betül Yılmaz	*Marmara University*	Generations in The Workplace and Changing Work Values
Türkan Kaplan	*University of Turkish Aeronautical Association*	Participation Patterns of Adults Participating in The University of Turkish Aeronautical Association Lifelong Development Application and Research Centre (Yagem) Certificate Programmes

(All speakers required to be connected to the session 10 min before the session starts)
Moderator is responsible for ensuring the smooth running of the presentation, managing the group discussion and dynamics.

Face to Face / İbis Lisboa Malhoa

14.04.2024	HALL-1
LISBON LOCAL TIME 18 ^{00} : 21 ^{00}	

HEAD OF SESSION: Prof. Dr. M. Fırat BARAN

Authors	Affiliation	Presentation title
Eda Koçak Giyak	*Siirt University*	Evaluation of The Concept of Urban Heat Island in Terms of Urban Sink Areas
M. Berkay Kızılkan Eda Koçak Giyak	*Siirt University*	A Review To Space Syntax With The Scope Of Urban Planning And Architecture
Melekber Sülüşoğlu Durul Sezai Ercişli	*Kocaeli University*	The Importance Of Callus Culture In Fruit Growing And Its Areas Of Use
Arzu Altuntaş	*Siirt University*	The Effects of Global Migration on Urban Identity from the Perspective of Landscape Architecture
Arzu Altuntaş	*Siirt University*	An Evaluation on Artificial Intelligence Supported Design and Planning in Landscape Architecture: Trends and Applications
Canser Gül Nilay Çömez Sevda Albayrak Hülya Durmuş	*Manisa Celal Bayar University*	The Effect of Surface Treatments on Wear Resistance in Cold Spray Coating of 7075 Aluminum Alloys
Hülya Durmuş Canser Gül Nilay Çömez Sevda Albayrak	*Manisa Celal Bayar University*	Effects of Surface Treatments Prior to Cold Spray on the Wear Resistance of 2024 Alloys
Seyithan Seydoşoğlu Gülşah Bengisu	*Siirt University*	What's That Smell? Alternative Forage Basil with Reference of Pharmacological Animal Studies
Mehmet Karaman	*Muş Alparslan University*	Examination of Advanced Bread Wheat Genotypes (*Triticum aestivum* L.) in Terms of Yield and Some Technological Quality Characteristics
Mehmet Karaman	*Muş Alparslan University*	Evaluation of Some Chickpea Varieties in Terms of Morphological and Physiological Characteristics
Esra Bilici	*Usak University*	The Role of Estrogen Receptors in Malignities
Şahin Ay	*Siirt University*	Money Laundering Crime And Related Regulations
Ayhan Dağdeviren Yusuf Ziya Akbaş	*Çankırı Karatekin University*	The City of Museums: Bursa
Yusuf Ziya Akbaş Ayhan Dağdeviren	*Çankırı Karatekin University*	Culture Routes of Turkey

(All speakers required to be connected to the session 10 min before the session starts)
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Face to Face / İbis Lisboa Malhoa

14.04.2024	HALL-2
LISBON LOCAL TIME $18^{00} : 21^{00}$	

HEAD OF SESSION: Nilgün ONURSAL

Authors	Affiliation	Presentation title
Nilgün Onursal	*Siirt University*	Examination Of The Removal Of Cobalt (Ii) From Aqueous Solution By Mixed Type Sivas/Yildizeli Clay In Terms Of Isotherm And Kinetic
Nilgün Onursal	*Siirt University*	Analysis Of Adsorption Kinetics Of Zinc With Malatya Kilo With Linear Models Derived From Pseudo-Second Kinetic Order Model
Ferhat Öztürk Tarkan Ayaz	*Şırnak University*	Evaluatıon of Yield Characteristics of Different Maize Varieties Under Derik/Mardin Conditions
Ferhat Öztürk Tarkan Ayaz	*Şırnak University*	Determination of Yield Characteristics of Some Maize Varieties Under Kızıltepe/Mardin Conditions
Yılmaz Seçim Mehmet Fatih Yalçinkaya Zekeriya Yetiş	*Necmettin Erbakan University*	Cultural Journey in the Kitchen: Ethiopian Culinary Culture
Raziye Pekşen Akça Hatice Bekçi Umay Büşra Celiloğlu	*Kayseri University*	Supporting Children Learning with Nature with Biomimicry
Hatice Bekçi Raziye Pekşen Akça Umay Büşra Celiloğlu	*Kayseri University*	Contribution Of Experimental Activity Examples Prepared For Children To Learning
Yeter Çilesiz	*Sivas University of Science and Technology*	An Overview of Artificial Intelligence (AI) Applications in Agricultural Biotechnology
Yeter Çilesiz	*Sivas University of Science and Technology*	Modern Plant Biotechnology to Achieve Food Security

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12.04.2024 / HALL-1 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Yahya NAS

Authors	Affiliation	Presentation title
Ijlal Ocak Emine Akkaş Baysal Hazal Çelikkaya	*Afyon Kocatepe University*	An Action Research on Using "Outdoor Experiments" on "Pressure" Subject in 8th Grade Science Teaching
Latif Onur Uğur Servet Kesim	*Afyon Kocatepe University*	A Model Proposal for Estimate the Approximate Costs and Contract Fees of Public Education Buildings (School Buildings)
Latif Onur Uğur	*Düzce University*	A Model for Determining The Achievement Level in Civil Engineering Education
Mena Azimi Mehtap Ünlü Söğüt	*Ondokuz Mayıs University*	Relationship Between Vitamin B-12 and The Human Gut Microbiome
Mena Azimi	*Ondokuz Mayıs University*	The Role of Probiotic and Prebiotics in Calcium Bioavailability
Bertuğ Sakın	*University of Health Sciences*	The Effect of Individuals Emotional States on Language Usage in Relation to Environmental Influences
Kemal Barış Ilbi Ceren Güneröz	*Ankara University*	Evaluation of Gertrude Stein's Studio in the Context of Postmodern Museum Practices
Yahya Nas	*Şırnak University*	Influence of Foliar Applications of Calcium on Yield and Quality of Head Lettuce (*Lactuca sativa* L. var capitata)
Kübra Öztürk Emine Anik	*İstanbul Kültür University*	Digital Human Resources Management and Digital Marketing Management; Innovative Cooperation

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12.04.2024 / HALL-2 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Özge KUTLU

Authors	Affiliation	Presentation title
Özge Kutlu Sevinç Sütlü	*Burdur Mehmet Akif Ersoy University*	Digital Old Age: Digital Literacy and Adaptation to Technology in The Elderly
Özge Kutlu Deniz Say Şahin	*Burdur Mehmet Akif Ersoy University*	Safe Housing from Elderly Rights Perspective
Ferhat Öztürk Tarkan Ayaz	*Sirnak University*	Evaluation of Yield Factors of Different Corn Varieties Under Harran Conditions
Özge Ökcü Ayşe Tanşu Yonca Yavuz Akçay	*İstanbul Rumeli University*	Current Treatment Approaches in Fibromyalgia Syndrome
Özge Ökcü Rıdvan Gök	*İstanbul Rumeli University*	Benefits of Exercise for Children
Celalettin Vatandaş Saniye Vatandaş	*Tekirdağ Namık Kemal University*	Transformation Process of Shopping Spaces and Shopping Centres
Veysi Acıbuca Aybüke Kaya	*Mardin Artuklu University*	Wheat Production and Self-Sufficiency Levels of Oecd Countries
Tarkan Ayaz	*Şırnak University*	Potential Pest in Pistachio Fields of Şırnak Province: Pistachio Psyllid [Agonoscena Pistaciae Burck. and Laut.) (Hemiptera: Aphalaridae)]
Mehmet Günsen Bilal Can Erkan Korkmaz Bellitürk Ahmet Çelik	*Adıyaman University*	Obtaining Vermicomposting From Mixture Of Snack Sunflower Waste And Cow Manure For Zero Waste Aim
Lebriz Çınar Korkmaz Bellitürk Ahmet Çelik	*Adıyaman University*	Organic Matter in Sustainable Agriculture and The Relationship Between Earthworms and Soil Health
Ferhat Öztürk Tarkan Ayaz	*Sirnak University*	Comparison of Yield Characteristics of Some Corn Varieties Under Harran/Şanlıurfa Environments

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12.04.2024 / HALL-3 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Ayşe BOZKURT

Authors	Affiliation	Presentation title
Celalettin Vatandaş Saniye Vatandaş	*Tekirdağ Namık Kemal University*	Semantic and Functional Change of Shopping and Fashion in the Age of Consumer Culture
Ayşe Bozkurt	*Cukurova University*	Digital Transformation in the Public Sector: A New Era in Governance
Nalan Şahin Petek Balcı Ali Kara	*Uludağ University*	Investigation of the pH Effect on APN Polymer
Nalan Şahin Petek Balcı Ali Kara	*Uludağ University*	Investigation of The Temperature Effect on APN Polymer
Sevde Hasanoğlu Sayın Fatih Karataş Fatıma Ceren Tunçel Meral Günaldı Sacide Pehlivan	*Istanbul University*	Investigation of The Htert Gene Mns16a Vntr Variant in Lung, Breast and Gastrointestinal Cancer Patients
Sevde Hasanoğlu Sayın Sacide Pehlivan	*Istanbul University*	Molecular Mechanisms of Pyroptosis and Its Relationship with Diseases
Gül Kadan Nazan Kaytez	*Çankırı Karatekin University*	Investigation of The Effect of The Social Skills Training Program Prepared for Primary School Children During the Pandemic Period on Children's Social Development and Friendship Skills
Gül Kadan	*Çankırı Karatekin University*	Investigation of University Students' Perceptions of Death and Happiness After Kahramanmaraş Earthquake

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12.04.2024 / HALL-4 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Esam Y. Salah

Authors	Affiliation	Presentation title
Konstantin Babov Svitlana Onishchak Oleksandr Bibikov Irina Babova Alexander Plakida	*Ukrainian Research Institute of Medical Rehabilitation and Resort Therapy of the Ministry of Health of Ukraine*	Robotic Systems in Rehabilitation for Gunshot Wounds of the Upper Limb
Harish-A Suganthi P	*R.M.K. Engineering College*	Flight Control System Using System of Linear Equation
Darshini K Christy Jenefa J Suganthi P	*R.M.K. Engineering College*	The Synergy of Mathematics and Biosystems Engineering: Enhancing Precision and Sustainability
Esam Y. Salah	*Dr. Babasaheb Ambedkar Marathwada University*	A Conformable Fractional Derivative Model for Hiv-1 Infection with Stem Cell Transplantation
Dushyanth N Suganthi P	*R.M.K. Engineering College*	Mathematics: The Key to Unlocking Solar and Wind Energy Optimization
Deepak A Balapriyan R Brijesh M	*R.M.K. Engineering College*	Guardian of the Deep: AI-powered Underwater Drones for Aquatic Life Health Monitoring and Conservation
R. J. Vishal Suganthi P Meena M	*R.M.K. Engineering College*	Mathematical Applications in Medical Science: Mathematical Applications in Epidemiological Analysis and Disease Control
G. Kushal K. Sravan Kumar Akshay Jilla	*R.M.K. Engineering College*	A Matrix Based Simulation

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12.04.2024 / HALL-5 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Jitender Kumar

Authors	Affiliation	Presentation title
Akshay Jilla	*R.M.K. Engineering College*	Basis and Rank
Atmakuri Bhuvanesh Suganthi P	*R.M.K. Engineering College*	Diy Ventilator
Atmakuri Bhuvanesh Suganthi P	*R.M.K. Engineering College*	Harmonizing Harvest: Revolutionizing Farming Economies Through Mathematical Modeling and Optimization
PR. Krithika Priya S. Rekha	*R.M.D. Engineering College,*	Elevating Ayurvedic Education: Integration of ChatGPT for Personalized Learning and Interactive Teaching
Aseel A. Kareem Hussein Kh. Rasheed Eman K. Hassan Reem Y. Mahmood	*University of Baghdad*	Study the Effect of Glycerin on the Optical Properties of PVA/ H 2 SO 4
Humaira Muzaffar Muhammad Naeem Faisal Bilal Aslam Haseeb Anwar Arslan Iftikhar Shazad Irfan Imran Mukhtar Maham Fatima Usman Haider Muhammad Jawad Aslam	*Government College University Faisalabad*	Effect of Chieranthus Chieri Seeds on Pancreatic Physiology and Beta-Cell Regeneration in Alloxan-Induced Diabetic Rats
Jitender Kumar Garima Hooda	*Maharshi Dayanand University*	Assessing the Efficacy and Challenges of Skill Development Programmes in India: Towards Strategic Enhancements
Jitender Kumar Simran Sikka		Role of Artificial Intelligence (AI) in Sustainable Education of Higher Education Institutions in India: Teacher's Perception
Noureddine Djilali Mohamed Dahmouni Said Mustapha kamel fodil	*University MOSTAGANEM*	Poultry Feeding by Azolla Microphyla Case of Fayoumi (Mostaganem)

(All speakers required to be connected to the session 10 min before the session starts)
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12.04.2024 / HALL-6 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Khalid Reggab

Authors	Affiliation	Presentation title
Khalid Reggab	*Ziane Achour University*	The Investigation of The Energy Spectrum of Specified Diatomic Molecules Via the Resolution of Schrodinger Equation
Kawya Pandey Rafraf Shakil	*Sharda University*	Partition Shadows and Dalit Identity in Manoranjan Byapari's 'Interrogating My Chandal Life'
Farhat Ullah Shah	*UET Peshawar*	Sustainable Manufacturing in Garments Industry by Applying Simulation and Lean Tools
Pradhap R Muthukumaran G Ram Prakash K. R	*R.M.K. Engineering College*	Mathematics Applications in Engineering: Bridging Theory to Practice
Priyanshi Goyal	*Mangalayatan University*	A Review Article on Recent Innovation and Future Obstacles in Drug Delivery System to the Eye
Arnav Sharma Tarunjot Singh Kuldeep Singh Harminder Singh	*Guru Nanak Dev University*	Road Anomaly Detection in Real-Time Leveraging Artificial Intelligence in Advanced Driver Assistance Systems (ADAS)
Touil Zoulikha Lefkaier Ibn khaldoun Ahmed Benbelghit Halifa Bachir	*Laghouat Amar Telidji University of Laghouat*	The Characterization of a Plate Composite

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12.04.2024 / HALL-1 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time		Ankara Local Time	
$10^{30} : 12^{30}$		$12^{30} : 14^{30}$	

HEAD OF SESSION: Aynur BİLMEZ ÖZÇINAR

Authors	Affiliation	Presentation title
Dilan Kenanoğlu Yeşim Fazlıoğlu	*Trakya University*	Content Analysis of Postgraduate Theses on Multicultural Education
Şekip Caner Esmerli Ceyla Özgür	*Adana Alparslan Türkeş Science and Technology University*	Optimization of Exhaust Emissions of A Diesel Engine Using Different Proportions of Alcohol Diesel Fuel Blends
Doğan Arslan Aynur Bilmez Özçınar	*Siirt University*	Medicinal and Aromatic Plants from Past to Present
Ayşe İrem Keskin Cevdet Kızıl	*Kadir Has University*	Continous Assurance Auditing and Computer-Assisted Accounting Auduting Processes
Işıl Var Nuray Güzeler Büşra Alomar Berfin Sucu	*Cukurova University*	Effect of Spirulina platensis on Lactic Acid Bacteria Used as Starter Culture in Cheese Production
Işıl Var Berfin Sucu Çağrı Çelik Nuray Güzeler	*Cukurova University*	Evaluation of Employees in a Catering Company in Terms of Hand Hygiene
Gül Eda Kılınç Yeliz Vergi	*Ondokuz Mayıs University*	Evaluation of Nutritional Status and Physical Activity Levels in Nutrition and Dietetics Department Students
Gül Eda Kılınç Alev Keser	*Ondokuz Mayıs University*	Evaluation of Sensory Properties of Plant-Based Fermented Beverages

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12.04.2024 / HALL-2 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	Ankara Local Time		
$10^{30} : 12^{30}$	$12^{30} : 14^{30}$		

HEAD OF SESSION: Mustafa CENGIZ

Authors	Affiliation	Presentation title
Melike Karabaş Ayden Çoban	*Menderes University Institute of Health Sciences*	Women's Awareness Towards Gynecological Cancers: The Example of Denizli Province
Haşim Bağcı	*Aksaray University*	Review of Cash, Debt and Profitability Situation in İstanbul Stock Exchange Real Estate Activities Sector
Ismail Akşit Bahri Gür	*Kafkas University*	The Importance Of Duties And Responsibilities In The Area Of Health And Safety At Work
Özgür Cengiz Ismail Akşit Okan Özbakır	*Kafkas University*	Measures to Be Taken Within the Scope of Occupational Health and Safety in The Textile Industry
Derya Güloğlu	*Isparta University of Applied Sciences*	Inoculation Sequence in Soil and Seed
Canan Vejselova Sezer Mustafa Cengiz Hatice Mehtap Kutlu	*Eskişehir Teknik University*	Evaluation of Effects of Harpagophytum Procumbens on Wound Healing: an in Vitro Study
Mustafa Cengiz	*Siirt University*	Evaluation Of The Cytotoxicity Of Devil's Claw Plant On Mouse Fibroblast Cells
Ana Luiza Ferreira Aydoğdu	*Istanbul Health and Technology University*	The Influence of Nursing Teamwork on The Quality of Care
Dicle Özavcı	*Siirt University*	Repair of Traditional Masonry Stone Lime Buildings

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12.04.2024 / HALL-3 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time		Ankara Local Time	
$10^{30} : 12^{30}$		$12^{30} : 14^{30}$	

HEAD OF SESSION: Fatma GÜR

Authors	Affiliation	Presentation title
Mehmet Turhal	*Karadeniz Technical University*	Multifractal Behavior of the Electrooculography Signal
Mehmet Turhal	*Karadeniz Technical University*	Reactive NiO Thin Film Coating Application with DC Magnetron Sputtering Method
Fırat Pala Husrev Mennan	*Siirt University*	Weeds for Ecological Restoration
Fırat Pala Husrev Mennan	*Siirt University*	Principles Of Integrated Pest Management
Ismail Keleş Alpaslan Bayrakdar	*Iğdır University*	Phytotherapeutic Plants Commonly Used In Wound Care In Iğdir Province
Fatma Gür	*Ataturk University*	A Current Denture Base Materials: Polyetheretherketone (Peek)
Muhammet Bayram Topcu Ali Fuat Güneri	*Yildiz Technical University*	Engaging Flight Crew in Occupational Health and Safety Risk Management: an Implementation Occupational Health and Safety Volunteer Flight Crew
Bahri Gür Fatma Gür	*Atatürk University*	Interaction of Selenium with Apoptotic Markers in Chemotherapeutic Agent-Induced Liver Injury: in Silico Evaluation

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12.04.2024 / HALL-4 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Sanjeev Gupta

Authors	Affiliation	Presentation title
Jeevankumar N. Sandeep	*Central University of Karnataka*	Computational Analysis of Nanoparticle Shapes Impact on Cylindrical Stream of Unsteady Oldroyd B Hybrid Nanofluid with Radiative Heat
Sanjeev Gupta	*GLA University*	Generalized System of Extended Nonlinear Variational Inequalities Governed by Gauss-Seidel-Type Iterative Approach
Serenenen Altan-Uya	*Citi University*	Influencing Factors on The Origin of Musical Sounds and Vowels
Analice Maciel De Melo Mateus David Finco	*Federal University of Paraíba*	Motivation in The Unıversıty Experıence and Its Posıtıve Impact on the Job Market
Belahlou Khalida Belaidi Sihem Belhadi Khaled Sehili Tahar	*University of Brothers Mentouri Constantine 1*	Green Synthesıs of Zno Nanopartıcles by Two Methods: Comparison and Application in Photocatalysis
Ferfeche Lynda Debbache Nadra Taher Sehili	*University of the Brothers Mentouri Constantine1*	Efficient Ibuprofene Degradation Via Photo-Fenton Process Over Eco-Friendly Fe-Succinate Mof
Muinat Wuraola Salawu Moruff Adeyemi Salawu	*University of Lagos*	Influence of Directors Compensation on Earnings Management Practices in the Nigerian Banking Sector
Tetyana Ivanova Valery Kardashova	*Sumy State University*	Emotional Interaction and Locus of Control in Adolescence

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12.04.2024 / HALL-5 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	$10^{30} : 12^{30}$	Ankara Local Time	$12^{30} : 14^{30}$

HEAD OF SESSION: Marilena Carbone

Authors	Affiliation	Presentation title
Fahima Salaa Aicha Medjdoub Amine Khelifa Asmaa Benabbou	*Université de Mostaganem*	Development and Characterisation of A Composite Based on Diatomite
Fahima Salaa Aicha Medjdoub Asmaa Benabbou Amine Khelifa	*Université de Mostaganem*	Elaboration of Organo-Inorganic Materials Based on of Natural Products and Their Applications in Chemical Processes
Nesrine Dhieb Chaima Jemai Sana Khamessi Skandar Msolly Maryam Cheikhrouhou Yosra Htira Zohra Hadj Ali Olfa Lajili Faika Ben Mami	*National Institute of Nutrition*	Does the Presence of Diabetic Neuropathy Predict the Presence of Retinopathy in Type 2 Diabetics?
Chaima Jemai Nesrine Dhieb Yosra Htira Zohra Hadj Ali Imen Hedfi Olfa Lajili Faika Ben Mami	*National Institute of Nutrition*	Clinical and Biological Characteristics of A Population With Early-Onset Diabetic Neuropathy
S. Fatima Rosaline Mary	*Fatima College*	A Study on Youth Perception Towards Millet Based Enterprises with Specail Reference to Madurai, Tamil Nadu, India
Marilena Carbone	*University or Rome Tor Vergata*	Influence of Cortisol on the Fibril Formation Kinetics of Ab42 Peptide: A Multi-Technical Approach
Alketa Caushi Selim Ibrahimi Amelia Ibrahimi	*Faculty of Movement Science*	Mitigating Gestational Diabetes Risk: The Positive Impact of Physical Activity During Pregnancy
J. Nadhiya K. Snega MK Vijayalaskmi	*Universiti Kuala Lumpur*	Therapy for Tuberculosis and Medication Schedules: A Comprehensive Review

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12.04.2024 / HALL-6 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 ^{30} : 12 ^{30}	Ankara Local Time	12 ^{30} : 14 ^{30}

HEAD OF SESSION: Amelia Ibrahimi

Authors	Affiliation	Presentation title
Moulay Driss Mellaoui Khalid Abbiche Abdallah Imjjad Souad El Issami Hanane Zejli	*Ibn Zohr University*	Revealing the Influence of Tether Length on Theintramolecular [3 + 2] Cycloaddition Reactions of Nitrones with Alkynes from the Molecular Electron Density Theory Perspective
Ananya Lamba Adwita Manocha Sanidhya Mukund	*Symbiosis International University*	A Comparative Analysis of Enforcement of Investment Arbitration Awards in India, Uk and Usa:
M.Brijesh Suganthi P	*R.M.K. Engineering College*	Linear Algebra Applications in Rural Development : A Systematic Approach
G. Revanth Kumar Suganthi P	*R.M.K. Engineering College*	Mathemacal Modeling for Solar & Wind Energ
Amelia Ibrahimi Marin Barleti Selim Ibrahimi Olsi Caushi	*University of Tirana*	The Role of Pharmacists in Pandemic Management: Responsibilities and Contribution in Education, Counseling, and Medication Assurance
Mohamed Ait Oumeraci Tarek Berrama Hayet Tizi Aya Alterkaoui Nadir Dizge	*University of Sciences and Technology Houari Boumediene*	Potentiel Applications of Green Zinc Oxide Nanoparticles for Degradation of Difenoconazole in Water

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12.04.2024 / HALL-1 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Ayşe DEMIRKIRAN

Authors	Affiliation	Presentation title
Sena Eren Semanur Sağlam Feride N. Türk Hasan Arslanoğlu	*Canakkale Onsekiz Mart University*	Cr (Vi) Removal of Çanakkale Çan Thermal Power Plant Flue Gas Treatment Waste from Wastewater: Comparison with Magnetic Activated Carbon
Süleyman Karataş Özlem Güngören Pazzanese	*Akdeniz University*	Opinions Of Education Administrators On Effective School Development: A Case Study
Azra Namuslu	*Atatürk University*	In The Context Of Otheralization In Queer Cinema: Movie Analysis Of Your Name Engraved Here
Ayşe Demirkıran	*Ege University*	Investigation of Ptn (N= 2-15,18,22,24) Nano Clusters by Usıng Density Functional Theory
Evren Ayduran Özge Cihanbeğendi	*Dokuz Eylul University*	Multi-Sensor Based Interface Desıgn for Biomolecule Diagnosis
Mehmet Salih Durdu Uğur Talaş Burakhan Çubukçu	*Bilecik Seyh Edebali University*	Construction Management And Image Processing Based Inventory Tracking Automation
Hüseyin Bayram Çakıroğlu Mehmet Günay	*Ağrı İbrahim Çeçen University*	Examining the Role of Middle School Social Studies Coursebooks in Acquiring Entrepreneurship Skill Based on Students' Views

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12.04.2024 / HALL-2 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Selin ATİK

Authors	Affiliation	Presentation title
Gökhan Karayunlu Murat Ercan	*Mersin University*	Effects of Foreign Migration on Service Provision of Municipalities
Selin Atık	İzmir Katip Çelebi University	Flat Character Desıng; The Example of The Jetsons
Ersin Orak Mithat Şimşek	*Tokat Gaziosmanpaşa University*	Determination Of Speed And Amperage Parameters In Cnc Plasma Air Cutting Processes
Büşra Kılıç	*Independent Researcher*	The European Union's Response to The Covid-19 Pandemıc: Evaluatıng Actorness in Global Crises
Sevinç Eşer Durmaz Alev Keser	*Kırıkkale University*	Does Food Inflation Affect Nutritional Habits?
Erdinç Cesur	*Sakarya University of Applied Sciences*	An Evaluation on Determining Common Success Factors of High-Performance Insurance Agencies
Erdinç Cesur	*Sakarya University of Applied Sciences*	A Review on Professional Skills and Competencies Affecting the Performance of Insurance Professionals
Levend Coşkuntuna	*Tekirdağ Namık Kemal University*	Animal Welfare Practices in Dairy Farming
Levend Coşkuntuna	*Tekirdağ Namık Kemal University*	The Importance of Increasing Silage Consumption in Dairy Cows

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12.04.2024 / HALL-3 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Emine TIMUÇIN

Authors	Affiliation	Presentation title
Alper Tunga Şenay Ali Aygün	Selçuk University	Effects Of Outdoor Access Age On The Body Weight Of Broilers Raised In A Free-Range System
Zeynep Karaçor Burcu Güvenek	Selçuk University	Application of Rational Transformation Programs in Turkish Economy and Its Effects
Ayşe Çoban Taner Çevik Fatih Özyurt Engin Avcı	Arel University	Performance Evaluation of ConvNeXt, Swin Transformers and ResNet-50 Models for Classification of Medical Images
Zeynep Tatlı Emine Timuçin	Trabzon University	Concept Cartoon Development Process Of Teacher Candidates
Emine Timuçin Zeynep Tatlı	Trabzon University	Reflections of an Online Training Program About Autism
Zeynep Karaçor Burcu Güvenek Saim Mert Kalın	Selçuk University	The Impacts of Green Economy on Resource Utilization by Sectors
Zeynep Karaçor Burcu Güvenek	Selçuk University	The Effectiveness of Monetary Policy in The Learning Economy: an Evaluation on The Turkish Economy

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12.04.2024 / HALL-4 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Natalia Hakimi

Authors	Affiliation	Presentation title
Natalia Hakimi Fatin Syazwani Safiyuddin Ija Hazirah Nur Rosni Liyana Nadhirah Kamal Erma Shahida Kaap Rasheedul Haque	*MAHSA University*	Transforming Accounting Systems in Hospitality: Embracing Cloud Technology and Technological Innovations
R Shamganesh Suganthi P	*R.M.K. Engineering College*	AI for Fashion
Poojitha. N Suganthi P	*R.M.K. Engineering College*	Tech-Infused Landscapes: Advancements and Challenges in Modern Landscape Architecture
Suganthi P	*R.M.K. Engineering College*	Nethiya Sree M
Priyadarshini K Priyajothi N Suganthi P	*R.M.K. Engineering College*	Vector Calculus in Computer Graphics
Parvatha Srini K P Suganthi P	*R.M.K. Engineering College*	Application of Mathematics in Rocket Launch Trajectory Analysis
Dushyanth N Afrith Sulthan A Judson Samuel Y Rajesh B	*R.M.K. Engineering College*	Medical Diagnosis: Transforming Healthcare

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12.04.2024 / HALL-5 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Ivan PAVLOVIC

Authors	Affiliation	Presentation title
Natasa Antic	*Beka Vet Veterinary Pharmacy*	A Complementary Approach to Treating Pets - Bach Flower Drops
Aberrahamane Ziari Abderrahmane Medjerab	*Climatology Laboratory*	Impact of Climate Change on Temperatures Study Area: North-East Algeria
Baratadewa Sakti Perdana Tamamudin Hendri Hermawan Adinugraha	*UIN KH Abdurrahman Wahid Pekalongan*	Enhancing Customer Trust Through Islamic Digital Marketing: An Empirical Study
Abhijit Chatterjee Pintu Das	*Sarala Birla University*	Comparative Study of Water Excellency for the Two Distinct Water Bodies of Ranchi, Jharkhand
Ivan Pavlovic	*Scientific Institute of Veterinary Medicine of Serbia*	Coccidiosis of Partridges (Perdix Perdix) in Serbia
Purushoth V S Siddharth P	*R.M.K. Engineering College*	Footstep Power Generator
Salah Uddin Maruf Habibur Rahman Masrur Farjana Akther Niha	*University of Science and Technology Beijing*	Impact of Climate Change on Vulnerable People in Bangladesh: A Study in Sunamganj
Anna Kopiczko Joanna Cieplińska	*Józef Piłsudski University of Physical Education in Warsaw*	Determinants of Bone Mineral Density After Spinal Cord Injury

(All speakers required to be connected to the session 10 min before the session starts)
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12.04.2024 / HALL-6 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Drita Avdyli

Authors	Affiliation	Presentation title
R. Sundhararajan S.G.Raman R.Jothilakshmi	*Mohamed Sathak AJ College of Pharmacy*	Herbal Elegance: Unveiling the Potential of Natural Ingredients in Anti-Dandruff Hair
Drita Avdyli	*Universiteti Meshetar*	Political Immigration in The Arberesh Areas in Italy, Turkey and Argentine, from 1945 to 1990
Dora Naletina Toni Kozina Tomislav Rožić	*University of Zagreb*	The Importance of Safe Public Transport: A Systematic Literature Review
Rida Zulfiqar	*University of Szeged*	The Impact of Political Pressure on Judicial Independence: A Comparative Analysis of India and the UK
Jogendra Kumar	*Pauri Garhwal Utarakhand*	Human Activity Recognition Using Rnn
Sam Jefferston Baipalli Nikhilesh S. Vignesh Radhakrishnan P. Pathmanaban U. Elaiyarasan	*Easwari Engineering College*	Arduino Based Autonomous Vehicle Using Voice Recognition
Osamah Ihsan Ali Gyurika István Taha Husseın Mohammed	*University of Pannonia*	Microstructural Enhancement of CVD Coatings for Machining Applications
V.S. Tharun Prasath S. Mithun Raj S. Tharun Ganesh U. Elaiyarasan	*Easwari Engineering College*	All Wheel Parking Brake using Commercial Vehicle Spring Actuator

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13.04.2024 / HALL-1 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Uğur DURAN

Authors	Affiliation	Presentation title
Burcu Güvenek Zeynep Karaçor Hümeyra Avcı	*Selçuk University*	The Relationship Between Green Economy and Sustainable Growth
Berkant Dindar	*Tokat Gaziosmanpaşa University*	Carbon Fiber Reinforced Nanocomposite Swim Fin Design
Özgür Karataş Emine Öztürk Karataş	*İnönü University*	Institutionalization in Football Clubs
Özgür Karataş Emine Öztürk Karataş	*İnönü University*	Sports Facilities Problem in Turkish Sports
Uğur Duran	*İskenderun Technical University*	The Hermite-Bell-Based Apostol-Bernoulli Polynomials
Uğur Duran	*İskenderun Technical University*	The 2-Variable Truncated Degenerate Exponential Polynomials of Order A
Mustafa Er Elif Nur Er Özkan Mete Kalyoncu	*Konya Teknik University*	Optimization of Material Transportation Route During The in-Factory Logistics Process Using the Bees Algorithm
Pınar Kızılkaya Handan Evran	*Ardahan University*	Composite Film Production from Cellulose Nanofibrils

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13.04.2024 / HALL-2 / SESSION-1

Zoom Meeting ID: 833 4101 6484	Zoom Passcode: 121314
Lisbon Local Time	Ankara Local Time
08 ^{00} : 10 ^{00}	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Ali Beyhan UÇAK

Authors	Affiliation	Presentation title
Serap Tepe Serkan Eti	*University of Health Sciences*	Determining the Levels of Psychological Preparedness for Disasters Among Students in the Health Field
Serap Sarıbaş	*Karamanoğlu Mehmetbey University*	Apocalyptic Narratives in Cinema: the Political, Religious and Cultural Presence of the Maya, a Mesoamerican Civilization in the movie "Apocalypto"
Elif Sarıgüzmen	*Katip Çelebi University*	Match Box Packaging Designs Produced as Corporate Identity Carrier Reflections of 20th Century Art Movements
Barış Incesu Samet Çelik Kevser Bahadır Muhittin Baran Filiz Karadağ	*Ege University*	Obesity Prediction Model Proposal Using Machine Learning Techniques
Ali Beyhan Uçak	*Siirt University*	Benefitting from Climate Data, Siirt Zivzik Pari Determination of Plant Water Consumption
Ali Beyhan Uçak	*Siirt University*	Sunflower Lines Using Climate Data Determination of Plant Water Consumption
Halime Erzen Yıldız Berna Oto	*Van Yuzuncu Yil University*	The Interaction of Electromagnetic Radiation With (18F) Fluorodeoxyglucose
Selda Karadağ Fikret Bektaşoğlu Turgut Kırmızıbayrak	*Kafkas University*	General Situation of Turkey Breeding in Türkiye

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13.04.2024 / HALL-3 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Görkem ÖZTÜRK

Authors	Affiliation	Presentation title
Hanife Müderrisoğlu Attila Erdemirci Furkan Çapoğlu	*Hitit University*	Evaluations On Secularism In The Early Republican Period
Furkan Çapoğlu Attila Erdemirci Hanife Müderrisoğlu	*Hitit University*	Understanding Of Public Administration Of Local Administrators In Anatolian Geography
Nimet Yaşın	*İzmir Katip Çelebi University*	Minimalist Approach in Patrick Caulfield Illustrations
Tuğçe Uçar Sait San	*Eskişehir Osmangazi University*	Soliton Solutions Of (2 + 1)-Dimensional Calogerobogoyavlenskii-Schiff Equation With Rational (G'/G) Expansion Method
Tuğçe Uçar Sait San	*Eskişehir Osmangazi University*	Application Of The Modified Sardar Sub Equation Method For Zakharov-Kuznetsov Coupled System
R. Gülay Öztürk	*Istanbul Commerce University*	New Consumers of The Digital World and The Digitalization of The Gifting Tradition
Görkem Öztürk Mehmet Fırat Baran Belma Doğan Öz	*Siirt University*	Economic Analysis Of Open Vegetable Production In Batman Province
Görkem Öztürk Mehmet Fırat Baran Belma Doğan Öz	*Siirt University*	Profitability Analysis of Field Crops Production in Batman Province
Kader Aydın Mehmet Fırat Baran	*Siirt University*	Input Usage and Gross Profit Analysis in Banana Production (Mersin Province Example)

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13.04.2024 / HALL-4 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
	Lisbon Local Time		Ankara Local Time
	08 ^{00} : 10 ^{00}		10 ^{00} : 12 ^{00}

HEAD OF SESSION: Victoria POSTOLACHE

Authors	Affiliation	Presentation title
Kapil Ahuja Ekta Rani	*IMSAR*	Volatility Analysis of ESG Indices and Conventional Stock Market Indices: A comparative study
Hassan Boukita Mohamed El Ammari Najiba Brhadda Rabea Ziri	*Ibn Tofail University*	A bibliometric review of literature in urban vegetation studies over the last five years
Victoria Postolache	*Alecu Russo Balti State University*	Optimal Directions for Ensuring Financial Security at the Economic Entity Level
Mammadova Asmethanım	*Azerbaycan, Bakü Devlet Üniversiteti*	Consonants in Two Languages of The Same Language Famıly Within Comparative Study
Mahalakshmi Avnk Suganthi P	*R.M.K. Engineering College*	An Overview of Food Engineering Branches: From Chemistry to Packaging
S. Sindhuja S. Keshikaa S. Pavai Madheswari R. Subhashinib Santhi M Georgeb	*R.M.K Engineering College*	Advancements in Smart Waste Management Systems: A Comprehensive Overview
M. Monika Suganthi P, Meena	*R.M.K Engineering College*	Integrating Mathematics into Zootechnics: A Pathway to Efficient Livestock Management

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13.04.2024 / HALL-5 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Felicia KING-AGBOTO

Authors	Affiliation	Presentation title
Felicia King-Agboto Chizoma Catherine Okpara	*Imo State University*	Retirement Anxiety and Job Performance Among Secondary School Teachers
Laksita M Parvatha Srini K P Suganthi P	*R.M.K Engineering College*	Comprehensive Overview of All Branches of Food Engineering: Innovations, Challenges, and Future Prospects
Prithwin V P Suganthi P Meena M	*R.M.K Engineering College*	Mathematical Optimization in 3D Printing: Maximizing Efficiency and Minimizing Cost
Muhammad Yousuf Ibrar Ul Haq Anns Uzair Fouzia Liaqat Muhammad Kamran	*Thal University Bhakkar*	Exploring Connectivity in Fuzzy Graphs: Applications in Network Analysis and Decision Making
Muhammed, Y. Adejoh, S. O. Muhammad, U. H. Aliyu, P. A.	*Federal University of Technology*	Effects of Interest Rate on Credit Accessed by Maize Farmers in Kuje Area Council of Abuja, Nigeria
Akhtarul Islam Amjad Mohd. Vaseem	*National Institute of Fashion Technology*	Ecofriendly Fibres for Sustainable Textile Production
Sam Jones. J	*R.M.K Engineering College*	Hybrid Inverter with Solar Battery Charging
Mokesh V Pragathish B Suganthi P	*R.M.K Engineering College*	Unlocking Agricultural Potential: Harnessing the Power of Mathematics in Agriculture

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13.04.2024 / HALL-6 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Harshini chiramani

Authors	Affiliation	Presentation title
Harshini chiramani Joshika S Kancharala Likhitha Pulivarthi Manisha	*R.M.K. Engineering College*	Cosmic Solar: Revolutionizing Energy
Asrith. R Gnanabalan. D Rathinavel. M Atmakuri Bhuvanesh Lalitha Ramachandran	*R.M.K. Engineering College*	QR-Enhanced Pill Barcode Scanner for Safer Medication Management
A. Harish, S. Kavin, A. Chaitanya Teja A.Afrith Sulthan	*R.M.K. Engineering College*	Smart Remote
Kaviya R Suganthi P	*R.M.K. Engineering College*	Harnessing Biotechnology for Sustainable Food Production
Priyavarshini A Suganthi P	*R.M.K. Engineering College*	Signal Processing Using Differential Algebra
Nancy lilly Maria C.S. Suganthi P	*R.M.K. Engineering College*	Sustainability 2.0: Harnessing the Power of Innovation to Heal Our Planet
Jayavarsini. M Suganthi P	*R.M.K. Engineering College*	Engineering science: using Mathematics in Image Processing
Darshini K Christy Jenefa J Divya Shri S Deepika Lalitha Ramachandran	*R.M.K. Engineering College*	Harnessing the Power Of AI: A Motivational Tool for Depression

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13.04.2024 / HALL-1 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Atik RAHIMOV

Authors	Affiliation	Presentation title
Fatih Türkoglu Mustafa Şahin	*Selcuk University*	Carcinoid Tumors of The Appendix
Fatih Türkoglu Mustafa Şahin	*Selcuk University*	Mırızzı Syndrome and Choledoc Injury Encountered During Cholecystectomy Operation
Songül Düger Gülay Ekici	*Gazi University*	Interculturalism and Coursebook: A Critical Analysis
Songül Düger Gülay Ekici	*Gazi University*	A Content Analysis Of Research From Different Countries On Pisa Exam Results
Gökçe Sarı	*Süleyman Demirel University*	An Analysis Of The Movie Metropolis Through Heidegger's Technical Concept
Busra Özdenizci Köse	*Gebze Technical University*	From Bits to Qubits: Exploring the Quantum Software Development Lifecycle
Busra Özdenizci Köse	*Gebze Technical University*	Challenges and Innovations In Testing and Validation for Quantum Software Development
Atik Rahimov	*Bursa Technical University*	Syrian Arab Republic in the Eurasianism, Middle East and Mediterranean Policy of the Russian Federation from Historical Perspective to the Present

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13.04.2024 / HALL-2 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time		Ankara Local Time	
$10^{30} : 12^{30}$		$12^{30} : 14^{30}$	

HEAD OF SESSION: Ilkün ORBAK

Authors	Affiliation	Presentation title
Berkay Karaçor Metin Mustafa Elçim Mustafa Özcanlı	*Çukurova University*	A Modal Analysis Study Using Different Materials in the Formula Student Car Chassis
Berkay Karaçor Anıl Aslan Mustafa Özcanlı Özgür Kılınç	*Çukurova University*	An Optimization Study: Examining Different Materials Usage in The Truck Chassis
Canan Duygu Arslan Pınar Sökülmez Kaya	*Ondokuz Mayıs University*	The Role Of Nutrition In Circadian Rhythm
Farid Huseynov Ibrahim Dipçik	*Gebze Technical University*	Trust and Help Intention of Internet Users Regarding Calls for Help in Disaster Relief Calls Via Social Media: A Survey Research
Ibrahim Dipçik Farid Huseynov	*Gebze Technical University*	The Role of Social Media in Disaster Relief and Crisis Communication: A Literature Review
Ilkün Orbak Âli Yurdun ORBAK	*Maltepe University*	Lean Manufacturing Study in Industrial Engineering – Automotive Supplier Company Application
Ali Yarıkkaya Fatih Sezer	*Çanakkale Onsekiz Mart University*	Functional Analysis of Hb24 Gene and Its Role in Adventitious Rooting in Arabidopsis Thaliana
Kerim Güler Ceren Göksu Ahmet Feyzioğlu	*Marmara University*	Development of Fintech Technologies for Moneypay Application

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13.04.2024 / HALL-3 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Erhan KAHYA

Authors	Affiliation	Presentation title
Taner Ateş Huseyin Selcuk Kılıç Bahar Sennaroğlu	*Marmara University*	An Analysis of Time Series Data and Enhancing Demand Forecasting Accuracy: A Case Study Using Arima Modeling in Glass Production Industry
Fatih Sarı Umutcan Pekmez Işıl Keçik Büyükhatipoğlu	*Gaziantep University*	Factors Affecting The Success Of Porcelain Laminate Veneer Restorations
Durmuş Ali Bircan Bekir Yıldırımcı Yılmaz Erbil	*Çukurova University*	Minimizing Delamination Factor in Glass Fiber Reinforced Plastic Composite Drilling Through Taguchi Optimization
Süleyman Karataş Zhyldyz Akunova	*Akdeniz University*	Migration Policies In Education, Immigrant, Asylum Seeker And Refugee Problems: The Case Of Afghan Immigrants
Erkin Cihangir Karataş	*Independent Researcher*	Water Resources and Availability Status in Turkey
Erhan Kahya Yasin Aslan	*Tekirdağ Namık Kemal University*	Identification of Artichoke (Cynara scolymus) on Seedlings with The Help of Deep Learning Method
Haluk Gümüş Hakan Adanacıoğlu	*Ege University*	Food Miles: an Assessment of Agricultural Products
Burcu Kunay Hilal Özdemir	*İstanbul Ticaret University*	Analysıs of the Impact of Sustainable New Luxury Brands on Generatıon Y and Z's Purchase Intentions and Consumer Behavıor in Terms of Gender and Income Status

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13.04.2024 / HALL-4 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Jenifer Alat Stephen

Authors	Affiliation	Presentation title
Nitika Saini Barinderjit Singh	*I.K. Gujral Punjab Technical University*	Kinnow Waste Utilization: Essential Compounds, Extraction and Utilization
Ramisetti Veera Harshitha Pranathi T M Nandhini S D	*R.M.K. Engineering College*	Mathematical Modeling of Neural Networks for Predictive Analysis in Healthcare
Tünde Dzurov Vargová Daniela Matušíková	*University of Prešov*	New Era in Tourism Service Delivery by Merging Quality and Safety
V. Pavithra G.Sandhiya K. Sanjani Suganthi P Meena M	*R.M.K. Engineering College*	Clearing Our Cosmic Path: Innovative Solutions for Space Debris Mitigation
Jenifer Alat Stephen	*Tashkent Medical Academy*	Development of Crispr-Cas9 Technology
Rosy Dhall Mikul	*Gandhinagar University*	Mapping the Landscape of Service Quality
Salma S Reshma L Suganthi P Meena M	*R.M.K. Engineering College*	Innovations in Aquaponics Technology

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13.04.2024 / HALL-5 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Ripom Paul

Authors	Affiliation	Presentation title
Ripom Paul	*Raiganj University*	From Tradition to Trends: The Emergence of Folk Art Innovation by Rural Entrepreneurs of Uttar Dinajpur
Muhammad Shoaib Muhammad Yasin Naz Shazia Shukrullah Rishmail Saleem Bilal Shoukat Summer Piao	*University of Science and Technology Beijing*	Rare Earth Element Doped Cobalt Nickel Ferrites for Treatment of Synthetic Dyes from Wastewater
Gokul Raj.V Karthik Surya.A.A Samsundar.A Sharavana Deepak.S.V Sudhanssu.R.S S. Pavai Madheshwari R. Subhashini Santhi M George	*R.M.K Engineering College*	Analysis of Development of a Three-Dimensional Constitutive Model for Simulating Shape Memory Alloys – A Review
Igor Pantić Jovana Paunović Pantić Svetlana Valjarević Jelena Čumić	*University of Belgrade*	Deep Learning in Analysis of Two-Dimensional Signals in Physiological Sciences
Prabhu Das	*Birsa Munda College*	Understanding the Rising Threat of Cybercrime Against Women in India
Lahouel Khemissi Boumaza Abdecharif Gasmi Meriem	*University of Abbes Laghrour*	Synthesis and Characterization of Cu doped ZnO Thin Films Prepared by Sol-Gel Dip Coating Technique
Soham Bindu Koustav Sarkar	*SRM Institute of Science and Technology*	Immunotherapy for Cancer Using Chimeric Antigen Receptors (CARs)
Ummulkher Abdulqadir Badlani Sakina Kheda	*Caucasus International University*	Studying the Effects of Screen Time and Digital Devices on Children's Endocrine and Metabolic Health

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13.04.2024 / HALL-6 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Adjoudj Abdellatif

Authors	Affiliation	Presentation title
Saima Abbas Zainab Umar Motasem Mirza Shaima Aslam Saima Ayyaz	*University of Cyberjaya*	The Impact of Anger Management Training on Anger and Odd Behavior: A Study Among University Students in Pakistan
Adjoudj Abdellatif	*University Center of Tipaza*	The Behavior of Barley in A Changing Environment
S. Shivaanishri Mr. Yuvashree	*R.M.K Engineering College*	The Third Eye for The Blind
Ananya Lamba Adwita Manocha Sanidhya Mukund	*Symbiosis International University*	A Comparitive Analysis of Enforcement of Investment Arbitration Awards in India, UK and USA
Tanzeela Asghar Abdul Ghaffar Muhammad Yasin Naz Shazia Shukrullah	*University of Agriculture*	Computational Study on Hyperthermic Cancer Treatment: Evaluating Pristine and Coated Nanostructures through Finite Element Analysis
Nur Syazwani Binti Mohd Nawi Nur Ezza Fitrani Binti Muhammad Fitri	*Universiti Utara Malaysia*	Awareness of Ergonomics Among Oil Palm Office Workers
M.Monica R.Saravanan R. Srinivasan	*Bharath Institute of Higher Education and Research*	Pharmacological and Toxicological aspects of Datura
Bukola O. Adetola Ireoluwa H. Omoniyi Raquel H. Nieves	*University Institute of Tourism Research-IUIT*	Social Sustainability Perceptions of Osun-Osogbo Festival at Nigeria's World Heritage Site

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13.04.2024 / HALL-1 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Nurullah TAŞ

Authors	Affiliation	Presentation title
Derya Kaman	*Kayseri University*	Evaluation Of The Environment-Development Relationship In Development Plans
Elif Bayrakçı Burcu Çaki Döner	*Gaziantep Islamic Science and Technology University*	Care And Counseling In Maternal-Perinatal Infections
Nurullah Taş	*Gebze Technical University*	From Traditional to Smart: Managing Change in Cities
Nurullah Taş	*Gebze Technical University*	Local Government Activities Towards Becoming A Smart City: The Case of Istanbul
Ayman Kole Emre Daghan Tokgöz	*Khoja Akhmet Yassawi International Kazakh-Turkish University*	The Role of Media in Dictatorships: Historical Perspective and Implications
Ömer Keski Merve Okutan	*Hitit University*	Investigation of Catalyst Effect in The Preparation of Pda Based Melamine Sponges
Faysal Selimoğlu	*Necmettin Erbakan University*	Studies On The Use Of Chemometric Methods In The Biotechnological Production And Analysis Of Antibiotics
Eldam Shams Aldeen Mustafa Gediz Uğuz	*Ondokuz Mayıs University*	Modification And Characterization Of Clinopthylloline For Adsorptive Desulfurization Of Crude Oil

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13.04.2024 / HALL-2 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Hasan Hüseyin ÖZTÜRK

Authors	Affiliation	Presentation title
Yücel Kadıoğlu Samira Samadzadeh	*Ataturk University*	Analysis of Voriconazol in Pharmaceutical Preparations Using Assisted Uv-Visible Region Spectrophotometry Method
Özlem Arat Dilek Kaya-Akyüzlü Mustafa Danışman Selin Özkan-Kotiloğlu	*Ankara University*	Effect of Faah Rs324420 Polymorphism on The Risk of Opioid Use Disorder
Çiğdem Akça İsmail Karabekmez Filiz Boran Erol Alver	*Hitit University*	Production of Carbon-Based Materials From Walnut And Peanut Biomass
H. Hazar Camci F. Betül Yilmaz Güler Gülşah Aktaş Çelik Ş. Hakan Atapek	*Kocaeli University*	Metallurgical and Mechanical Characterization of Aluminide Coated Inconel 625 Alloy by Thermo-Reactive Diffusion Method
Abdulaziz Alkan F. Betül Yilmaz Güler Gülşah Aktaş Çelik Ş. Hakan Atapek	*Kocaeli University*	Surface Modification of Ti6al4v Alloy by Thermo-Reactive Diffusion Coatings
Hasan Hüseyin Öztürk Ulaş Başar Gezgin	*Istanbul Galata University*	Optimism in Positive Psychology
Feyza Döndü Bilgin	*Aydın Adnan Menderes University*	Effects of Drought on Paspalum dilatatum Anatomy
Muhammed Emre Ayhan	*Necmettin Erbakan University*	Sers Active Nanomaterials for Biosensor Application

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13.04.2024 / HALL-3 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Hanife DURGUN

Authors	Affiliation	Presentation title
Cem Özkurt Emir Ayçiçek	*Sakarya University of Applied Sciences*	Text Summarisation with Deep Learning: An Investigation on the Effect of Epoch Number
Fatma Aksoy Hanife Durgun Neslihan Geçer	*Ordu University*	Nursing Care of a Patient with a Diagnosis of Pneumonia According to The Henderson Nursing Model: Case Report
Fatma Aksoy Hanife Durgun Beyzanur Toy	*Ordu University*	Orlando's Nursing Interaction Model For Nursing Care in The Postpartum Period: Case Report
Filiz Büyüker Tan Şeyda Korkmaz Özlem Tuna	*Yalova University*	Investigation Of Activated Carbon Production And Dyestate Removal From Surgery Sludge
Filiz Büyüker Tan Şeyda Korkmaz Özlem Tuna	*Yalova University*	Production Of Activated Hydrochar By Hydrothermal Carbonization Method And Its Evaluation In Crystal Violet Adsorption
Müslim Bayrak Mehmet Irfan Karadede	*İzmir Katip Çelebi University*	Effects of Vitamins on Orthodontic Tooth Movements
Gökçe Kayin Arici Ayden Çoban	*Aydın Adnan Menderes University*	The Effect Of Birth Interventions On Met Birth Expectations And Satisfaction
Hanife Durgun Fatma Aksoy Nejla Köksal	*Ordu University*	Nursing Care Plan for A Copd Patient According to Roy Adaptation Theory: Case Report

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13.04.2024 / HALL-4 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Neha Agrawal

Authors	Affiliation	Presentation title
Shreyas K.C. Kiran Kumar M.	*Jain Deemed to be University*	A Study on The Causal Impact of World Crude Oil Prices on Indian Stock Market
Raymond Oriebe Anyasi Harrison Ifeanyichukwu Atagana Desmond Chiagozie Agbo Joyce Onyenaturuchi Anyasi Raymond	*University of South Africa*	Modelling of the Growth of Tobacco by Indole Acetic Acid (IAA) Used to Control Soil Organic Pollution
Neha Agrawal Sagaya Aurelia	*Christ Deemed to be University*	Image Segmentation Method for Checking The Effectiveness of Vitiligo Treatment
Olufemi Adeyemi Adetola	*Federal University of Technology Akure*	Selected Physical, Mechanical and Chemical Properties of Groundnut Kernel for Processing of Groundnut
Olufemi Timothy Ogunbode Ogbomoso, Oyo State	*Ladoke Akintola University of Technology*	Decolonization and its Aftermath: Pessimism and Optimism's description of Nigerian Space, 1980 s-2015
Olufemi Timothy Ogunbode Ogbomoso, Oyo State	*Ladoke Akintola University of Technology*	A History of the Phenomena of the 'First' in the Baptist Medical Centre Ogbomoso, 1907-1997
Miss Poonam Vijay Kumar Sunil Kumar	*Indira Gandhi University*	Sustainable Utilization of Bio-waste Compost for Faradic and non -Faradic Type Energy Storage Applications
Ribka Nova Sartika Sembiring Parmiana Bangun	*Kemenkes Poltekkes Medan Prodi D III Kebidanan Pematangsiantar*	The Effectiveness of Pilates and Birthing Ball Exercises on Lower Back Pain and Self-Efficacy in Pregnant Women in the Third Trimester at the Batu Anam Community Health Center, Siantar District. Simalungun Regency

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13.04.2024 / HALL-5 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 ^{00} : 15 ^{00}	Ankara Local Time	15 ^{00} : 17 ^{00}

HEAD OF SESSION: Sakina Kheda

Authors	Affiliation	Presentation title
Abderrahim Guetteche Rima Boutkouk Mohamed Nacer Guetteche Salah Eddine Bensebti Abdelhafid Chabane	*Université Constantine 1*	Study of A Beam Reinforced with Glass Fiber and Carbon Fiber Composites
Kabiru Hamisu Hafsat Sanusi Mohammed Sulaiman Auwalu Yaro Abdulnasir Lawan Isah Ahmad Usman Shuaib Abdullahi Taofeek Lawal G. Sriker Reddy	*SR University*	Influence of Artificial Intelligence in Sustaining Agriculture and Poverty Alleviation in Nigeria
Shahid Ali Rajput Aziz Ul Rahman Atif Rehman Asghar Abbas Kashif Hussain Sarmad Frogh Arshad Usman Ali Muhammad Asif Raza Baseer Ahmad Rana Muhammad Shahbakht	*Muhammad Nawaz Shareef University of Agriculture*	Icariin Rescued Deoxynivalenol-Induced Intestinal Injury in Mice via Nrf2 Signaling Pathway
Sakina Kheda	*Tbilisi State Medical University*	Implications of Professional Stress on Pregnancy Complications
Hafsa Naeem	*University of Agriculture*	Production of Bio-Plastic and its Characterization using Banana Peel
Bouthaina Trabelsi Werchfeni Mariem Ben Hamida Houda Ben Ayed Maroua Trigui Sourour Yaich Mondher Kassis Jamel Dammak	*Hedi Chaker University*	Evaluation of Medical Device Reprocessing, As Part of A Quality Improvement Project
Souhir Chelly Boutheina Trabelsi Wercheni Asma Ammar Olfa Ezzi Mansour Njah Mohamed Mahjoub	*Hedi Chaker University*	Students & Knowledge of the Healthcare Associated Infection Prevention Climate in the Practice

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13.04.2024 / HALL-6 / SESSION-3

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	13 00 : 15 00	Ankara Local Time	15 00 : 17 00

HEAD OF SESSION: Mengxiangji

Authors	Affiliation	Presentation title
Bouthaina Trabelsi Werchfeni Houda Ben Ayed Mariem Ben Hamida Mahdi Kchaw Ons Walha Sourour Yaich Jamel Damak	*Hedi Chaker University*	Evaluation of Health Professionals' Knowledge on Septic Isolation: Results of A Quasi-Experimental Study
Souhir Chelly Boutheina Trabelsi Wercheni Asma Ammar Olfa Ezzi Mansour Njah Mohamed Mahjoub	*Hedi Chaker University*	Post-Covid Irritability in the Tunisian Population 2022 – Prevalence and Predictive Factors
Ajayi, Olayemi T. Omisakin, Funke-Wale T	*The Federal Polytechnic Ilaro*	Assessment of the Role of Art in the Built Environment and Enhancement of Education: An Example of The Federal Polytechnic, Ilaro
Nguyen Thi Kim Phuoc Le Tran Thanh Liem	*Kien Giang University*	Heavy Metals Polluted Soil Treatment by Phytoremediation in Vietnam – A Review
Shanza Khanum Muhammad Asad	*University of Education*	Therapeutic Potential of Sareehn (Albizia Lebbeck) Seeds Extract Against Toxic Effects of Graphene Nanosheets in Mori (Cirrhinus Mrigala)
Simeana Beshi Driola Susuri	*University Ukshin Hoti*	Corporate Insolvency and Restructuring: Legal Approaches to Financial Distress
S. Saravanan P. Velmurugan	*Annamalai University*	Effect of Pyramid Shaped Absorber Plate and Cotton Fins on the Solar Still
Mengxiangji Rasheedul Haque	*MAHSA University*	Research on Factors Affecting the Development Direction of Independent Clinical Laboratories in China in the Post Epidemic Era

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14.04.2024 / HALL-1 / SESSION-1

Zoom Meeting ID: 833 4101 6484	Zoom Passcode: 121314
Lisbon Local Time	Ankara Local Time
08 ^{00} : 10 ^{00}	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Alamettin BAYAV

Authors	Affiliation	Presentation title
Tuğçe Bulut Demir Irfan Marangoz	*Kırşehir Ahi Evran University*	Frequently Used Methods in Determining the Aerobic Capacity of Athletes
Zeynep Şimşek Irfan Marangoz	*Kırşehir Ahi Evran University*	Strength Measurement Tests In Individual And Team Sports
Rabia Reyhan Kısa	*Marmara University*	The Experience of Raising Children As A Single Mother: The Goat And Her Three Children Fable
Hümeyra Akbayir Mahsa Hakki	*İstanbul Sabahattin Zaim University*	Investıgatıon of Children's Educational Place Furniture in Terms of Ergonomics
Onur Muratal Hasan Ismail Yavuz Can Duran Funda Gül Koç Rıdvan Yamanoğlu	*Kocaeli University*	Hot-Press Coating of Ni-Hard 4 Alloy on Pure Iron
Aylin Karaca Leyla Güven	*Ataturk University*	Plants and Herbal Products Frequently Used in The Treatment of Rheumatic Diseases
Alamettin Bayav Bektaş Kadakoğlu Bahri Karli	*Isparta University of Applied Sciences*	A Global Outlook on Beekeeping from Türkiye
Bektaş Kadakoğlu Bahri Karlı Alamettin Bayav	*Isparta University of Applied Sciences*	Structural Analysis Of Wheat Production: Türkiye Example
Cemal Özalp	*Muş Alparslan University*	Determining the Relationship Between Nurses' Evaluation of Health Technologies and Their Attitudes Towards Artificial Intelligence

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14.04.2024 / HALL-2 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Zekiye ŞENGÜL

Authors	Affiliation	Presentation title
Mustafa Enes Öztürk	*Istanbul Technical University*	Seismic Analysis of Bridges with Piers on Different Local Soil Classes
Fatma Meydaneri Tezel Necmi Serkan Tezel	*Karabük University*	Mxenes for Energy Storage in Supercapacıtors
Fatma Meydaneri Tezel Necmi Serkan Tezel	*Karabük University*	Effects of Pore Structure on Electrochemical Charge Storage Mechanism in Supercapacitors
Merve Kılıç Ayden Çoban	*Aydın Adnan Menderes University*	The Effect of Current Inductıon Methods on The Intrapartum Process
Şerife Nur Güçlüer Ayden Çoban	*Aydın Adnan Menderes University*	Postpartum Hypertensıon and Current Approaches
Miray Kaya F. Gül Koçsoy	*Firat University*	The Function of Gothic Objects In “The Transition of Juan Romeo” and “The Enormous Radio”
Zekiye Şengül	*Siirt University*	Adapting to Climate Change through Climate-Smart Agricultural Insurance Smart Contracts and Distributed Ledger Technology (DLT)

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14.04.2024 / HALL-3 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Sipan SOYSAL

Authors	Affiliation	Presentation title
Hilal Yılmaz Serap Demirel Sibel Turan Sirke	*Kocaeli University*	The Role of WRKY Transcription Factors in Drought Stress Tolerance of Plants
Serap Demirel Hilal Yılmaz Sibel Turan Sirke	*Van Yüzüncü Yıl University*	Use of Ribosome-Inactivating Proteins (RİPs) in Agriculture
Sibel Turan Sirke Hilal Yılmaz Serap Demirel	*Van Yüzüncü Yıl University*	Use of Chloroplast Genomes in Plant Breeding
Ibrahim Selvikaya Abdurrahim Yılmaz	*Bolu Abant İzzet Baysal University*	Dormancy in Seeds and Methods of Breaking Dormancy
Abdurrahim Yilmaz Fatih Demirel Sipan Soysal	*Bolu Abant İzzet Baysal University*	A General Assessment of Seed Banks
Fatih Demirel Sipan Soysal Abdurrahim Yılmaz	*Iğdır University*	In Silico Investigation of Some Monoterpenes Against Fusarium oxysporum
Sipan Soysal Fatih Demirel Abdurrahim Yılmaz	*Siirt University*	Use of Seaweed Fertilizers in Organic Farming

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14.04.2024 / HALL-4 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 ^{00} : 10 ^{00}	Ankara Local Time	10 ^{00} : 12 ^{00}

HEAD OF SESSION: R. Saravanan

Authors	Affiliation	Presentation title
Ramzi El Idrissi Abdelkabir Bacha Fatima Lmai	*Hassan II University*	Analysis of a Traditional and a Fuzzy Logic Enhanced Perturb and Observe Algorithm for the MPPT of a Photovoltaic System
Imo Moses Akpan Michael Okon Bassey Aniekan Essienubong Ikpe	*Akwa Ibom State Polytechnic Ikot Osurua*	Adoption of Electric Vehicles (Evs) As A Sustainable Transportation Solution: Reshaping the Trends in Conventional Automobile Applications
R. Saravanan	*Bharath Institute of Higher Education and Research*	Synthesis and Evaluation of Silver Nanoparticles from Ethanolic Leaf Extract of Tridax Procumbens.L
Ristina Siti Sundari Rilla Tresnadola Tarigan Farhan Ahmad	*University of Perjuangan Tasikmalaya*	Added Value of Over-Riped Bananas Fruit Become Dried-Soggy Sale-Pisang

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14.04.2024 / HALL-5 / SESSION-1

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	08 00 : 10 00	Ankara Local Time	10 00 : 12 00

HEAD OF SESSION: Karimova Rena Jabbar

Authors	Affiliation	Presentation title
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Ismayilova Konul Idris Ismayilova Fatma Zakir Mammadov Shahmar Ajdar	*Azerbaijan Medical University*	Insulin Resistance and Iron Metabolism in Diabetes
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Ismayilova Fatma Zakir Abaszade Zumrud Amirgulu Mammadov Shahmar Ajdar	*Azerbaijan Medical University*	Characterization and Diagnostic Determination of Physiological Changes of Persistent Hyperplasia of The Thymus Gland
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Aliyeva Samaya Mirmohammed Jafarova Zemfira Ibrahim Alakbarova Mehriban Gani	*Azerbaijan Medical University*	Pathophysiology, Clinical Manifestations and Adipose Tissue Dysfunction of Metabolic Complications Associated with Adiposogenital Obesity
Nelya Novotorzhina Shafa Kazimzadeh Mehpara Safarova Gariba Gahramanova Yegana Mustafayeva	*Institute of Chemistry of Additives*	1,3-Bisisopropylxanthogenatesulfophenol As an Extreme Pressure Additive for Transmission Oils
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Huseynova Gulbeniz Asif Abiyev Huseyn Azizulla Aliyeva Gunel Muharram Mammadov Shahmar Ajdar	*Azerbaijan Medical University*	Physıologıcal Study of Adrenal Cortex Drug Deficiency
Karimova Rena Jabbar Babayeva Mansura Yashar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Aliyeva Gunel Muharram Mammadov Shahmar Ajdar	*Azerbaijan Medical University*	Stress-Induced Disruption of the Adrenal Glands, One of The Most Important Organs for Pregnancy
Ulviyya Mammadova	*Ministry of Science and Education of Azerbaijan*	Exploring the Ecological and Medical Benefits of Dill (Anethum graveolens) as an Alternative to Spirulina (Arthrospira platensis): A Comparative Study
Boyukkhanim Jafarzade Rana Ibrahimova Vilayet Abdiyev Sevinj Ismayilova Nigar Aliyeva	*Baku State University*	Study of Respiration intensity and Reducing Activity in Different Barley snd Wheat Genotypes Under Salt Stress Conditions

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14.04.2024 / HALL-6 / SESSION-1

Zoom Meeting ID: 833 4101 6484	Zoom Passcode: 121314
Lisbon Local Time	Ankara Local Time
08 ^{00} : 10 ^{00}	10 ^{00} : 12 ^{00}

HEAD OF SESSION: Le Thi Hong Nhung

Authors	Affiliation	Presentation title
Nazila Ragimova Almammadova Mehriban	*Ukrainian State University of Railway Transport*	Improving the Approach to Software Configuration of Automated Control Systems Using Experimental-Static Models
Lkadi Omar Nassraoui Mohammed Bouksour Otmane	*University Hassan II*	Design Optimization and Mechanical Characterization of Additively Manufactured Lattice Structures
Shirinova Lala Abbasov Mehraj Namazova Kamala Aslanov Azer Gasım Amrahlı Musayeva Narmina Guliev Rashad Shirinova Nargiz	*Western Caspian University*	Immune System Actıvatıon in the Path Morphology of Sars-Cov
Le Thi Hong Nhung	*Nha Trang University*	The Problem of Competition for Clean Agricultural Products and Solution for an Integrated Value-Added Model for Clean Agriculture in Khanh Hoa, Vietnam
Le Thi Hong Nhung	*Nha Trang University*	Proposing a Model of Experiential Education Through Social Impact Projects in Vietnam

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14.04.2024 / HALL-1 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Laila AFIA

Authors	Affiliation	Presentation title
Laila Afia Rachid Salghi	*Ibnou Zohr University*	Insights into the Corrosion Inhibition Performance of Three Natural Heterocyclic Diazepines for Carbon Steel El in 1m Hcl Medium
Laila Afia Rachid Salghi	*Ibnou Zohr University*	Experimental Evaluation of 2-Hydroxy-1-(2-Hydroxy-4-Sulfo-1-Naphthylazo)-3-Naphthoic Acid As A Novel Corrosion Inhibitor for C38 Steel in Hydrochloric Medium
Hina Mohsin Bilal Bahadar	*University of Peshawar*	Sustainable Urban Development in Pakistani Cities: Challenges, Opportunities, and Policy Implications
Farzin Sheikh Muhammad Yasin Naz Shazia Shukrullah Muhammad Rizwan Khalid	*University of Agriculture*	Catalytic Conversion of Mixed-Density Plastics into Combustible Fuel Through Microwave Pyrolysis
Ahmed Nawaz Muhammad Umair Abdul Ghaffar	*University of Agriculture*	Electromagnetic Surface Waves Between Two Dissimilar Media for High Frequency Applications
Ahmed M. Al-Hammadi Chhaya Sonar Prakash Kamble	*B A M University*	Factors Affecting Water Quality- A PCA Approach

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14.04.2024 / HALL-2 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time		Ankara Local Time	
$10^{30} : 12^{30}$		$12^{30} : 14^{30}$	

HEAD OF SESSION: Talha Usman

Authors	Affiliation	Presentation title
Syed Anam Shaheen Abbas Shah Muhammad Shoaib Muhammad Yasin Naz Shazia Shukrullah	*University of Agriculture*	Synthesis and Characterization of Silica-Chitosan Decorated Magnetic Nanostructure for Wastewater Treatment
Talha Usman	*University of Technology and Applied Sciences,*	Analysis of Integral Transforms and Their Numerical Simulations
Iqra Asghar	*University of Agriculture*	Synthesis of Silver Nanoparticles by Chemical Reduction of Agno3 with Nabh4
Soham Bindu Koustav Sarkar	*SRM Institute of Science and Technology*	ImmunotherapyfFor Cancer Using Chimeric Antigen Receptors T Cell (Cars)
Imade Choulli Mustapha Elyaqouti Elhanafi Arjdal Driss Saadaoui Dris Benhmamou	*Ibn Zohr University*	JAYA-Integrated Hybrid Optimization: Accurate Estimation of Single-Diode Model Parameters in Photovoltaic Cells
Baso Madiong Andi Tira Almusawir	*Bosowa University*	Social Forestry: Solutions for Resolving Tenurial Conflicts in Forest Areas in South Sulawesi, Indonesia

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14.04.2024 / HALL-3 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time	10 30 : 12 30	Ankara Local Time	12 30 : 14 30

HEAD OF SESSION: Bertina HOXHA LAMI

Authors	Affiliation	Presentation title
Khanifah Auliana Sultan Mubarok	*UIN K.H. Abdurrahman Wahid Pekalongan*	Halal Behavior in Media Technology System
Seema Rathee Nishu Goyal Sonali Parashar	*Maharshi Dayanand University,*	Mapping the Evolution of the Gig Economy: A Comprehensive Review of Scientific Literature and Trends
Dyah Anindita Nur Wulandari	*UIN K.H. Abdurrahman Wahid Pekalongan*	The Level of Awareness of The Younger Generation in Avoiding Usury on Interest in Using Sharia Products in Kendal, Indonesia
Usama Zahid Muhammad Ramzan Khawar Yasir Javed Dongwhi Choi	*University of Agriculture*	Fabrication of Metal-Organic Frameworks Based Supercapacitors and Investigation of its Faradaic and Non-Faradaic Response
Natesh Gunturu Balamurali Dhara V Adepu Ramesh	*JSS College of Pharmacy*	Regulatory Pathway of Class I Medical Device Elastic Bandage of USA
Syed Anam Shaheen Abbas Shah Muhammad Shoaib Muhammad Ayyaz Muhammad Yasin Naz Shazia Shukrullah	*University of Agriculture*	Testing of a CdS/g-C3N4/TiO2 Ternary Photocatalysts for Photocatalytic Applications
Bertina Hoxha Lami Denada Rada	*Sports University of Tirana*	Impact of The Digital Transformation in Medical Laboratories

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14.04.2024 / HALL-4 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time		Ankara Local Time	
$10^{30} : 12^{30}$		$12^{30} : 14^{30}$	

HEAD OF SESSION: Pham Duc Thuan

Authors	Affiliation	Presentation title
Denada Ahmeti Ambra Purde	*Logos University*	Effects of Artficial Intelligence on the Labor Market
Pham Duc Thuan	*Can Tho University*	Diplomatic Relations Between Vietnam and the United States As Seen From Us Covid-19 Vaccine Aid Policy to Vietnam
Ayesha Batool Farkhanda Anjum Hafsa Naeem Zainab Fatima	*University of Agriculture*	Climate Change: a Pathway to the Economic Prosperity
M. Amzaoued S. Zriouel M. Mabrouki	*University Sultane Moulay Slimane*	Room Temperature Ferromagnetic Behavior of Diluted Magnetic Semiconductor for Spintronics Applications
M. Amzaoued S. Zriouel M. Mabrouki	*University Sultane Moulay Slimane*	First Principle Study of Of High-TC Ferromagnetism of ZnTe for Spintronic and Opto-Electronic Applications
M. Amzaoued S. Zriouel M. Mabrouki	*University Sultane Moulay Slimane*	Spintronics System: Spin Polarization and Magnetic Characterization
Nina Kanev Assya Bojinova Karolina Papazova	*University of Sofia*	Anatase/Rutile Composites – On The Photocatalytic Degradation Of Orange Ii Azo-Dye
Nina Kanev Assya Bojinova Karolina Papazova	*University of Sofia*	Synthesis Of Zno, Znfe2o4 And Zno/Znfe2o4 Films And Investigation Of Their Photocatalytic Efficiencies

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14.04.2024 / HALL-5 / SESSION-2

Zoom Meeting ID: 833 4101 6484	Zoom Passcode: 121314
Lisbon Local Time	Ankara Local Time
$10^{30} : 12^{30}$	$12^{30} : 14^{30}$

HEAD OF SESSION: Irina-Ana DROBOT

Authors	Affiliation	Presentation title
Irina-Ana Drobot	*Technical University of Civil Engineering Bucharest,*	Walks in the Personal Opinions and Fictional Works of Virginia Woolf and Graham Swift
Milena Milojević Suzana Knežević Došenović Marinković Goran Stanišić	*Unit for Agricultural and Business Studies and Tourism,*	Application of Unconventional Livestock Production As an Alternative and Support for Rural and Sustainable Development
Boussalah Mohammed Ettahar Guella Sofiane Medjahdi Malika	*Djillali Liabes University,*	Removal of Textile Dyes by Adsorption on Activated Carbon Synthesized from the Jujube Kernels
Ganya, Adamu Hauni Dauda, Hauwa Ango, Monica Asabe Ibrahim	*Usmanu Danfodiyo University,*	The Effectiveness of School Placements in Facilitating Student Teacher Learning and Professional Development
Simeana Beshi Driola Susuri	*University "Ukshin Hoti,"*	Corporate Insolvency and Restructuring: Legal Approaches to Financial Distress
Nedeljko M. Milanović Andrijana Ž. Miletić Sanja D. Mijajlović	*University of Kragujevac*	Teachers and Parents in The World of Stem Concepts - Action Research in the Function of Popularizing Stem Activities
Sabrina Roguai Abdelkader Djelloul	*The University of Abbes Laghrour Khenchela*	Investigation of The Effects of Ni Doping on The Structural, Microstructural, and Optical Properties of Tin Oxide Films Using Psp Method
Sara Seddoqi Fatima Aouinti Ouahiba Laout Zaina Idir Nadia Gseyra	*Mohammed First University*	Chemical Composition, Antioxidant, and Anti-İnflammatory Activities of Aqueous Extract of Pistacia lentiscus L. from the Eastern Region of Morocco

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14.04.2024 / HALL-6 / SESSION-2

Zoom Meeting ID: 833 4101 6484		Zoom Passcode: 121314	
Lisbon Local Time		Ankara Local Time	
$10^{30} : 12^{30}$		$12^{30} : 14^{30}$	

HEAD OF SESSION: Fidan Nasirova

Authors	Affiliation	Presentation title
Shahriyar Guliyev	*Nakhchivan State University*	Reliable Systems for Prototype Fly-By-Wire Autopilot Uav Building Overview
Cemil Atakara	*Cyprus International University*	Reconstructıon Practıces: A Comparatıve Study of London, Tallınn, and Gırne
Fidan Nasirova	*Azərbaycan Milli Elmlər Akademiyası*	“Kalila and Dimna” As a Source of Moral-Didactic Motives
Səriyyə Abidova Elşən Qızı	*Elmi Araşdırmalar*	Quba qəzasında yaşayan etnik qruplar
Vusal Zulfugarov	*Azerbaycan Milli Bilimler Akademisi*	Organization of İnterdisciplinary Research at Azerbaijan National Academy of Sciences: Philosophical Approach
Murat Özay Taşkın Sümer Esin Şenyurt	*University of Wroclaw*	Turkey's Strengthening Military Presence in the Horn of Africa: The Case of Somalia
Seriyye Gündoğdu	*AMEA Doğubilimleri Enstitüsü*	The role of Yücel Feyzioğlu in the upbringing of Turkish immigrant children in Germany in line with national-spiritual values

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SYMPOSIUM PHOTOS





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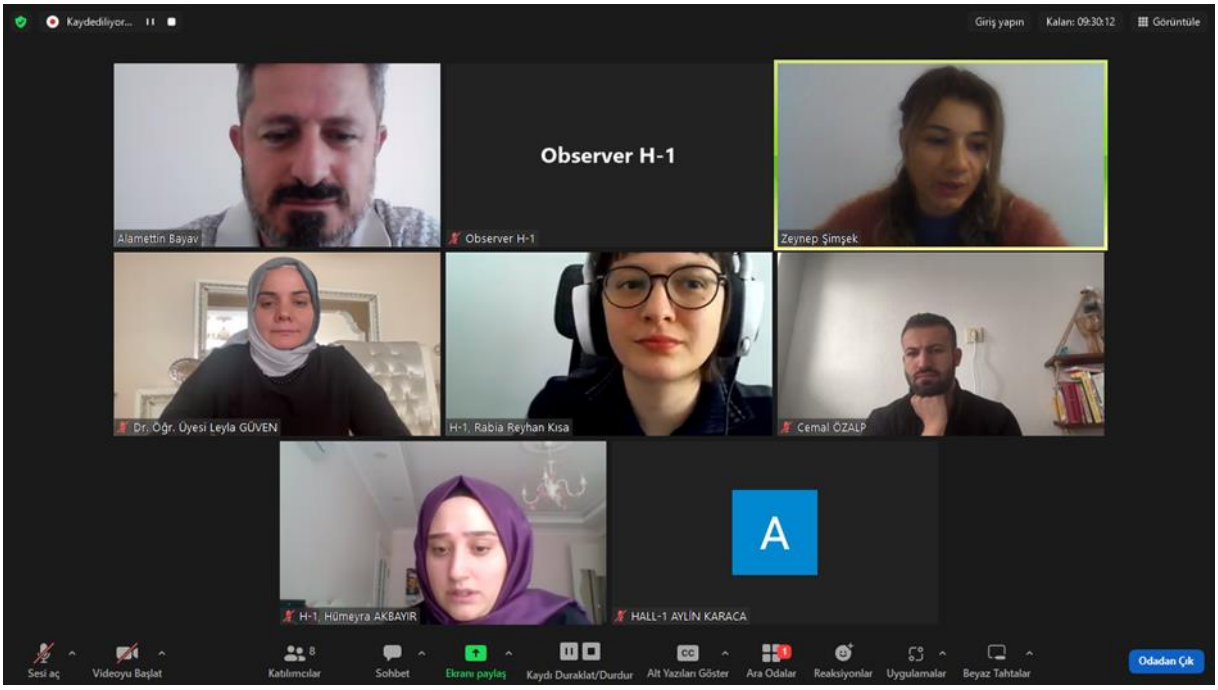


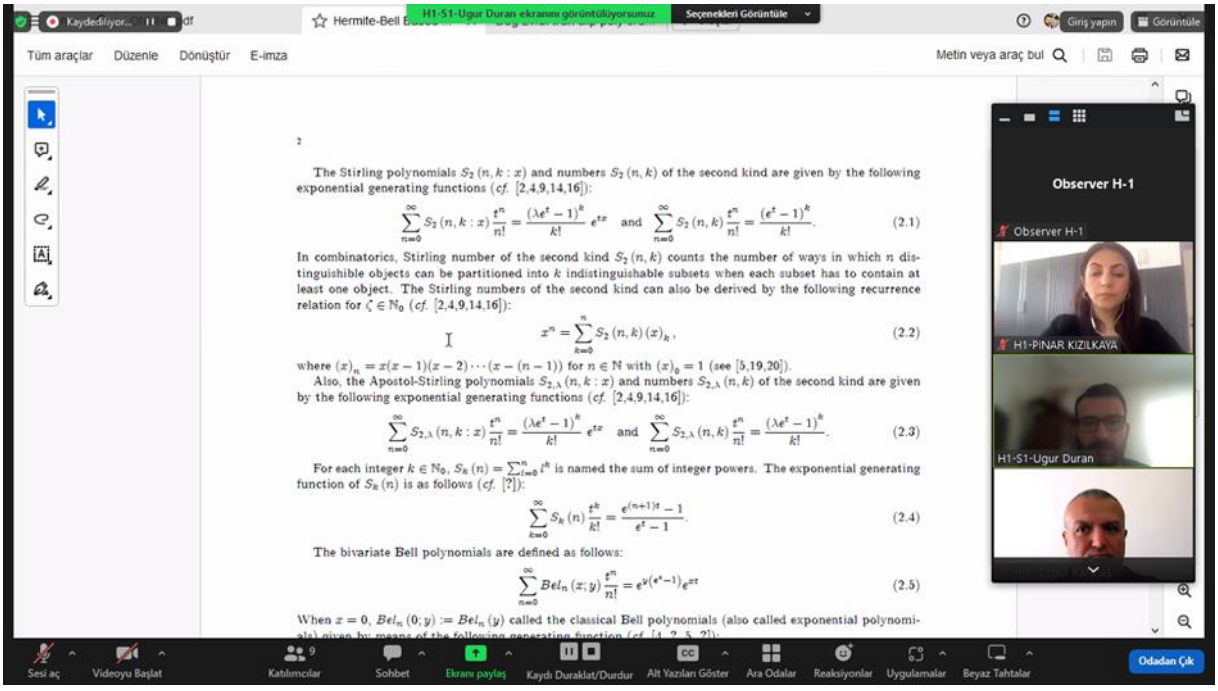
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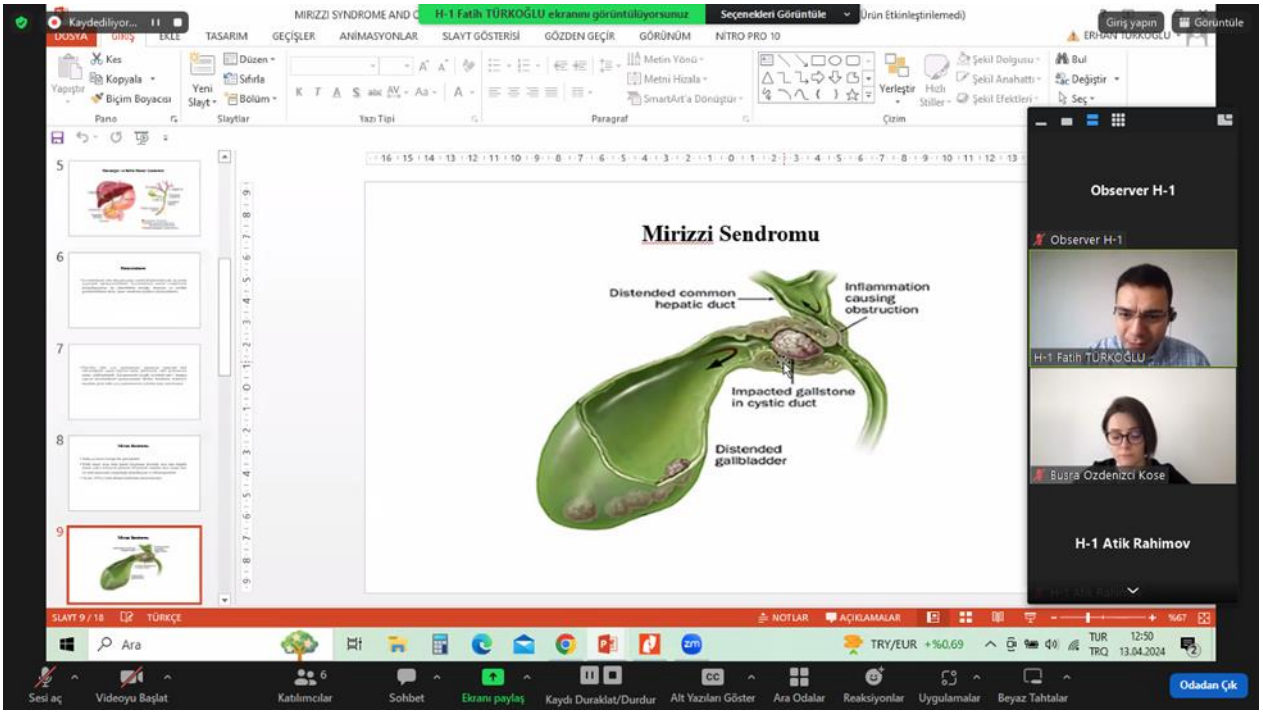


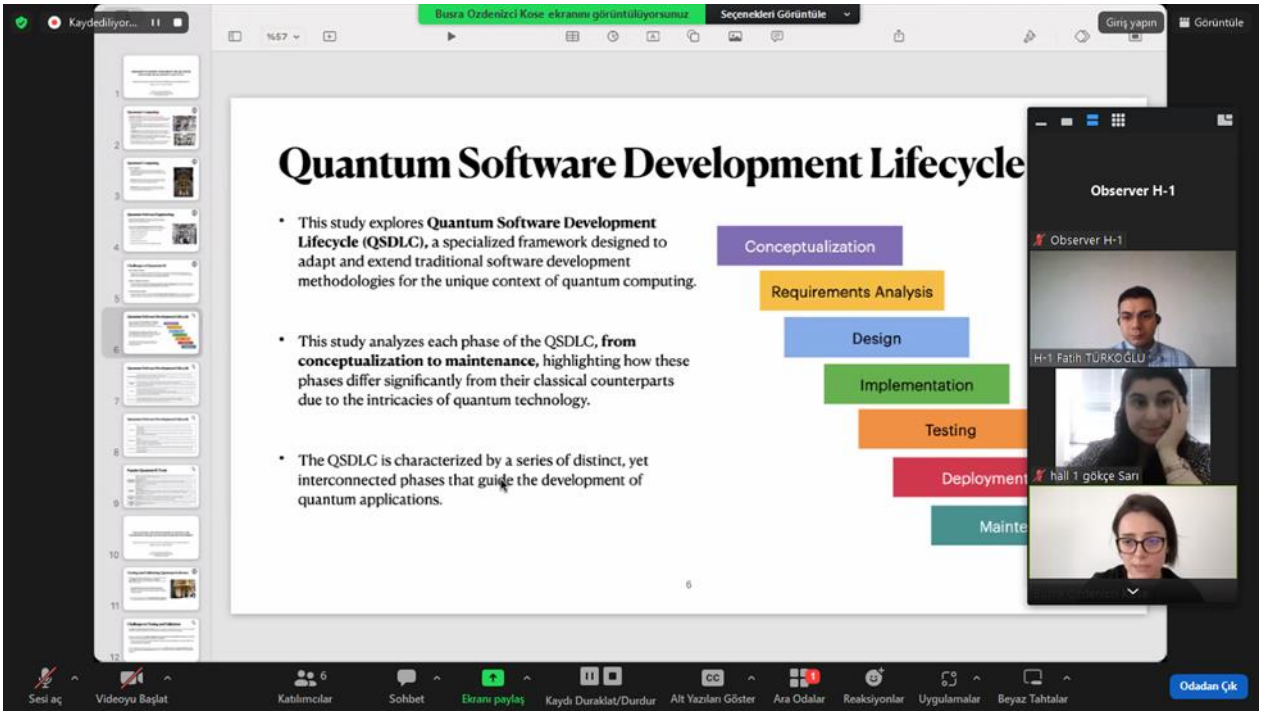
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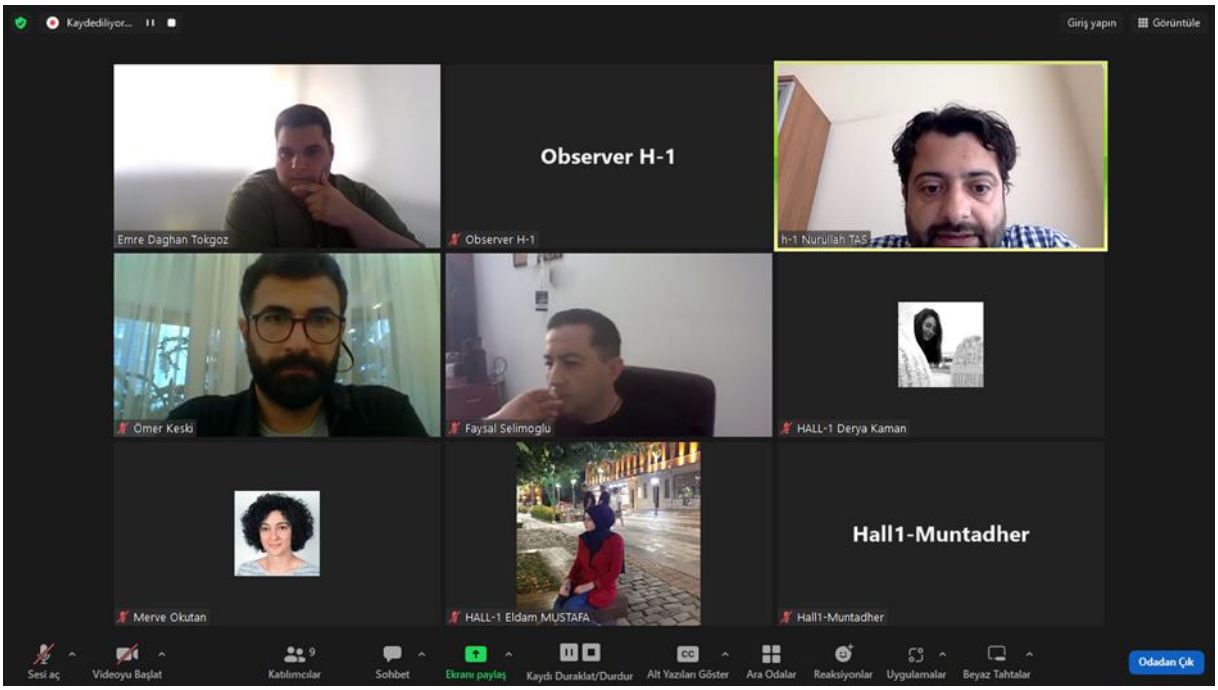


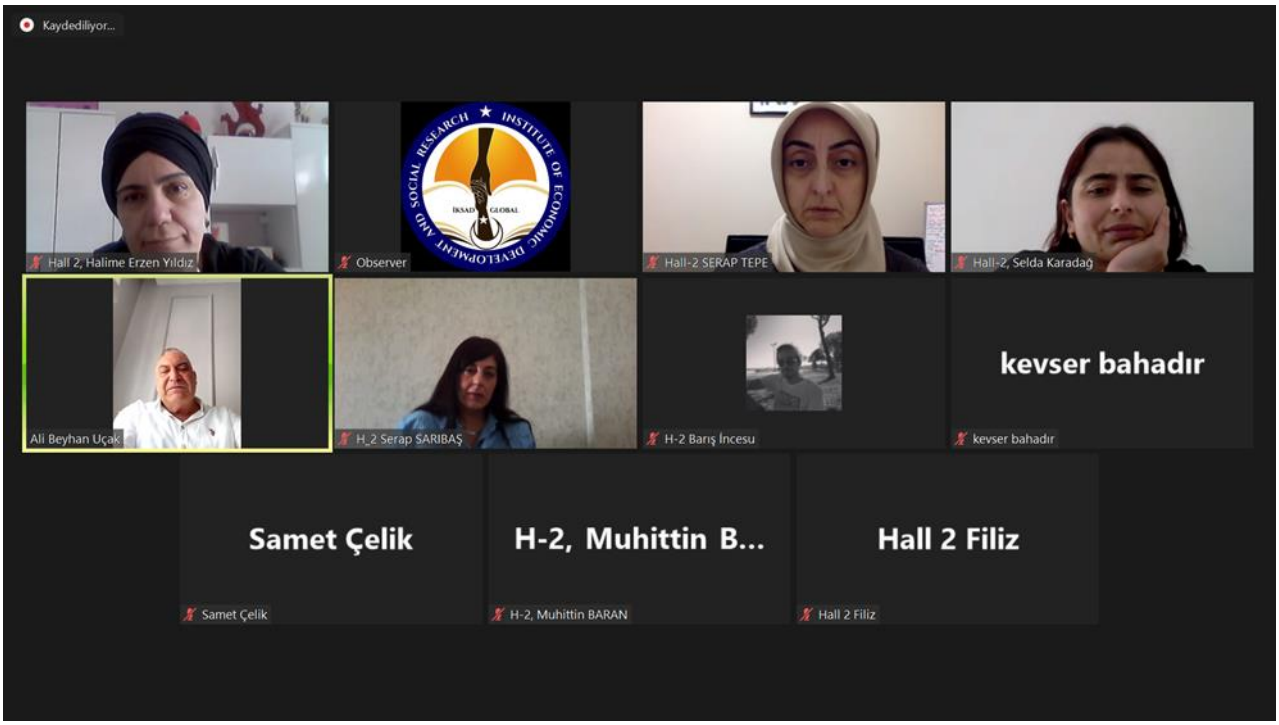
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SYMPOSIUM PHOTOS





CONTENTS

AUTHOR	TITLE	Page No
Ali Yarıkkaya Fatih Sezer	Functional Analysis Of Hb24 Gene And Its Role In Adventitious Rooting In Arabidopsis Thaliana	1
Leman Üstündağ	Proverbs Expressıon With Kinetic Typographyabstract	3
Mustafa Deniz Türkoğlu Merve Uysal	On The Existence Of Concircular Transformation On Non-Riemannian Manifolds	4
Yashchenko Ganna	Public Administration Decisions In The Conditions Of Military And Humanitarian Crises	6
Islam Safa Kaya	Criminal Jurisdiction For International Crimes Committed On The High Seas	7
Ali Cengiz	Application Of International Law Of War	9
Betül Yılmaz	Generations In The Workplace And Changing Work Values	11
Türkan Kaplan	Participation Patterns Of Adults Participating In The University Of Turkish Aeronautical Association Lifelong Development Application And Research Centre (Yagem) Certificate Programmes	13
Bertuğ Sakın	The Effect Of Individuals Emotional States On Language Usage In Relation To Environmental Influences	15
Yahya Nas	Influence Of Foliar Applications Of Calcium On Yield And Quality Of Head Lettuce (*Lactuca Sativa* L. Var Capitata)	17
Özge Ökcü Ayşe Tanşu Yonca Yavuz Akçay	Current Treatment Approaches In Fibromyalgia Syndrome	19
Özge Ökcü Rıdvan Gök	Benefits Of Exercise For Children	21
Veysi Acıbuca Aybüke Kaya	Wheat Production And Self-Sufficiency Levels Of Oecd Countries	23
Tarkan Ayaz	Potential Pest In Pistachio Fields Of Şırnak Province: Pistachio Psyllid [Agonoscena Pistaciae Burck. And Laut.) (Hemiptera: Aphalaridae)]	25
Ferhat Öztürk Tarkan Ayaz	Evaluatıon Of Yield Characteristics Of Different Maize Varieties Under Derik/Mardin Conditions	26
Ferhat Öztürk Tarkan Ayaz	Determination Of Yield Characteristics Of Some Maize Varieties Under Kızıltepe/Mardin Conditions	27
Ferhat Öztürk Tarkan Ayaz	Evaluation Of Yield Factors Of Different Corn Varieties Under Harran Conditions	28
Ferhat Öztürk Tarkan Ayaz	Comparison Of Yield Characteristics Of Some Corn Varieties Under Harran/Şanlıurfa Environments	29
Ayşe Bozkurt	Digital Transformation In The Public Sector: A New Era In Governance	30
Konstantin Babov Svitlana Onishchak Oleksandr Bibikov Irina Babova Alexander Plakida	Robotic Systems In Rehabilitation For Gunshot Wounds Of The Upper Limb	32
Harish-A Suganthi P	Flight Control System Using System Of Linear Equation	33
Darshini K Christy Jenefa J Divya Shri S Deepika Lalitha Ramachandran	Harnessing The Power Of Ai: A Motivational Tool For Depression	34

Darshini K Christy Jenefa J Suganthi P	The Synergy Of Mathematics And Biosystems Engineering: Enhancing Precision And Sustainability	35
Esam Y. Salah	A Conformable Fractional Derivative Model For Hiv-1 Infection With Stem Cell Transplantation	36
Dushyanth N Suganthi P	Mathematics: The Key To Unlocking Solar And Wind Energy Optimization	37
Deepak A Balapriyan R Brijesh M	Guardian Of The Deep: Ai-Powered Underwater Drones For Aquatic Life Health Monitoring And Conservation	38
R. J. Vishal Suganthi P Meena M	Mathematical Applications In Medical Science: Mathematical Applications In Epidemiological Analysis And Disease Control	39
G. Kushal K. Sravan Kumar Akshay Jilla	A Matrix Based Simulation	40
Akshay Jilla	Basis And Rank	41
Atmakuri Bhuvanesh Suganthi P	Diy Ventilator	42
Atmakuri Bhuvanesh Suganthi P	Harmonizing Harvest: Revolutionizing Farming Economies Through Mathematical Modeling And Optimization	43
Pr. Krithika Priya S. Rekha	Elevating Ayurvedic Education: Integration Of Chatgpt For Personalized Learning And Interactive Teaching	44
Aseel A. Kareem Hussein Kh. Rasheed Eman K. Hassan Reem Y. Mahmood	Study The Effect Of Glycerin On The Optical Properties Of Pva/ H_2SO_4	45
Humaira Muzaffar Muhammad Naeem Faisal Bilal Aslam Haseeb Anwar Arslan Iftikhar Shazad Irfan Imran Mukhtar Maham Fatima Usman Haider Muhammad Jawad Aslam	Effect Of Chieranthus Chieri Seeds On Pancreatic Physiology And Beta-Cell Regeneration In Alloxan-Induced Diabetic Rats	46
Jitender Kumar Garima Hooda	Assessing The Efficacy And Challenges Of Skill Development Programmes In India: Towards Strategic Enhancements	48
Jitender Kumar Simran Sikka	Role Of Artificial Intelligence (Ai) In Sustainable Education Of Higher Education Institutions In India: Teacher's Perception	49
Noureddine Djilali Mohamed Dahmouni Said Mustapha Kamel Fodil	Poultry Feeding By Azolla Microphyla Case Of Fayoumi (Mostaganem)	50
Khalid Reggab	The Investigation Of The Energy Spectrum Of Specified Diatomic Molecules Via The Resolution Of Schrodinger Equation	51
Kawya Pandey Rafraf Shakil	Partition Shadows And Dalit Identity In Manoranjan Byapari's 'Interrogating My Chandal Life'	52
Farhat Ullah Shah	Sustainable Manufacturing In Garments Industry By Applying Simulation And Lean Tools	53
Pradhap R Muthukumaran G Ram Prakash K. R	Mathematics Applications In Engineering: Bridging Theory To Practice	54
Priyanshi Goyal	A Review Article On Recent Innovation And Future Obstacles In Drug Delivery System To The Eye	56

Arnav Sharma Tarunjot Singh Kuldeep Singh Harminder Singh	Road Anomaly Detection In Real-Time Leveraging Artificial Intelligence In Advanced Driver Assistance Systems (Adas)	57
Touil Zoulikha Lefkaier Ibn Khaldoun Ahmed Benbelghit Halifa Bachir	The Characterization Of A Plate Composite	58
Derya Güloğlu	Inoculation Sequence In Soil And Seed	59
Jeevankumar N. Sandeep	Computational Analysis Of Nanoparticle Shapes Impact On Cylindrical Stream Of Unsteady Oldroyd B Hybrid Nanofluid With Radiative Heat	61
Sanjeev Gupta	Generalized System Of Extended Nonlinear Variational Inequalities Governed By Gauss-Seidel-Type Iterative Approach	62
Serenenen Altan-Uya	Influencing Factors On The Origin Of Musical Sounds And Vowels	63
Analice Maciel De Melo Mateus David Finco	Motivation In The Unıversıty Experıence And Its Posıtıve Impact On The Job Market	64
Belahlou Khalida Belaidi Sihem Belhadi Khaled Sehili Tahar	Green Synthesıs Of Zno Nanopartıcles By Two Methods: Comparison And Application In Photocatalysis	65
Ferfeche Lynda Debbache Nadra Taher Sehili	Efficient Ibuprofene Degradation Via Photo-Fenton Process Over Eco-Friendly Fe-Succinate Mof	66
Muinat Wuraola Salawu Moruff Adeyemi Salawu	Influence Of Directors Compensation On Earnings Management Practices In The Nigerian Banking Sector	67
Tetyana Ivanova Valery Kardashova	Emotional Interaction And Locus Of Control In Adolescence	68
Fahima Salaa Aicha Medjdoub Amine Khelifa Asmaa Benabbou	Development And Characterisation Of A Composite Based On Diatomite	69
Fahima Salaa Aicha Medjdoub Asmaa Benabbou Amine Khelifa	Elaboration Of Organo-Inorganic Materials Based On Of Natural Products And Their Applications In Chemical Processes	70
Nesrine Dhieb Chaima Jemai Sana Khamessi Skandar Msolly Maryam Cheikhrouhou Yosra Htira Zohra Hadj Ali Olfa Lajili Faika Ben Mami	Does The Presence Of Diabetic Neuropathy Predict The Presence Of Retinopathy In Type 2 Diabetics?	71
Chaima Jemai Nesrine Dhieb Yosra Htira Zohra Hadj Ali Imen Hedfi Olfa Lajili Faika Ben Mami	Clinical And Biological Characteristics Of A Population With Early-Onset Diabetic Neuropathy	73
S. Fatima Rosaline Mary	A Study On Youth Perception Towards Millet Based Enterprises With Specail Reference To Madurai, Tamil Nadu, India	75
Marilena Carbone	Influence Of Cortisol On The Fibril Formation Kinetics Of Ab42 Peptide: A Multi-Technical Approach	76

Moulay Driss Mellaoui Khalid Abbiche Abdallah Imjjad Souad El Issami Hanane Zejli	Revealing The Influence Of Tether Length On Theintramolecular [3 + 2] Cycloaddition Reactions Of Nitrones With Alkynes From The Molecular Electron Density Theory Perspective	77
Ananya Lamba Adwita Manocha Sanidhya Mukund	A Comparative Analysis Of Enforcement Of Investment Arbitration Awards In India, Uk And Usa:	78
M.Brijesh Suganthi P	Linear Algebra Applications In Rural Development : A Systematic Approach	80
G. Revanth Kumar Suganthi P	Mathemacal Modeling For Solar & Wind Energ	81
Mohamed Ait Oumeraci Tarek Berrama Hayet Tizi Aya Alterkaoui Nadir Dizge	Potentiel Applications Of Green Zinc Oxide Nanoparticles For Degradation Of Difenoconazole In Water	82
Ayşe Demirkıran	Investigation Of Ptn (N= 2-15,18,22,24) Nano Clusters By Usıng Density Functional Theory	83
Evren Ayduran Özge Cihanbeğendi	Multi-Sensor Based Interface Desıgn For Biomolecule Diagnosis	85
Hüseyin Bayram Çakıroğlu Mehmet Günay	Examining The Role Of Middle School Social Studies Coursebooks In Acquiring Entrepreneurship Skill Based On Students' Views	87
Gökhan Karayunlu Murat Ercan	Effects Of Foreign Migration On Service Provision Of Municipalities	89
Büşra Kılıç	The European Union's Response To The Covid-19 Pandemıc: Evaluatıng Actorness In Global Crises	91
Sevinç Eşer Durmaz Alev Keser	Does Food Inflation Affect Nutritional Habits?	93
Levend Coşkuntuna	Animal Welfare Practices In Dairy Farming	95
Levend Coşkuntuna	The Importance Of Increasing Silage Consumption In Dairy Cows	97
Zeynep Karaçor Burcu Güvenek	Application Of Rational Transformation Programs In Turkish Economy And Its Effects	99
Zeynep Karaçor Burcu Güvenek Saim Mert Kalın	The Impacts Of Green Economy On Resource Utilization By Sectors	101
Zeynep Karaçor Burcu Güvenek	The Effectiveness Of Monetary Policy In The Learning Economy: An Evaluation On The Turkish Economy	103
Natalia Hakimi Fatin Syazwani Safiyuddin Ija Hazirah Nur Rosni Liyana Nadhirah Kamal Erma Shahida Kaap Rasheedul Haque	Transforming Accounting Systems In Hospitality: Embracing Cloud Technology And Technological Innovations	105
R Shamganesh Suganthi P	AI For Fashion	107
Poojitha. N Suganthi P	Tech-Infused Landscapes: Advancements And Challenges In Modern Landscape Architecture	108
Priyadarshini K Priyajothi N Suganthi P	Vector Calculus In Computer Graphics	109
V. Pavithra G.Sandhiya K. Sanjani	Clearing Our Cosmic Path: Innovative Solutions For Space Debris Mitigation	110

Suganthi P Meena M		
M. Monika Suganthi P, Meena	Integrating Mathematics Into Zootechnics: A Pathway To Efficient Livestock Management	111
Prithwin V P Suganthi P Meena M	Mathematical Optimization In 3d Printing: Maximizing Efficiency And Minimizing Cost	112
Salma S Reshma L Suganthi P Meena M	Innovations In Aquaponics Technology	113
Mokesh V Pragathish B Suganthi P	Unlocking Agricultural Potential: Harnessing The Power Of Mathematics In Agriculture	114
Parvatha Srini K P Suganthi P	Application Of Mathematics In Rocket Launch Trajectory Analysis	115
Dushyanth N Afrith Sulthan A Judson Samuel Y Rajesh B	Medical Diagnosis: Transforming Healthcare	116
Natasa Antic	A Complementary Approach To Treating Pets - Bach Flower Drops	117
Aberrahamane Ziari Abderrahmane Medjerab	Impact Of Clımate Change On Temperatures	118
Baratadewa Sakti Perdana Tamamudin Hendri Hermawan Adinugraha	Enhancing Customer Trust Through Islamic Digital Marketing: An Empirical Study	119
Abhijit Chatterjee Pintu Das	Comparative Study Of Water Excellency For The Two Distinct Water Bodies Of Ranchi, Jharkhand	120
Ivan Pavlovic	Coccidiosis Of Partridges (Perdix Perdix) In Serbia	121
Purushoth V S Siddharth P	Footstep Power Generator	122
Salah Uddin Maruf Habibur Rahman Masrur Farjana Akther Niha	Impact Of Climate Change On Vulnerable People In Bangladesh: A Study In Sunamganj	124
Anna Kopiczko Joanna Cieplińska	Determinants Of Bone Mineral Density After Spinal Cord Injury	125
Drita Avdyli	Political Immigration In The Arberesh Areas In Italy, Turkey And Argentine, From 1945 To 1990	126
Rida Zulfiqar	The Impact Of Political Pressure On Judicial Independence: A Comparative Analysis Of India And The Uk	127
Jogendra Kumar	Human Activity Recognition Using Rnn	128
Sam Jefferston Baipalli Nikhilesh S. Vignesh Radhakrishnan P. Pathmanaban U. Elaiyarasan	Arduino Based Autonomous Vehicle Using Voice Recognition	129
Osamah Ihsan Ali Gyurika István Taha Husseın Mohammed	Microstructural Enhancement Of Cvd Coatings For Machining Applications	130
V.S. Tharun Prasath S. Mithun Raj S. Tharun Ganesh U. Elaiyarasan	All Wheel Parking Brake Using Commercial Vehicle Spring Actuator	131
Burcu Güvenek Zeynep Karaçor Hümeyra Avcı	The Relationship Between Green Economy And Sustainable Growth	132

Serap Sarıbaş	Apocalyptic Narratives In Cinema: The Political, Religious And Cultural Presence Of The Maya, A Mesoamerican Civilization In The Movie “Apocalypto”	134
Barış Incesu Samet Çelik Kevser Bahadır Muhittin Baran Filiz Karadağ	Obesity Prediction Model Proposal Using Machine Learning Techniques	136
Kader Aydın Mehmet Fırat Baran	Input Usage And Gross Profit Analysis In Banana Production (Mersin Province Example)	138
Hanife Müderrisoğlu Attila Erdemirci Furkan Çapoğlu	Evaluations On Secularism In The Early Republican Period	140
Furkan Çapoğlu Attila Erdemirci Hanife Müderrisoğlu	Understanding Of Public Administration Of Local Administrators In Anatolian Geography	142
Nimet Yaşın	Minimalist Approach In Patrick Caulfield Illustrations	144
Tuğçe Uçar Sait San	Soliton Solutions Of (2 + 1)-Dimensional Calogerobogoyavlenskii-Schiff Equation With Rational (G'/G) Expansion Method	146
Tuğçe Uçar Sait San	Application Of The Modified Sardar Sub Equation Method For Zakharov-Kuznetsov Coupled System	148
Kapil Ahuja Ekta Rani	Volatility Analysis Of Esg Indices And Conventional Stock Market Indices: A Comparative Study	150
Hassan Boukita Mohamed El Ammari Najiba Brhadda Rabea Ziri	A Bibliometric Review Of Literature In Urban Vegetation Studies Over The Last Five Years	151
Victoria Postolache	Optimal Directions For Ensuring Financial Security At The Economic Entity Level	152
Mammadova Asmethanım	Consonants In Two Languages Of The Same Language Famıly Within Comparative Study	153
Mahalakshmi Avnk Suganthi P	An Overview Of Food Engineering Branches: From Chemistry To Packaging	155
S. Sindhuja S. Keshikaa S. Pavai Madheswari R. Subhashinib Santhi M Georgeb	Advancements In Smart Waste Management Systems: A Comprehensive Overview	156
Felicia King-Agboto Chizoma Catherine Okpara	Retirement Anxiety And Job Performance Among Secondary School Teachers	157
Laksita M Parvatha Srini K P Suganthi P	Comprehensive Overview Of All Branches Of Food Engineering: Innovations, Challenges, And Future Prospects	158
Muhammad Yousuf Ibrar Ul Haq Anns Uzair Fouzia Liaqat Muhammad Kamran	Exploring Connectivity In Fuzzy Graphs: Applications In Network Analysis And Decision Making	159
Akhtarul Islam Amjad Mohd. Vaseem	Ecofriendly Fibres For Sustainable Textile Production	160
Sam Jones. J	Hybrid Inverter With Solar Battery Charging	161
Harshini Chiramani Joshika S Kancharala Likhitha Pulivarthi Manisha	Cosmic Solar: Revolutionizing Energy	162

Asrith. R Gnanabalan. D Rathinavel. M Atmakuri Bhuvanesh Lalitha Ramachandran	Qr-Enhanced Pill Barcode Scanner For Safer Medication Management	163
A. Harish, S. Kavin, A. Chaitanya Teja A.Afrith Sulthan	Smart Remote	164
Kaviya R Suganthi P	Harnessing Biotechnology For Sustainable Food Production	165
Priyavarshini A Suganthi P	Signal Processing Using Differential Algebra	166
Jayavarsini. M Suganthi P	Engineering Science: Using Mathematics In Image Processing	167
Fatih Türkoglu Mustafa Şahin	Carcinoid Tumors Of The Appendix	168
Fatih Türkoglu Mustafa Şahin	Mırızzı Syndrome And Choledoc Injury Encountered During Cholecystectomy Operation	169
Gökçe Sarı	An Analysis Of The Movie Metropolis Through Heidegger's Technical Concept	170
Kerim Güler Ceren Göksu Ahmet Feyzioğlu	Development Of Fintech Technologies For Moneypay Application	172
Fatih Sarı Umutcan Pekmez Işıl Keçik Büyükhatipoğlu	Factors Affecting The Success Of Porcelain Laminate Veneer Restorations	174
Nitika Saini Barinderjit Singh	Kinnow Waste Utilization: Essential Compounds, Extraction And Utilization	176
Ramisetti Veera Harshitha Pranathi T M Nandhini S D	Mathematical Modeling Of Neural Networks For Predictive Analysis In Healthcare	177
Tünde Dzurov Vargová Daniela Matušíková	New Era In Tourism Service Delivery By Merging Quality And Safety	178
Jenifer Alat Stephen	Development Of Crispr-Cas9 Technology	179
Rosy Dhall Mikul	Mapping The Landscape Of Service Quality	180
Ripom Paul	From Tradition To Trends: The Emergence Of Folk Art Innovation By Rural Entrepreneurs Of Uttar Dinajpur	181
Muhammad Shoaib Muhammad Yasin Naz Shazia Shukrullah Rishmail Saleem Bilal Shoukat Summer Piao	Rare Earth Element Doped Cobalt Nickel Ferrites For Treatment Of Synthetic Dyes From Wastewater	182
Gokul Raj.V Karthik Surya.A.A Samsundar.A Sharavana Deepak.S.V Sudhanssu.R.S S. Pavai Madheshwari R. Subhashini Santhi M George	Analysis Of Development Of A Three-Dimensional Constitutive Model For Simulating Shape Memory Alloys – A Review	183
Igor Pantić Jovana Paunović Pantić Svetlana Valjarević Jelena Čumić	Deep Learning In Analysis Of Two-Dimensional Signals In Physiological Sciences	184

Prabhu Das	Understanding The Rising Threat Of Cybercrime Against Women In India	185
Lahouel Khemissi Boumaza Abdecharif Gasmi Meriem	Synthesis And Characterization Of Cu Doped Zno Thin Films Prepared By Sol-Gel Dip Coating Technique	186
Soham Bindu Koustav Sarkar	Immunotherapy For Cancer Using Chimeric Antigen Receptors (Cars)	187
Ummulkher Abdulqadir Badlani Sakina Kheda	Studying The Effects Of Screen Time And Digital Devices On Children's Endocrine And Metabolic Health	188
Saima Abbas Zainab Umar Motasem Mirza Shaima Aslam Saima Ayyaz	The Impact Of Anger Management Training On Anger And Odd Behavior: A Study Among University Students In Pakistan	189
Adjoudj Abdellatif	The Behavior Of Barley In A Changing Environment	190
S. Shivaanishri Mr. Yuvashree	The Third Eye For The Blind	191
Ananya Lamba Adwita Manocha Sanidhya Mukund	A Comparitive Analysis Of Enforcement Of Investment Arbitration Awards In India, Uk And Usa	192
Tanzeela Asghar Abdul Ghaffar Muhammad Yasin Naz Shazia Shukrullah	Computational Study On Hyperthermic Cancer Treatment: Evaluating Pristine And Coated Nanostructures Through Finite Element Analysis	194
Nur Syazwani Binti Mohd Nawi Nur Ezza Fitrani Binti Muhammad Fitri	Awareness Of Ergonomics Among Oil Palm Office Workers	195
M.Monica R.Saravanan R. Srinivasan	Pharmacological And Toxicological Aspects Of Datura	196
Derya Kaman	Evaluation Of The Environment-Development Relationship In Development Plans	197
Elif Bayrakçı Burcu Çaki Döner	Care And Counseling In Maternal-Perinatal Infections	199
Ayman Kole Emre Daghan Tokgöz	The Role Of Media In Dictatorships: Historical Perspective And Implications	201
Ömer Keski Merve Okutan	Investigation Of Catalyst Effect In The Preparation Of Pda Based Melamine Sponges	202
Yücel Kadıoğlu Samira Samadzadeh	Analysis Of Voriconazol In Pharmaceutical Preparations Using Assisted Uv-Visible Region Spectrophotometry Method	204
Gökçe Kayin Arici Ayden Çoban	The Effect Of Birth Interventions On Met Birth Expectations And Satisfaction	205
Shreyas K.C. Kiran Kumar M.	A Study On The Causal Impact Of World Crude Oil Prices On Indian Stock Market	207
Neha Agrawal Sagaya Aurelia	Image Segmentation Method For Checking The Effectiveness Of Vitiligo Treatment	208
Miss Poonam Vijay Kumar Sunil Kumar	Sustainable Utilization Of Bio-Waste Compost For Faradic And Non -Faradic Type Energy Storage Applications	209
Ribka Nova Sartika Sembiring Parmiana Bangun	The Effectiveness Of Pilates And Birthing Ball Exercises On Lower Back Pain And Self-Efficacy In Pregnant Women In The Third Trimester At The Batu Anam Community Health Center, Siantar District. Simalungun Regency	210
Abderrahim Guetteche Rima Boutkouk Mohamed Nacer Guetteche	Study Of A Beam Reinforced With Glass Fiber And Carbon Fiber Composites	211

Salah Eddine Bensebti Abdelhafid Chabane		
Shahid Ali Rajput Aziz Ul Rahman Atif Rehman Asghar Abbas Kashif Hussain Sarmad Frogh Arshad Usman Ali Muhammad Asif Raza Baseer Ahmad Rana Muhammad Shahbakht	Icarin Rescued Deoxynivalenol-Induced Intestinal Injury In Mice Via Nrf2 Signaling Pathway	212
Sakina Kheda	Implications Of Professional Stress On Pregnancy Complications	214
Hafsa Naeem	Production Of Bio-Plastic And Its Characterization Using Banana Peel	215
Bouthaina Trabelsi Werchfeni Mariem Ben Hamida Houda Ben Ayed Maroua Trigui Sourour Yaich Mondher Kassis Jamel Dammak	Evaluation Of Medical Device Reprocessing, As Part Of A Quality Improvement Project	216
Souhir Chelly Boutheina Trabelsi Wercheni Asma Ammar Olfa Ezzi Mansour Njah Mohamed Mahjoub	Students & Knowledge Of The Healthcare Associated Infection Prevention Climate In The Practice	217
Bouthaina Trabelsi Werchfeni Houda Ben Ayed Mariem Ben Hamida Mahdi Kchaw Ons Walha Sourour Yaich Jamel Damak	Evaluation Of Health Professionals Knowledge On Septic Isolation: Results Of A Quasi-Experimental Study	219
Souhir Chelly Boutheina Trabelsi Wercheni Asma Ammar Olfa Ezzi Mansour Njah Mohamed Mahjoub	Post-Covid Irritability In The Tunisian Population 2022 – Prevalence And Predictive Factors	221
Ajayi, Olayemi T. Omisakin, Funke-Wale T	Assessment Of The Role Of Art In The Built Environment And Enhancement Of Education: An Example Of The Federal Polytechnic, Ilaro	222
Shanza Khanum Muhammad Asad	Therapeutic Potential Of Sareehn (Albizia Lebbeck) Seeds Extract Against Toxic Effects Of Graphene Nanosheets In Mori (Cirrhinus Mrigala)	224
Simeana Beshi Driola Susuri	Corporate Insolvency And Restructuring: Legal Approaches To Financial Distress	225
S. Saravanan P. Velmurugan	Effect Of Pyramid Shaped Absorber Plate And Cotton Fins On The Solar Still	227
Mengxiangji Rasheedul Haque	Research On Factors Affecting The Development Direction Of Independent Clinical Laboratories In China In The Post Epidemic Era	228
Rabia Reyhan Kısa	The Experience Of Raising Children As A Single Mother: The Goat And Her Three Children Fable	230
Aylin Karaca Leyla Güven	Plants And Herbal Products Frequently Used In The Treatment Of Rheumatic Diseases	231

Mustafa Enes Öztürk	Seismic Analysis Of Bridges With Piers On Different Local Soil Classes	233
Ramzi El Idrissi Abdelkabir Bacha Fatima Lmai	Analysis Of A Traditional And A Fuzzy Logic Enhanced Perturb And Observe Algorithm For The Mppt Of A Photovoltaic System	235
R. Saravanan	Synthesis And Evaluation Of Silver Nanoparticles From Ethanolic Leaf Extract Of Tridax Procumbens.L	236
Ristina Siti Sundari Rilla Tresnadola Tarigan Farhan Ahmad	Added Value Of Over-Riped Bananas Fruit Become Dried-Soggy Sale-Pisang	237
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Ismayilova Konul Idris Ismayilova Fatma Zakir Mammadov Shahmar Ajdar	Insulin Resistance And Iron Metabolism In Diabetes	238
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Ismayilova Fatma Zakir Abaszade Zumrud Amirgulu Mammadov Shahmar Ajdar	Characterization And Diagnostic Determination Of Physiological Changes Of Persistent Hyperplasia Of The Thymus Gland	239
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Aliyeva Samaya Mirmohammed Jafarova Zemfira Ibrahim Alakbarova Mehriban Gani	Pathophysiology, Clinical Manifestations And Adipose Tissue Dysfunction Of Metabolic Complications Associated With Adiposogenital Obesity	240
Nelya Novotorzhina Shafa Kazimzadeh Mehpara Safarova Gariba Gahramanova Yegana Mustafayeva	1,3-Bisisopropylxanthogenatesulfophenol As An Extreme Pressure Additive For Transmission Oils	242
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Huseynova Gulbeniz Asif Abiyev Huseyn Azizulla Aliyeva Gunel Muharram Mammadov Shahmar Ajdar	Physıologıcal Study Of Adrenal Cortex Drug Deficiency	244
Karimova Rena Jabbar Babayeva Mansura Yashar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Aliyeva Gunel Muharram Mammadov Shahmar Ajdar	Stress-Induced Disruption Of The Adrenal Glands, One Of The Most Important Organs For Pregnancy	245
Ulviyya Mammadova	Exploring The Ecological And Medical Benefits Of Dill (Anethum Graveolens) As An Alternative To Spirulina (*Arthrospira Platensis*): A Comparative Study	246
Boyukkhanim Jafarzade Rana Ibrahimova Vilayet Abdiyev Sevinj Ismayilova Nigar Aliyeva	Study Of Respiration Intensity And Reducing Activity In Different Barley Snd Wheat Genotypes Under Salt Stress Conditions	247
Lkadi Omar Nassraoui Mohammed Bouksour Otmane	Design Optimization And Mechanical Characterization Of Additively Manufactured Lattice Structures	249
Shirinova Lala Abbasov Mehraj Namazova Kamala Aslanov Azer Gasım Amrahlı	Immune System Actıvatıon In The Path Morphology Of Sars-Cov	250

Musayeva Narmina Guliev Rashad Shirinova Nargiz		
Le Thi Hong Nhung	The Problem Of Competition For Clean Agricultural Products And Solution For An Integrated Value-Added Model For Clean Agriculture In Khanh Hoa, Vietnam	252
Le Thi Hong Nhung	Proposing A Model Of Experiential Education Through Social Impact Projects In Vietnam	253
Laila Afia Rachid Salghi	Insights Into The Corrosion Inhibition Performance Of Three Natural Heterocyclic Diazepines For Carbon Steel El In 1m Hcl Medium	254
Laila Afia Rachid Salghi	Experimental Evaluation Of 2-Hydroxy-1-(2-Hydroxy-4-Sulfo-1-Naphthylazo)-3-Naphthoic Acid As A Novel Corrosion Inhibitor For C38 Steel In Hydrochloric Medium	255
Hina Mohsin Bilal Bahadar	Sustainable Urban Development In Pakistani Cities: Challenges, Opportunities, And Policy Implications	256
Farzin Sheikh Muhammad Yasin Naz Shazia Shukrullah Muhammad Rizwan Khalid	Catalytic Conversion Of Mixed-Density Plastics Into Combustible Fuel Through Microwave Pyrolysis	257
Ahmed Nawaz Muhammad Umair Abdul Ghaffar	Electromagnetic Surface Waves Between Two Dissimilar Media For High Frequency Applications	258
Ahmed M. Al-Hammadi Chhaya Sonar Prakash Kamble	Factors Affecting Water Quality- A Pca Approach	259
Syed Anam Shaheen Abbas Shah Muhammad Shoaib Muhammad Yasin Naz Shazia Shukrullah	Synthesis And Characterization Of Silica-Chitosan Decorated Magnetic Nanostructure For Wastewater Treatment	260
Talha Usman	Analysis Of Integral Transforms And Their Numerical Simulations	261
Iqra Asghar	Synthesis Of Silver Nanoparticles By Chemical Reduction Of Agno3 With Nabh4	262
Soham Bindu Koustav Sarkar	Immunotherapyffor Cancer Using Chimeric Antigen Receptors T Cell (Cars)	263
Baso Madiong Andi Tira Almusawir	Social Forestry: Solutions For Resolving Tenurial Conflicts In Forest Areas In South Sulawesi, Indonesia	264
Khanifah Auliana Sultan Mubarok	Halal Behavior In Media Technology System	265
Seema Rathee Nishu Goyal Sonali Parashar	Mapping The Evolution Of The Gig Economy: A Comprehensive Review Of Scientific Literature And Trends	266
Dyah Anindita Nur Wulandari	The Level Of Awareness Of The Younger Generation In Avoiding Usury On Interest In Using Sharia Products In Kendal, Indonesia	267
Usama Zahid Muhammad Ramzan Khawar Yasir Javed Dongwhi Choi	Fabrication Of Metal-Organic Frameworks Based Supercapacitors And Investigation Of Its Faradaic And Non-Faradaic Response	268
Natesh Gunturu Balamurali Dhara V Adepu Ramesh	Regulatory Pathway Of Class I Medical Device Elastic Bandage Of Usa	269
Syed Anam Shaheen Abbas Shah Muhammad Shoaib Muhammad Ayyaz	Testing Of A Cds/G-C3n4/Tio2 Ternary Photocatalysts For Photocatalytic Applications	270

Muhammad Yasin Naz Shazia Shukrullah		
Bertina Hoxha Lami Denada Rada	Impact Of The Digital Transformation In Medical Laboratories	271
Ayesha Batool Farkhanda Anjum Hafsa Naeem Zainab Fatima	Climate Change: A Pathway To The Economic Prosperity	273
M. Amzaoued S. Zriouel M. Mabrouki	Room Temperature Ferromagnetic Behavior Of Diluted Magnetic Semiconductor For Spintronics Applications	274
M. Amzaoued S. Zriouel M. Mabrouki	First Principle Study Of Of High-Tc Ferromagnetism Of Znte For Spintronic And Opto-Electronic Applications	275
M. Amzaoued S. Zriouel M. Mabrouki	Spintronics System: Spin Polarization And Magnetic Characterization	276
Milena Milojević Suzana Knežević Došenović Marinković Goran Stanišić	Application Of Unconventional Livestock Production As An Alternative And Support For Rural And Sustainable Development	277
Boussalah Mohammed Ettahar Guella Sofiane Medjahdi Malika	Removal Of Textile Dyes By Adsorption On Activated Carbon Synthesized From The Jujube Kernels	278
Ganya, Adamu Hauni Dauda, Hauwa Ango, Monica Asabe Ibrahim	The Effectiveness Of School Placements In Facilitating Student Teacher Learning And Professional Development	279
Simeana Beshi Driola Susuri	Corporate Insolvency And Restructuring: Legal Approaches To Financial Distress	280
Sabrina Roguai Abdelkader Djelloul	Investigation Of The Effects Of Ni Doping On The Structural, Microstructural, And Optical Properties Of Tin Oxide Films Using Psp Method	281
Sara Seddoqi Fatima Aouinti Ouahiba Laout Zaina Idir Nadia Gseyra	Chemical Composition, Antioxidant, And Anti-Inflammatory Activities Of Aqueous Extract Of Pistacia Lentiscus L. From The Eastern Region Of Morocco	282
Shahriyar Guliyev	Reliable Systems For Prototype Fly-By-Wire Autopilot Uav Building Overview	284
Cemil Atakara	Reconstructıon Practıces: A Comparatıve Study Of London, Tallınn, And Gırne	286
Murat Özay Taşkın Sümer Esin Şenyurt	Turkey's Strengthening Military Presence In The Horn Of Africa: The Case Of Somalia	287
Ayhan Dağdeviren Yusuf Ziya Akbaş	The City Of Museums: Bursa	289
Yusuf Ziya Akbaş Ayhan Dağdeviren	Culture Routes Of Turkey	291
Yılmaz Seçim Mehmet Fatih Yalçınkaya Zekeriya Yetiş	Cultural Journey In The Kitchen: Ethiopian Culinary Culture	293
Muhammed, Y. Adejoh, S. O. Muhammad, U. H. Aliyu, P. A.	Effects Of Interest Rate On Credit Accessed By Maize Farmers In Kuje Area Council Of Abuja, Nigeria	295
R. Sundhararajan S.G.Raman R.Jothilakshmi	Herbal Elegance: Unveiling The Potential Of Natural Ingredients In Anti-Dandruff Hair	296

Mena Azimi	The Role of Probiotic and Prebiotics in Calcium Bioavailability	297
Fidan Nasirova	“Kalila and Dimna” As a Source of Moral-Didactic Motives	299

FULL TEXT

Lebriz Çınar Korkmaz Bellitürk Ahmet Çelik	Organic Matter in Sustainable Agriculture and The Relationship Between Earthworms and Soil Health	300
Mehmet Günsen Bilal Can Erkan Korkmaz Bellitürk Ahmet Çelik	Obtaining Vermicomposting From Mixture Of Snack Sunflower Waste And Cow Manure For Zero Waste Aim	326
Gül Kadan	Investigation of University Students' Perceptions of Death and Happiness After Kahramanmaraş Earthquake	360
Gül Kadan Nazan Kaytez	Investigation of The Effect of The Social Skills Training Program Prepared for Primary School Children During the Pandemic Period on Children's Social Development and Friendship Skills	379
Alketa Caushi Selim Ibrahimi Amelia Ibrahimi	Mitigating Gestational Diabetes Risk: The Positive Impact of Physical Activity During Pregnancy"	397
Amelia Ibrahimi Marin Barleti Selim Ibrahimi Olsi Caushi	The Role of Pharmacists in Pandemic Management: Responsibilities and Contribution in Education, Counseling, and Medication Assurance	424
Nedeljko M. Milanović Andrijana Ž. Miletić Sanja D. Mijajlović	Teachers and Parents in The World of Stem Concepts - Action Research in the Function of Popularizing Stem Activities	434
Şekip Caner Esmerli Ceyla Özgür	Optimization of Exhaust Emissions of A Diesel Engine Using Different Proportions of Alcohol Diesel Fuel Blends	446
Olufemi Adeyemi ADETOLA	Selected Physical, Mechanical and Chemical Properties of Groundnut Kernel for Processing of Groundnut	459
Ana Luiza Ferreira Aydoğdu	The Influence of Nursing Teamwork on The Quality of Care	477
Serap Tepe Serkan Eti	Determining the Levels of Psychological Preparedness for Disasters Among Students in the Health Field	487
Canan Vejselova Sezer Mustafa Cengiz Hatice Mehtap Kutlu	Evaluation of Effects of Harpagophytum Procumbens on Wound Healing: an in Vitro Study	502
Mustafa Cengiz	Evaluation Of The Cytotoxicity Of Devil's Claw Plant On Mouse Fibroblast Cells	511
Bukola O. Adetola Ireoluwa H. Omoniyi Raquel H. Nieves	Social Sustainability Perceptions of Osun-Osogbo Festival at Nigeria’s World Heritage Site	521
Özgür Karataş Emine Öztürk Karataş	Sports Facilities Problem in Turkish Sports	536
Özgür Karataş Emine Öztürk Karataş	Institutionalization in Football Clubs	546
Mehmet Salih Durdu Uğur Talaş Burakhan Çubukçu	Construction Management And Image Processing Based Inventory Tracking Automation	556
Latif Onur Uğur	A Model for Determining The Achievement Level in Civil Engineering Education	567
Ijlal Ocak Emine Akkaş Baysal Hazal Çelikkaya	An Action Research on Using “Outdoor Experiments” on “Pressure” Subject in 8th Grade Science Teaching	599

Halime Erzen Yıldız Berna Oto	The Interaction of Electromagnetic Radiation With (18F) Fluorodeoxyglucose	624
Nazila Ragimova Almammadova Mehriban	Improving the Approach to Software Configuration of Automated Control Systems Using Experimental-Static Models	630
Uğur Duran	The Hermite-Bell-Based Apostol-Bernoulli Polynomials	636
Uğur Duran	The 2-Variable Truncated Degenerate Exponential Polynomials of Order A	649
Celalettin Vatandaş Saniye Vatandaş	Transformation Process of Shopping Spaces and Shopping Centres	669
Erdinç Cesur	An Evaluation on Determining Common Success Factors of High-Performance Insurance Agencies	680
Haşim Bağcı	Review of Cash, Debt and Profitability Situation in İstanbul Stock Exchange Real Estate Activities Sector	698
Dora Naletina Toni Kozina Tomislav Rožić	The Importance of Safe Public Transport: A Systematic Literature Review	712
J. Nadhiya K. Snega MK Vijayalaskmi	Therapy for Tuberculosis and Medication Schedules: A Comprehensive Review	728
Süleyman Karataş Özlem Güngören Pazzanese	Opinions Of Education Administrators On Effective School Development: A Case Study	737
Olufemi Timothy Ogunbode Ogbomoso, Oyo State	Decolonization and its Aftermath: Pessimism and Optimism's description of Nigerian Space, 1980 s- 2015	742
Olufemi Timothy Ogunbode Ogbomoso, Oyo State	A History of the Phenomena of the 'First' in the Baptist Medical Centre Ogbomoso, 1907-1997	755
Süleyman Karataş Zhyldyz Akunova	Migration Policies In Education, Immigrant, Asylum Seeker And Refugee Problems: The Case Of Afghan Immigrants	771
Ali Beyhan Uçak	Benefitting from Climate Data, Siirt Zivzik Pari Determination of Plant Water Consumption	787
Ali Beyhan Uçak	Sunflower Lines Using Climate Data Determination of Plant Water Consumption	796
M. Berkay Kızılkan Eda Koçak Giyak	A Review To Space Syntax With The Scope Of Urban Planning And Architecture	808
Yusuf Sert	2,4-Dihydro-1h-Cyclopenta[B]Indol-3-One: Frontier Molecular Orbbital Analysis	819
Yusuf Sert	2-(2,6-Dioxopiperidin-3-Yl)-5-Fluoroisoindoline-1,3-Dione: Molecular Docking and Mep Analysis	827
Miray Kaya F. Gül Koçsoy	The Function of Gothic Objects In "The Transition of Juan Romeo" and "The Enormous Radio"	836
Kağan Günçe	Conservation of Vernacular Architecture in Rural Settlements with Tourism: A Case Study from Northern Cyprus	845
Hümeyra Akbayir Mahsa Hakki	Investıgatıon of Children's Educational Place Furniture in Terms of Ergonomics	863
Zeynep Tatlı Emine Timuçin	Concept Cartoon Development Process Of Teacher Candidates	882
Zeynep Şimşek Irfan Marangoz	Strength Measurement Tests In Individual And Team Sports	896
Tuğçe Bulut Demir Irfan Marangoz	Frequently Used Methods in Determining the Aerobic Capacity of Athletes	907
Elif Sarıgüzmen	Match Box Packaging Designs Produced as Corporate Identity Carrier Reflections of 20th Century Art Movements	929
Fatma Gür	A Current Denture Base Materials: Polyetheretherketone (Peek)	951
Onur Muratal Hasan Ismail Yavuz Can Duran Funda Gül Koç Rıdvan Yamanoğlu	Hot-Press Coating of Ni-Hard 4 Alloy on Pure Iron	968
Nurullah Taş	From Traditional to Smart: Managing Change in Cities	977

Nurullah Taş	Local Government Activities Towards Becoming A Smart City: The Case of Istanbul	991
Merve Kılıç Ayden Çoban	The Effect of Current Inductıon Methods on The Intrapartum Process	1008
Müslim Bayrak Mehmet Irfan Karadede	Effects of Vitamins on Orthodontic Tooth Movements	1016
Filiz Büyüker Tan Şeyda Korkmaz Özlem Tuna	Investigation Of Activated Carbon Production And Dyestate Removal From Surgery Sludge	1025
Filiz Büyüker Tan Şeyda Korkmaz Özlem Tuna	Production Of Activated Hydrochar By Hydrothermal Carbonization Method And Its Evaluation In Crystal Violet Adsorption	1031
Eldam Shams Aldeen Mustafa Gediz Uğuz	Modification And Characterization Of Clinopthylloline For Adsorptive Desulfurization Of Crude Oil	1037
Mena Azimi Mehtap Ünlü Söğüt	Relationship Between Vitamin B-12 and The Human Gut Microbiome	1051
H. Hazar Camci F. Betül Yilmaz Güler Gülşah Aktaş Çelik Ş. Hakan Atapek	Metallurgical and Mechanical Characterization of Aluminide Coated Inconel 625 Alloy by Thermo-Reactive Diffusion Method	1070
Abdulaziz Alkan F. Betül Yilmaz Güler Gülşah Aktaş Çelik Ş. Hakan Atapek	Surface Modification of Ti6al4v Alloy by Thermo-Reactive Diffusion Coatings	1079
Işıl Var Nuray Güzeler Büşra Alomar Berfin Sucu	Effect of Spirulina platensis on Lactic Acid Bacteria Used as Starter Culture in Cheese Production	1089
Işıl Var Berfin Sucu Çağrı Çelik Nuray Güzeler	Evaluation of Employees in a Catering Company in Terms of Hand Hygiene	1101
Kübra Öztürk Emine Anik	Digital Human Resources Management and Digital Marketing Management; Innovative Cooperation	1114
Ersin Orak Mithat Şimşek	Determination Of Speed And Amperage Parameters In Cnc Plasma Air Cutting Processes	1122
Raziye Pekşen Akça Hatice Bekçi Umay Büşra Celiloğlu	Supporting Children Learning with Nature with Biomimicry	1134
Görkem Öztürk Mehmet Fırat Baran Belma Doğan Öz	Economic Analysis Of Open Vegetable Production In Batman Province	1140
Görkem Öztürk Mehmet Fırat Baran Belma Doğan Öz	Profitability Analysis of Field Crops Production in Batman Province	1151
Eda Koçak Giyak	Evaluation of The Concept of Urban Heat Island in Terms of Urban Sink Areas	1161
Dilan Kenanoğlu Yeşim Fazlıoğlu	Content Analysis of Postgraduate Theses on Multicultural Education	1170
Bektaş Kadakoğlu Bahri Karlı Alamettin Bayav	Structural Analysis Of Wheat Production: Türkiye Example	1208
Nguyen Thi Kim Phuoc Le Tran Thanh Liem	Heavy Metals Polluted Soil Treatment by Phytoremediation in Vietnam – A Review	1224
Erhan Kahya Yasin Aslan	Identification of Artichoke (*Cynara scolymus*) on Seedlings with The Help of Deep Learning Method	1242
Azra Namuslu	In The Context Of Otheralization In Queer Cinema: Movie Analysis Of Your Name Engraved Here	1263
Burcu Kunay Hilal Özdemir	Analysıs of the Impact of Sustainable New Luxury Brands on Generatıon Y and Z's Purchase Intentions and Consumer Behavıor in Terms of Gender and Income Status	131

Selin Atık	Flat Character Desıng; The Example of The Jetsons	1298
Kemal Barış Ilbi Ceren Güneröz	Evaluation of Gertrude Stein's Studio in the Context of Postmodern Museum Practices	1311
Ismail Keleş Alpaslan Bayrakdar	Phytotherapeutic Plants Commonly Used In Wound Care In Iğdir Province	1328
Busra Özdenizci Köse	From Bits to Qubits: Exploring the Quantum Software Development Lifecycle	1342
Busra Özdenizci Köse	Challenges and Innovations In Testing and Validation for Quantum Software Development	1350
Mehmet Karaman	Examination of Advanced Bread Wheat Genotypes (*Triticum aestivum* L.) in Terms of Yield and Some Technological Quality Characteristics	1357
Mehmet Karaman	Evaluation of Some Chickpea Varieties in Terms of Morphological and Physiological Characteristics	1367
Çiğdem Akça İsmail Karabekmez Filiz Boran Erol Alver	Production of Carbon-Based Materials From Walnut And Peanut Biomass	1377
Sena Eren Semanur Sağlam Feride N. Türk Hasan Arslanoğlu	Cr (VI) Removal of Çanakkale Çan Thermal Power Plant Flue Gas Treatment Waste from Wastewater: Comparison with Magnetic Activated Carbon	1385
Bahri Gür Fatma Gür	Interaction of Selenium with Apoptotic Markers in Chemotherapeutic Agent-Induced Liver Injury: in Silico Evaluation	1395
Haluk Gümüş Hakan Adanacıoğlu	Food Miles: an Assessment of Agricultural Products	1412
Faysal Selimoğlu	Studies On The Use Of Chemometric Methods In The Biotechnological Production And Analysis Of Antibiotics	1434
Gül Eda Kılınç Yeliz Vergi	Evaluation of Nutritional Status and Physical Activity Levels in Nutrition and Dietetics Department Students	1457
Gül Eda Kılınç Alev Keser	Evaluation of Sensory Properties of Plant-Based Fermented Beverages	1473
Zehra Funda Akbulut Soner Guler	Sustainability in Concrete: Exploring the Benefits of Pozzolanic Cementitious Materials	1493
Zehra Funda Akbulut Soner Guler Faruk Osmanoğlu Mehmet Rıza Kavanç	Assessing the Role and Significance of Colored Concrete in Modern Construction Practices	1501
Nasirov Azimidin Normamatovich	French and the Image of Amir Temur Interpretations in Uzbek Literature (in the example of the novels of Marcel Brion and Muhammad Ali)	1508
Botirov Azizbek Mirzakarimovich	Students in the Process of Independent Education Forming Knowledge Skills	1516
Rakhimov Akmal Akbarovich	Information in the Process of Electronic Education Methods of Ensuring Security	1521
Senem Akkoç Eyüp Başaran	Synthesis, Spectral Characterization and Antiproliferative Activity of a Novel Thymol-Linked Imino Compound	1526
Eyüp Başaran Senem Akkoç	A Novel Fluorine-Containing Hydrazone Compound: Synthesis, Structural and in Vitro Cytotoxic Activity Studies	1536
Nurhan Doğan	Project Implementation Course the Role of the Scientific Research Methodology in Determining the Self-Efficacy Level	1546
Nurhan Doğan İsmet Doğan	Suicide Mortality Trends in Children, Adolescents And Young Adults in Turkey	1554
Canser Gül Nilay Çömez Sevda Albayrak Hülya Durmuş	The Effect of Surface Treatments on Wear Resistance in Cold Spray Coating of 7075 Aluminum Alloys	1564
Hülya Durmuş Canser Gül	Effects of Surface Treatments Prior to Cold Spray on the Wear Resistance of 2024 Alloys	1574

Nilay Çömez Sevda Albayrak		
Esra Bilici	The Role of Estrogen Receptors in Malignities	1586
Latif Onur Uğur Servet Kesim	A Model Proposal for Estimate the Approximate Costs and Contract Fees of Public Education Buildings (School Buildings)	1595
Özge Kutlu Sevinç Sütlü	Digital Old Age: Digital Literacy and Adaptation to Technology in The Elderly	1624
Özge Kutlu Deniz Say Şahin	Safe Housing from Elderly Rights Perspective	1630
Celalettin Vatandaş Saniye Vatandaş	Semantic and Functional Change of Shopping and Fashion in the Age of Consumer Culture	1636
Celalettin Vatandaş Saniye Vatandaş	Transformation Process of Shopping Spaces and Shopping Centres	1647
Nalan Şahin Petek Balcı Ali Kara	Investigation of the pH Effect on APN Polymer	1658
Nalan Şahin Petek Balcı Ali Kara	Investigation of The Temperature Effect on APN Polymer	1667
Sevde Hasanoğlu Sayın Fatih Karataş Fatıma Ceren Tunçel Meral Günaldı Sacide Pehlivan	Investigation of The Htert Gene Mns16a Vntr Variant in Lung, Breast and Gastrointestinal Cancer Patients	1678
Sevde Hasanoğlu Sayın Sacide Pehlivan	Molecular Mechanisms of Pyroptosis and Its Relationship with Diseases	1687
Alamettin Bayav Bektaş Kadakoğlu Bahri Karli	A Global Outlook on Beekeeping from Türkiye	1701
Doğan Arslan Aynur Bilmez Özçınar	Medicinal and Aromatic Plants from Past to Present	1712
Ayşe İrem Keskin Cevdet Kızıl	Continous Assurance Auditing and Computer-Assisted Accounting Auduting Processes	1718
Melike Karabaş Ayden Çoban	Women's Awareness Towards Gynecological Cancers: The Example of Denizli Province	1728
Ismail Akşit Bahri Gür	The Importance Of Duties And Responsibilities In The Area Of Health And Safety At Work	1748
Özgür Cengiz Ismail Akşit Okan Özbakır	Measures to Be Taken Within the Scope of Occupational Health and Safety in The Textile Industry	1760
Dicle Özavcı	Repair of Traditional Masonry Stone Lime Buildings	1772
Mehmet Turhal	Multifractal Behavior of the Electrooculography Signal	1786
Mehmet Turhal	Reactive NiO Thin Film Coating Application with DC Magnetron Sputtering Method	1800
Muhammet Bayram Topcu Ali Fuat Güneri	Engaging Flight Crew in Occupational Health and Safety Risk Management: an Implementation Occupational Health and Safety Volunteer Flight Crew	1813
Erdinç Cesur	A Review on Professional Skills and Competencies Affecting the Performance of Insurance Professionals	1830
Alper Tunga Şenay Ali Aygün	Effects Of Outdoor Access Age On The Body Weight Of Broilers Raised In A Free-Range System	1848
Ayşe Çoban Taner Çevik	Performance Evaluation of ConvNeXt, Swin Transformers and ResNet-50 Models for Classification of Medical Images	1854

Fatih Özyurt Engin Avcı		
Emine Timuçin Zeynep Tatlı	Reflectıons of an Online Training Program About Autism	1863
Berkant Dindar	Carbon Fiber Reinforced Nanocomposite Swim Fin Design	1881
Mustafa Er Elif Nur Er Özkan Mete Kalyoncu	Optimization of Material Transportation Route During The in-Factory Logistics Process Using the Bees Algorithm	1887
Selda Karadağ Fikret Bektaşoğlu Turgut Kırmızıbayrak	General Situation of Turkey Breeding in Türkiye	1899
R. Gülay Öztürk	New Consumers of The Digital World and The Digitalization of The Gifting Tradition	1911
Nancy lilly Maria C.S. Suganthi P	Sustainability 2.0: Harnessing the Power of Innovation to Heal Our Planet	1931
Songül Düger Gülay Ekici	Interculturalism and Coursebook: A Critical Analysis	1935
Songül Düger Gülay Ekici	A Content Analysis Of Research From Different Countries On Pisa Exam Results	1951
Atik Rahimov	Syrian Arab Republic in the Eurasianism, Middle East and Mediterranean Policy of the Russian Federation from Historical Perspective to the Present	1969
Berkay Karaçor Metin Mustafa Elçim Mustafa Özcanlı	A Modal Analysis Study Using Different Materials in the Formula Student Car Chassis	1982
Berkay Karaçor Anıl Aslan Mustafa Özcanlı Özgür Kılınç	An Optimization Study: Examining Different Materials Usage in The Truck Chassis	2006
Canan Duygu Arslan Pınar Sökülmez Kaya	The Role Of Nutrition In Circadian Rhythm	2034
Farid Huseynov Ibrahim Dipçik	Trust and Help Intention of Internet Users Regarding Calls for Help in Disaster Relief Calls Via Social Media: A Survey Research	2046
Ibrahim Dipçik Farid Huseynov	The Role of Social Media in Disaster Relief and Crisis Communication: A Literature Review	2055
Ilkün Orbak Âli Yurdun ORBAK	Lean Manufacturing Study in Industrial Engineering – Automotive Supplier Company Application	2063
Taner Ateş Huseyin Selcuk Kılıç Bahar Sennaroğlu	An Analysis of Time Series Data and Enhancing Demand Forecasting Accuracy: A Case Study Using Arima Modeling in Glass Production Industry	2084
Durmuş Ali Bircan Bekir Yıldırımcı Yılmaz Erbil	Minimizing Delamination Factor in Glass Fiber Reinforced Plastic Composite Drilling Through Taguchi Optimization	2111
Erkin Cihangir Karataş	Water Resources and Availability Status in Turkey	2123
Melekber Sülüşoğlu Durul Sezai Ercişli	The Importance Of Callus Culture In Fruit Growing And Its Areas Of Use	2131
Özlem Arat Dilek Kaya-Akyüzlü Mustafa Danışman Selin Özkan-Kotiloğlu	Effect of Faah Rs324420 Polymorphism on The Risk of Opioid Use Disorder	2140
Çiğdem Akça İsmail Karabekmez	Production of Carbon-Based Materials From Walnut And Peanut Biomass	2150

Filiz Boran Erol Alver		
Hasan Hüseyin Öztürk Ulaş Başar Gezgin	Optimism in Positive Psychology	2158
Feyza Döndü Bilgin	Effects of Drought on Paspalum dilatatum Anatomy	2166
Muhammed Emre Ayhan	Sers Active Nanomaterials for Biosensor Application	2177
Cem Özkurt Emir Ayçiçek	Text Summarisation with Deep Learning: An Investigation on the Effect of Epoch Number	2189
Fatma Aksoy Hanife Durgun Neslihan Geçer	Nursing Care of a Patient with a Diagnosis of Pneumonia According to The Henderson Nursing Model: Case Report	2196
Fatma Aksoy Hanife Durgun Beyzanur Toy	Orlando's Nursing Interaction Model For Nursing Care in The Postpartum Period: Case Report	2209
Hanife Durgun Fatma Aksoy Nejla Köksal	Nursing Care Plan for A Copd Patient According to Roy Adaptation Theory: Case Report	2219
Raymond Oriebe Anyasi Harrison Ifeanyichukwu Atagana Desmond Chiagozie Agbo Joyce Onyenaturuchi Anyasi Raymond	Modelling of the Growth of Tobacco by Indole Acetic Acid (IAA) Used to Control Soil Organic Pollution	2229
Kabiru Hamisu Hafsat Sanusi Mohammed Sulaiman Auwalu Yaro Abdulnasir Lawan Isah Ahmad Usman Shuaib Abdullahi Taofeek Lawal G. Sriker Reddy	Influence of Artificial Intelligence in Sustaining Agriculture and Poverty Alleviation in Nigeria	2241
Fatma Meydaneri Tezel Necmi Serkan Tezel	Mxenes for Energy Storage in Supercapacıtors	2255
Fatma Meydaneri Tezel Necmi Serkan Tezel	Effects of Pore Structure on Electrochemical Charge Storage Mechanism in Supercapacitors	2264
Şerife Nur Güçlüer Ayden Çoban	Postpartum Hypertensıon and Current Approaches	2278
Imo Moses Akpan Michael Okon Bassey Aniekan Essienubong Ikpe	Adoption of Electric Vehicles (Evs) As A Sustainable Transportation Solution: Reshaping the Trends in Conventional Automobile Applications	2286
Nazila Ragimova Almammadova Mehriban	Improving the Approach to Software Configuration of Automated Control Systems Using Experimental-Static Models	2305
Imade Choulli Mustapha Elyaqouti Elhanafi Arjdal Driss Saadaoui Dris Benhmamou	JAYA-Integrated Hybrid Optimization: Accurate Estimation of Single-Diode Model Parameters in Photovoltaic Cells	2311
Denada Ahmeti Ambra Purde	Effects of Artficial Intelligence on the Labor Market	2321
Pham Duc Thuan	Diplomatic Relations Between Vietnam and the United States As Seen From Us Covid-19 Vaccine Aid Policy to Vietnam	2331
Nina Kanev Assya Bojinova Karolina Papazova	Anatase/Rutile Composites – On The Photocatalytic Degradation Of Orange Ii Azo-Dye	2348

Nina Kanev Assya Bojinova Karolina Papazova	Synthesis Of Zno, Znfe2o4 And Zno/Znfe2o4 Films And Investigation Of Their Photocatalytic Efficiencies	2359
Irina-Ana Drobot	Walks in the Personal Opinions and Fictional Works of Virginia Woolf and Graham Swift	2371
Mammadova Asmethanım	Consonants in Two Languages of The Same Language Famıly Within Comparative Study	2381
Səriyyə Abidova Elşən Qızı	Quba qəzasında yaşayan etnik qruplar	2491
Vusal Zulfugarov	Organization of İnterdisciplinary Research at Azerbaijan National Academy of Sciences: Philosophical Approach	2397
Seriyye Gündoğdu	The role of Yücel Feyzioğlu in the upbringing of Turkish immigrant children in Germany in line with national-spiritual values	2402
Zekiye Şengül	Adapting to Climate Change through Climate-Smart Agricultural Insurance Smart Contracts and Distributed Ledger Technology (DLT)	2413
Fırat Pala Husrev Mennan	Principles Of Integrated Pest Management	2430
Fırat Pala Husrev Mennan	Weeds for Ecological Restoration	2438
Abdurrahim Yilmaz Fatih Demirel Sipan Soysal	A General Assessment of Seed Banks	2444
Fatih Demirel Sipan Soysal Abdurrahim Yılmaz	In Silico Investigation of Some Monoterpenes Against Fusarium oxysporum	2452
Sipan Soysal Fatih Demirel Abdurrahim Yılmaz	Use of Seaweed Fertilizers in Organic Farming	2459
Ibrahim Selvikaya Abdurrahim Yılmaz	Dormancy in Seeds and Methods of Breaking Dormancy	2469
Hilal Yılmaz Serap Demirel Sibel Turan Sirke	The Role of WRKY Transcription Factors in Drought Stress Tolerance of Plants	2478
Serap Demirel Hilal Yılmaz Sibel Turan Sirke	Use of Ribosome-Inactivating Proteins (RİPs) in Agriculture	2487
Sibel Turan Sirke Hilal Yılmaz Serap Demirel	Use of Chloroplast Genomes in Plant Breeding	2503
Seyithan Seydoşoğlu Gülşah Bengisu	What's That Smell? Alternative Forage Basil with Reference of Pharmacological Animal Studies	2516
Cemal Özalp	Determining the Relationship Between Nurses' Evaluation of Health Technologies and Their Attitudes Towards Artificial Intelligence	2530
Arzu Altuntaş	The Effects of Global Migration on Urban Identity from the Perspective of Landscape Architecture	2540
Arzu Altuntaş	An Evaluation on Artificial Intelligence Supported Design and Planning in Landscape Architecture: Trends and Applications	2549
Nilgün Onursal	Analysis Of Adsorption Kinetics Of Zinc With Malatya Kilo With Linear Models Derived From Pseudo-Second Kinetic Order Model	2559
Nilgün Onursal	Examination Of The Removal Of Cobalt (Ii) From Aqueous Solution By Mixed Type Sivas/Yildizeli Clay In Terms Of Isotherm And Kinetic	2568

Hatice Bekçi Raziye Pekşen Akça Umay Büşra Celiloğlu	Contribution Of Experimental Activity Examples Prepared For Children To Learning	2581
Pınar Kızılkaya Handan Evran	Composite Film Production From Cellulose Nanofibrils	2587
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Ismayilova Konul Idris Ismayilova Fatma Zakir Mammadov Shahmar Ajdar	Insulin Resistance And Iron Metabolism In Diabetes	2605
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Ismayilova Fatma Zakir Abaszade Zumrud Amirgulu Mammadov Shahmar Ajdar	Characterization And Diagnostic Determination Of Physiological Changes Of Persistent Hyperplasia Of The Thymus Gland	2612
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Aliyeva Samaya Mirmohammed Jafarova Zemfira Ibrahim Alakbarova Mehriban Gani	Pathophysiology, Clinical Manifestations And Adipose Tissue Dysfunction Of Metabolic Complications Associated With Adiposogenital Obesity	2621
Karimova Rena Jabbar Irada Aliyeva Jamilyevna Huseynova Gulbeniz Asif Abiyev Huseyn Azizulla Aliyeva Gunel Muharram Mammadov Shahmar Ajdar	Physıologıcal Study Of Adrenal Cortex Drug Deficiency	2631
Karimova Rena Jabbar Babayeva Mansura Yashar Irada Aliyeva Jamilyevna Abiyev Huseyn Azizulla Aliyeva Gunel Muharram Mammadov Shahmar Ajdar	Stress-Induced Disruption Of The Adrenal Glands, One Of The Most Important Organs For Pregnancy	2638
Ömer Keski Merve Okutan	Investigation Of Catalyst Effect In The Preparation Of Pda Based Melamine Sponges	2647
Şahin Ay	Money Laundering Crime And Related Regulations	2660
Yeter Çilesiz	An Overview of Artificial Intelligence (AI) Applications in Agricultural Biotechnology	2667
Yeter Çilesiz	Modern Plant Biotechnology to Achieve Food Security	2675

ABSTRACT

ARABIDOPSIS THALIANA'DA HB24 GENİNİN FONKSİYONEL ANALİZİ VE ADVENTİF KÖKLENMEDEKİ ROLÜ

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ÖZET
Adventif köklenme bitkilerin kök dokusu dışındaki bir dokudan köklenmesi olayıdır. Zirai alanda yetiştirilen birçok tür, çelik yöntemiyle başarıyla üretilebilir ve uygulaması kolaydır, ancak bu tekniğin başarısı, çeliğin adventif kök oluşturma yeteneğine bağlıdır. Adventif köklenme aynı zamanda vejetatif yolla üreyen bitkiler için de önemlidir. Hormonların adventif köklenme üzerinde önemli etkileri olduğu bilinmektedir. Çelikle bitki üretiminde IBA ve IAA hormonları yaygın olarak kullanılan hormonlardır. IBA' ın etkisini IAA'e dönüşerek gösterdiği düşünülmektedir. Bu nedenle IBA-IAA dönüşümü, adventif kök oluşumunda kilit bir rol oynamaktadır. HB24 geninin Arabidopsis türünde köklenme sürecinde görev aldığı ve IBA-IAA dönüşümünü kontrol ettiği bilinmektedir, buna rağmen adventif köklenme üzerindeki etkileri tam olarak araştırılmamıştır. Bu çalışma HB24 geninin adventif köklenme üzerindeki etkilerini araştırmayı amaçlamıştır. Bu amaçla HB24 geninin insersiyonel TDNA mutant hatlarında adventif kök gelişimi yabanıl tip bitkilerle karşılaştırmalı olarak analiz edilmiştir. Çimlenme sonrası kökler uzaklaştırılarak, hipokotil kısımları medyaya temas edecek şekilde yeni bir medyaya aktarılmıştır. Bitkilerin adventif kök oluşumu 7. gün sonunda gözlenmiştir. Mutant bitkilerde yabanıl tip bitkiler ile karşılaştırıldığında adventif köklenmenin azaldığı gözlemlenmiştir. Bu etkinin bir transkripsiyon faktörü olan HB24'ün IBA-IAA dönüşümünü gerçekleştiren genlerin anlatımlarını kontrol ederek gerçekleştirdiği düşünülmektedir. Bu çalışma ile elde edilen sonuçlar adventif köklenmenin daha iyi anlaşılabilmesi adına önemli veriler ortaya çıkarmıştır. 2210-A burs programı için TÜBİTAK'a ve bu araştırmayı finanse ettiği için Çanakkale Onsekiz Mart Üniversitesi BAP'a (Zeytin HB24 geninin karakterizasyonu ve Fonksiyonel Analizi - FBA-2022-3917) teşekkür ederim.
Anahtar Kelimeler: Adventif köklenme, HB24, IBA-IAA dönüşümü

FUNCTIONAL ANALYSIS OF HB24 GENE AND ITS ROLE IN ADVENTITIOUS ROOTING IN ARABIDOPSIS THALIANA

ABSTRACT

Adventitious rooting is the rooting of plants from a tissue rather than the root tissue. Many cultivated agricultural species can be successfully propagated by the cutting method and are easy to implement, but the success of this technique depends on the ability of the cutting to form adventitious roots. Adventitious rooting is also important for plants that reproduce vegetatively. It is known that hormones have important effects on adventitious rooting. IBA and IAA hormones are hormones widely used in the cutting method. It is thought that IBA shows its effect by turning into IAA. Therefore, IBA-IAA conversion plays a key role in adventitious root formation. It is known that the HB24 gene is involved in the rooting process and controls the IBA-IAA conversion in Arabidopsis species, but its effects on adventitious rooting have not been fully investigated. This study aimed to investigate the effects of the HB24 gene on adventitious rooting. For this purpose, adventitious root development in insertion TDNA mutant lines of the HB24 gene has been analyzed comparatively with wild-type plants. Following germination, roots were removed, and hypocotyl portions were transferred to new media in a manner that they would come into contact with the media. Adventitious root formation in plants was observed after 7 days. It was observed that, compared to wild-type plants, adventitious rooting decreased in mutant plants. This effect is thought to be mediated by HB24, a transcription factor, regulating the expressions of genes involved in IBA-IAA conversion. The results obtained from this study have provided important data for a better understanding of adventitious rooting. I would like to thank TÜBİTAK for 2210-A scholarship program and Çanakkale Onsekiz Mart University BAP (Characterization and Functional Analysis of the olive HB24 gene - FBA-2022-3917) for funding this research.
Keywords: Adventitious rooting, HB24, IBA-IAA transformation

PROVERBS EXPRESSION WITH KINETIC TYPOGRAPHYABSTRACT

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ABSTRACT
Introduction and Purpose: Communication is our most basic need. Language is the most important tool for people to communicate with each other. Language consists of words and defines verbal communication, which is the most effective form of communication. The need for communication has constantly changed in the historical process and gained new forms. Technology has developed, changed and new communication channels have been formed with the need to reproduce information and deliver it to more masses. With the development of technology, which is one of the most important parts of this change, people's communication styles, their understanding of entertainment, and their social environment interactions have been reshaped. Each language has proverbs that describe its own values. Proverbs are a concise, pleasing, stereotyped expression tool that shows the moral and cultural values, lifestyle and thought structure of nations. In the simplest terms, kinetic typography is expressed as an animation application that conveys emotions and thoughts while using movement and writing together. Today, the widespread use of digital environments, smart devices, etc. and the need to access and comprehend information quickly have expanded the usage areas of kinetic typography. This research is about the expression of a proverb selected to transfer proverbs from the past to the present with kinetic typography. Due to the insufficiency of the number of previous studies on this subject, the aim of this research is to create an experimental example. The example chosen for the research; Ömer Asım Aksoy's "Dictionary of Proverbs and Sayings
Keywords: Proverbs, Kinetic Typography

RIEMANN OLMAYAN MANIFOLDLARDA ÇEMBER KORUYAN DÖNÜŞÜMÜN VARLIĞI ÜZERINE

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ÖZET
Weyl uzayları, Hermann Weyl tarafından 1918 yılında fizikteki birleşik alanlar teorisini formülüze etmek için ortaya atılmıştır. Weyl'in bu çalışması başta kabul edilmese de Weyl manifoldları hem fizikçilerin hem de matematikçilerin ilgi alanlarından olmuştur. Koordinat fonksiyonu ile ifade edilen metrik tensör uzayımızın yapısını belirlemede büyük önem taşır. Bu çalışmada, öncelikle olarak, Riemann manifoldları, bu manifoldlara ait uzayın geometrik büyüklükleri, bu büyüklüklere dair eğrilik ve eğrilikle ilgili özellikler; sonrasında Weyl manifoldları, bu manifoldların yapılarına dair özellikler verilerek; bunlara ek olarak üzerinde yarı simetrik rekürant metrik koneksiyonu tanımlanmış Weyl manifoldları ve bu manifoldların eğrilikleri, ilgili özellikleri ve niceliklerinden bahsedilmiştir. Böylece farklı metriklerle tanımlanmış Weyl uzayının dönüşümleri içerisinde yer alan bileşenleri nasıl değiştiği gözlenmiştir. Weyl manifoldları üzerinde çember koruyan (konsörkılır) dönüşümün varlığı incelenerek; ispatlanmıştır. Bunun yanısıra yarı simetrik rekürant metrik koneksiyona sahip eğriliğin yapısı, bu dönüşüm altında simetri özellikleri, Bianchi özdeşliği ispatlanarak literatüre kazandırılmıştır. Konsörkılır eğriliğin konformal eğrilik altında gradyant olabilmesi için gerek ve yeter koşul ispatlanarak, gösterilmiştir.
Anahtar Kelimeler: Weyl Manifoldlar, Riemannian Manifoldlar, Konsörkılır Dönüşümler

ON THE EXISTENCE OF CONCIRCULAR TRANSFORMATION ON NON-RIEMANNIAN MANIFOLDS

ABSTRACT
Weyl spaces were introduced by Hermann Weyl in 1918 to formulate the unified field theory in physics. Although Weyl's work was not accepted at first, Weyl manifolds have been of interest to both physicists and mathematicians. The metric expressed by the coordinate function is of great importance in determining the structure of our tensor space. In this study, first, Riemannian manifolds, geometric quantities of the space belonging to these manifolds, curvature and curvature related properties of these quantities; then Weyl manifolds, properties related to the structure of these manifolds; in addition to these, Weyl manifolds on which the semisymmetric recurrent metric connection is defined and the curvatures of these manifolds, the related properties and quantities are mentioned. Thus, it is observed how the components in the transformations of Weyl space defined by different metrics change. The existence of a circle preserving (concircular) map on Weyl manifolds is analyzed and proved. In addition, the structure of the curvature with a semisymmetric recurrent metric conformation, symmetry properties under this transformation, and Bianchi identity are proved and introduced to the literature. The necessary and sufficient condition for a concircular curvature to be gradient under conformal curvature is proved and shown.
Keywords: Weyl Manifolds, Riemannian Manifolds, Concircular Transformation

PUBLIC ADMINISTRATION DECISIONS IN THE CONDITIONS OF MILITARY AND HUMANITARIAN CRISES

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ABSTRACT
Crisis situations, whether military or humanitarian in nature, present complex challenges for decision-makers. The decisions made during such crises can have significant impacts on human life, safety, and well-being. This makes it essential that public administrators take a thoughtful and informed approach to decision-making in such situations. This essay will explore the role of public administration in navigating military and humanitarian crises. It will argue that decisions made during crisis situations should prioritize the protection of human life and safety, be transparent and accountable, and involve international cooperation and coordination. However, it will also consider counter-arguments that suggest decisions may need to prioritize national security interests, be made quickly and without full information, and may be difficult to achieve international cooperation and coordination. During crisis situations, decisions must prioritize the protection of human life and safety. Such decisions should be based on the principles of human rights and humanitarian law. This means that the needs of vulnerable populations, such as refugees and internally displaced persons, should be taken into account. Decision-makers should also consider the potential long-term consequences of their actions. For example, decisions made during military crises may have lasting impacts on the political and social stability of affected areas. Therefore, public administrators must take a comprehensive approach to decision-making during crises, which prioritizes the needs of affected communities. In addition to prioritizing human life and safety, decisions made during crisis situations should be transparent and accountable. This means that decisions should be communicated clearly to the public, and based on evidence and expert analysis. Decision-makers must be accountable for their actions and decisions, and should be willing to answer questions and justify their choices. Transparency and accountability are essential for maintaining public trust and ensuring that decisions made during crisis situations are effective and just. International cooperation and coordination are also essential for effective decision-making during crisis situations. Decisions should be made in consultation with other governments and international organizations, taking into account international norms and standards. Collaboration with non-governmental organizations and civil society groups can help ensure decisions are informed by the needs of affected communities. Effective international cooperation and coordination can help ensure that decisions made during crisis situations are effective, just, and responsive to the needs of affected communities.
Keywords: Crisis**,** human life, safety

AÇIK DENİZDE İŞLENEN ULUSLARARASI SUÇLARDA CEZA YETKİSİ

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ÖZET
Devletler, kendi egemenlikleri dahilinde olan iç sular ve karasuları ile yetinmemiş, kendi lehlerine hak ve yetkiler barındıran bitişik bölge, münhasır ekonomik bölge ve kıta sahanlığı alanlarında da egemenliklerini kullanmıştır. Tüm bu deniz alanları dışında kalan ve herhangi bir devletin egemenliğinin söz konusu olmadığı deniz alanı ise 'açık deniz' olarak adlandırılmaktadır. Tüm devletlerin ortak kullanımına tabi olan açık denizde, serbestlik ilkesi temel ilkedir. Açık deniz, hiçbir devletin egemenliği altında olmadığından açık denizde bir devletin yargı yetkisinin doğrudan uygulanması söz konusu olmamaktadır. Açık denizde işlenen suçlarda yargı yetkisi tartışmalı olduğu için bu alanda uluslararası işbirliği ve yapılan uluslararası andlaşmalar oldukça önem arz etmektedir. Ceza yetkisi belirlenirken belirli ilkeler ve uluslararası andlaşmalar göz önünde bulundurulmaktadır. Örneğin, 1982 tarihli Birleşmiş Milletler Deniz Hukuku Sözleşmesi, açık denizde işlenen suçlarla mücadele edebilmek için önemli düzenlemeler içermektedir. Ceza yetkisinin belirlendiği ilkelerden biri 'bayrak yasası' ilkesidir. Bu ilke gereğince devletler, kendi bayraklarını taşıyan gemiler üzerinde münhasır yetkiye sahip olmaktadır. Dolayısıyla, geminin bayrağını taşıdığı devlet, gemide işlenmiş olan suçlarda ceza yetkisine sahip olabilmekte ve yargılama yapabilmektedir. Açık denizde suç işleyen kişinin, vatandaşı olduğu devlet de, kendi vatandaşı için ceza yetkisine sahip olabilmekte ve yargı yetkisini kullanabilmektedir. Bazı suçların ise, tüm uluslararası toplumun ortak menfaatlerine karşı işlendiği kabul edilmektedir. Söz konusu bu suçlar işlendiğinde evrensel yargı yetkisi dediğimiz ilke devreye girmektedir. Bu suçları işleyen kişiler, herhangi bir devlet tarafından yargılanabilmektedir.
Anahtar Kelimeler: Açık deniz, uluslararası suçlar, ceza yetkisi, bayrak yasası, evrensel yargı yetkisi

CRIMINAL AUTHORITY FOR INTERNATIONAL CRIMES COMMITTED ON THE HIGH SEA

ABSTRACT
States were not satisfied with the internal waters and territorial waters within their sovereignty. They have also exercised their sovereignty in the contiguous zone, exclusive economic zone and continental shelf areas, which contain rights and powers in their favor. The sea area outside of all these sea areas, where the sovereignty of any state is not in question, is called the 'high sea'. In the high seas, which are subject to the common use of all states, the principle of freedom is fundamental. The high seas are not under the sovereignty of any state. Therefore, there is no direct application of a State's jurisdiction on the high seas. Since jurisdiction over crimes committed on the high seas is controversial, international cooperation and international agreements in this field are of great importance. Specific principles and international agreements are taken into account when determining criminal jurisdiction. For instance, the 1982 United Nations Convention on the Law of the Sea contains important provisions to combat crimes committed on the high seas. One of the principles on which criminal jurisdiction is determined is the principle of 'flag law'. According to this principle, states have exclusive jurisdiction over ships flying their flags. Therefore, the state whose flag the ship flies may have criminal jurisdiction and prosecute crimes committed on board the ship. The state of nationality of the person who commits a crime on the high seas may also have criminal jurisdiction and can exercise jurisdiction over its own nationals. Some crimes are recognized as being committed against the common interests of the entire international community. When such crimes are committed, the principle of universal jurisdiction comes into play. People who have committed such crimes can be prosecuted by any state.
Keywords: High seas, international crimes, criminal jurisdiction, flag law, universal jurisdiction.

ULUSLARARASI SAVAŞ HUKUKUNUN UYGULANMASI

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ÖZET
Savaş ne yazık ki tarih boyunca sayısız insanın ölümüne, yıkıma ve acıya sebep olmuş bir gerçektir. Özellikle 1. ve 2. Dünya Savaşları öncesi dönemde devletler savaşı meşru bir hak olarak gördüğü için bu dönemde savaş tarihin bir parçası haline gelmiştir. Gelişen teknolojik imkanlar, insan nüfusundaki artış ve küresel anlaşmazlıklar sebebiyle 1. ve 2. Dünya savaşları büyük bir insani felakete sebep olmuştur. Dünya kamuoyu artık bu duruma sessiz kalmamayı tercih etmiş ve savaşı meşru bir hak olarak gören geleneği terk ederek savaşı sadece zorunlu durumlarda ve sınırlı bir şekilde uygulanabileceği hukuki bir zemine oturtmaya çalışmıştır. Bunu yaparken savaş suçlarını ve yasaklarını uluslararası sözleşmelerle belirlemiş, bu suç ve yasakların ceza ve yaptırımlarını da belirleyerek bunlara aykırı eylemlerin yargılanacağı yargı organları tesis etmiştir. Bu hukuki reform küresel savaşları engellemiş görünse de bölgesel savaşları engellemede yeterli olamamıştır. Özellikle Bosna'da yaşanan Srebrenitsa Katliamı, ABD'nin Irak'ı İşgali ve Rusya-Ukrayna Savaşı gibi birçok bölgesel savaş gerçekleşmiştir. Savaş suçlarının tespiti ve bu suçların faillerinin yargılanarak cezalandırılması da uygulamada tam anlamıyla etkili olamamaktadır. Bu kapsamda uluslararası savaş hukukunu inceleyip, bu hukuk sisteminin eksik ve aksayan yönlerini tespit ederek çözüm ve öneriler sunmaya çalışacağız.
Anahtar Kelimeler: Savaş, Meşru Müdafaa, Kuvvet Kullanımı, Savaş Suçları

APPLICATION OF THE INTERNATIONAL LAW OF WAR

ABSTRACT
War is unfortunately a reality that has caused countless deaths, destruction and pain throughout history. Especially in the period before the 1st and 2nd World Wars, war became a part of history as states considered war as a legitimate right. Due to developing technological opportunities, increase in human population and global conflicts, the First and Second World Wars caused a great humanitarian disaster. The world public opinion has chosen not to remain silent to this stuation and has abandoned the tradition that considered war as a legitimate right and has tried to place war on a legal basis where it can only be implemented in cases of necessity and in a limited way. While doing this, it determined war crimes and prohibitions with international agreements, determined the penalties and sanctions of these crimes and prohibitions, and established judicial bodies where actions contrary to them would be tried. Although this legal reform seemed to prevent global wars, but it was not sufficient to prevent regional wars. Many regional wars took place, especially the Srebrenica Massacre in Bosnia, the US Occupation of Iraq and the Russia-Ukraine War. The most important reason for this i the detection of war crimes and the prosecution and punishment of the perpetrators of these crimes are not fully effective in practice. In this context, we will examine the international law of war, identify the deficiencies and defects of this legal system and try to offer solutions and suggestions.
Keywords: War, Self-Defense, Use of Force, War Crimes

ÇALIŞMA HAYATINDA KUŞAKLAR VE DEĞİŞEN ÇALIŞMA DEĞERLERİ

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ÖZET
Günümüz çalışma hayatı farklı kuşaklardan oluşmaktadır. Bu kuşaklar literatürde; Sessiz Kuşak (1925-1945), Bebek Patlaması Kuşağı (1946-1964), X Kuşağı (1965-1979), Y Kuşağı (1980-1995) ve Z Kuşağı (1995-2010) olarak adlandırılmaktadır. Her bir kuşağın kendine özgü karakteristik yapısı vardır ve birbirinden farklıdır. Aynı zamanda çalışma hayatında yer alan kuşakların çalışmadan beklentileri ve çalışmaya yükledikleri anlam da birbirinden farklıdır. Bu farklılıkların bilinmesi çalışma ortamında oldukça önem arz etmektedir. İş gücü piyasasının büyük bir kısmı X, Y ve Z kuşaklarından oluşmaktadır. Her bir kuşağın farklılaşan bireysel değerleri ve bunun etkisi çalışma hayatında da kendini göstermektedir. Bireysel değerler ve çalışma değerlerinde ortaya çıkan bu farklılıklar çatışmalara neden olmaktadır. Her kuşağın birbirini anlaması ve farklılıklarının ne olduğunu bilmesi kuşak çatışmalarını azaltacaktır. Ulusal literatürde, kuşak sınıflandırmaları ve kuşakların karakteristik özelliklerinin ele alınışı uluslararası literatürle benzer şekildedir. Her ülkenin, kültürü, değerleri, inançları gelenek ve görenekleri birbirinden farklıdır. Bu farklılıklar toplumun şekillenmesinde ve onların karakteristik yapısında etkili olmaktadır. Her kuşak bulunduğu dönem içinde kendine özgü siyasal, sosyal ve kültürel olarak bir kimlik oluşturmakta ve bulunduğu dönemin koşullarını yansıtmaktadır. Bu nedenle bu çalışmada kuşak konusu Türkiye özelinde ele alınacaktır. Türkiye'deki ekonomik, tarihsel, ve sosyo-kültürel olaylar dönemsel olarak incelenecek ve kuşaklar üzerindeki etkileri belirlenecektir. Ayrıca, kuşakların değişen çalışma değerleri ayrıntılı olarak ele alınacaktır.
Anahtar Kelimeler: Kuşak, Çalışma Değeri, Çalışma

GENERATIONS IN THE WORKPLACE AND CHANGING WORK VALUES

ABSTRACT
Today's working life consists of different generations. These generations are referred to in the literature as the Silent Generation (1925-1945), the Baby Boomers (1946-1964), Generation X (1965-1979), Generation Y (1980-1995), and Generation Z (1995-2010). Each generation has its own unique characteristic structure and differs from one another. At the same time, the expectations from work and the significance attributed to work vary among the generations present in the workforce. The awareness of these differences is highly significant in the work environment. The majority of the workforce consists of Generation X, Y, and Z. The evolving individual values of each generation have an impact on the working life as well. The differences arising in individual values and work values lead to conflicts. Each generation understanding one another and knowing their differences will reduce intergenerational conflicts. In national literature, the classification of generations and the examination of their characteristic features are similarly approached to the international literature. Each country has its own culture, values, beliefs, traditions, and customs that differ from one another. These differences are effective in shaping the society and its characteristic structure. Each generation forms its unique political, social, and cultural identity within the period it exists and reflects the conditions of that period. Therefore, this study will focus on the issue of generations specifically in Türkiye. Economic, historical, and socio-cultural events in Türkiye will be examined periodically, and their effects on generations will be determined. Additionally, the changing work values of generations will be detailedly examined.
Keywords: Generation, Work Value, Work

TÜRK HAVA KURUMU ÜNİVERSİTESİ YAŞAM BOYU GELİŞİM UYGULAMA VE ARAŞTIRMA MERKEZİ (YAGEM) SERTİFİKA PROGRAMLARINA KATILAN YETİŞKİNLERİN KATILIM ÖRÜNTÜLERİ

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ÖZET
Bu çalışma, küreselleşme sonucu üniversitelerin dönüşüm sürecine girmesi ile yaşam boyu öğrenme merkezlerinin sundukları sertifika programlarının tüm dünyada olduğu gibi ülkemizde de artmasından yola çıkılarak, Türk Hava Kurumu Üniversitesi Yaşam Boyu Gelişim Uygulama ve Araştırma Merkezi (YAGEM) bünyesinde sunulan programların düzenlenme biçimleri ile sertifika programlarına katılan yetişkinlerin katılım örüntülerinin ilişkilendirilmesi amacıyla yapılmıştır. Araştırmada, karma araştırma yöntemlerinden üçleme (triangulation) tercih edilmiştir. Araştırmanın evrenini, Eylül, 2022 – Mart, 2023 tarihleri arasında Türk Hava Kurumu Üniversitesi bünyesinde sunulan mesleki ve kişisel gelişim sertifika programlarına katılan 204 yetişkin oluşturmaktadır. Araştırmanın nicel kısmına basit tesadüfi örnekleme ve nitel kısmına kartopu örnekleme ile ulaşılmıştır. Araştırmada elde edilen nicel veriler, araştırmacı tarafından oluşturulan ve uzman görüşü alınan 14 maddelik anket yoluyla basılı ve çevrim içi form olacak şekilde toplanmıştır. Nicel verilerin analizi SPSS programı ile Ki-Kare Bağımsızlık Testi kullanılarak yapılmıştır. Araştırmanın nitel bölümünde ise 6 yönetici, 7 eğitici, 8 terk ve 12 mezun katılımcıyla yarı yapılandırılmış görüşme yapılmış ve veri analizinde betimsel veri analizi yöntemi uygulanmıştır. Araştırmada yetişkinlerin bazı demografik özellikleri, program biçimi ve katılım özellikleri ile katılım amaçları, programı tamamlamama nedenleri, öğrenme sürecinde karşılaşılan güçlükler ve programların sunulma biçimleri ilişkilendirilmiştir. Araştırmada gerek nicel gerekse nitel yöntemler yoluyla toplanan veriler ışığında YAGEM programlarına katılan yetişkin öğrenenler arasında katılım amacı olarak mesleki nedenlerin başat yönelim olduğu bulgulanmışken, katılımcı terklerinde çoğunlukla bireysel nedenler özellikle de aile ve iş sorumlulukları ve öğrenme sürecinde karşılaşılan güçlüklerde ise program düzenlenmesine dair sorunları içeren kurumsal engeller ortaya konulmuştur.
Anahtar Kelimeler: Yaşam boyu öğrenme, sertifika programı, yetişkin öğrenci, yüz yüze katılım, çevrim içi katılım, hibrit katılım

PARTICIPATION PATTERNS OF ADULTS PARTICIPATING IN THE UNIVERSITY OF TURKISH AERONAUTICAL ASSOCIATION LIFELONG DEVELOPMENT APPLICATION AND RESEARCH CENTRE (YAGEM) CERTIFICATE PROGRAMMES

ABSTRACT

Based on the fact that the number of certificate programmes offered by lifelong learning centres has increased in our country as well as all over the world with the transformation process of universities as a result of globalisation, this study was conducted in order to associate the ways of organising the programmes offered at the Lifelong Development Application and Research Centre (YAGEM) of the University of Turkish Aeronautical Association with the participation patterns of adults participating in the certificate programmes. In the research, triangulation, one of the mixed research methods, was preferred. The population of the study consists of 204 adults who participated in professional and personal development certificate programmes offered at Turkish Aeronautical Association University between September, 2022 and March, 2023. The quantitative part of the research was reached by simple random sampling and the qualitative part was reached by snowball sampling. The quantitative data obtained in the study were collected in printed and online forms through a 14-item questionnaire created by the researcher and received expert opinion. Quantitative data were analysed using the SPSS programme and Chi-Square Independence Test. In the qualitative part of the study, semi-structured interviews were conducted with 6 managers, 7 trainers, 8 dropouts and 12 graduates and descriptive data analysis method was applied in data analysis. In the research, some demographic characteristics of the adults, programme format and participation characteristics, participation purposes, reasons for not completing the programme, difficulties encountered in the learning process and the way the programmes are presented were associated. In the light of the data collected through both quantitative and qualitative methods, among the adult learners who participated in the YAGEM programmes; vocational reasons were found to be the dominant orientation as the purpose of participation while individual reasons, especially family and work responsibilities, were found to be the most common reasons for participant drop-outs and institutional barriers, including problems related to the organisation of the programme, were revealed as the difficulties encountered in the learning process.

Keywords: Lifelong learning, certificate programmes, adult learner, face-to-face participation, online participation, hybrid participation

BİREYLERİN ÇEVRESEL ETKİLERE BAĞLI DEĞİŞEN DUYGU DURUMLARININ DİL KULLANIMLARINA ETKİSİ

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ÖZET
İletişim, dünya üzerinde yaşamını devam ettiren insan ve hayvan gibi canlı türler ve artık günümüzde teknolojinin gelişimi ile ortaya çıkan yapay zeka gibi insan ya da hayvan dışı cansız varlıkların kullandığı önemli bir sistemdir. Şüphesiz ki dili kullanan tüm canlı cansız varlıklar arasında en gelişmiş dilsel iletişim sistemine insanoğlu sahiptir. Canlı bir varlık olarak insan nasıl ki yaşamı boyunca karşılaştığı iyi ya da kötü deneyimlere bağlı olarak farklı psikolojik süreçler geçirebiliyor ve bu duygudurum dönemlerine bağlı olarak davranışları değişkenlik gösterebiliyorsa, yaşadığı psikolojik değişikliklere bağlı olarak diğer insanlarla iletişimde kullandığı dilsel eğilimler de farklılaşabilmektedir. Önde gelen birçok ünlü dilbilimci, insan iletişiminin temelinde kullanılan dilsel yapıların insanın maruz kaldığı çevrenin bilişsel algısı ile yakından ilişkili olduğunu savunmaktadır. İnsan iletişim sistemi beyindeki Broca, Wernicke ve Angular Girus gibi dominant dil merkezleri ve dilsel üretimi mükemmel kılmak için sahip olduğumuz dil, dudak, damak, diş, gırtlak ve yutak gibi artikülasyon organlarının varlığı sebebiyle son derece fizyolojik bir yapı barındırmakla beraber aynı zamanda da dil üretimini sağlayabilmek için psikolojik bir alt yapıya sahiptir. Bu açıdan dilin kognitif süreçlerini inceleyen ve dilbilim ile psikolojinin kesişiminde bulunan psikodilbilim alanı, bireylerin psikolojik özelliklerine bağlı olarak gelişen dilsel üretimler üzerinde de durmaktadır. Bu araştırmada, kişilerin maruz kaldıkları çevresel faktörlerin onların psikolojik durumlarına etkileri ve bu etki sonucu bireylerin dil kullanım eğilimlerinin ne şekilde etkilendiği ve ne yönde değiştiği ele alınmıştır. Elde edilen bulgular, bireylerin günlük hayatta yaşadıkları deneyimlerin onların dili linguistikal çerçevede ne şekilde kurguladıkları ve sosyal iletişimde ne şekilde kullandıklarını ortaya çıkarmaktadır.
Anahtar Kelimeler: Dil Kullanımı, Dil Psikolojisi, Psikodilbilim

THE EFFECT OF INDIVIDUALS EMOTIONAL STATES ON LANGUAGE USAGE IN RELATION TO ENVIRONMENTAL INFLUENCES

ABSTRACT
Communication is a crucial system utilized by living species such as humans and animals, as well as non-living entities like artificial intelligence that has emerged with the advancement of technology. Undoubtedly, among all living and non-living entities using language, humans possess the most advanced linguistic communication system. As living beings, individuals can undergo various psychological processes based on the positive or negative experiences they encounter throughout their lives. The behaviors of individuals can vary depending on these emotional states. Linguistic tendencies used in communication by individuals may differ based on the mood swings related to these emotional states. Many prominent linguists argue that the linguistic structures at the core of human communication are closely linked to the cognitive perception of the environment the individual is exposed to. The human communication system encompasses highly physiological structures such as dominant language centers in the brain like Broca, Wernicke, and Angular Gyrus, as well as articulation organs like the tongue, lips, palate, teeth, larynx, and pharynx, which contribute to perfecting linguistic production. Additionally, it possesses a psychological infrastructure to enable language production. In this regard, the field of psycholinguistics, which examines the cognitive processes of language and intersects with linguistics and psychology, also focuses on linguistic productions that develop based on individuals' psychological characteristics. This study explores the impact of environmental factors on individuals' psychological states and how individuals' language usage tendencies are affected and altered as a result of this influence. The findings reveal how individuals construct their language in a linguistic framework and utilize it in social communication based on their daily experiences.
Keywords: Language usage, language psychology, psycholinguistics.

YAPRAKTAN KALSİYUM UYGULAMALARININ BAŞ SALATA (*Lactuca sativa* L. var capitata) VERİMİ VE KALİTESİ ÜZERİNE ETKİSİ

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ÖZET
Yapraktan gübreleme, yaprağı tüketilen sebzelerin bitki gelişimi, verim ve kalite özellikleri üzerinde önemli bir role sahiptir. Bu çalışmada, yapraktan uygulanan kalsiyum nitrat ve kalsiyum klorür gübrelerinin baş salatada (*Lactuca sativa* L. var *capitata*) verim ve kalitesine olan etkileri araştırılmıştır. Çalışma örtü altında yürütülmüştür. Kalsiyum nitrat ve kalsiyum klorür (50 ppm, 100 ppm ve 150 ppm) gübreleri üç farklı dozda ve üç farklı periyotta yapraklara püskürtülmüştür. Uygulamalar fide dikiminden 15 gün sonra başlayarak 10'ar gün arayla yapılmıştır. Gübreler, yapraklar tamamen ıslanıncaya kadar şarjlı sırt pülverizatörü ile uygulanmıştır. Çalışma tesadüf blokları deneme desenine göre 4 tekerrürlü olarak yürütülmüştür. Sonuçlar, yapraktan uygulanan kalsiyum nitrat ve kalsiyum klorür gübrelerinin, ortalama baş ağırlığı, renk, pH, ve verimi artırarak olumlu yönde etkilediğini göstermiştir. Kalsiyum nitrat gübresi, kontrol uygulamasına göre her üç dozda da verimi artırmıştır. Benzer şekilde, renk değerleri yapraktan uygulanan kalsiyum nitrat ve kalsiyum klorür gübreleri ile artış göstermiştir. Bununla birlikte, uygulamaların SÇKM, yaş ve kuru ağırlık üzerine etkisi önemsiz çıkmıştır. Sonuç olarak, bu çalışma yapraktan uygulanan kalsiyum nitrat ve kalsiyum klorür gübrelerinin baş salatada verim ve kaliteyi artırabileceğini ortaya koymuştur.
Anahtar Kelimeler: Yapraktan gübreleme, kalsiyum, renk, verim

INFLUENCE OF FOLIAR APPLICATIONS OF CALCIUM ON YIELD AND QUALITY OF HEAD LETTUCE (*Lactuca sativa* L. var capitata)

ABSTRACT
Foliar fertilization plays an important role in the development, yield, and quality characteristics of leafy vegetables. This study investigated the effects of foliar-applied calcium nitrate and calcium chloride fertilizers on the yield and quality of lettuce (Lactuca sativa L. var capitata) under greenhouse conditions. Calcium nitrate and calcium chloride fertilizers (at concentrations of 50 ppm, 100 ppm, and 150 ppm) were sprayed on the leaves in three different doses and at three distinct periods. Applications began 15 days after transplanting and were repeated at 10-day intervals using a rechargeable back sprayer until the leaves were thoroughly wetted. The study were laid out a randomized complete block design with four replicates. The results shawed that foliar application of calcium nitrate and calcium chloride fertilizers had a positive influence by increasing average head weight, color, pH, and yield. Calcium nitrate fertilizer significantly increased yield at all three doses compared to the control treatment. Similarly, color values improved with foliar application of both fertilizers. However, the effects on TSS, wet weight, and dry weight were not statistically significant. In conclusion, this study suggests that foliar spraying with calcium nitrate and calcium chloride fertilizers can be an effective strategy to enhance the yield and quality of head lettuce.
Keywords: Foliar spray, calcium, colour, yield

FİBROMİYALJİ SENDROMUNDA GÜNCEL TEDAVİ YAKLAŞIMLARI

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ÖZET
Fibromiyalji sendromu (FMS), klinik olarak kas-iskelet sistemi ağrısı, kas gücü ve enduransında azalma, genel kondisyon kaybı, eklem hareket açıklığı kaybı, yumuşak doku hassasiyeti, sertlik, genel yorgunluk ve uyku bozuklukları ile karakterize, yaygın kronik, idiyopatik bir durumdur. Etiyoloji ve patogenezi iyi bilinmemekle birlikte FMS'nin oksidatif stres, mitokondriyal fonksiyon bozukluğu, multivitamin eksiklikleri ve oksidanlar/ antioksidanlar arasındaki orantısızlığın bu sendroma sebep olduğu düşünülmektedir. Hastalık başlangıç ve devamı, hastalığın seyrini ve yaşam kalitesini olumsuz yönde etkileyen genetik/biyolojik ve psikososyal faktörler ile yakından ilişkilidir. Ayrıca FMS, kronik yorgunluk sendromu, irritabl bağırsak sendromu, fonksiyonel dispepsi, miyojenik temporomandibular bozukluk, gerilim baş ağrısı, miyofasiyal ağrı sendromu, huzursuz bacak sendromu, interstisyel sistit, mesane ağrısı sendromu, travma sonrası stres bozukluğu ile de ilişkili olan karmaşık bir sendromdur. Hastalık tanısına ilişkin herhangi bir objektif test veya biyobelirteç tanımlanmamış olmakla birlikte bu hastalarda tek başına farmakolojik tedavi yetersizdir. Ağrıya neden olan farklı mekanizmalar göz önüne alındığında, kronik ağrının periferik, merkezi, bilişsel-duygusal ve kişilerarası nedenlerini hedef alan multidisipliner programlar ile tedavi edilmesi uygun olmaktadır. Bu popülasyondaki duygusal semptomların tedavi edilmesi ile, bilişsel durumdaki bozulma devam etse bile, dikkat süreçlerindeki iyileşmenin artacağı gösterilmiştir. FMS'li hastalarda aerobik ve dirençli egzersizler, elektroterapi yöntemleri, hidroterapi, balneoterapi, manipülasyon, kayropraktik yöntemler, biofeedback, hipnoz, duyusal tedaviler, magnetoterapi, masaj, bilişsel davranışçı terapi, farmakolojik ajanlar, akupunktur, zihin beden tedavileri, hiper barik oksijen tedavisi, optik sinir stimülasyonu, lidokain infüzyonu, melatonin, koenzim Q10, D ve E vitaminleri takviyesi ile palmitoiletanolamid uygulanması gibi çok çeşitli tedavi yaklaşımları hastalık semptomlarında iyileşmeye neden olacağı bilinmektedir. Bu bağlamda FMS'nin tedavisinde multidisipliner bir bakış açısıyla interdisipliner bir yaklaşım hastalık semptomları azaltmakta etkili olacaktır.
Anahtar Kelimeler: Fibromiyalji sendromu, tedavi, koenzim Q10

CURRENT TREATMENT APPROACHES IN FIBROMYALGIA SYNDROME

ABSTRACT
Fibromyalgia syndrome (FMS) is a common chronic, idiopathic condition clinically characterized by musculoskeletal pain, decreased muscle strength and endurance, general deconditioning, loss of joint range of motion, soft tissue tenderness, stiffness, general fatigue and sleep disorders. Although the etiology and pathogenesis of FMS are not well known, oxidative stress, mitochondrial dysfunction, multivitamin deficiencies and disproportion between oxidants / antioxidants are thought to cause this syndrome. The onset and continuation of the disease are closely related to genetic/biological and psychosocial factors that negatively affect the course of the disease and quality of life. In addition, FMS, chronic fatigue syndrome, irritable bowel syndrome, functional dyspepsia, myogenic temporomandibular disorder, tension headache, myofascial pain syndrome, irritable It is a complex syndrome that is also associated with leg syndrome, interstitial cystitis, bladder pain syndrome, and post-traumatic stress disorder. Although no objective test or biomarker has been defined for the diagnosis of the disease, pharmacological treatment alone is inadequate in these patients. Considering the different mechanisms that cause pain, it is appropriate to treat chronic pain with multidisciplinary programs targeting peripheral, central, cognitive-emotional and interpersonal causes. It has been shown that by treating emotional symptoms in this population, improvement in attentional processes will increase, even if impairment in cognitive status persists. In patients with FMS, aerobic and resistant exercises, electrotherapy methods, hydrotherapy, balneotherapy, manipulation, chiropractic methods, biofeedback, hypnosis, sensory treatments, magnetotherapy, massage, cognitive behavioral therapy, pharmacological agents, acupuncture, mind-body treatments, hyperbaric oxygen therapy, It is known that a wide variety of treatment approaches, such as optic nerve stimulation, lidocaine infusion, melatonin, coenzyme Q10, vitamins D and E supplementation, and administration of palmitoylethanolamide, will lead to improvement in disease symptoms. In this context, an interdisciplinary approach from a multidisciplinary perspective in the treatment of FMS will be effective in reducing disease symptoms.
Keywords: Fibromyalgia syndrome, Treatment, coenzyme Q10

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ÖZET
Egzersiz kas ve eklem hareketleri kullanarak enerji harcanmasıyla sonuçlanan düzenli fiziksel aktiviteler olarak tanımlanabilir. Çocukluk çağında egzersiz yapma alışkanlığı bilişsel, duygusal, fiziksel ve psikolojik gelişime, yetişkinlik çağında yapılan egzersize göre daha çok etkilidir. Bunun sebebi, bireylerin hareket ve yaşam tarzı gelişimi ve öğrenmenin çocukluk çağlarında daha kolay olmasıdır. Günümüz teknolojik olanakların hızla gelişmesi, beden gücüyle gerçekleştirilen birçok eylemin artık tamamen teknolojik olanaklar kullanılarak kolaylıkla yapılması ve sedanter yaşamın yaygınlaşması çocukluk çağlarında bile obezite, diyabet, inme, yüksek tansiyon, osteoporoz ve koroner hastalıkların görülme sıklığında artışa sebep olmuştur. Dünya Sağlık Örgütü verilerine göre kronik hastalıklardaki artışın risk faktörleri coğrafyalara göre değişmekle birlikte, yüksek gelirli ülkelerdeki en büyük risk faktörü fiziksel inaktivite ve yüksek kolesteroldür. Egzersiz ve yüksek fiziksel aktivite düzeyi ile diyabet, koroner kalp hastalığı, inme, yüksek tansiyon, osteoporoz, kolon kanseri riski, depresyon, kaygı ve aşırı stres bulguları azalmaktadır. Düzenli fiziksel aktivite ve spor yapan çocuklarda olumlu benlik saygısı, beden imgesi değerlendirmesi, kendilik algısı ve mental dayanıklılığın gelişmesinin kolaylaştığı bilinmektedir. Ayrıca sigara, alkol, uyuşturucu madde ve ilaç kullanım sıklıkları daha düşük, birine zarar verme ve bir şeyleri kırıp dökme isteklerinin daha az, ders çalışma, kitap gazete okuma ve akademik performans oranlarının daha yüksek olduğu gözlenmektedir. Amerikan Pediatri Akademisi, 2 yaşın altındaki çocuklar için ekran başında zaman geçirilmemesini, 2 yaşın üzerinde ise bu sürenin 1-2 saat ile kısıtlanmasını önermektedir. Bunların dışında özellikle sosyal çevrede çocuklar için aerobik egzersize uygun alanlar oluşturulması için belediyelerle iş birliği içinde olunmalı ve ilgili birimler bu konularda teşvik edilmelidir.
Anahtar Kelimeler: Egzersiz, çocukluk çağı, psikolojik gelişim

BENEFITS OF EXERCISE FOR CHILDREN

ABSTRACT
Exercise can be defined as regular physical activities that result in energy expenditure using muscle and joint movements. The habit of exercising in childhood is more effective on cognitive, emotional, physical and psychological development than exercise in adulthood. The reason for this is that individuals' movement and lifestyle development and learning are easier in childhood. The rapid development of today's technological opportunities, the fact that many actions performed with physical strength are now easily performed using technological facilities, and the spread of sedentary life has led to an increase in the incidence of obesity, diabetes, stroke, high blood pressure, osteoporosis and coronary diseases, even in childhood. According to World Health Organization data, although the risk factors for the increase in chronic diseases vary by geography, the biggest risk factors in high-income countries are physical inactivity and high cholesterol. With exercise and high physical activity levels, diabetes, coronary heart disease, stroke, high blood pressure, osteoporosis, colon cancer risk, depression, anxiety and excessive stress symptoms decrease. It is known that the development of positive self-esteem, body image evaluation, self-perception and mental endurance is facilitated in children who engage in regular physical activity and sports. In addition, it is observed that the frequency of cigarette, alcohol, drug and medication use is lower, the desire to harm someone and break things is less, and the rates of studying, reading books and newspapers and academic performance are higher. The American Academy of Pediatrics recommends that children under the age of 2 not spend time in front of the screen, and for children over the age of 2, this time should be limited to 1-2 hours. Apart from these, cooperation should be made with municipalities to create areas suitable for aerobic exercise for children, especially in the social environment, and relevant units should be encouraged on these issues.
Keywords: Exercise, childhood, psychological development

OECD ÜLKELERİNİN BUĞDAY ÜRETİMİ VE KENDİNE YETERLİLİK SEVİYELERİ

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ÖZET
Buğday üretimi, dünya genelinde gıda güvenliği, ekonomik kalkınma ve tarımsal faaliyetlerin sürdürülebilirliği açısından büyük öneme sahiptir. Buğday, önemli besin maddeleri içeren, özellikle de karbonhidrat, protein, lif, vitaminler ve mineraller bakımından zengin bir üründür. Yeterli buğday üretimi, bir ülkenin kendi nüfusunu besleyebilmesi ve dışa bağımlılığın azaltılması bakımından önemlidir. Dünya buğday üretiminin ülkelere göre dağılışındaki farklılıklar, birçok etkenin bir araya gelmesi sonucunda ortaya çıkar. İklim, toprak özellikleri, tarım politikaları, teknolojik kapasite, sulama sistemleri, ticaret politikaları ve ekonomik koşullar bu faktörler arasında yer almaktadır. Bu sebeple, dünya genelinde buğday üretimi belirli bölgelerde yoğunlaşabilir veya azalabilir. Buğday üretiminin dağılımındaki farklılıkları anlamak, hem yerel hem de küresel gıda güvenliği stratejileri için önemlidir. Bu çalışmada, OECD (Ekonomik İşbirliği ve Kalkınma Örgütü), ülkelerindeki buğday üretimi ve söz konusu ülkelerin buğday üretiminde kendine yeterlilik seviyeleri araştırılmıştır. OECD, dünya genelinde ekonomik işbirliği ve kalkınma konularında bir araya gelen 38 ülkeden oluşmaktadır. Araştırmanın ana materyalini Birleşmiş Milletler Gıda ve Tarım Örgütünün (FAO) 2020 yılına ilişkin buğday verileri oluşturmaktadır. 38 OECD ülkesinden İzlanda ve Kosta Rika ülkeleri için belirtilen dönemde FAO'da veri bulunmadığı için veriler 36 ülke üzerinden analiz edilmiştir. Belirtilen dönemde üretim miktarında ABD, ithalat miktarında Türkiye, ihracat miktarında Kanada, hektara buğday veriminde Yeni Zelanda'nın ilk sırada yer aldığı belirlenmiştir. Buğday üretiminde kendine yeterlilik seviyeleri en yüksek olan ülkeler sırasıyla Letonya, Litvanya ve Estonya gibi nüfus miktarı düşük olan ülkeler olarak tespit edilmiştir. Kolombiya, Güney Kore ve Portekiz ise buğdayda kendine yeterlilik seviyeleri en düşük ülkeler olarak belirlenmiştir. Bu çalışmadan elde edilen sonuçlar ile, ilgili ülkelerin buğday ile ilgili tarım politikaları ve yayım stratejilerinin oluşturulmasında daha etkili kararlar alınmasına yardımcı olunması, tarımsal uygulamaların optimize edilmesi, üretimin sürdürülebilirliği ile ticaret ve pazarlama planlarını gerçekleştirmesine katkı sağlaması hedeflenmektedir.
Anahtar Kelimeler: OECD, buğday, üretim, pazar.

WHEAT PRODUCTION AND SELF-SUFFICIENCY LEVELS OF OECD COUNTRIES

ABSTRACT
Wheat production is important for global food security, economic development and agricultural sustainability. Wheat is an important source of nutrients, in particular carbohydrates, protein, fibre, vitamins and minerals. Adequate wheat production is important for a country's ability to feed its own population and can be a factor in the reduction of external dependence. Many factors combine to determine how wheat is produced in different parts of the world. These factors include climate, soil characteristics, agricultural policy, technological capabilities, irrigation schemes, trade policy and economic conditions. When these factors come together, the world's wheat production can be concentrated in certain regions or can be reduced. It is important for both local and global food security strategies to understand differences in the distribution of wheat production. This study looked at wheat production in OECD (Organisation for Economic Co-operation and Development) countries. It also looked at the degree of self-sufficiency in wheat production in these countries. The OECD consists of 38 countries that work together on economic cooperation and development issues around the world. The main material used in the research is the wheat data for the year 2020 from the Food and Agriculture Organisation of the United Nations (FAO). Out of the 38 OECD countries, data for Iceland and Costa Rica were analysed for 36 countries, as the FAO did not have any data for the period in question. Over the period, the United States was the first country in terms of production, Turkey was the first in terms of imports, Canada was the first in terms of exports and New Zealand was the first in terms of wheat yield per hectare. The countries with the highest degree of self-sufficiency in wheat production were Latvia, Lithuania and Estonia, which have small populations. Colombia, South Korea and Portugal were the countries with the lowest level of self-sufficiency in wheat. The results of this study are intended to help the countries concerned to make more effective decisions in the formulation of agricultural policies and extension strategies related to wheat, the optimisation and sustainability of agricultural practices and the implementation of trade and marketing plans.
Keywords: OECD, wheat, production, market.

POTENTIAL PEST IN PISTACHIO FIELDS OF ŞIRNAK PROVINCE: PISTACHIO PSYLLID [AGONOSCENA PISTACIAE BURCK. AND LAUT.) (HEMIPTERA: APHALARIDAE)]

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ABSTRACT
Pistachio is one of the agricultural products that have an important place in the economy of our country. It provides employment opportunities in many areas from the production stage until it is ready for consumption. Since it is such an economically important product, it is tried to be grown in every area where it can be cultivated. In recent years, there has been a rapid increase in production areas in Şırnak province and its districts. In parallel with this increase in area, problems related to plant protection arise. Plant protection problems that may arise in pistachio fields should be combated in a timely and technically appropriate manner. In many scientific studies conducted in pistachio fields, it has been reported that Pistachio Psyllid [Agonoscena pistaciae Burck. and Laut.) is one of the most common and intensive pests. The pest, which does its main damage by sucking plant sap during the nymph stage, also causes fumagin formation. With its damage, it causes early and dense fall of leaves and prevents the fruits from filling. Especially in the pistachio fields located in Şırnak Center, Güçlükonak, İdil and Silopi districts, pistachio trees should be controlled from mid-April when pistachio trees start to leaf out and when 20-30 nymphs per compound leaf are seen, it is necessary to decide to fight against A. Pistaciae and spraying should be done. Determination of the prevalence, damage status and contamination rate of A. pistaciae, which is a potential main pest for pistachio orchards established and to be established in Şırnak province and its districts, will form the basis for the Integrated Pistachio Control studies to be carried out in this province.
Keywords: Pistachio, potential pest, nymph, Sirnak

EVALUATION OF YIELD CHARACTERISTICS OF DIFFERENT MAIZE VARIETIES UNDER DERİK/MARDİN CONDITIONS

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ABSTRACT
This study was conducted to determine the yield characteristics of some maize varieties as second crop in Kuyulu/Derik conditions in 2017. The study was established according to the randomized block design with three replications. In the study, 3 varieties (Dkc 5783, Agm 1644 and 32T83) were used. Differences between varieties were found to be significant for all traits. In the study, plant number, moisture content, hectoliter weight and yield characteristics were analyzed. According to the average results obtained from the traits examined in the study, the number of plants varied between 80000 (plants/ha) and 91000 (plants/ha), moisture content between 23% and 29%, hectoliter weight between 61 kg/hl and 68 kg/hl and grain yield between 14580 kg/ha and 14870 kg/ha. Agm 1644 was the leading variety in terms of grain yield.
Keywords: Maize, Genotype, yield, quality

DETERMINATION OF YIELD CHARACTERISTICS OF SOME MAIZE VARIETIES UNDER KIZILTEPE/MARDİN CONDITIONS

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ABSTRACT
This study was conducted to determine the yield characteristics of some maize varieties as second crop in Kılduman/Kiziltepe /Mardin conditions in 2015. The study was established according to the randomized block design with three replications. In the study, 3 varieties (As 66, Agn 720, and 71May69) were used. Differences between varieties were found to be significant for all traits. In the study, plant number, moisture content, hectoliter weight and yield characteristics were analyzed. According to the average results obtained from the traits examined in the study, the number of plants varied between 78000 (plants/ha) and 93000 (plants/ha), moisture content between 23% and 29%, hectoliter weight between 61 kg/hl and 68 kg/hl and grain yield between 14580 kg/ha and 14870 kg/ha. Agm720 was the leading variety in terms of grain yield.
Keywords: Maize, Genotype, yield, quality

EVALUATION OF YIELD FACTORS OF DIFFERENT CORN VARIETIES UNDER HARRAN CONDITIONS

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ABSTRACT
This study was conducted to determine the yield characteristics of some maize varieties as second crop in Harran (Şanlıurfa) conditions in 2020. The study was established according to the randomized block design with three replications. In the study, 4 varieties (Aramis, Agm 1670, 32T83 and Capella) were used. Differences between varieties were found to be significant for all traits. In the study, plant number, moisture content, hectoliter weight and yield characteristics were analyzed. According to the average results obtained from the traits examined in the study, the number of plants varied between 83000 (plants/ha) and 113000 (plants/ha), moisture content between 22,3% and 27,9%, hectoliter weight between 61 kg/hl and 69 kg/hl and grain yield between 11770 kg/ha and 15620 kg/ha. Agm1670 was the leading variety in terms of grain yield.
Keywords: Maize, Genotype, yield, quality

COMPARISON OF YIELD CHARACTERISTICS OF SOME CORN VARIETIES UNDER HARRAN/ŞANLIURFA ENVIRONMENTS

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ABSTRACT
This study was conducted to determine the yield characteristics of some maize varieties as second crop in Harran/Sanliurfa conditions in 2020. The study was established according to the randomized block design with three replications. In the study, 4 varieties (32T83, Dkc 6101, Agm 1670 and Agm 6919) were used. Differences between varieties were found to be significant for all traits. In the study, plant number, moisture content, hectoliter weight and yield characteristics were analyzed. According to the average results obtained from the traits examined in the study, the number of plants varied between 88000 (plants/ha) and 105000 (plants/ha), moisture content between 25,3% and 26,5%, hectoliter weight between 64 kg/hl and 68 kg/hl and grain yield between 10490 kg/ha and 12380 kg/ha. 32T83 was the leading variety in terms of grain yield.
Keywords: Maize, Genotype, yield, quality

KAMU SEKTÖRÜNDE DİJİTAL DÖNÜŞÜM: YÖNETİŞİMDE YENİ BİR ÇAĞ

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ÖZET
Kamu hizmetlerindeki dijital dönüşüm, modern toplumların karşılaştığı birçok zorluğu ele alırken, vatandaşlara daha etkili, erişilebilir ve şeffaf hizmetler sunma potansiyeline sahiptir. Bu dönüşüm, geleneksel hizmet sunum yöntemlerinin yerini dijital teknolojilerin aldığı bir süreç olarak tanımlanabilir. İnternet üzerinden yapılan başvurular, online ödemeler, e-devlet uygulamaları ve diğer dijital platformlar aracılığıyla hizmet sunumu, vatandaşların bekleme sürelerini azaltırken, hizmetlere daha hızlı erişim imkanı sağlamaktadır. Bu da, vatandaş memnuniyetinin artmasına ve kamu kurumlarının daha verimli çalışmasına katkıda bulunmaktadır. Ancak, kamu hizmetlerindeki dijital dönüşümün beraberinde getirdiği güvenlik ve gizlilik konuları, hassas kamu verilerinin çevrimiçi ortamlarda saklanması ve işlenmesiyle ilgili endişeler de vardır. Bu nedenle, güçlü siber güvenlik politikaları ve veri koruma yönetmelikleri bu süreçte kritik öneme sahiptir. Dijitalleşme aynı zamanda yönetişim süreçlerinde de önemli bir dönüşüme neden olmaktadır. Ancak, dijital dönüşümün başarılı olabilmesi için dijital okuryazarlık düzeyinin artırılması ve herkesin teknolojiye eşit şekilde erişim sağlaması gerekmektedir. Bu çalışma, kamu hizmetlerindeki dijital dönüşümün potansiyelini ve zorluklarını ele almaktadır. Bu dönüşümün başarılı olabilmesi için güvenlik, gizlilik, eşitlik ve katılım gibi konuların dikkate alınması gerekmektedir. Yalnızca bu şekilde, kamu hizmetlerinde dijitalleşme, toplumların ihtiyaçlarını daha etkili bir şekilde karşılayabilir ve kapsayıcı bir toplum için adil bir fırsat eşitliği sağlayabilir.
Anahtar Kelimeler: Dijital dönüşüm, dijitalleşme, yönetişim, kamu hizmetleri, e-devlet

DIGITAL TRANSFORMATION IN THE PUBLIC SECTOR: A NEW ERA IN GOVERNANCE

ABSTRACT
The digital transformation in public services holds the potential to address many of the challenges faced by modern societies while providing citizens with more effective, accessible, and transparent services. This transformation can be defined as a process where traditional service delivery methods are replaced by digital technologies. Application submissions, online payments, e-government applications, and other digital platforms facilitate service delivery, reducing waiting times and providing faster access to services, thereby contributing to increased citizen satisfaction and more efficient functioning of public institutions. However, the security and privacy concerns associated with the digital transformation of public services, particularly regarding the storage and processing of sensitive public data in online environments, are significant. Therefore, robust cybersecurity policies and data protection regulations are critically important in this process. Additionally, digital transformation also brings about a significant transformation in governance processes. However, for digital transformation to be successful, it is essential to increase digital literacy levels and ensure equal access to technology for everyone. This study addresses the potential and challenges of digital transformation in public services, emphasizing the importance of considering security, privacy, equality, and participation. Only in this way can digitalization of public services effectively meet the needs of societies and provide fair opportunities for inclusive communities.
Keywords: Digital transformation, digitization, governance, public services, e-government

ROBOTIC SYSTEMS IN REHABILITATION FOR GUNSHOT WOUNDS OF THE UPPER LIMB

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ABSTRACT
Robotic systems usage in the rehabilitation of gunshot and mine-explosive wounds of the upper limb is an evidence-based method that improves function and quality of life. Polytrauma, including traumas of extremities, occupies first place in the structure of primary permeable wounds. Injuries of the upper extremities are often accompanied by damage to peripheral nerves. Such injuries significantly increase the duration of rehabilitation and lead to further disability and decreasing in quality of life.We reviewed a clinical case of long-term staged rehabilitation after a mine explosion wound of the left upper limb, complicated by post-traumatic neuritis of the left radial, ulnar and median nerves and significant loss of limb function (loss of function of left hand, flexion contracture of the left elbow joint etc.) in 45 years old man with a diagnosis of gunshot fragmentation wound of the lower third of the left shoulder with a gunshot multi-fragment intra-articular fracture of the distal epimetaphysis of the left humerus. The examination revealed a significant decrease in muscle strength of the left upper limb up to 1-2 points, pain during movements up to 6-7 points due to VAS, almost complete limitation of movements in the left elbow and wrist joints, limitation of movements in the left shoulder joint, impaired sensitivity, and edema syndrome in the lower third of the forearm, impaired grasping function. Outpatient rehabilitation was carried out, and the volume of rehabilitation assistance was high. Rehabilitation was carried out in three courses of 18–21 days with breaks of 1–2 weeks over a long period. Rehabilitation includes: physical therapy, ergotherapy, physical modalities (laser, ultrasound, electrotherapy), and medicines to reduce pain, edema and inflammation. During the 1st rehabilitation course, a robotic Smart glove was used, and in the 2nd and 3rd courses, Upper Limb Intelligent Feedback and Training System was additionally used.
Keywords: gunshot wounds, rehabilitation, robotic systems

FLIGHT CONTROL SYSTEM USING SYSTEM OF LINEAR EQUATION

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ABSTRACT
Modern flight control systems rely heavily on linear algebra for real-time decision making. These systems model the complex dynamics of an aircraft using systems of linear equations. Each equation relates the aircraft's state, including position, velocity, and orientation, to the control inputs like movements of ailerons, elevators, and rudders. Solving these systems in real-time allows the control system to predict how the aircraft will respond to pilot commands or external disturbances. By analyzing these equations, engineers can design control laws that ensure stability and efficient flight paths. Linear algebra's ability to represent relationships between flight parameters and efficiently solve complex systems makes it a cornerstone of modern flight control technology, contributing to safe and smooth air travel.
Keywords: Flight control systems, Linear algebra, Real-time decision making, Systems of linear equations, Aircraft dynamics, Control inputs, State variables, Control laws, Stability, Efficient flight paths, Safe air travel

HARNESSING THE POWER OF AI : A MOTIVATIONAL TOOL FOR DEPRESSION

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ABSTRACT
In the realm of mental health, depression stands as a formidable challenge where communication barriers often hinder seeking help, the advent of a Motivational AI Tool for Depression emerges as a beacon of hope. Designed to cater to individuals battling depression, this innovative tool offers solace and support when words fail. Through personalized encouragement and empathetic interactions, it serves as a virtual confidant, fostering emotional resilience and alleviating stress. In the face of despair and the alarming rise in suicide rates, this tool stands as a lifeline, offering companionship and motivation, ultimately paving the path towards healing and renewed hope.
Keywords: Mental health, depression, offers solace and support, virtual confident, paving the path towards healing and renewed hope.

THE SYNERGY OF MATHEMATICS AND BIOSYSTEMS ENGINEERING: ENHANCING PRECISION AND SUSTAINABILITY

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ABSTRACT
This research paper explores the integral role of mathematics in advancing Biosystems Engineering. It delves into the application of mathematical models, optimization techniques, and statistical analyses in addressing complex challenges within agricultural and biological systems. By employing mathematical tools, researchers can enhance precision, efficiency, and sustainability in various aspects of Biosystems Engineering.
Keywords: Biosystems Engineering, mathematics, mathematical modeling, optimization, statistical analysis, precision agriculture, sustainability, biological systems.

A CONFORMABLE FRACTIONAL DERIVATIVE MODEL FOR HIV-1 INFECTION WITH STEM CELL TRANSPLANTATION

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ABSTRACT
The authors have proposed a new mathematical model to analyze the effects of stem cell transplantation on HIV-1-infected patients. The model employs a system of first-order nonlinear ordinary differential equations. The equations represent five main populations: stem cells, free HIV viral particles, productively infected T cells (actively producing new virus), infected T cells in the eclipse phase (infected but not yet producing virus), and uninfected T cells. This mathematical modelling approach can be utilized to study the interactions between transplanted stem cells and the dynamics of HIV infection within the patient's T cell population. By developing these novel differential equations, the authors aim to gain insights into how stem cell transplantation may impact disease progression in individualspositive for HIV-1. In this study, the conformable fractional derivative (CFD) of order ϱin conjunction with the LC operator of order ρ is employed to develop the model. Fixed-point theorems were utilized to prove the existence and uniqueness of the solutions to this model. The study discusses the stability of the mathematical model and equilibrium points. Adam Moulton's method was used to find an approximate solution to the given model. The study also examined the effects of changing the ϱ and ρ values. The study found that there is convergence in solution curves when altering ϱ while maintaining a constant ρ value, in contrast to what it observed when changing the value of ρ and preserving the ϱ value constant.
Keywords: Conformable derivative; Fixed point theorem; Adams-Moulton approach.

MATHEMATICS: THE KEY TO UNLOCKING SOLAR AND WIND ENERGY OPTIMIZATION

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ABSTRACT
This paper explores how mathematics is essential for optimizing solar and wind energy systems. It dives into various aspects of both technologies, starting with solar energy, where mathematical models predict sunlight levels, optimize panel positioning, and account for factors like shading and weather. Additionally, optimization algorithms are instrumental in designing solar tracking systems for enhanced energy capture. When it comes to wind energy, mathematical models simulate airflow and predict wind speeds, aiding in turbine design and placement optimization. Furthermore, mathematical optimization fine-tunes turbine geometry and layout to maximize energy output while minimizing wake effects. Integrating these renewable sources with storage and the grid is facilitated by algorithms, ensuring efficient utilization of clean energy. Overall, this paper underscores the pivotal role of mathematics in advancing solar and wind technologies for a sustainable future.
Keywords: Solar and wind energy, mathematical models

GUARDIAN OF THE DEEP: AI-POWERED UNDERWATER DRONES FOR AQUATIC LIFE HEALTH MONITORING AND CONSERVATION

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ABSTRACT
Guardian of the Deep is an innovative idea to monitor and enhance the health of aquatic species. It works through integration of autonomous underwater drones with advanced artificial intelligence algorithm and environmental sensors. Nowadays marine ecosystem faces several challenges such as pollution, overfishing and climate change. In order to it, this project aims to update the conservation methods by providing real time data on the health of aquatic organisms. The autonomous underwater drones navigate through oceans, capturing comprehensive datasets and the collected data undergoes detailed analysis through AI algorithms and it generates the health reports for various aquatic species. It also monitors pollution level, thermal imaging, overfishing. The reports collected highlights trends, identify potential trends and areas need for attention. This innovative initiative emerges as a formidable force in safeguarding aquatic life and restoring the health of our Aquatic species. This is a collaborative approach, engaging research institutions, conservation organizations and public. By this project we increase understanding about marine ecosystem and also it promotes active participation of public in marine conservation effort.
Keywords: Underwater drones, Artificial intelligence, aquatic life health, marine ecosystem, biodiversity monitoring

MATHEMATICAL APPLICATIONS IN MEDICAL SCIENCE: MATHEMATICAL APPLICATIONS IN EPIDEMIOLOGICAL ANALYSIS AND DISEASE CONTROL

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ABSTRACT
Epidemiology, a cornerstone of medical sciences, intricately unravels the complex web of health and disease within populations. At its core, it delves into the distribution, determinants, and dynamics of health-related events, employing meticulous research methodologies and statistical techniques such as observational studies, cohort investigations, case-control analyses, and randomized controlled trials. Through these endeavours, epidemiology identifies patterns, risk factors, and causal relationships, offering a comprehensive understanding of diverse diseases. Its paramount significance lies in contributing to public health through the informed development of evidence-based interventions and policies. By scrutinizing demographics, genetics, environmental exposures, and socio-economic determinants, epidemiologists yield crucial insights into disease prevention and control. Whether tracking infectious diseases, investigating outbreaks, or studying chronic conditions and lifestyle influences, epidemiology serves as a guiding force for healthcare strategies. Beyond its analytical methodologies, epidemiology stands as the vanguard in the ongoing quest for global health equity. Its influence extends into the development of targeted interventions and vaccination programs, actively mitigating the burden of diseases worldwide. The discipline addresses disparities in health outcomes, acknowledging the intricate interplay between biological, environmental, and social determinants. In navigating public health crises and contributing to the formulation of holistic healthcare strategies, epidemiologists become indispensable agents of change. In an era marked by interconnected global health challenges, epidemiology fosters resilience and paves the way for a healthier, more equitable future for communities worldwide.
Keywords: Epidemiology, health-related events, research methodologies, statistical techniques, evidence-based interventions, global health equity, disease prevention, public health.

A MATRIX BASED SIMULATION

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ABSTRACT
This abstract proposes a novel solution to urban traffic congestion by leveraging matrix-based simulation and control techniques. It begins with comprehensive data collection from sensors and cameras to analyze traffic patterns and congestion points. Representing the road network as a graph, an adjacency matrix is created to model traffic dynamics. Optimization algorithms are then applied to devise optimal traffic signal timings and routing strategies. A real-time control system adjusts signals and lanes based on current conditions, aiming to minimize travel times and enhance efficiency. Evaluation through simulations and field trials assesses the system's impact on travel time reduction, fuel savings, and emissions. This approach offers a promising avenue for cities to address congestion and create more sustainable urban environments.
Keywords: urban traffic congestion, to model traffic dynamics

BASIS AND RANK

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ABSTRACT
Basis and rank are fundamental concepts in linear algebra with broad applications in various fields including mathematics, engineering, and computer science. A basis for a vector space is a set of linearly independent vectors that span the entire space, providing a framework for expressing any vector within that space as a unique linear combination of basis vectors. The concept of basis allows for the representation and analysis of vectors in terms of a minimal set of independent components, facilitating operations such as solving systems of linear equations and understanding the structure of vector spaces. The rank of a matrix is a measure of its linear independence and dimensionality, defined as the maximum number of linearly independent columns or rows within the matrix. It provides crucial insights into the properties and solutions of systems of linear equations, as well as the geometric interpretation of transformations represented by matrices. Understanding the rank of a matrix is essential in numerous computational tasks such as solving systems of linear equations, performing matrix factorizations, and solving optimization problems. In summary, the concepts of basis and rank play pivotal roles in linear algebra, offering powerful tools for analyzing vector spaces, matrices, and their transformations. Their applications extend across diverse fields, underpinning essential operations and insights in mathematical and computational domains.
Keywords: vector spaces**,** Basis, rank

DIY VENTILATOR

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ABSTRACT
The COVID-19 pandemic has underscored the critical need for accessible and affordable ventilator solutions, particularly in resource-constrained environments. This abstract explores the concept of a do-it-yourself (DIY) ventilator as a viable alternative. Utilizing readily available materials and open-source designs, DIY ventilators offer a low-cost solution for providing respiratory support to patients in emergency situations. By leveraging components such as Arduino microcontrollers, 3D-printed parts, and basic electronic circuits, individuals with basic technical skills can assemble functional ventilators. However, safety, reliability, and adherence to medical standards remain paramount considerations. Collaborative efforts between medical professionals, engineers, and DIY enthusiasts are essential for refining designs, ensuring efficacy, and disseminating best practices. DIY ventilators have the potential to complement traditional medical equipment during crises, extending respiratory support to those in need, especially in underserved communities. Continued research and innovation in this field hold promise for enhancing global healthcare resilience.
Keywords: DIY ventilators, COVID-19, 3D-printed parts

HARMONIZING HARVEST: REVOLUTIONIZING FARMING ECONOMIES THROUGH MATHEMATICAL MODELING AND OPTIMIZATION

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ABSTRACT
The agricultural sector stands on the precipice of transformation, poised to embrace the symbiotic relationship between mathematics and farming economies. This ABSTRACT delves into the innovative application of mathematical modeling and optimization techniques to revolutionize traditional farming practices, catalyzing sustainable growth and prosperity. At the heart of this paradigm shift lies the integration of advanced data analytics, machine learning algorithms, and mathematical models. Through meticulous analysis of historical crop yield data, weather patterns, soil quality metrics, and market demand fluctuations, farmers can unlock invaluable insights into the complex dynamics of agricultural production. By harnessing the predictive power of mathematical models, farmers gain the ability to forecast optimal planting schedules, irrigation regimes, and fertilizer applications, tailored to specific crop varieties and regional conditions. Moreover, optimization algorithms serve as the cornerstone of resource allocation strategies, orchestrating the efficient utilization of water, energy, and nutrients to maximize yield while minimizing environmental impact. By fine-tuning these variables, farmers can achieve remarkable improvements in productivity and profitability, fostering economic resilience and food security in farming communities.
Keywords: Agriculture, Mathematical Modeling, Optimization, Sustainability, Farming Economy, Data Analytics, Machine Learning, Resource Allocation, Crop Yield Prediction, Environmental Impact.

ELEVATING AYURVEDIC EDUCATION: INTEGRATION OF CHATGPT FOR PERSONALIZED LEARNING AND INTERACTIVE TEACHING

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ABSTRACT
This research paper explores the transformative impact of integrating ChatGPT, an advanced language model, into Ayurvedic education to enhance the overall learning experience. With the increasing interest in Ayurveda and the demand for innovative educational approaches, this research explores how ChatGPT can enrich the learning environment. Ayurvedic students often struggle to memorize extensive information, especially complex terms, within tight deadlines. Integrating ChatGPT enables efficient access to Ayurvedic information, helping students overcome memorization challenges and stay current in their studies. This facilitates a better grasp of intricate concepts, allowing them to stay informed and updated in their studies. This contemporary paper provides the responses given by ChatGPT for the authors' prompt on Ayurveda, teaching, and learning.
Keywords: Ayurvedic education, language models, ChatGPT, personalized learning, interactive teaching, artificial intelligence, Ayurveda, educational technology.

STUDY THE EFFECT OF GLYCERIN ON THE OPTICAL PROPERTIES OF PVA/ H_2SO_4

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ABSTRACT
In this study the optical properties of PVA/(2 and 4)wt.% glycerin doping by (3,5,7 and 9) M H_2SO_4 such as the, transmission and absorption spectra have been record as a function of doping ratio.The UV-vis absorption properties of polyvinyl alcohol (PVA)membranes were investigated by UV-VIS spectroscopy. The samples were investigated in initial state and after UV and gamma exposure. Some modification appears in the spectra of samples containing glycerin after doping by H_2SO_4. This behavior indicates modifications induced in the local structure of the polymeric, membranes.
Keywords: UV-VIS spectroscopy**,** gamma exposure

EFFECT OF *CHIERANTHUS CHIERI* SEEDS ON PANCREATIC PHYSIOLOGY AND BETA-CELL REGENERATION IN ALLOXAN-INDUCED DIABETIC RATS

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ABSTRACT
Diabetes is defined as a metabolic disease commonly observed in clinics and is characterized by hyperglycemia due to impaired insulin secretion, insulin resistance, or both, resulting in impaired metabolism of sugars, lipids, and protein. Herbal plants are now used to treat diabetes since they have fewer adverse effects. However, the current study was designed to evaluate the effects of *Cheiranthus cheiri* seeds in alloxan-induced diabetic rats. For this purpose, adult

albino rats weighing about 180-200g were separated into four groups. The first group was negative group (non-diabetic) rats. The second group was positive control alloxan (150 mg/kg body weight) and a standard diet. The third group was standard (glibenclamide 10 mg/kg body weight) along with The fourth group was treated as ethanolic extract of *Cheiranthus cheiri* seeds (10 mg/kg body weight). On the 21st day, the blood sample was collected for measuring blood glucose levels. Parameters like serum CBC, serum glucose, serum insulin, and Oxidative stress markers (TAC, TOS, MDA) were assessed. For histological analysis, samples of pancreatic tissue were collected. One-way ANOVA (Analysis of Variance) and DMR (Duncan's multiple range) were used to statistically analyze the data. Results of the current study revealed that *Cheiranthus cheiri* had significant effects on body weight and normalized the levels of fasting blood glucose, serum glucose, and serum insulin in the treatment group as compared to the positive control group. According to histopathological examination. However, in the positive control group, the pancreas showed the destruction of β-cells, small-sized islets of Langerhans, and loss of cellular contents. The normal histological structure was restored in the *Cheiranthus cheiri* seeds-treated group, demonstrating that normal pancreatic parenchyma and completely functional β- -cells in islets of Langerhans were advantageous for pancreatic beta-cell regeneration. Additionally, *Cheiranthus cheiri* seeds enhanced beta cell performance and returned INS-1, INS-2, PDX-1, and IGF-1 expression to normal levels. In conclusion, it was discovered that *Cheiranthus cheiri* seeds are advantageous for the normal functioning of the pancreas and the regeneration of beta cells.

Keywords: *Cheiranthus cheiri*, alloxan, glibenclamide

ASSESSING THE EFFICACY AND CHALLENGES OF SKILL DEVELOPMENT PROGRAMMES IN INDIA: TOWARDS STRATEGIC ENHANCEMENTS

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ABSTRACT
Programmes for skill development are essential because they empower people, improve their employability, and promote economic growth. This research paper delves into the assessment of available skill development programmes in India so as to determine their effectiveness and identify some critical obstacles that hamper their success. The need for skill development to empower people and boost the economy keeps growing, as it is important to know the strengths and weaknesses of present activities. This study utilizes a mixed-methods approach to assess the results and consequences of skill development programmes among various sectors and demographic segments. The comprehensive analysis identifies key challenges impeding the effectiveness of these initiatives like access issues, standards-related problems, significance issues, and inclusiveness concerns, among others. Moreover, this paper has strategic recommendations based on empirical evidence and stakeholder perspectives designed to increase the impact and extend the reach of skill development programmes in India. Policymakers, practitioners, and stakeholders can create an enabling environment for capacity building through resolving these challenges and implementing targeted strategies thereby contributing towards inclusive growth for socioeconomic advancement.
Keywords*:* Skill Development Programmes, India, Efficacy Assessment, Challenges, Strategic Enhancements, Socioeconomic Advancement.

ROLE OF ARTIFICIAL INTELLIGENCE (AI) IN SUSTAINABLE EDUCATION OF HIGHER EDUCATION INSTITUTIONS IN INDIA: TEACHER'S PERCEPTION

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ABSTRACT
Human resource management is a very imperative feature in the education practice. Human resources in an educational institution submit to every individual or group functioning in that institute, counting educators, learners, administrators, and all supplementary members of the workforce running in that institute. Online teaching and learning came into the style. Artificial intelligence (AI) is altering every market sector, and the education sector is no exception. AI has been converted into a fundamental component of educational institutions and has a force on teachers and students. The educational sector has embraced the recent techniques of training and learning. Hence, artificial intelligence (AI) gives opportunities for education to turn effortlessly accessible both inside and outside the classroom. In the demand of the present times, AI has a vast potential in the education sector in the market and is a progressive change. This paper attempts to get an insight on the role of AI in sustainable instruction of higher education institutions from the teacher's perception.
Keywords: artificial intelligence, higher education institution, human resource management, sustainability

POULTRY FEEDING BY AZOLLA MICROPHYLA CASE OF FAYOUMI (MOSTAGANEM)

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ABSTRACT
This in-depth study examines the use of Azolla microphylla, rich in protein with a rate of up to 27%, in chicken feed at different percentages: 5%, 10% and 15%, in separate batches. The results obtained are remarkable, particularly with regard to the weight gain of the Fayoumi hens, with a concentration of 15% of Azolla which particularly stands out. It is notable that even fresh Azolla, used as a dietary supplement at 50%, resulted in a higher average live weight compared to the control group (1150.90g vs 1034.63g). This approach also led to impressive results in terms of lipid content and weight gain. The demonstrated effectiveness of Azolla suggests that it could be used as a partial substitute for soybean meal, thereby improving the protein quality of Fayoumi chicken meat.
Keywords: Azolla, Fayoumi, Food, Protein, weight

THE INVESTIGATION OF THE ENERGY SPECTRUM OF SPECIFIED DIATOMIC MOLECULES VIA THE RESOLUTION OF SCHRODINGER EQUATION

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ABSTRACT
Quantum mechanics is a physical science, it allows the development of technology in many fields such as computing, electronics, and chemistry. Quantum mechanics is the description of the behavior of matter in all their details, everything that happens at the atomic scale. The phenomena are described by the wave function which contains all the information on the particles of a system and its behavior follows the Schrödinger equation. There are several challenges in modern physics like the resolution of the Schrödinger, Klein Gordan, Dirac equations, etc with the attractive Coulomb force and other potentials. The resolution of the Schrodinger equation allows the identification of some physical systems and their properties by finding bound states and the eigenfunctions which are resolved using many different methods, with modified Kratzer potential. The results obtained are important in several branches of theoretical physics as well as quantum chemistry because they are more general and useful for studying nuclear charge radius, spin, and nuclear diffusion.In this paper the shrodinger equation was solved to determine the energy eigenvalues of some selected diatomic molecules like (CO,NO…) for the Kratzer fues potential emoploying an analytical method called the WKB approximation.The results are satisfied and accurate with other method outcomes.
Keywords: Shrodinger equation, Kratzer fues potential, WKB approximation, eigenvalues of energy, diatomic molecules.

PARTITION SHADOWS AND DALIT IDENTITY IN MANORANJAN BYAPARI'S 'INTERROGATING MY CHANDAL LIFE'

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ABSTRACT
This study delves into the profound impacts of the Bengal Partition and the subsequent Bangladesh Partition on the marginalized Namasudra Dalit community, focusing on their struggles and identity. The Bengal Partition of 1947 carved the region into East Bengal, a part of Pakistan, and West Bengal, which remained a part of India. This division based on religious lines led to immense communal violence and mass migrations. The Namasudra Dalits, primarily residing in East Bengal, were profoundly affected by this partition. Many were forced to leave their ancestral lands, facing displacement, violence, and a loss of identity. The Bangladesh Partition of 1971 was another pivotal moment, resulting in the formation of the independent nation of Bangladesh. This partition, arising from the Bangladesh Liberation War, brought further turmoil to the Namasudra Dalit community. The conflict and subsequent partition led to widespread violence, displacement, and an erosion of their socio-economic standing. These partitions had a lasting impact on the lives of the Namasudra Dalit community. Displaced from their homes and facing discrimination in both East and West Bengal, they struggled to rebuild their lives. The loss of land and livelihoods exacerbated their already marginalized status, pushing many into poverty and vulnerability. In his autobiography 'Interrogating My Chandal Life,' Manoranjan Byapari offers a poignant account of these partition shadows and the Dalit identity crisis. Byapari, a Namasudra Dalit himself, vividly portrays the struggles, discrimination, and resilience of his community amidst the chaos of partition. Through his personal narrative, he sheds light on the profound impacts of these historical events on the lives of the Namasudra Dalits, highlighting their quest for identity and dignity.
Keywords: Partition, Namasudra Dalit, Caste discrimination, violence and displacement.

SUSTAINABLE MANUFACTURING IN GARMENTS INDUSTRY BY APPLYING SIMULATION AND LEAN TOOLS

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ABSTRACT
Addressing the pressing challenges of resource depletion and climate change requires the adoption of sustainable practices in production and consumption. This study explores the application of simulation and lean tools to reduce waste in manufacturing processes, employing techniques such as simulations and Kaizen in the garment production. By examining the gap between batch production flow and single-piece flow using ARENA simulation software, the study evaluates their impact on productivity and resource utilization. Results indicate a notable improvement in productivity (31 pieces per day), also average work in progress (WIP) decreased from 26.1 to 5.75 pieces, when adopting the one-piece flow approach, showcasing its advantage over batch flow in terms of reducing waste and optimizing resource usage. Furthermore, through Kaizen, the study demonstrates significant improvements in time and cost efficiency. For instance, by streamlining the watch pocket operation, cycle time decreased from 0.83 minutes to 0.75 minutes per garment, thus 0.08 minutes per garment is saved. As daily production is 30,000 pieces resulting in substantial cost savings of Rs 120,000 per month. Similarly, by optimizing the parts numbering operation, cycle time is reduced from 0.68 minutes to 0.52 minutes per garment, thus 0.16 minutes is saved per garment. As daily production is 30,000 pieces this leads to a cost savings of Rs 240,000 per month. The results highlight the potential for reduced waste in support of sustainable manufacturing and consumption practices for the circular economy. This study contributes to increased efficiency, reduced waste, and improved overall performance in the garments industry.
Keywords: Lean tools, Sustainable manufacturing, ARENA simulation tool, Kaizen, Waste reduction, Performance improvement.

MATHEMATICS APPLICATIONS IN ENGINEERING: BRIDGING THEORY TO PRACTICE

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ABSTRACT
Mathematics serves as the backbone of engineering, providing the fundamental tools and methodologies for analysis, design, and problem-solving. Through a comprehensive overview, this paper highlights key areas where mathematics is employed, including modeling and simulation, statics and dynamics, control systems, signal processing, optimization, probability and statistics, numerical methods, and electrical engineering. Each section demonstrates how mathematical principles are intricately woven into the fabric of engineering practice, enabling engineers to tackle complex challenges and innovate across diverse domains. By elucidating the symbiotic relationship between mathematics and engineering, this paper underscores the significance of mathematical proficiency in shaping the modern landscape of technological advancement and innovation. It also delves into the critical intersections between mathematics and engineering, illuminating the pervasive influence of mathematical principles on engineering practice. Through a systematic examination of key domains, including modeling, analysis, and optimization, it underscores the indispensable role of mathematics in fostering innovation and problem-solving in engineering. By elucidating concrete examples and applications, this paper illustrates how mathematical concepts such as differential equations, linear algebra, and optimization algorithms underpin various engineering disciplines, from mechanical and civil engineering to electrical and biomedical engineering. Moreover, it explores the evolving landscape of interdisciplinary research, where the integration of mathematics and engineering fuels advancements in fields such as robotics, artificial intelligence, and sustainable infrastructure. Through a nuanced exploration of theory and practice, this paper underscores the symbiotic relationship between mathematics and

engineering, emphasizing the imperative of cultivating mathematical literacy for engineers to thrive in an increasingly complex and interconnected world.
Keywords: Modeling, Analysis, Optimization, Differential Equations, Linear Algebra, Artificial Intelligence, Sustainable Infrastructure, Problem-solving, Innovation.

A REVIEW ARTICLE ON RECENT INNOVATION AND FUTURE OBSTACLES IN DRUG DELIVERY SYSTEM TO THE EYE

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ABSTRACT
The presence of numerous anatomic and physiologic obstacles has long made ocular drug delivery a problem for ophthalmologists and researchers into drug delivery. Invincible ocular obstacles, both static and dynamic, not only prevent xenobiotics from entering the eye, but also prevent therapeutic substances from being actively absorbed. Improved medication bioavailability and controlled drug release at the location of action, which can address several ocular defences, should be included when creating the optimum delivery system. To treat disorders of the anterior and posterior segment, traditional ophthalmic drugs include anti-vascular endothelial growth factor intravitreal injections and topical eye drops agents. Puncture plugs, eye implants, contact lenses with drug-eluting material, and ocular iontophoresis are examples of modern innovations for controlled and prolonged medication release for the anterior ocular segment illnesses. Various intravitreal implants have been approved as a result of parallel attempts ocular drug delivery method for diseases of the back of the eye. Dendrimers, microneedles, nanomicelles, nanoparticles, nanomicelles, liposomes, and nanowafers are among the new drug delivery technologies being investigated for anterior and posterior abnormalities. To increase patient compliance for diseases of the back of the eye, new techniques for the noninvasive delivery of potent treatments are becoming more popular. In this review article topics are covered in the current developments and upcoming difficulties in ocular drug administration this review article.
Keywords: Anatomy of Eye; Drug delivery; Intravitreal; Diseases; Administration

ROAD ANOMALY DETECTION IN REAL-TIME LEVERAGING ARTIFICIAL INTELLIGENCE IN ADVANCED DRIVER ASSISTANCE SYSTEMS (ADAS)

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ABSTRACT
As transportation technology advances, it's more important than ever to make sure that roads are safe, especially for Advanced Driver Assistance Systems (ADAS). Many innovative approaches to capturing road incident data using advanced sensors and processing it through an intelligent algorithm that utilizes Machine Learning and AI techniques. The goal is to improve ADAS's ability to detect and respond to road irregularities quickly. Various Deep Learning and AI frameworks are being used on extensive datasets that include different road conditions. The models are fine-tuned to recognize different features associated with the classification of the dataset, allowing for a comprehensive and accurate detection mechanism. Much research has been done including studying a robust dataset that has a wide range of road scenarios. This dataset is used to train and validate the machine learning models to ensure they can work in real-world conditions. ADAS has been optimized with contributions that allow vehicles to identify and respond to road anomalies in real-time. This solution will enhance safety for vehicle occupants and contribute to the overall reliability of autonomous and semi-autonomous driving systems. In conclusion, this research advances the field of road anomaly detection by proposing a comprehensive solution that powers Machine Learning and Artificial Intelligence within ADAS.
Keywords: Advanced Driver Assistance Systems (ADAS), Deep learning, Machine Learning, Artificial Intelligence (AI), Road Anomalies.

THE CHARACTERIZATION OF A PLATE COMPOSITE

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ABSTRACT
Composite materials are increasingly used in aeronautics. Their excellent mechanical properties and their low weight give them a definite advantage over to metallic materials. In this work we presented a numerical study of anisotropic and stratified plates. Le sujet principal est la mécanique des matériaux composites renforcés de fibres. Ces matériaux sont généralement composés de fibres cassantes et d'un matrice ductile. La géométrie se présente sous la forme d'un stratifié. qui se compose de plusieurs couches parallèles. L'avantage de Cette construction est qu'elle donne au matériau plus de résistance et moins de poids. calculation consists in determining the characteristics mechanics of the material according to those of its components is to determine the homogenized technical constants of the layer (E, G and $\mathcal{V}$), due to the regular arrangement of the fibres, by the mixing rule.
Keywords: Composite, epoxy carbon, mechanical properties, the mixing rule..

AŞI SIRASI TOPRAKTA VE TOHUMDA

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ÖZET
Azot, hücre bileşiminde karbon içeren maddelerle birleşerek aminoasitler, amidler, proteinler, vitaminler ve hormonlar gibi çeşitli organik bileşikler oluşturması nedeniyle canlı yaşamında önemli bir yer tutar. Atmosferde bitkilerin yararlanamayacağı formda oldukça yüksek düzeylerde azot bulunmasına rağmen, topraklarda bitkilerin yararlanabileceği formdaki azotun miktarı genel olarak çok düşüktür. Atmosferde bulunan azottan canlıların büyük bir bölümü doğrudan doğruya yararlanamazlar. Organizmaların büyük bir bölümü azotu ancak suda erimiş nitrat veya amonyum iyonları halinde topraktan alabilmektedir. Doğada oldukça hareketli olan azot, toprak ile atmosfer arasında canlı organizmalar (biyolojik yolla); endüstriyel faaliyetler, şimşek çakma, yıldırım düşme gibi atmosferik olaylarla sürekli bir dolanım halindedir. Biyolojik yolla yarayışlı azotun toprağa bağlanmasında etkili olan mikroorganizmaların başlıcaları; toprakta serbest yaşayan aktinomisetler, mavi-yeşil algler, clostridiumlar ve baklagil köklerinde ortak yaşayan(simbiyoz) Rhizobium türü bakterilerdir. Bunların en önemlileri, konak seçici Rhizobium bakterileri olup, *Leguminosae* (Baklagiller) familyasındaki bitkilerle birlikte bulunur ve bu bitkilerin köklerinde nodüller oluşturarak atmosfer azotunu toprağa fikse ederler. Bu gruba giren baklagillerin simbiyotik yaşam sürdükleri bitkiler ve bu bitkilere özgü bakteri türleri birbirlerinden belirgin olarak farklıdır. Bu nedenle yeni baklagil ekilen bir alanda, ürün artışını önemli derecede sağlayan uygun bakteri ile aşılama yapılması önerilmektedir. Pek çok toprakta nodül bakterilerinin sayısı veya kalitesi yeterli olmamaktadır. Bu koşullarda toprak veya tohumun etkinliği yüksek olan Rhizobium kültürleriyle aşılanması gereklidir. Aşılama: Azot tespit etmek yönünden baklagil bitkilerinin köklerinde yumrucuk meydana getirebilecek etkili bakteri suş veya suşlarının toprağa/tohuma verilmesidir. Her baklagil bitkisi için özel bakteri grubu olduğu gibi, her grup içerisinde de azot tespit etme yönünden etkili veya etkisiz suşlar bulunmaktadır. Etkisiz suşlar, yumrucuk meydana getirmelerine karşılık azot tespit etme güçleri çok düşüktür. Bu nedenle, çeşitli bitkiler için etkili suşların bulunup üretilmesi zorunludur.
Anahtar Kelimeler: Bakteri aşılama, Biyolojik azot fiksasyonu, İnokülasyon, Rhizobium bakterisi.

INOCULATION SEQUENCE IN SOIL AND SEED

ABSTRACT
Nitrogen has an important place in living life because it combines with carbon-containing substances in cell composition to form various organic compounds such as amino acids, amides, proteins, vitamins and hormones. Although there are quite high levels of nitrogen in the atmosphere in the form that plants cannot utilise, the amount of nitrogen in the form that plants can utilise in soils is generally very low. Most of the living organisms cannot directly utilise the nitrogen in the atmosphere. Most of the organisms can only take nitrogen from the soil in the form of nitrate or ammonium ions dissolved in water. Nitrogen, which is highly mobile in nature, is in a continuous circulation between the soil and the atmosphere by living organisms (biologically) and atmospheric events such as industrial activities, lightning strikes and lightning strikes. The main microorganisms that are effective in the binding of biologically useful nitrogen to the soil are actinomycetes, blue-green algae, clostridium and Rhizobium bacteria that live freely in the soil and symbiosis in legume roots. The most important of these are host-selective Rhizobium bacteria, which coexist with plants of the Leguminosae family and fix atmospheric nitrogen into the soil by forming nodules on the roots of these plants.The plants with which the legumes in this group live symbiotically and the bacterial species specific to these plants are distinctly different from each other. For this reason, it is recommended to inoculate a newly planted legume area with the appropriate bacteria, which significantly increases the yield. In many soils, the number or quality of nodule bacteria is not sufficient. Under these conditions, it is necessary to inoculate the soil or seed with highly effective Rhizobium cultures. Inoculation: In terms of nitrogen fixation, it is the introduction of effective bacterial strains or strains that can form nodules in the roots of legume plants into the soil/seed. As there is a special group of bacteria for each legume plant, there are effective or ineffective strains within each group in terms of nitrogen fixation. Although ineffective strains form nodules, their nitrogen fixing power is very low. Therefore, it is necessary to find and produce effective strains for various plants.
Keywords: Bacterial inoculation, Biological nitrogen fixation, Inoculation, Rhizobium bacteria.

COMPUTATIONAL ANALYSIS OF NANOPARTICLE SHAPES IMPACT ON CYLINDRICAL STREAM OF UNSTEADY OLDROYD B HYBRID NANOFLUID WITH RADIATIVE HEAT

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ABSTRACT
In thermal power and manufacturing processes, solar energy has grown extensively utilized. This work investigates the heat diffusion characteristics of an Unsteady Oldroyd B hybrid nano liquid across an expanding cylinder to improve the Parabolic Trough Solar Collector (PTSC) heat transfer efficiency. A stable magnetic field is used in the radial path in the appearance of radiant heating and general generating or absorbing heat with the Cattaneo-Christov (CC) heat flow model. A hybrid nano liquid composed of two distinct nanoparticles, $CoFe_2O_4$ and Fe_3O_4, embedded in ethylene glycol as the primary fluid, is used to formulate the mathematical model. The mathematical model is then reconstructed into a nonlinear ordinary differential equations (ODEs) system, utilizing the proper likeness transformation. The MATLAB software function bvp5c is employed to arrive at a numerical solution to the posed problem. We observed the fluctuations in the flow and thermal area, as well as the local Nusselt number, impacted by the pertinent dimensionless characteristics. The findings are addressed graphically and tabularly for several nanoparticle shapes (spherical, brick, and platelet). It has been discovered that spherical shapes have a faster heat conduction rate than brick and platelet nanoparticle shapes. While unsteadiness parameters tend to increase the temperature field, the augmentation of the temperature relaxation factor reduces the energy profile.
Keywords: Thermal radiation, Magnetic field, Oldroyd B, Catteneo-Christov (CC) heat flux, Heat transfer.

GENERALIZED SYSTEM OF EXTENDED NONLINEAR VARIATIONAL INEQUALITIES GOVERNED BY GAUSS-SEIDEL-TYPE ITERATIVE APPROACH

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ABSTRACT
This paper aims to investigate novel generalized systems encompassing extended nonlinear variational inequalities, featuring 3k-distinct nonlinear relaxed cocoercive operators. We delve into the associated fixed point problem arising from this innovative generalized system of extended nonlinear variational inequalities. To address this problem, we propose explicit iterative methods with k steps, incorporating projection operators. Leveraging the equivalent fixed point problem, we advocate the utilization of k-steps Gauss-Seidel-type iterative algorithms to derive an approximate solution for the system under consideration. Convergence results for these newly introduced k-step explicit iterative methods are established. Additionally, the paper explores specific instances of the extended variational inequalities system as special cases.
Keywords: k-steps Gauss-Seidel type iterative algorithm, Generalized system of extended nonlinear variational inequalities, Projection, Relaxed (α, β)-cocoercitivity, κ-Lipschitz continuity.

INFLUENCING FACTORS ON THE ORIGIN OF MUSICAL SOUNDS AND VOWELS

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ABSTRACT
The creation of Mother Nature is the conscious man. In connection with the birth of this perfect human being, the first forms of interaction between nature and human sounds were formed, and the first cultural forms such as dance, music, and writing developed over thousands of years. Human and natural sounds are the sources of factors that influence the formation of musical sounds. Sound is a physical phenomenon that humans and animals hear, and is a wave that vibrates through solids, liquids, and gases. Humans are capable of hearing sounds in the range of 20-20,000 Hertz, and the process of human sound has evolved over 20,000-30,000 years through the stages of family, tribe, and ethnicity. As early humans communicated with each other through sound, intelligence developed and language emerged. The famous English scientist Charles Darwin wrote in his book " On the Origin of Species & quot; 150 years ago that "the sounds of birds are somewhat similar to human sounds." Darwin's theory was supported by Shiner Miyagawa, a scientist from Japan, who noted that & quot;it seems that ancient people imitated the chirping of birds and made various sounds. International linguists agree that " Language is a whole system of gestures, rules, signs, pronunciations, and words that communicate with each other that convey common human understanding, ideas, and meanings." As language developed, so did the need for people to write down what they were thinking and what they wanted to say. Human history has survived to this day thanks to the origins of literacy, but it has often flourished and perished. Linguists divide the origin of ancient writing into the following periods: sign language, gestural signs, pictorial signs, semantic signs, phonetic signs, perfect signs, conventional signs, pronouns, etc. Influenced by these factors, modern music led to the historical stage of vowel marking.
Keywords: human, sounds, talk, letters, musical sounds

MOTIVATION IN THE UNIVERSITY EXPERIENCE AND ITS POSITIVE IMPACT ON THE JOB MARKET

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ABSTRACT
What does made someone get up early and feel good with themselves? The motivation. For many tasks, the brain needs to produce what moves us. In the university, there is a natural competition to be better than our classmates. The students are involved in projects beyond the classroom with the aim of getting better opportunities at university. However, it is important to note that this motivation can be an important factor in the job market that students may face in the future. It is for this reason that it is essential to prepare for competition in the job market right from university. Cognitive maturation requires students to take responsibility when it comes to participating in university projects. Making compromises during this period is the first step towards understanding the rules of coexistence and ensuring a better working environment. The objective of this study is to examine how motivated students are when they join and actively participate in extracurricular activities offered at their educational institution - seeing that gaining this experience can prevent the frustration and anxiety that the demands of a job can bring, and what impact the experience has on the job market. The first step to analyze these impacts will be to interview students from different courses. Interviewing those who participate, those who do not participate and questioning them how experience in acquiring this previous knowledge can help them in the job market. Those who do not participate tend to have difficulties in finding better opportunities and, consequently, those who participate will have more opportunities due to the contacts that are made during the participation in these projects. In the end, it is expected to understand the results of an experience acquired at the university, before entering the job market. Aiming to improve the quality of life of students, avoiding anxiety and promoting motivation in the execution of tasks. In addition to promoting the extracurricular opportunities that the university environment provides to students the various benefits of participating in projects.
Keywords: Motivation, University, Job Market, Extracurricular, Experience.

GREEN SYNTHESIS OF ZnO NANOPARTICLES BY TWO METHODS: COMPARISON AND APPLICATION IN PHOTOCATALYSIS

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ABSTRACT
This study consisted of a comparative study of the photocatalytic performance of zinc oxide nanoparticles (ZnO NPs) synthesized through two distinct green methods: hydrothermal synthesis and co-precipitation in the presence of Retama (RT) plant extract. The hydrothermal method involved the use of water-based solvents and controlled temperature-pressure conditions, while the co-precipitation method utilized aqueous solutions form RT-ZnO NPs. The nanoparticles were characterized using various analytical techniques such as X-ray diffraction (XRD), Fourier Transform Infrared Spectroscopy (FT-IR), and the point of zero charge (PZC). Subsequently, the synthesized RT-ZnO nanoparticles were tested for their photocatalytic efficiency, specifically their ability to degrade the herbicide Linuron (LNR) in pure water using UV light under various conditions. The kinetics of LNR photodegradation were also studied. RT-ZnO NPs synthesized via hydrothermal synthesis and co-precipitation demonstrated an effective degradation rate of approximately 90% and 100% for LNR (2 x 10-5 M) at neutral pH (pH=7.21) under UV light, respectively. These results highlighted variations in photocatalytic activity between the ZnO nanoparticles produced using the two different green synthesis routes. The findings revealed that RT-ZnO nanoparticles prepared through the hydrothermal method exhibited superior photocatalytic efficiency compared to those synthesized by co-precipitation. The study suggests that the synthesis method significantly affects the photocatalytic performance of ZnO, offering insights into optimizing eco-friendly approaches for producing highly efficient photocatalysts for environmental remediation applications. This comparative analysis sheds light on the potential and limitations of different green synthesis methods in achieving enhanced photocatalytic efficiency in ZnO nanoparticles to be used in the treatment of wastewater.
Keywords: Zinc Oxide nanoparticles, green synthesis, hydrothermal and co-precipitation methods, photocatalytic degradation, Linuron.

EFFICIENT IBUPROFENE DEGRADATION VIA PHOTO-FENTON PROCESS OVER ECO-FRIENDLY FE-SUCCINATE MOF

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ABSTRACT
The presence of emerging contaminants such as pharmaceuticals in natural waters has raised increasing concern due to their frequent appearance and persistence in the aquatic ecosystem and the threat to health and safety of aquatic life, even at trace concentrations. Subsequently, it is essential to develop new technologies that can efficiently eliminate such contaminants from the wastewater. Photocatalytic degradation in the presence of light is one of the most advanced and efficient technologies for wastewater decontamination due to simple, economical, and eco-friendly process. Many photocatalysts such as metal oxides, sulfides, and other semiconductors are used for wastewater treatment. Recently, metal–organic frameworks (MOFs) possess fascinating photocatalytic applications with their unique properties of ultra-high surface area, high porosity, and controllable chemical properties and strong stability Iron based metal organic framework using a di-carboxylate linker succinic acid (Fe-SA MOF), was synthesized using co-precipitation method and characterized by the point of zero charge (PZC) it was examined for the photocatalytic degradation of a pharmaceutical polluant namely Ibuprofen (IBP) via photo-Fenton process.Fe-SA MOF exhibited highest degradation of 75% in 150 min at natural pH (4.5) in the presence of 0.25 g L-1 of the synthesized catalysts under UV-Visible is light. The as-prepared Fe-SA MOF was applied for photo-Fenton oxidation of Ibuprofene (IBP).It exhibited efficient photo-Fenton catalytic degradation upon visible light irradiation . The IBP (5.10-5 M) was completely degraded within 150 min under UV-visible light with the aid of Fe-SA MOF (0.25 g/L) and H2O2 (10-3 M) in aqueous solution (pH = 4.5).
Keywords: AOPs, Metal-organic framework, Degradation, Photo-Fenton, IBP, Photocatalysis.

INFLUENCE OF DIRECTORS COMPENSATION ON EARNINGS MANAGEMENT PRACTICES IN THE NIGERIAN BANKING SECTOR

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ABSTRACT
The study evaluated the influence of director compensation on earnings management (EM) practices within the Nigerian banking sector. This stems from the fact that, while compensation contracts have been proposed as one tool for ensuring that both executive directors and non-executive directors (NEDs) effectively monitor the organization's affairs, they may induce EM practices due to being tied to accounting earnings (e.g. bonuses) or stock prices (e.g. stock based compensation). The adjusted population of eleven listed commercial banks was used as the census sampling method was employed. Anchored on the agency theory, the study measured directors compensation using a mix of executive directors and NEDs compensation while EM practices was proxied by discretionary provision for loan loss (DPLLs) measured using the Beaver and Engel (1996) model. Using the Ordinary least square regression, all forms of directors compensation except executive compensation were found to have positive effect on EM practices of the studied banks which shows that regulating compensation of directors should be a focus for regulatory agencies. Although only NEDs fees and allowances was found to significantly affect EM practices while other compensation variables has an insignificant effect on EM practices. The study thus recommended a shift of focus from just Chairmans compensation to include the totality of NEDs compensation and an institution of guidelines for mandatory disclosure of directors compensation.
Keywords: directors compensation, earnings management, discretionary provision for loan loss, fees and allowances, banking sector

EMOTIONAL INTERACTION AND LOCUS OF CONTROL IN ADOLESCENCE

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ABSTRACT
The modern world faces an increase in psychosocial problems associated with reduced emotional contact among youth. It is particularly important to study barriers to establishing emotional connections during adolescence. Understanding the relationship between locus of control and emotional contact may contribute to the development of effective youth psychological support strategies. The research aims to elucidate the features of barriers to establishing emotional contacts in adolescents with different loci of control. The sample consists of 96 adolescents, including 49 females (51%) and 47 males (49%). The average age of respondents is 20 years old. In the majority of surveyed adolescents, namely 90.6%, an external locus of control prevails, while 9.4% of young men exhibit an internal locus. When considering internality in spheres such as failures, family relations, work relationships, health, and illness, externality predominates critically, whereas in the spheres of achievements and interpersonal relationships, the values of externality and internality are approximately balanced. The indicators of barriers to establishing emotional contacts in adolescents are at a fairly high level. Half of the study participants have a high level of barriers to establishing emotional contacts in interpersonal communication, significantly deteriorating the quality of communication with their environment. One-quarter of respondents have an average level of barriers, and another quarter is distributed across moderate and low levels of barriers to establishing emotional contacts. Regarding the relationship between internality level and barriers to establishing emotional contacts in adolescents, the following features were identified: 1) among young men with an external locus of control, a high level of barriers to establishing emotional contacts prevails; 2) among young men with an internal locus of control, the average level of these barriers predominates. A reverse relationship between internality and the level of barriers to establishing emotional contacts in adolescents was established. That is, as the level of internality increases, the level of barriers decreases.
Keywords: emotional contact, locus of control, externality, internality.

DEVELOPMENT AND CHARACTERISATION OF A COMPOSITE BASED ON DIATOMITE

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ABSTRACT
Diatomite is a natural material of Algerian origin in powder form also called kieselguhrs a white coloration and high porosity over 72%, Textural and superficial characterization of diatomite was carried out by several analysis techniques, X-ray diffraction and scanning electron microscope SEM and IR infrared and BET. The results show that crude kieselguhr is formed of several components and in particular silica, alumina and calcium carbonates occupying time the surface of the pores of the material in question. To this end we have made of chemical and thermal treatments on natural porous diatomite to improve the quality and valued these materials, the chemical activation was performed with sulfuric acid and nitric acid. Another thermal activation was conducted at two temperatures, 800 ° C and 1000 ° C. The results showed that this activation has a significant effect on the average pore diameter. This was presumably attributed to the elimination of carbonates which leads to the improvement of the porous structure of the diatomite. These characterizations prepared and processed materials were performed in different laboratories. Particular attention was paid to the identification of the effect of the activation of the diatomite on these features by linking with the adsorbent properties in perspective prepared materials will be used in the water treatment field.
Keywords*:* diatomite; Characterization; Adsorption, Mechanism

ELABORATION OF ORGANO-INORGANIC MATERIALS BASED ON OF NATURAL PRODUCTS AND THEIR APPLICATIONS IN CHEMICAL PROCESSES

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ABSTRACT
A series of naturally occurring diatomaceous earth samples from sig mascara (Algeria northwestern), were investigated, which are characterized by the expansion and evolution during the Messinian age. Four varieties of diatomite were distinguished, characterized, and successfully used to adsorb methylene blue dye in aqueous medium. Several properties and characteristics of diatomite have been outlined using analytical methods such as X-ray fluorescence spectrometry, X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), N2 adsorption–desorption (BET), and scanning electron microscopy (SEM), as well as other complementary analysis tests. Results showed that silica and calcium carbonates were the main constituents of the diatomite samples (ranging between 32.8 and 61.5% for SiO_2; and 13.8–25.9% for CaO), with a slight difference in chemical composition between selected samples. Typical for all diatomite samples, the XRD analysis suggests a high mass quantity of amorphous phase (Opal); high content of crystal phase was also registered. FTIR allowed determining the basic characteristic silica bands regarding diatomite samples. While the BET and SEM investigations revealed that the studied diatomite material has a highly porous structure and was very rich in diatoms. The maximum adsorption capacity of methylene blue that was calculated from the Langmuir isotherm model was 116.59 mg/g. The diatomite deposit may find promising applications as low-cost adsorbent for dyes removal from water.
Keywords: diatomite; Characterization; Adsorption, Mechanism.

DOES THE PRESENCE OF DIABETIC NEUROPATHY PREDICT THE PRESENCE OF RETINOPATHY IN TYPE 2 DIABETICS?

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ABSTRACT

Diabetic peripheral neuropathy (DPN) is a complex condition influenced by various factors, with primary risks linked to unbalanced glycemic levels and the duration of diabetes. It exhibits a robust correlation with other diabetes' micorangiopathies. The aim of our work was to assess of the association of DPN with diabetic retinopathy (DR) in a population of patients with type 2 diabetes. This was a descriptive cross-sectional study of 100 type 2 diabetic patients hospitalized at the Tunis National Institute of Nutrition (INNTA). The sample was subdivided into two groups; the first comprises patients with DR and the second patients without DR. In each group, we compared clinical and metabolic characteristics and associated degenerative complications. Mean age was 57.20 ±8.48 years. Women accounted for 74%. 29% of patients were smokers. Median weight was 91 [65 ;110] kg. Median BMI was 30.46 [22.50 ;38.28]kg/m². The mean duration of diabetes was 14.79 4.55 years. The majority (70%) of patients were on human insulin. Mean HbA1C was 10.33%. Chronic kidney disease was 35%. Mean creatinine clearance was 93.16 ±19.19 ml/L/1.73m². The respective frequencies of diabetic neuropathy, diabetic retinopathy and diabetic nephropathy were 30%, 55% and 46%. Macroangiopathy was present in 35% of cases (coronary artery disease (10%), stroke (3%),

obliterative arteriopathy of the lower limbs (18%).The onset of DR was significantly correlated with the duration of diabetes (p=0,003). DR was associated with poor glycemic control (p=0.004), with diabetic nephropathy (p=0,004) but not with coronary artery disease (p =0,65) . DR was significantly more prevalent in patients with PDN ($p<10^{-3}$). In conclusion, our study suggests a significant association between the presence of diabetic neuropathy and the likelihood of concurrent retinopathy in individuals with Type 2 diabetes. The findings underscore the interconnection of microvascular complications in diabetes, emphasizing the potential utility of neuropathy assessments as indicators for the presence of retinopathy.
Keywords: diabetic retinopathy, Diabetic peripheral neuropathy

CLINICAL AND BIOLOGICAL CHARACTERISTICS OF A POPULATION WITH EARLY-ONSET DIABETIC NEUROPATHY

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ABSTRACT

Diagnosis of peripheral diabetic neuropathy can significantly improve the prognosis and help prevent severe complications. The aim of this work was to assess early onset diabetic neuropathy and to study clinical and biological characteristics of this population. This was a prospective study carried out over 6 months in department C of the national nutrition institute of Tunis. We included all diabetic patients hospitalized for poorly controlled diabetes in whom diabetes had been progressing for less than 5 years and who presented with diabetic neuropathy. Then we collected their clinico-biological characteristics from medical records. Creatinine clearance was estimated using CKD-Epi formula. We included 31 patients. The population was characterized by a female predominance with a sex ratio of 4.16. The mean age was 61.4 ±8.2 years. 71% of patients were smokers. The frequency of hypertension and dyslipidemia was respectively 45% and 61.3%. All were men. The median BMI was 32.4Kg/m² with extremes of 26.2 and 34,2 Kg/m². Median weight was 82 with extremes of 67 and 110 kg. The mean duration of diabetes was 3.7±1.6 years with extremes of 4 months and 5 years. All of patients of patients were on human insulin. The mean HbA1C was 11.2±3.5%. All patients were characterized by a glycemic imbalance on oral antidiabetics indicating a switch to insulin.

Chronic kidney disease was was present in 4 patients. Mean creatinine clearance was 100.8 ±19.6 ml/mn. No patient had diabetic retinopathy. In summary, our study illuminates the clinical and biological features of early-onset diabetic neuropathy. Our population was characterized by the high prevalence of male gender, smoking, uncontrolled diabetes and obesity. Further study are needed to characterize this entity.
Keywords: HbA1C**,** peripheral diabetic neuropathy

A STUDY ON YOUTH PERCEPTION TOWARDS MILLET BASED ENTERPRISES WITH SPECAIL REFERENCE TO MADURAI, TAMIL NADU, INDIA

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ABSTRACT
Millets, a ray of sustainability, are gaining renewed attention in recent years for their significant contribution to food security, climate resilience, nutritional density, and as a boon to the field of Entrepreneurship. Indian millets are nutritionally superior to wheat and rice as they are rich in protein, vitamins and minerals. India is among the top five exporters of millets in the world Millet start-ups have emerged as a promising industry in India, focusing on production and global reach. Understanding the youth's perception and attitude towards millets is crucial for gauging the feasibility of integrating these ancient grains into contemporary diets and lifestyles. This study is centred on examining the awareness levels and attitudes of youth of Madurai district towards millet products and its nutritional benefits and consumption pattern with a particular emphasis on their potential for long chain millet-based start-ups. This study delves into the perceptions and attitude of youth regarding the taste, accessibility and versatility of millets while exploring the entrepreneurial inclination for the betterment of society. This study examines the youth awareness level about existing Indian government start-ups schemes and support mechanism aiming to promote millet, awareness and entrepreneurial opportunities in India. 200 respondents were chosen and stratified random sampling method has been used. To assess their perception towards the readiness to embrace multi-based enterprises sophisticated tools such as factor analysis, Mann-Whitney test, Kruskal-Wallis test, one way ANOVA test, post hocc test, weighted average and Garrett ranking technique. Based on the research findings suggestions were given in order to enhance budding entrepreneurs to enter into millet industry. This study is initiative to support with the Indian government in the achievement of SDG goal of zero poverty and no hunger.
Keywords: India, ANOVA, Mann-Whitney test

INFLUENCE OF CORTISOL ON THE FIBRIL FORMATION KINETICS OF A□42 PEPTIDE: A MULTI-TECHNICAL APPROACH

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ABSTRACT
Amyloid-□□peptide (A□) aggregates are known to be correlated with pathological neurodegenerative diseases. The fibril formation process of such peptides in solution is influenced by several factors, such as the ionic strength of the buffer, concentration, pH, and presence of other molecules, just to mention a few. In this paper, we report a detailed analysis of in vitro A□42 fibril formation in the presence of cortisol at different relative concentrations. The thioflavin T fluorescence assay allowed us to monitor the fibril formation kinetics, while a morphological characterization of theaggregates was obtained by atomic force microscopy. Moreover, infrared absorption spectroscopy was exploited to investigate the secondary structure changes along the fibril formation path. Molecular dynamics calculations allowed us to understand the intermolecular interactions with cortisol. The combined results demonstrated the influence of cortisol on the fibril formation process: indeed, at cortisol-A□42 concentration ratio (□) close to 0.1 a faster organization of A□42 fragments into fibrils is promoted, while for □ = 1 the formation of fibrils is completely inhibited.
Keywords: A□42 peptide; fibril formation; ThT fluorescence; secondary structure; infrared spectroscopy; atomic force microscopy; molecular dynamics

REVEALING THE INFLUENCE OF TETHER LENGTH ON THEINTRAMOLECULAR [3 + 2] CYCLOADDITION REACTIONS OF NITRONES WITH ALKYNES FROM THE MOLECULAR ELECTRON DENSITY THEORY PERSPECTIVE

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ABSTRACT
This study investigates the [3+2] cycloaddition (32CA) reactions involving nitrone and acetylene derivatives 4b, 5b, and 6b using Molecular Electron Density Theory (MEDT) and Density Functional Theory (DFT) methods at the B3LYP-D3/6 31G (d) computational level. The research reveals the zwitterionic (zw-type) nature of these reactions, unveiling a one-step mechanism with activation enthalpies ranging from 8.80 to 14.37 kcal mol^{-1} in acetonitrile and ethanol solvents. The reaction with (4b) produces two regioisomeric pathways leading to products $P_{1,5\text{-}4b}$ and $P_{1,4\text{-}4b}$, while reactions with (5b) and (6b) result in the formation of a single product. Topological analysis categorizes the nitrone as a zwitterionic three-atom component (TAC), and conceptual density functional theory (CDFT) indices classify the 32CA reactions as forward electron density flux (FEDF) reactions. Further insights from Bond Evolution Theory (BET) indicate that the formation of new C-C and C-O covalent bonds does not initiate in the transition states but occurs in intermediate stages, displaying pseudoradical centers of atoms already engaged in bonding.
Keywords: 4-isoxazoline, DFT/B3LYP-D3, regioselectivity, cycloaddition reaction, MEDT, ELF.

A COMPARITIVE ANALYSIS OF ENFORCEMENT OF INVESTMENT ARBITRATION AWARDS IN INDIA, UK AND USA

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ABSTRACT

This research paper aims to compare different mechanisms associated with the recognition and enforcement of international investment awards under distinct jurisdictions, specifically focusing on the legal landscapes of India, the United Kingdom, and the United States. Principally, India has not participated in the ICSID Convention, thereby absolving it from any obligation to attend to investment arbitral awards on par with domestic court judgements as stated under Article 54. In addition to this, India has referred to the commercial reservation provision of Article I(3) within the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, that is the "New York Convention". Subsequently, there is a restriction on the application of New York Convention in India solely to foreign awards arising from commercial relationships under the Indian law as elucidated by Section 44 of the Act. This paper aims to branch out and delve into how Indian courts interpret this provision, thereby acknowledging its applicability and potentially excluding investment arbitral awards from its scope at the same time.Unlike India, the regime in the United States of America is oriented towards a pro-enforcement stance, as far as investment arbitration awards under ICSID are concerned. The enforcement of such awards is governed by the provisions of the Federal Arbitration Act (FAA) and the New York convention. The FAA lays down a framework for the enforcement of arbitration agreements and awards, encompassing both, domestic as well as international awards. Section 207 of this act deals particularly with ICSID awards, giving them the same status as final judgments of a U.S court as far as enforcement and recognition are concerned. The country is also a party to the New York Convention. Chapter-2 of the FAA ensures that it is implemented. As enshrined in Article-III of the convention, the US enforces and recognizes ICSID awards. Enforcement of ICSID awards however can be refused if one of the grounds mentioned in Article-V, such as a breach of public policy or procedural irregularities are found. The United Kingdom member of the International Centre for Settlement of Investment Disputes (ICSID) and is a signatory to the New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards. Further, the United Kingdom adheres to the United Nations Commission on International Trade Law (UNCITRAL) Model Law on International Commercial Arbitration.The enforcement of an award depends on the country in which the seat of arbitration is situated and is governed by the rules followed in that country. In the UK, arbitration awards can be enforced by invoking the Arbitration Act 1996, the New York Convention, the Geneva Convention 1927, the Administration of Justice Act 1920, the Foreign Judgments (Reciprocal Enforcement) Act 1933, and Common Law.

There are two procedures to enforce an arbitral award. The first method is to seek the leave of the Court to enforce the award, and the second is to seek the same relief from the national Courts as set out in the arbitral award. The enforcement of the award can be challenged on the limited grounds laid down in the New York convention. The National Court can refuse to enforce the award if the Court opines that enforcement of the award would violate public policy. Arbitral proceedings dealing with complex issues of law can be appealed to the Supreme Court; this process can take approximately two years. There is a specified time limit in which the award is to be enforced. Non-compliance with an award is considered a violation of the arbitration agreement.
Keywords: Arbitration, enforcement, ICSID, New York Convention, Award

LINEAR ALGEBRA APPLICATIONS IN RURAL DEVELOPMENT: A SYSTEMATIC APPROACH

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ABSTRACT
Rural development aims to uplift the standard of living and economic prospects in rural regions. This paper delves into the realm of linear algebra, showcasing its potential in addressing the distinct challenges faced by rural communities. Imagine it as wielding mathematical tools—like matrix operations, eigenvalue analysis, and linear regression—to optimize resource allocation, infrastructure planning, and community empowerment strategies. Through the exploration of case studies and theoretical frameworks, we illuminate how linear algebra can dissect agricultural productivity, streamline transportation networks, and tailor energy systems to suit rural environments seamlessly. Furthermore, we highlight its role in social dynamics, such as healthcare accessibility and education levels. These insights are invaluable for policymakers and community leaders striving to make well-informed decisions. By weaving mathematics with rural development objectives, this research provides a roadmap for leveraging linear algebra to foster sustainable growth and inclusivity in rural areas. It paints a vivid picture of how mathematical rigor can translate into real-world solutions, driving positive change and prosperity in rural communities. Using Geometric Information Systems software we can improve transportation networks and how to make transportation efficient.
This paper serves as a testament to the transformative power of linear algebra, showcasing its capacity to address multifaceted challenges and drive progress in even the most remote corners of the world.
Keywords: Linear algebra, Resource allocation, Infrastructure planning, Matrix operations, Eigenvalue analysis, Linear regression, Sustainable growth, Transportation networks, Geometric Information Systems (GIS).

MATHEMATICAL MODELING FOR SOLAR & WIND ENERG

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ABSTRACT
This abstract provides an overview of different ways to use math to study solar and wind energy. ıt discusses how researchers have applied mathematical models to understand and improve the efficiency of renewable energy systems. these models help predict energy production, optimize resource allocation, and design beſer technologies. the review covers various methods such as differential equations, optimization techniques, and statistical analysis. ıt also explores real-world applications like forecasting energy generation, assessing environmental impacts, and enhancing energy storage solutions. overall, this review highlights the importance of mathematical modeling in advancing sustainable energy sources like solar and wind power.
Keywords: solar energy, wind energy, mathematical modeling, efficiency improvement, renewable energy systems, energy production prediction, resource allocation optimization, technology design, differential equations, optimization techniques, statical analysis, energy generation forecasting, environmental impact assessment, energy storage solutions, sustainable energy sources.

POTENTIEL APPLICATIONS OF GREEN ZINC OXIDE NANOPARTICLES FOR DEGRADATION OF DIFENOCONAZOLE IN WATER

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ABSTRACT
The green method was utilized to produce zinc oxide nanoparticles (ZnO-NPs) by utilizing juice from Rosmarinus officinalis. The Green approach is safer, less hazardous, more cost-efficient, energy-efficient, and environmentally friendly than its chemically produced counterparts. The ZnO-NPs were examined for their optical characteristics using XRD, FT-IR, and UV-Vis spectroscopy. The Zn-O bond's distinctive absorption peak was discovered in the FTIR spectrum at 416 cm-1. The ZnO XRD results revealed a propensity for the three strongest diffraction peaks. The average diameter of ZnO NP crystallites was 31 nm. ZnO nanoparticles were evaluated for their photocatalytic ability when exposed to UV for drug degradation in aqueous solution. The ZnO photocatalyst is able to remove difenoconazole from water with strong photocatalytic activity, as evidenced by the results. Additionally, after 2 hours, total deterioration was achieved.
Keywords: ZnO nanoparticles, Pesticide, Green method, difenoconazole, Degradation.

YOĞUNLUK FONKSİYONEL TEORİSİ KULLANILARAK Ptn (n= 2-15,18,22,24) NANO KÜMELERİNİN İNCELENMESİ

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ÖZET
Pt_n (n=2-15, 18,22,24) atom kümelerinin elektronik, geometrik ve manyetik özellikleri, genelleştirilmiş gradyent yaklaşımı ile yoğunluk fonksiyonel teori (YFT) kullanılarak incelendi. Platin kümelerinin en yüksek dolu moleküler orbital (HOMO), en düşük boş moleküler orbital (LUMO), homo-lumo fark enerjisi (HLG), bağlanma enerjisi, manyetizasyon ve bağ uzunluğu değerleri artan atom sayısına bağlı olarak hesaplandı. Bu kümelerin artan atom sayısı ile boyut olarak hangi yapıları tercih ettiği belirlendi. Bulk yapıya bakıldığında Pt'nin manyetik olmadığı halde, platin nano atom kümelerininmanyetik değerler kazandığı ve artan atom numarası ile genel olarak azaldığı bulundu. Pt_{14} atom kümesinin manyetik özelliğini kaybettiği belirlendi.
Anahtar Kelimeler: Yoğunluk Fonksiyonel Teori, Elektronik yapı, Pt_n atom kümleri, Genelleştirilmiş gradyent yaklaşımı

INVESTIGATION of Ptn (n= 2-15,18,22,24) NANO CLUSTERS by USING DENSITY FUNCTIONAL THEORY

ABTRACT
The electronic, geometric and magnetic properties of Pt_n (n=2-15,18,22,24) clusters are investigated by using density functional theory (DFT) within generalized gradient approximation. The size dependence of binding energy, highest occupied moleculer orbital (HOMO), lowest unoccopied moleculer orbital (LUMO), homo-lumo difference energy (HLG), magnetizasyon and bond length values are calculated for platinum clusters. It was determined that Ptn clusters prefer the structure in size with increasing number of atoms. Looking at the bulk structure, it was found that while Pt is not magnetic, the magnetic values of Pt_n (n=2-15,18,22,24) nano atom clusters generally decrease with increasing atomic number. It was determined that the Pt_{14} cluster lost its magnetic properties.
Keywords: Density Functional Theory, Electronic structure, Pt_n clusters, generalized gradient approximation

BİYOMOLEKÜL TANISI İÇİN ÇOKLU SENSÖR TABANLI ARAYÜZ TASARIMI

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ÖZET
Biyomoleküler tanı, hastalıkların erken teşhisi, tedavi süreçlerinin izlenmesi gibi klinik uygulamalarda kullanılan araştırma teknikleri yoluyla elde edilen bilgilerdir. Biyosensör teknolojilerinde ve elektrokimyasal hücre tasarımlarında gerçekleştirilen elektrokimyasal ölçümler, biyomoleküler etkileşimleri ve hücresel olayları anlamak için kullanılır. Bu bağlamda biyomoleküler teşhiste yaygın olarak kullanılan cihazlar potansiyostat cihazlarıdır, ancak mevcut potansiyostat cihazları genellikle yalnızca tek bir elektrotu ölçer ve bu da birden fazla elektrot kullanmanın faydalarını sınırlandırır. Ayrıca mevcut çok kanallı potansiyostat cihazları pahalıdır. Bu bağlamda bu çalışma, biyomoleküler teşhis uygulamaları için potansiyostat cihazlarının daha etkin kullanımını geliştirmek amacıyla tek kanallı bir potansiyostata bağlanan bir arayüz tasarımıdır. Buradaki arayüz tasarımı, mikroişlemci yazılımı ve özel devre tasarımı ile tek kanaldan birden fazla elektrotun sıralı ölçümlerini gerçekleştirebilmektedir. Bu özellik, birden fazla elektrot kullanıldığında analitik esneklik, hızlı veri toplama ve pratik ölçüm gibi avantajlar sağlar. Aynı zamanda pahalı çok kanallı potansiyostat cihazına olan ihtiyacı da azaltır. Ayrıca mikroişlemci yazılımı ile ölçümler potansiyostat cihazının bilgisayar yazılımına veri olarak aktarılabilmektedir. Bu veriler potansiyostat yazılımı ile grafiksel verilere dönüştürülebilmekte ve bu veriler üzerinde yorum yapılabilmektedir. Mevcut devre topolojisinden farklı bir devre topolojisi kullanıldığından ve yazılım desteği eklendiğinden, bireysel ölçümler veya zaman girişi yapılarak analitik tarama ve ölçümler belirlenen periyotlarda otomatik olarak gerçekleştirilebilmektedir. Bu çalışma, biyomoleküler teşhis alanında elektrokimyasal ölçümleri geliştirerek tıp, analitik kimya, eczacılık gibi ölçüm gerektiren sektörlere kolaylık sağlamayı hedeflemektedir. Deneylerin daha pratik ve hızlı bir şekilde gerçekleştirmesine katkıda bulunacaktır.
Keywords: Biyosensör teknolojileri, analitik kimya, eczacılık

MULTI-SENSOR-BASED INTERFACE DESIGN FOR BIOMOLLECULE DIAGNOSIS

ABSTRACT
Biomolecular diagnosis is the information obtained through research techniques used in clinical applications such as early diagnosis of diseases and monitoring of treatment processes. Electrochemical measurements performed in biosensor technologies and electrochemical cell designs are used to understand biomolecular interactions and cellular events. Devices commonly used in biomolecular diagnostics in this context are potentiostat devices, but current potentiostat devices generally measure only a single electrode, limiting the benefits of using multiple electrodes. Additionally, existing multi-channel potentiostat devices are expensive.In this context, this study is the design of an interface connected to a single-channel potentiostat to improve the more effective use of potentiostat devices for biomolecular diagnostic applications. The interface design here can perform sequential measurements of multiple electrodes from a single channel with microprocessor software and special circuit design. This feature provides advantages such as analytical flexibility, rapid data collection and practical measurement when multiple electrodes are used. It also reduces the need for expensive multi-channel potentiostat device. In addition, measurements can be transferred as data to the computer software of the potentiostat device with the microprocessor software. These data can be converted into graphical data with potentiostat software and comments can be made on these data. Since a circuit topology different from the existing circuit topology is used and software support is added, analytical scanning and measurements can be carried out automatically in specified periods by making individual measurements or time entry. This study aims to provide convenience to sectors requiring measurement such as medicine, analytical chemistry and pharmacy by developing electrochemical measurements in the field of biomolecular diagnostics. It will contribute to making experiments more practical and faster.
Keywords: Biosensor technologies, analytical chemistry, pharmacy

ORTAOKUL SOSYAL BİLGİLER DERS KİTAPLARININ GİRİŞİMCİLİK BECERİSİ KAZANDIRMADAKİ ROLÜNÜN ÖĞRENCİ GÖRÜŞLERİ KAPSAMINDA İNCELENMESİ

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ÖZET
Sosyal bilgiler; tarih, coğrafya, sosyoloji, psikoloji, antropoloji gibi birçok sosyal bilim disiplininden derlediği bilgileri ilkokul ve ortaokul düzeyindeki öğrencilerin hazırbulunuşluklarına uygun biçimde düzenleyip öğreten ve öğrencilere günlük yaşamlarında kullanabilecekleri bilgi, değer ve beceriler kazandırmayı amaçlayan bir derstir. Sosyal bilgiler dersinin öğrencilere kazandırmayı amaçladığı becerilerden biri, girişimciliktir. Girişimcilik, bireyin karşılaştığı olanakları en iyi biçimde değerlendirerek yaşam kalitesini geliştirmesine yönelik bir beceridir. Girişimcilik bireysel yarar sağlamak odaklı olabileceği gibi toplumsal koşulların geliştirilmesine ilişkin de olabilmektedir. Dolayısıyla girişimciliğin hitap ettiği alanlar bağlamında birçok türü mevcuttur. Sosyal bilgiler dersinde öğrencilere girişimcilik becerisi kazandırmak amacıyla kullanılan materyallerin başında ders kitapları gelmektedir. Ders kitaplarının bu kapsamdaki önemi göz önüne alındığında girişimcilik becerisini kazandırmakla ilgili içeriğinin yeterli düzeyde ve girişimcilik becerisi kazandırma amacına uygun biçimde tasarlanmış olması beklenmektedir. Bu bakış açısıyla gerçekleştirilen çalışmada sosyal bilgiler ders kitaplarının girişimcilik becerisi kazandırmadaki rolünün öğrenciler tarafından nasıl görüldüğü irdelenmiştir. Çalışmada nitel araştırma yöntemlerinden temel nitel desen kullanılmıştır. Çalışmanın katılımcı grubu kolay ulaşılabilir örnekleme yöntemi ile oluşturulmuştur. Katılımcı grubunda Ağrı il sınırları içerisindeki üç ortaokulda öğrenim görmekte olan dört tane 5. sınıf, beş tane 6. sınıf ve dört tane 7. sınıf öğrencisi olmak üzere toplam 13 katılımcı yer almıştır. Araştırmanın verileri araştırmacılar tarafından tasarlanan yarı yapılandırılmış görüşme formu kullanılarak toplanmıştır. Verilerin çözümlenmesinde betimsel analiz tekniğinden yararlanılmıştır. Çalışmanın sonunda ortaokul öğrencilerinin sosyal bilgiler ders kitaplarını girişimcilik becerisi kazandırmada başlıca role sahip ancak içerik açısından yetersiz materyaller olarak gördükleri belirlenmiştir. Çalışmada ayrıca öğrencilerin; sosyal bilgiler ders kitaplarının girişimcilik bağlamlı içeriğinin geliştirilmesi gerektiği ve girişimcilik becerisi kazandırmak amaçlı sınıf içi etkinlikler yapılması görüşünde oldukları sonucuna ulaşılmıştır. Araştırmada ulaşılan sonuçlar esas alınarak, ortaokul öğrencilerinin sosyal bilgiler ders kitaplarının girişimcilik kazandırmadaki rolüne ilişkin görüşleriyle ilgili daha kapsamlı araştırmalar yapılması önerilmiştir.
Anahtar Kelimeler: Sosyal bilgiler ders kitabı, ortaokul öğrencileri, girişimcilik becerisi, görüş

EXAMINING THE ROLE OF MIDDLE SCHOOL SOCIAL STUDIES COURSEBOOKS IN ACQUIRING ENTREPRENEURSHIP SKILL BASED ON STUDENTS' VIEWS

ABSTRACT
Social studies is a course that organizes the information compiled from many social science disciplines such as history, geography, sociology, psychology and anthropology in accordance with the readiness of primary and middle school students and aims to provide students with knowledge, values and skills that they can use in their daily lives. One of the skills that the social studies course aims to provide students with is entrepreneurship. Entrepreneurship is a skill focused on improving the quality of individuals' lives by making the best use of the opportunities they encounter. Entrepreneurship can be focused on providing individual benefit or it can be related to the development of social conditions. Therefore, there are many types of entrepreneurship in terms of the areas it covers. Coursebooks are one of the most important materials used in the social studies course to provide students with entrepreneurship skills. Considering the importance of coursebooks in this context, it is expected that the content related to acquiring entrepreneurship skills should be adequate and designed in accordance with the purpose of acquiring entrepreneurship skill. This study examined how students view the role of social studies coursebooks in acquiring entrepreneurship skill. Basic qualitative design, was used in the study. A total of 13 participants, four 5th grade, five 6th grade and four 7th grade students from three middle schools in Ağrı province, were included in the participant group which was formed by convenience sampling method. The data were collected through a semi-structured interview form and analyzed through descriptive analysis. In the study, it was determined that middle school students saw social studies coursebooks as materials that have a major role in acquiring entrepreneurship skills but are insufficient in terms of content. In the study, it was also concluded that students thought that the content of social studies coursebooks in the context of entrepreneurship should be improved and in class activities should be carried out in order to acquire entrepreneurship skill. In the study, it is recommended that more comprehensive research be conducted on the views of middle school students on the role of social studies coursebooks in acquiring entrepreneurship skill.
Keywords: Social studies coursebook, middle school students, entrepreneurship skill, view

YABANCI GÖÇÜNÜN BELEDİYELERİN HİZMET SUNUMU ÜZERİNDEKİ ETKİLERİ

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ÖZET
Yabancı göçü, global çapta çözüm bulunması ve kontrollü biçimde yürütülmesi gereken, göçmenlerin ikamet ettiği kentler de merkezi yönetimi ve belediyeleri ciddi biçimde çok yönlü programlar uygulamaya zorlayan, dinamik yapıya sahip bir süreçtir. Bireylerin ülkelerinde ki savaş, iç çatışmalar, daha iyi eğitim ve yaşam koşulları gibi gerekçelerle yapmış olduğu dış göç, yerleşme düşüncesinde olunan ülkeyi siyasi, ekonomik, kültürel ve psikolojik olarak etkilemektedir. Türkiye'de merkezi idare adına göç sürecini Göç İdaresi Genel Müdürlüğü yönetmekte olup, kentler de il temsilcilikleri vasıtasıyla denetim ve kontrolleri gerçekleşmektedir. Kentlerin belediye yönetimleri de merkezi idareyle birlikte bu sürece zorunlu olarak dâhil olmaktadır. Yabancı göçüyle gelen insanların barınma, ulaşım, eğitim, güvenlik ve alt yapı sorunlarının doğrudan muhatabı, merkezi yönetime ilaveten belediyeler olmaktadır. Belediyeler, yabancı göçüyle ortaya çıkan sorunlara yönelik olarak kısıtlı bütçeleriyle çözüm üretmeye çalışmaktadırlar. 6458 sayılı Yabancılar ve Uluslararası Koruma Kanunu, 5216 ile 6360 sayılı Büyükşehir Belediyesi Kanunları ve 5393 Sayılı Belediye Kanunu göçmen ve sığınmacı süreciyle olarak belediyeleri yetkilendirmiş bulunsa da, önemli olan özellikle yoğun yabancı göçü alan belediyelerin bütçelerine, bütün süreci zorlanmadan yürütebileceği ve gerekli alt yapı yatırımlarını oluşturabileceği bütçeyi aktarmaktır. TÜİK verilerine göre, Türkiye'ye 2022 yılında gelen yabancı uyruklu nüfus %25 ile Rusya Federasyonu, %8,1 ile Ukrayna, %6,5 ile İran, %5,4 ile Afganistan ve %4,8 ile Irak vatandaşlarıdır. Türkiye'de hâlihazırda çok sayıda Suriyeli ve Afganistanlı göçmen ve sığınmacıların bulunduğu da göz önünde bulundurulursa, göçmen nüfusunun hızla artmış olduğu değerlendirilmektedir. Çalışmanın amacı; belediyelerin karşı karşıya kaldığı yabancı göçüyle nasıl mücadele edebileceğini değerlendirmek, ortaya çıkan problemlerin çözüm yollarını irdeleyerek incelemektir. Yabancı göç sürecinin belediyeleri ciddi kaynak sıkıntısı içerisine ittiğinin ve hizmet sunumunda problemler yarattığının anlaşılması bakımından alana katkısı olacaktır. Çalışmada belediyelerce göç sürecinin yönetilmesine ilişkin kanunlar, ilgili mevzuatlar, konuya ilişkin yazılı eserler, internet kaynakları irdelenerek, literatür taraması uygulanmıştır.
Anahtar Kelimeler: Yabancı göçü, belediyeler, alt yapı, yatırımlar, kanunlar

EFFECTS OF FOREIGN MIGRATION ON SERVICE PROVISION OF MUNICIPALITIES

ABSTRACT
Foreign migration is a dynamic process that needs to be solved on a global scale and carried out in a controlled manner, forcing the central government and municipalities to implement seriously multifaceted programs in the cities where immigrants reside. Emigration by individuals due to reasons such as war, internal conflicts, better education and living conditions in their country affects the country where they intend to settle politically, economically, culturally and psychologically. In Turkey, the General Directorate of Migration Management manages the migration process on behalf of the central administration, and inspections and controls are carried out in cities through provincial representatives. Municipal administrations of cities are also necessarily involved in this process together with the central administration. In addition to the central government, municipalities are the direct addressees of the housing, transportation, education, security and infrastructure problems of people who come with foreign migration. Municipalities are trying to find solutions to the problems arising from foreign immigration with their limited budgets. Although the Law on Foreigners and International Protection No. 6458, the Metropolitan Municipality Laws No. 5216 and 6360 and the Municipality Law No. 5393 have authorized municipalities with regard to the immigrant and refugee process, the important thing is that the municipalities, especially those receiving intense foreign immigration, have access to their budgets so that they can carry out the whole process without difficulty and create the necessary infrastructure investments. is to transfer the budget. According to TÜİK data, the foreign national population coming to Turkey in 2022 are citizens of the Russian Federation with 25%, Ukraine with 8.1%, Iran with 6.5%, Afghanistan with 5.4% and Iraq with 4.8%. Considering that there are already many Syrian and Afghan immigrants and refugees in Turkey, it is considered that the immigrant population has increased rapidly. Purpose of the study; The aim is to evaluate how municipalities can combat the foreign migration they face and to examine the solutions to the problems that arise. It will contribute to the field in terms of understanding that the foreign migration process pushes municipalities into serious resource shortages and creates problems in service delivery. In the study, a literature review was conducted by examining the laws regarding the management of the migration process by municipalities, relevant legislation, written works and internet resources on the subject.
Keywords: Foreign immigration, municipalities, infrastructure, investments, laws

AVRUPA BİRLİĞİ'NİN COVİD-19 PANDEMİSİNE MÜDAHALELERİ: KÜRESEL KRİZLERDE AKTÖRLÜĞÜN DEĞERLENDİRİLMESİ

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ÖZET
Bu araştırma, COVID-19 pandemisi sürecinde Avrupa Birliği'nin (AB) sergilediği politik eylemler ve reaksiyonlar üzerine odaklanarak, aktörlük teorisi bağlamında kapsamlı bir analiz sunmaktadır. François Duchêne tarafından 1972 yılında ileri sürülen "Sivil Güç" paradigması temel alınarak, AB'nin "aktör olarak doğası"na yönelik tartışmalar, Ian Manners'ın 2000'lerde geliştirdiği "Normatif Güç" kavramı ile derinleşerek yeni bir boyut kazanmıştır. COVID-19 pandemisi, AB'nin dayanıklılığını, işbirliğine dayalı politika oluşturma yeteneğini ve genel kriz yönetim kapasitesini kritik bir şekilde test etmiştir. Bu bağlamda, üye devletlerin sınırlarını kapatma ve bağımsız yardım arayışlarına girişmeleri, özellikle İtalya'nın uluslararası alanda geniş yankı bulan ve karşılıksız kalan yardım talepleri dikkat çekici olmuştur. Pandemiye bağlı ekonomik sıkıntılara karşılık olarak, AB liderleri, büyük bir kurtarma fonunun kurulması da dahil olmak üzere, geniş kapsamlı bir toparlanma stratejisine yönelik taahhütlerde bulunmuşlardır. AB'nin COVID-19 pandemisine yanıtları, "hastalığın yayılmasını sınırlama, ulusal sağlık sistemlerini destekleme, sosyo-ekonomik etkileriyle mücadele ve aşıların adil dağıtımını sağlama" konularında kapsamlı bir yaklaşımı içermektedir. Bu çalışma, aktörlük teorisinin çerçevesi içinde AB'nin COVID-19 pandemisi süresince dış politika sahnesindeki performansını değerlendirir. Araştırma, özellikle dayanışma, güven oluşturma ve komşu ülkelere mali yardım sağlama gibi kritik faktörlere odaklanarak, AB'nin beklenmedik küresel durumlar karşısındaki rolünün evrimine yönelik derinlemesine bir perspektif sunmayı amaçlamaktadır. Bu bağlamda, Birliğin öngörülemeyen zorluklara nasıl tepki verdiğine dair kapsamlı bir inceleme gerçekleştirilecektir.
Anahtar Kelimeler: AB Dış Politikası, COVID-19, Aktör Olarak AB, Küresel Krizler

THE EUROPEAN UNION'S RESPONSE TO THE COVID-19 PANDEMIC: EVALUATING ACTORNESS IN GLOBAL CRISES

ABSTRACT
This research focuses on the political actions and reactions exhibited by the European Union (EU) during the COVID-19 pandemic, offering a comprehensive analysis within the context of actorness theory. Starting with François Duchêne's "Civilian Power" paradigm proposed in 1972, discussions on the EU's "nature as an actor" have deepened and gained a new dimension through Ian Manners' "Normative Power" concept developed in the 2000s. The COVID-19 pandemic critically tested the EU's resilience, capacity for collaborative policy-making, and overall crisis management capabilities. In this context, the closing of borders by member states and their independent efforts to seek aid, particularly Italy's widely echoed and unmet requests for assistance, have been noteworthy. In response to the economic difficulties caused by the pandemic, EU leaders have committed to a broad recovery strategy, including the establishment of a significant recovery fund. The EU's responses to the COVID-19 pandemic encompass a comprehensive approach addressing "limiting the spread of the disease, supporting national health systems, combating the socio-economic impacts, and ensuring the equitable distribution of vaccines." This study evaluates the EU's performance on the foreign policy stage during the COVID-19 pandemic through the lens of actorness theory. The research aims to provide a deep perspective on the EU's evolving role in the face of unexpected global situations, focusing specifically on critical factors such as solidarity, trust-building, and providing financial assistance to neighboring countries. In this regard, a comprehensive examination of how the Union has responded to unforeseen challenges will be conducted.
Keywords: EU Foreign Policy, COVID-19, EU as an Actor, Global Crises

GIDA ENFLASYONU BESLENME ALIŞKANLIKLARINI ETKİLİYOR MU?

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ÖZET
Bu araştırmada, yetişkin bireylerde gıda enflasyonunun beslenme alışkanlıklarına etkisini belirlemek amaçlanmıştır. Araştırma, Ankara Üniversitesine bağlı faküte ve yüksekokullarda çalışan 19-64 yaş arası, gıda alışverişi yapan akademik/idari personel ile anket formu aracılığıyla yürütülmüştür. Araştırmaya katılan bireylerin %61,1'i kadın, %38,9'u erkektir. Kadınların yaş ortalaması 32,9±8,26 yıl, erkeklerin 35,1±9,65 yıldır (t=-2,017, p=0,045). Katılımcıların hane içine giren aylık toplam gelirleri%29,5'i 60.001 ₺ ve üzeri, %14,9'u 50.001-60.000 ₺, %16,7'si 40.001-50.000 ₺ , %17,5'i 30.001-40.000 ₺, %15,6'sı 20.001-30.000 ₺, %4,4'ü 12.001-20.000 ₺ aralığında yer almaktadır. Araştırma kapsamında bireylere son zamanlarda gıda enflasyonu nedeniyle beslenme alışkanlıklarının değişme durumu sorgulanmış, bireylerin %69,8'i gıda enflasyonunun beslenme alışkanlıklarını değiştirdiğini ifade etmiştir. Bu bireylerin %49,5'i daha uygun fiyatlı gıdaları tercih etmeye başladığını, %22,4'ü gıda çeşitliliğini azalttığını, %13,0'ü gıda miktarını azalttığını belirtmektedir. Gıda enflasyonu nedeniyle bireylerin %27,3'ü ana öğün atlamak zorunda kaldıklarını belirtmiş, tüketilmeyen ana öğünün sıklıkla öğle öğünü (%58,7) ve sonrasında kahvaltı öğünü (%28) olduğu görülmektedir. Gıda enflasyonu nedeniyle ara öğün tüketiminde azalma oranı erkeklerde kadınlara kıyasla daha yüksektir ve bu fark istatistiksel olarak anlamlıdır (p=0,034). Bireylerin %36,7'si gıda enflasyonu nedeniyle ana/ara öğünde tükettikleri yiyecek miktarının azaldığını ifade etmiştir. Gelir düzeyi, bireylerin beslenme alışkanlıklarını önemli düzeyde etkileyen bir faktördür. Düşük gelir düzeylerindeki bireylerin beslenme alışkanlıklarının gıda enflasyonundan daha fazla etkilendiği anlaşılmaktadır. Artan gıda fiyatları sonucu ortaya çıkan gıda enflasyonunun bireylerin beslenme alışkanlıklarını etkilediği görülmektedir. Bu sonuçların politika yapıcılar için önemli bir veri kaynağı olduğu ve gerekli düzenlemeler yapılırken dikkate alınması gerektiği düşünülmektedir.
Anahtar Kelimeler: gıda enflasyonu, beslenme, öğün tüketimi

DOES FOOD INFLATION AFFECT NUTRITIONAL HABITS?

ABSTRACT
The study aimed to determine the effect of food inflation on eating habits of adult individuals. The study was conducted with academic/administrative staff aged between 19-64 working in faculties and colleges affiliated to Ankara University who shop for food through a questionnaire form. Of the individuals, 61.1% were female and 38.9% were male. The mean age of women was 32.9±8.26 and 35.1±9.65 years for men(t=-2.017, p=0.045). The total monthly household income of the participants is 29.5% 60.001₺ and above, 14.9% 50.001-60.000₺, 16.7% 40.001-50.000₺, 17.5% 30.001-40.000₺, 15.6% 20.001-30.000₺, 4.4% 12.001-20.000₺. The research, individuals were asked about the recent changes in their eating habits due to food inflation, and 69.8% of the individuals stated that food inflation has changed their eating habits. Among these individuals, 49.5% stated that they started to prefer more affordable foods, 22.4% stated that they reduced food variety, and 13.0% stated that they reduced the amount of food. Due to food inflation, 27.3% of the individuals stated that they had to skip main meals, and it was observed that the main meal that was not consumed was lunch (58.7%) and then breakfast(28%). The rate of decrease in snack consumption due to food inflation was higher in men than in women and this difference was statistically significant(p=0.034). 36.7% of the individuals stated that the amount of food consumed at main/intermediate meals decreased due to food inflation. Income level is a factor that significantly affects the dietary habits of individuals. It is understood that the dietary habits of individuals at low income levels are more affected by food inflation. It is observed that food inflation resulting from rising food prices affects the dietary habits of individuals. It is thought that these results are an important data source for policy makers and should be taken into consideration when making necessary arrangements.
Keywords: food inflation, nutrition, meal consumption

SÜT SIĞIRCILIĞIDA HAYVAN REFAHI UYGULAMALARI

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ÖZET
Süt sığırcılığı, büyükbaş hayvancılığın içinde önemli bir bölümünü oluştumaktadır. Süt sığırcılığı faaliyetlerinin başarılı bir şekilde yürütülebilmesi için, hayvan bakımı, yönetimi, uygun hayvan seçimi ve barınak gibi faktörlerin yanı sıra yeterli ve kaliteli yem ile etkili bir besleme programının uygulanması gerekmektedir. Günümüzde süt sığırcılığı genellikle entansif koşullarda büyük kapasiteli işletmelerde yapılmaktadır, Bu tip işletmelerde verim kontrolü ve hayvanların doğal davranışlarını sergileyebilmeleri için gerekli düzenlemeler yapılması ve hayvan refahının korunması büyük bir önem taşımaktadır. Hayvan refahı, bir hayvanın yaşadığı koşulların, sağlık durumunun, yaşam kalitesinin ve mutluluğunun bir yansıması olarak tanımlanmaktadır. Bir hayvanın refah içinde olduğu kabul edilebilmesi için, bu hayvanın sağlıklı, rahat, iyi beslenmiş, güvende, türünün doğal davranışlarını sergileyebilir, korkusuzca yaşayabilir, ağrı veya stresten muzdarip olmadığı kabul edilmektedir. Hayvan refahıyla ilgili olarak, farklı ülkelerde çok sayıda yasa ve yönetmelik düzenlenmiştir. İklimsel ve çevresel koşulların dikkatlice yönetilmesi, süt sığırları işletmesinin başarısı için kritik bir rol oynamaktadır. Hayvan refahının sağlanabilmesi değişik faktörlere bağlıdır. Bunlardan bazıları, İşletmenin konumlandırılacağı bölgenin iklimsel faktörleri ve işletme içi iklim şartları olarak sıralamak mümkündür. İklim koşulları, belirli bir bölgenin sıcaklık, nem, rüzgâr ve yağış gibi faktörlerini içermektedir. Bu koşulların istenilen sınırların altında veya üstünde olması, özellikle süt sığırlarının verimliliğini olumlu ya da olumsuz yönde etkileyebilmektedir. Süt sığırlarının yaşadığı iklim koşulları, süt üretimi, sağlık ve genel refahlarını etkileyebilir. Süt sığırları için en uygun sıcaklık genellikle 5-25°C arasındadır; ancak 10-20°C arasındaki sıcaklıklar süt sığırları için en ideal olanlardır. Yüksek sıcaklık, düşük sıcaklığa göre süt sığırları üzerinde daha fazla olumsuz etki yaratabilir. Ayrıca, nem seviyeleri de önemlidir. Süt sığırları için en uygun nem seviyeleri genellikle %50-70 arasında bulunur. Yüksek sıcaklık ve yüksek nem koşulları altında, süt sığırları verimlerini kaybedebilir ve stres yaşayabilirler. Hayvanların refahını artırmak için bulundukları işletmelerde farklı uygulamalar yapılmaktadır. Bu uygulamalarda, hemhayvan refanı arttırmakta hem de işletme karlılığına olumlu bir şekilde yansımaktadır.
Anahtar Kelimeler: Süt sığırı, Hayvan Refahı, Stress, Sıcaklık.

ANIMAL WELFARE PRACTICES IN DAIRY FARMING

ABSTRACT
Dairy cattle farming constitutes an important part of cattle farming. To carry out dairy cattle activities successfully, it is necessary to implement an effective feeding program with sufficient and high-quality feed as well as factors such as animal care, management, appropriate animal selection, and shelter. Nowadays, dairy cattle farming is generally carried out in large-capacity enterprises under intensive conditions. In such enterprises, it is of great importance to make the necessary arrangements for yield control so that animals can exhibit their natural behaviors and to protect animal welfare. Animal welfare is defined as a reflection of an animal's living conditions, health, quality of life, and happiness. For an animal to be considered to be in welfare, it must be healthy, comfortable, well-fed, safe, able to exhibit the natural behaviors of its species, able to live without fear, and not suffering from pain or stress. Animal welfare is regulated by numerous laws and regulations in different countries. Careful management of climatic and environmental conditions plays a critical role in the success of the dairy cattle enterprise. Ensuring animal welfare depends on different factors. Some of these factors can be listed as climatic factors of the region where the enterprise will be located and climatic conditions within the enterprise. Climatic conditions include factors such as temperature, humidity, wind, and precipitation in a particular region. The fact that these conditions are below or above the desired limits can affect the productivity of dairy cattle positively or negatively. The climatic conditions in which dairy cattle live can affect their milk production, health, and general welfare. The optimum temperature for dairy cattle is usually between 5-25°C; however, temperatures between 10-20°C are the most ideal for dairy cattle. High temperatures can have more negative effects on dairy cattle than low temperatures. Humidity levels are also important. Optimal humidity levels for dairy cattle are usually found between 50-70%. Under conditions of high temperature and humidity, dairy cattle can lose productivity and experience stress. To improve the welfare of animals, different practices are carried out on the farms where they are located. These practices both increase animal welfare and have a positive impact on business profitability.
Keywords: Dairy cattle, Animal Welfare, Stress, Temperature.

SÜT SIĞIRLARINDA SİLAJ TÜKETİMİNİ ARTTIRMANIN ÖNEMİ

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ÖZET
Dünya süt üretiminin % 85'ı ve et üretiminin % 20'ine yakını sığırlardan elde edilmektedir. Ülkemizde ise süt üretiminin yaklaşık % 90'nı ve kırmızı et üretiminin yaklaşık olarak % 80'i sığırlardan karşılanmaktadır. Bu değerli hayvanların beslenmesi de büyük önem arzetmektedir. Bu beslemenin de ekonomik olarak yapılması gerekmektedir. Bunun için, hazırlanan rasyonların dengeli olması ve hayvanın tüm günlük ihtiyaçlarını karşılaması gerekmektedir. Hayvanın ihtiyaçlarını karşılamada ise, farklı yem hammaddelerinde yararlanılmaktadır. Bu yem hammddeleri içerisinde de silaj önemli bir yer tutmaktadır.Silaj, günümüzde tüm hayvancılık işletmelerinde gelişmekte olan düvelerin, besi danalarının, kurudaki ve laktasyondaki ineklerin yemlenmesinde yoğun bir şekilde kullanılmaktadır. Silajının veriliş miktarı, hayvanların yaşına ve verim düzeyine bağlı olarak değişim göstermektedir. Silajı kısaca tanımlayacak olursak; su içeriği yüksek yeşil yem bitkilerinin, küçük parçacıklara ayrılarak, havasız bir ortamda süt asidi bakterilerinin fermantasyonuna uğratılmaları yoluyla elde edilmektedir. Silaj; bir çeşit hayvan turşusu olarak ta adlandırılabilir. Silaj, yeterli düzeyde şeker içerdiğinden herhangi bir katkı maddesi kullanmaya gerek duyulmadan değerlendirilebilecek bir yem kaynağıdır. Silaj; birim alandan fazla miktarda sindirilebilir besin maddesi sağlayan, lezzetli ve besleme değeri yüksek bir yemdir. Silaj; uzun süre saklanabilen ve kış mevsiminde taze ve sulu yem olarak tüketilebilen ideal bir besin maddesidir. Silaj yapımında birbiri ile ilişkili üç etken bulunmaktadır. Bunlar; silajı yapılacak yem materyali, silaj yapım yönetimi ve fermantasyon işlemidir. Kaliteli bir silaj elde edebilmek için tüm bu etkenlerin üzerinde özenle durulması gerekmektedir. Silo yemleri hem süt inekleri tarafından severek tüketilmekte hem rumen faaliyetlerinin düzenlenmesine yardımcı olmaktadır. Ayrıca süt verimini arttırmaktadır. Bu açıdan, rasyona katılım ve hayvanlar tarafından tüketim miktarının arttırılma yollarına gidilmesi gerekmektedir. Süt ineklerinin beslenmesinde rasyonlarında günlük 15 – 30 kg kadar kullanılmaktadır. Silaj kullanımı sırasında kesif yem ve kaliteli kuru ot ile desteklenmesi gerekmektedir.
Anahtar Kelimeler: Silaj, Yem Tüketimi, Ruminant, Besleme, Süt Verimi.

THE IMPORTANCE OF INCREASING SILAGE CONSUMPTION IN DAIRY COWS

ABSTRACT
In the world, 85% of milk production and nearly 20% of meat production is obtained from cattle. In our country, approximately 90% of milk production and 80% of red meat production is made from cattle. Feeding these valuable animals is also of great importance. This feeding should also be done economically. For this, the rations prepared must be balanced and meet all the daily needs of the animal. Different feed raw materials are used to meet the needs of the animal. Silage has an important place among these feed raw materials. Silage is used intensively in all livestock farms today for feeding developing heifers, fattening calves, and dry and lactating cows. The amount of silage fed varies depending on the age and efficiency level of the animals. If we define silage briefly; It is obtained by separating green fodder plants with high water content into small particles and fermentation of milk acid bacteria in an airless environment. Silage can also be called a kind of animal pickle. Silage is a feed source that can be evaluated without the need to use any additives since it contains sufficient sugar. Silage is a feed that provides a large amount of digestible nutrients per unit area, is delicious, and has high nutritional value. Silage is an ideal nutrient that can be stored for a long time and can be consumed as fresh and juicy feed during the winter season. There are three interrelated factors in silage production. These are; forage material to be silaged, silage production management, and fermentation process. All these factors should be carefully emphasized to obtain a quality silage. Silo feeds are both consumed fondly by dairy cows and help to regulate rumen activities. It also increases milk yield. In this respect, it is necessary to increase the amount of inclusion in the ration and consumption by animals. It is used in the rations of dairy cows at a daily rate of 15 - 30 kg. During the use of silage, it should be supported with concentrated feed and quality dry grass.
Keywords: Silage, Feed Consumption, Ruminant, Feeding, Milk Yield

TÜRK EKONOMİSİNDE RASYONEL DÖNÜŞÜM PROGRAMLARININ UYGULANMASI VE ETKİLERİ

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ÖZET
Türkiye ekonomisi dünya ekonomisindeki değişme ve gelişmelere bağlı olarak geleneksel ekonomi politikaları uygulamaları ile makroekonomik istikrarı sağlamayı çalışmıştır. Ancak 2016 yılından sonra başlayan ve 2021 yılında ‘’yeni ekonomi politikası‘’ ile adlandırılan politika geleneksel olmayan geleneksel ekonomi politikalarından oluşan farklı bir model arayışı dönemidir. 1990-2016 yılları arası ekonomi politikası liberalleşme politikaları temeline dayalı dışa açılma ve finansal liberalizasyon politikalarını içermektedir. 2016 yılından sonra ise serbest piyasa ekonomisi kural ve kurumlarını işletirken, enerji ve ara mallardaki dış bağımlılığın düşürülmesi hedeflenmiştir. 2020 yılındaki küresel pandemi süreci sonrası ise cari fazla vermeyi ve rekabetçi kurlarla üretimdeki ve dünya ticaretindeki payını artırma amacıyla ‘’geleneksel ekonomi politikalarına aykırı düşük faiz politikası’’ ile ekonomik yapısını bağımlılığı yüksek bir yapıdan, ileri teknoloji ve ithal girdi bağımlılığı düşük bir yapıya dönüştürmeyi hedeflemiştir (Buluş; 2023,23). Ancak uygulanan bu politikanın enflasyon üzerinde yarattığı baskı, Türkiye ekonomisinde yeniden yüksek enflasyonun yaşanması politika değişikliğini de beraberinde getirmiştir. Türkiye ekonomisi 2023 yılında 191 ülke arasında en yüksek enflasyona sahip altıncı ülke olmuştur. Bu durum ekonomi politikası yapımcılarını “Ekonomide Rasyonel Dönüşüm Programı” olarak adlandırılan tekrar geleneksel politikalara dönmesine neden olmuştur. Ekonomide rasyonel dönüşüm programı toplumsal refahın artması için rasyonel politikaların uygulanmasını temel almıştır. Toplumsal refah hedefine ulaşmak için şeffaflık, sürdürülebilir yüksek büyüme için mali disiplinin tesis edilmesi ve fiyat istikrarı temel hedef olarak belirlenmiştir. Özellikle orta vadede enflasyonun yeniden tek haneli rakamlara düşürülmesi risk ve belirsizliğin azaltılarak her alanda öngörülebilirliğin artırıldığı, güvenilirliğinin sağlandığı makro ekonomik yapının sağlanması için etkin ekonomi politikalarının uygulanması gerekliliği vurgulanmıştır.
Anahtar Kelimeler: Türkiye Ekonomisi, yeni ekonomi, rasyonel politikalar.

APPLICATION OF RATIONAL TRANSFORMATION PROGRAMS IN TURKISH ECONOMY AND ITS EFFECTS

ABSTRACT
Depending on the changes and developments in the world economy, the Turkish economy has tried to ensure macroeconomic stability through the implementation of traditional economic policies. However, the policy that started after 2016 and is called the "new economic policy" in 2021 is a period of searching for a different model consisting of non-traditional traditional economic policies. Economic policy between 1990 and 2016 includes opening up and financial liberalization policies based on liberalization policies. After 2016, it was aimed to reduce external dependence on energy and intermediate goods while operating the free market economy rules and institutions. After the global pandemic process in 2020, it aimed to transform its economic structure from a highly dependent structure to a structure with low dependence on advanced technology and imported inputs, with a "low interest policy contrary to traditional economic policies" in order to achieve a current account surplus and increase its share in production and world trade with competitive exchange rates. (Invention; 2023,23). However, the pressure created by this policy on inflation and the re-experiencing high inflation in the Turkish economy brought about a policy change. In 2023, the Turkish economy was the sixth country with the highest inflation among 191 countries. This situation has caused economic policy makers to return to traditional policies, which is called the "Rational Transformation Program in the Economy". The rational transformation program in the economy is based on the implementation of rational policies to increase social welfare. In order to achieve the goal of social welfare, transparency, establishment of fiscal discipline for sustainable high growth and price stability have been determined as the main objectives. It was emphasized that effective economic policies should be implemented in order to reduce inflation back to single digits, to reduce risk and uncertainty, to increase predictability in all areas and to ensure a macroeconomic structure in which reliability is ensured, especially in the medium term.
Keywords: Turkish Economy, new economy, rational policies.

YEŞİL EKONOMİ'NİN SEKTÖRLERE GÖRE KAYNAK KULLANIMI ÜZERİNDEKİ ETKİLERİ

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ÖZET
İnsanlar ve iktisatçılar yıllarca doğayı sınırsız bir kaynak olarak görmüşlerdir. Doğal kaynakların varlığının kıt olması ve bilinçsiz kullanımının çevreye zararlarının anlaşılmasından sonra yeni kavramlara ihtiyaç duyulmuştur. Yeşil ekonomi diğer adıyla düşük karbon emisyonlu ekonomi tam olarak burada ortaya çıkmıştır. Yeşil ekonomi, çevre problemlerinin giderek arttığı günümüz çağında çevresel riskleri ve ekolojik kıtlıkları azaltmayı hedefleyen ve bu hedefleri korurken sürdürülebilir kalkınmayı destekleyen bir ekonomi anlayışıdır. Yeşil ekonominin kaynak kullanımına etkileri hem çevresel hem ekonomik açıdan çok önemlidir. Kaynak kullanımı; çevresel açıdan, doğal kaynakların etkili bir şekilde kullanılması, çevre kirliliğinin azaltılmasına, iklim değişikliğinin engellenmesine ve doğal yaşamın korunmasına yönelik bir önem taşımaktadır. Ekonomik açıdan ise, kaynakların daha verimli kullanımı, işletmelerin maliyetlerinin düşürülmesi ve rekabet gücünün artırılması gibi faktörlerle birlikte uzun vadeli sürdürülebilir bir büyümeyi desteklemektedir. Kaynak kullanımlarını yeni boyutlara geçirmek enerjinin, suyun ve ham maddelerin daha etkin verimli kullanılmasına teşvik etmek, israfların önüne geçilmesini sağlayıp çevreci kaynak kullanımının teşvik edilmesi yeşil ekonomi modelinin temellerinde yatmaktadır. Yeşil ekonominin geniş kapsamlı bir şekilde benimsenmesi için, ülkelerin oluşturduğu politikaların sektörlerde faaliyet gösteren şirketleri yeşil ekonomiye geçiş konusunda teşvik edici ve yeşil ekonomi uygulayan firmalara destek sağlayıcı nitelikte olması gerekmektedir. Bu çerçevede çalışmanın amacı; yeşil ekonomi anlayışının önce genel anlamda ele alınarak sonrasında harcanan kaynaklar üzerinde sırasıyla turizm, enerji, inşaat, tarım ve gıda sektörlerinde sektör bazında negatif ve pozitif etkilerini ortaya koymaktır.
Anahtar Kelimeler: Yeşil ekonomi, çevre, doğal kaynaklar, yeşil sürdürülebilirlik, kaynak etkinliği, kaynak kullanımı.

THE IMPACTS OF GREEN ECONOMY ON RESOURCE UTILIZATION BY SECTORS

ABSTRACT
After the scarcity of natural resources and the understanding of the environmental damages of unconscious use of natural resources, new concepts were needed. A green economy, also known as a low carbon emission economy, has emerged here. The green economy is an understanding of the economy that aims to reduce environmental risks and ecological shortages in today's age of increasing environmental problems and supports sustainable development while maintaining these goals. The effects of a green economy on resource utilization are very important both environmentally and economically. Resource utilization is environmentally important for the effective use of natural resources, reduction of environmental pollution, prevention of climate change, and protection of natural life. In economic terms, it supports long-term sustainable growth with factors such as more efficient use of resources, reducing the costs of enterprises, and increasing competitiveness. Taking resource use to new dimensions, encouraging more efficient use of energy, water, and raw materials, preventing waste, and encouraging the use of environmentally friendly resources lie at the foundations of the green economy model. For the green economy to be adopted comprehensively, the policies established by the countries should encourage the companies operating in the sectors to transition to a green economy and provide support to the companies implementing the green economy. In this framework, the study aims to first discuss the green economy concept in general terms and then to reveal the negative and positive effects on the resources spent on a sectoral basis in tourism, energy, construction, agriculture, and food sectors respectively.
Keywords: Green economy, environment, natural resources, green sustainability, resource efficiency, resource utilisation.

ÖĞRENEN EKONOMİSİNDE PARA POLİTİKASININ ETKİNLİĞİ: TÜRKİYE EKONOMİSİ ÜZERİNE BİR DEĞERLENDİRME

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ÖZET
Dünya ekonomisindeki değişim dinamiğinin etkilendiği en önemli politik araçlardan biri para politikasıdır. Çünkü günümüzde hızla değişen ve gelişen piyasalar finansal piyasalardır. Bu gelişmeler finansal sistemin düzenli işlemesini sağlamak adına Merkez bankalarına ve para politikası uygulamalarına önemli görevler yüklemiştir. Hükümetin para arzını kontrol etmek için izlediği politikalar bütünü para politikasıdır. Ülkelerin para politikasını yürüten kurum merkez bankasıdır. Her ülkenin merkez bankası bir tür spesiyal kamu iktisadi kuruluşudur. Merkez bankaları para politikaları uygularken ve para arzlarını belirlerken paranın dolaşım hızını dikkate almaktadır. Öğrenme, bilgi ve yeni değişime uyum içinde gerekli olan sorumluluktur. Merkez bankasına yenilik ve değişim ortamında düşen sorumluluk, etkinliği, güvenliği ve etkin parasal kontrolü aynı anda sağlamaktır. Merkez bankaları bu sorumluluklarını piyasaları gÖZETim altında tutarak uyguladıkları para politikası ile gerçekleştireceklerdir. Fakat, yenilik ve değişim merkez bankalarının finansal sistemin sağlıklı bir şekilde işlemesini ve enflasyonsuz bir ortamda sürdürülebilir bir büyüme oranının gerçekleşmesini giderek zorlaştırmaktadır. Çünkü finansal yeniliklerdeki değişme ve gelişmeler paranın tanımını değiştirmeye başlamıştır. Yapısal değişiklikler ve finansal yeniliklere paralel olarak önceden bir politika belirlenmeye temel olabilecek bir parasal ilişkiyi tahmin edebilmek zorlaşmıştır. Bu durum bütünselleşmiş ekonomi politikalarını da başarısız kılmış, bütünleşmiş politikaların başarısızlığı da para politikalarını etkilemiştir. Çünkü karar birimlerinin amaç fonksiyonunu gerçekleştirmede en çok öğrenip bilgi akışını gerçekleştirdikleri ve birebir etkilendikleri para ve paraya dair konulardır. Onun için değişimin baş döndürücü hızla olduğu finansal piyasalarda para politikasının ve merkez bankasının dinamik yapıda olması gerekmektedir.
Anahtar Kelimeler: Türkiye Ekonomisi, öğrenen ekonomi, para politaları.

THE EFFECTIVENESS OF MONETARY POLICY IN THE LEARNING ECONOMY: AN EVALUATION ON THE TURKISH ECONOMY

ABSTRACT
One of the most important political tools that affects the dynamics of change in the world economy is monetary policy. Because today's rapidly changing and developing markets are financial markets. These developments have imposed important duties on central banks and monetary policy practices in order to ensure the regular functioning of the financial system. Monetary policy is the set of policies followed by the government to control the money supply. The institution that carries out the monetary policy of the countries is the central bank. The central bank of every country is a type of specialized public economic institution. Central banks take into account the speed of circulation of money when implementing monetary policies and determining money supplies. Learning is the responsibility required to adapt to knowledge and new change. The responsibility of the central bank in an environment of innovation and change is to ensure efficiency, security and effective monetary control at the same time. Central banks will fulfill these responsibilities through the monetary policy they implement by keeping the markets under surveillance. However, innovation and change make it increasingly difficult for central banks to ensure the healthy functioning of the financial system and to achieve a sustainable growth rate in an inflation-free environment. Because changes and developments in financial innovations have begun to change the definition of money. In parallel with structural changes and financial innovations, it has become difficult to predict a monetary relationship that could be the basis for determining a policy in advance. This situation also made integrated economic policies unsuccessful, and the failure of integrated policies also affected monetary policies. Because it is money and money-related issues that decision-making units learn the most about, flow information to, and are directly affected by in achieving their objective function.Therefore, in financial markets where change occurs at a dizzying pace, monetary policy and the central bank must have a dynamic structure.
Keywords: Turkish Economy, learning economy, monetary policies.

TRANSFORMING ACCOUNTING SYSTEMS IN HOSPITALITY: EMBRACING CLOUD TECHNOLOGY AND TECHNOLOGICAL INNOVATIONS

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ABSTRACT

Technology advancements and cloud accounting have significantly impacted the calibre of accounting information systems, especially in the hospitality sector. Accuracy and operational performance have grown because of the faster and more effective data processing made possible by the incorporation of cloud accounting into accounting procedures. Better access to real-time financial data, which is essential for decision-making in the hospitality sector, has also been made possible by cloud computing. Additionally, technological advancements have aided in the creation of cloud-based accounting systems, which improve decision-making abilities and support the development of higher-calibre information systems. These developments have been crucial in helping businesses become more cost-effective while also improving business performance through digital transformation and digital leadership. This study investigates how technology improvements and cloud accounting affect the calibre of accounting information systems in the hospitality sector. The swift advancement of technology has led to the emergence of cloud accounting as a game-changing instrument for augmenting data processing and administration across multiple industries. This study intends to offer important insights into how accounting information systems are changing in the hotel sector in response to cloud accounting and technology breakthroughs through a quantitative data analysis. The results of this study regarding the impact of cloud accounting and technological advancements on the calibre of accounting information systems in the hospitality sector will be very helpful to

regulators in improving policies, the government in making better decisions, and educators in creating curricula emphasising the role of technology in accounting practices.
Keywords: Cloud Accounting, Technology Advances, Accounting Information Systems Quality, Hospitality

AI FOR FASHION

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ABSTRACT
Online shopping platforms have been attracting many customers since they were introduced in the last decade of the 20th century. Using online shopping platforms, customers can purchase any merchandise anywhere and anytime without the need to physically go from store to store to find a product or wait in lines to check out. Despite their advantages in comparison with instore shopping, customers often have concerns when they shop for products that require measurements estimation such as furniture and clothes. Choosing the wrong clothing size, in particular, is a common issue experienced by many online shoppers. Therefore, in this research, a model is proposed that utilizes computer vision and machine learning to estimate upper body measurements of humans. The process involves using a portable camera to capture an image, enhancing its quality, isolating the human body, calibrating, extracting body features, marking the image, and generating accurate results. This method, using a single RGB camera, holds great potential for the fashion industry. We have also introduced ellipse-like approximations to minimize the difference between manual and software measurements. Our approach has shown better results than the current state-of-the-art, with an average difference of ± 1cm compared to traditional manual tape measurements. Artificial intelligence is being applied to predict body dimensions in the apparel industry, leading to cost reduction and improved efficiency. We proposed a back propagation artificial neural network (BP-ANN) model to predict pattern making-related body dimensions using key human body measurements. The model was trained using anthropometric data from 120 young females in northeastern China, demonstrating that the BP-ANN model is more accurate and stable than the linear regression (LR) model. This method can be valuable in creating garment patterns for form-fitting clothing, and its precision can be further enhanced with a larger learning dataset in the future. There is a growing interest in deep learning-based recommender systems, particularly for outfit recommendation. Deep neural networks can identify important product features from images and text descriptions, and represent them as semantic vectors. This is especially relevant in the fashion domain, where various product features contribute to creating outfits. In our study, we compare different fusion methods for outfit recommendation that combine product features extracted from visual and textual data into multimodal item representations. We evaluate traditional fusion methods against attention-based fusion methods, which are designed to capture the interdependencies between different modalities more effectively.
Keywords: BP-ANN model, Online shopping platforms

TECH-INFUSED LANDSCAPES: ADVANCEMENTS AND CHALLENGES IN MODERN LANDSCAPE ARCHITECTURE

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ABSTRACT
Recent technological progress has revolutionized landscape architecture, offering a suite of tools that enhance design precision and sustainability. Geographic Information Systems (GIS), Remote Sensing (RS), and Global Positioning Systems (GPS) provide landscape architects with invaluable data for informed decision-making, fostering sustainable design solutions. Building Information Modeling (BIM) and parametric design streamline processes and promote collaboration, driving innovation in landscape architecture. Virtual Reality (VR) and Augmented Reality (AR) technologies enable immersive experiences, facilitating stakeholder engagement and early design feedback. Drones and LIDAR technology improve site analysis, monitoring, and safety on construction sites, while digital fabrication and robotics push boundaries in material innovation. Addressing challenges such as data privacy and digital literacy is essential to fully harness the potential of these technologies. Through continuous research, education, and collaboration, landscape architecture can lead towards a more resilient, inclusive, and sustainable future."
Keywords: Global Positioning Systems, Remote Sensing

VECTOR CALCULUS IN COMPUTER GRAPHICS

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ABSTRACT
Vector calculus is an indispensable tool in the field of computer graphics, serving as the mathematical foundation for a wide range of techniques and algorithms essential for creating visually compelling digital imagery. This paper provides a comprehensive overview of the applications of vector calculus in computer graphics, focusing on its role in various aspects of rendering, modelling, and simulation. The methodology of this paper involves a systematic exploration of vector calculus principles and their implementation in key areas of computer graphics. Beginning with an introduction to basic vector calculus concepts such as dot products, cross products, and vector derivatives, the paper proceeds to delve into specific applications within the realm of computer graphics. These applications include geometric transformations, surface modelling, lighting and shading computations, ray tracing, and physics-based simulations. Geometric transformations, such as translation, rotation, and scaling, are essential for positioning and animating objects in a virtual scene. Vector calculus enables the representation and manipulation of geometric transformations, facilitating the seamless integration of objects into a coherent visual environment. Additionally, vector calculus plays a crucial role in surface modelling techniques, such as parametric surfaces, implicit surfaces, and spline interpolation, enabling the creation of smooth and natural-looking surfaces. Furthermore, vector calculus is integral to lighting and shading computations, where it facilitates the simulation of light interactions with surfaces. Through operations such as surface normal calculations, lighting models, and material properties, vector calculus contributes to the generation of realistic illumination and shading effects. In the domain of ray tracing, vector calculus operations are employed to compute ray-object intersections, reflections, refractions, and shadowing effects, resulting in high-fidelity renderings with accurate light transport. In conclusion, the applications of vector calculus in computer graphics are vast and diverse, spanning across rendering, modelling, and simulation domains. By leveraging vector calculus principles, computer graphics practitioners can achieve unparalleled levels of realism and visual fidelity in digital imagery, paving the way for ground breaking advancements in the field. As computational power continues to advance, further exploration and innovation in vector calculus-based techniques promise to push the boundaries of what is possible in computer graphics.
Keywords: Rendering, modelling, simulation, ray tracing, physics-based simulations

CLEARING OUR COSMIC PATH: INNOVATIVE SOLUTIONS FOR SPACE DEBRIS MITIGATION

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ABSTRACT
Space debris mitigation is crucial for ensuring the sustainability of space activities. This ABSTRACT proposes novel approaches to tackle this pressing issue. Firstly, employing active debris removal techniques, such as robotic capture and deorbiting, can effectively reduce the population of hazardous debris. Secondly, implementing satellite design standards for end-of-life disposal, including provisions for propulsion systems or deployable sails for deorbiting, can prevent the creation of new debris. Additionally, advancements in collision avoidance algorithms and satellite maneuvering capabilities can mitigate the risk of collisions, thereby reducing the generation of debris fragments. Furthermore, international cooperation and regulations are essential for promoting responsible space practices and enforcing debris mitigation measures. By integrating these innovative strategies, we can address the growing challenge of space debris and safeguard the long-term sustainability of space exploration and utilization.
Keywords: Space debris mitigation, Sustainability, Active debris removal.

INTEGRATING MATHEMATICS INTO ZOOTECHNICS: A PATHWAY TO EFFICIENT LIVESTOCK MANAGEMENT

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ABSTRACT
Zootechnics, the science of animal husbandry, plays a crucial role in ensuring efficient livestock production while considering animal welfare and sustainability. Mathematics, with its analytical and predictive capabilities, offers a powerful toolset for optimizing various aspects of zootechnical practices. This ABSTRACT explores the integration of mathematics into zootechnics, focusing on its application in areas such as breeding, nutrition, health management, and environmental impact assessment. Mathematical modeling facilitates the understanding of complex biological processes underlying animal growth, reproduction, and disease dynamics. By employing techniques such as differential equations, optimization algorithms, and statistical analysis, researchers can develop predictive models to optimize breeding programs, enhance feed efficiency, and mitigate disease outbreaks. Furthermore, mathematical modeling allows for the simulation of environmental factors, enabling the assessment of their impact on animal welfare and production systems. In addition to modeling, mathematical tools like linear programming and decision analysis aid in resource allocation, such as determining optimal feed formulations to meet nutritional requirements while minimizing costs. Furthermore, mathematical optimization techniques can optimize breeding strategies to maximize desired traits while considering genetic diversity and inbreeding avoidance.
Keywords: Zootechnics, livestock management, mathematical modeling, optimization, nutrition, health management, sustainability.

MATHEMATICAL OPTIMIZATION IN 3D PRINTING: MAXIMIZING EFFICIENCY AND MINIMIZING COST

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ABSTRACT
This research delves into the realm of 3D printing, exploring the transformative potential of mathematical optimization techniques in the pursuit of maximizing efficiency and minimizing production costs. Additive manufacturing, while revolutionary, faces challenges in terms of optimizing various parameters to enhance overall performance. The study centres on the utilization of mathematical models and algorithms to optimize critical aspects of the 3D printing process, including print speed, layer thickness, and material usage. By employing mathematical optimization, the research aims to achieve a balance between efficiency and cost-effectiveness, paving the way for a more streamlined and resource-efficient additive manufacturing workflow. Mathematical optimization algorithms play a pivotal role in fine-tuning the intricate parameters involved in 3D printing. These algorithms systematically explore and analyze a vast design space, identifying optimal configurations that lead to enhanced production efficiency. Case studies exemplify the practical applications of mathematical optimization, showcasing its ability to significantly reduce production times and material waste. Through quantitative analysis, the research demonstrates the tangible impact of mathematical optimization on the economic viability of 3D printing processes, making a compelling case for its integration into mainstream additive manufacturing workflows. The findings contribute to the broader discourse on advancing the precision and economic sustainability of 3D printing technologies. By elucidating the synergies between mathematical optimization and additive manufacturing, this research not only expands our understanding of the intricate dynamics within 3D printing but also presents a quantitative framework for realizing cost-effective, high-performance outcomes. Ultimately, the study advocates for the incorporation of mathematical optimization as a fundamental tool in the arsenal of additive manufacturing, propelling the industry towards greater efficiency and economic viability.

Keywords: Additive Manufacturing, Mathematical Optimization, 3D Printing Efficiency, Production Cost Reduction, Algorithmic Parameter Tuning.

INNOVATIONS IN AQUAPONICS TECHNOLOGY

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ABSTRACT
Aquaponics technology represents a sustainable and innovative approach to food production that combines aquaculture and hydroponics in a closed-loop system. In aquaponics, fish and plants are cultivated together in a symbiotic relationship where fish waste provides nutrients for plant growth, and plants help filter and clean the water for the fish. This self-sustaining ecosystem maximizes resource efficiency, minimizes waste, and offers numerous benefits, including higher yields, reduced water usage, and minimal environmental impact. Aquaponics technology involves components such as fish tanks, grow beds, water circulation systems, beneficial bacteria, and monitoring mechanisms to maintain optimal conditions for both fish and plants. By integrating aquaculture and hydroponics, aquaponics technology offers a sustainable and environmentally friendly solution for producing a diverse range of crops in a controlled and efficient manner. Continued research, development, and education in aquaponics technology can further enhance its potential as a viable and scalable method of food production for the future.
Keywords: Aquaponics technology, Sustainable food production, Resource efficiency.

UNLOCKING AGRICULTURAL POTENTIAL: HARNESSING THE POWER OF MATHEMATICS IN AGRICULTURE

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ABSTRACT
The intersection of mathematics and agriculture presents a fertile ground for innovation, optimization, and sustainable development. This Abstract explores the pivotal role of mathematics in addressing key challenges and unlocking the potential of agriculture to feed a growing global population while ensuring environmental sustainability and economic viability. Mathematical models and algorithms play a crucial role in optimizing various aspects of agricultural systems, from crop planning and management to livestock production and farm mechanization. Optimization techniques enable farmers to make informed decisions regarding resource allocation, land use, and production practices, leading to increased efficiency, productivity, and profitability. Furthermore, mathematical modeling facilitates the analysis and prediction of complex biological phenomena such as plant growth, pest dynamics, and disease spread. By harnessing mathematical principles, researchers and practitioners can develop innovative plant protection strategies, mitigate risks, and enhance resilience against environmental stressors and climate variability.
Keywords: agriculture, farmers

APPLICATION OF MATHEMATICS IN ROCKET LAUNCH TRAJECTORY ANALYSIS

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ABSTRACT
Mathematics plays a pivotal role in the analysis and optimization of rocket launch trajectories, ensuring precise and efficient delivery of payloads into space. This paper explores the application of mathematics in rocket trajectory analysis, focusing on key areas such as dynamics, orbital mechanics, numerical methods, optimization algorithms, control theory, and uncertainty analysis. Differential equations derived from classical mechanics and orbital dynamics are used to model the motion of rockets, accounting for gravitational forces, aerodynamic drag, and thrust from rocket engines. Numerical methods, including numerical integration techniques and optimization algorithms, are employed to solve complex trajectory equations and optimize mission parameters such as launch angle, thrust profile, and staging events. Control theory is utilized to design guidance and control systems that steer rockets along their intended trajectories and stabilize their orientation during flight. Additionally, uncertainty analysis techniques are applied to assess and mitigate uncertainties in trajectory predictions, ensuring the reliability and success of space missions. Through the application of mathematics, rocket launch trajectory analysis facilitates the advancement of space exploration and satellite deployment with improved accuracy and efficiency.
Keywords: rocket launch, trajectory analysis, mathematics, dynamics, orbital mechanics, numerical methods, optimization algorithms, control theory, uncertainty analysis, space exploration.

MEDICAL DIAGNOSIS: TRANSFORMING HEALTHCARE

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ABSTRACT
Medical analysis is evolving with innovative technology, enhancing affected person consequences and healthcare transport. Advancements encompass mRNA vaccines for customized most cancers remedies, PSMA-centered therapy refining prostate most cancers care, and immunotherapeutic strategies for noncommunicable sicknesses. User pleasant diagnostic exams cater to resource-confined settings, while virtual connectivity and AIassisted telemedicine enhance real-time selection-making. Wearable sensors reveal important symptoms, and blockchain secures health information. Nanomedicine gives particular focused therapies, and genomic medicine tailors treatments to genetic profiles. These improvements herald a transformative era in analysis, promising revolutionized healthcare, advanced results, and personalized remedy. Facing prostate cancer can feel daunting, but new treatments are like precision weapons, precisely targeting the disease while advanced imaging helps catch it early, like a skilled detective cracking a case. No matter where you are, top-quality healthcare should be accessible. Imagine diagnostic tests as simple as brewing your morning coffee, providing rapid results and peace of mind, even in remote areas. Telemedicine brings your doctor to you, offering advice and support through video calls, while wearable devices keep you informed about your health, like a trusted friend always by your side. Your medical history is precious and should be protected. Blockchain technology ensures your data stays secure, like a fortress guarding your secrets. Tiny nanoparticles are like silent warriors, fighting disease without harming healthy cells, while genomic medicine unlocks the secrets of your DNA, guiding personalized treatment decisions. In essence, these innovations are revolutionizing healthcare, ensuring that every step of your medical journey is tailored to your needs, preferences, and unique biology.
Keywords: AI-powered diagnostics, Deep learning Healthcare technology, Digital health, Rapid testing, Mobile health, Remote monitoring, Wearable devices, Medical sensors, Imaging technology.

A COMPLEMENTARY APPROACH TO TREATING PETS - BACH FLOWER DROPS

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ABSTRACT
Bach's flower essences result from the research of Dr. Edward Bach, a British doctor. Learning from nature and living beings, and from his personal experience with the disease, led him to hypotheses about the influence of emotional imbalance on the disease manifestation. He divided emotional states into seven groups: fear, insecurity, lack of interest (absence of spirit), loneliness, and hypersensitivity to the influence and ideas of others, depression and despair, and excessive concern for the well-being of others and treated them with thirty eight flower essences. Pets also may express personality, awareness, emotions, and may get into an emotional imbalance. Such conditions alters behavior of the pet, and may lead to psychosomatic diseases (diarrhea due to fear). In addition to allopathic treatment, inclusion of Bach drops shortens the recovery time, which is a kind of blessing for both the pet and the owner. Bach's flower essences, are natural and do not have contraindications. No antagonism, no synergism with other medicines has been demonstrated, nor can they be overdosed. These are the reasons why they can be used for a wide range of animal behavioral problems. They are safe and gently and subtly restore balance and reduce flaws, while enhancing virtues. Treatment with Bach essences is carried out through individual therapy. Five to a maximum of seven flower essences in water solution can be combined in the so-called utility bottle. The length of therapy is usually three weeks. Bach drops may help in situations such are; stress from relocation (animals are territorial); fear from loud noises, new things, people, etc.; aggression; dominant behavior; lack of self-confidence; depression; traumatic past, and many other conditions. Bach's flower essences, with their uniqueness and perfect simplicity, are valuable tool that may improve practitioners' art of healing (*ars medica*) and allows self-healing of living beings.
Keywords: Bach drops, flower essences, complementary approach to treating pets

IMPACT OF CLIMATE CHANGE ON TEMPERATURES

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ABSTRACT
In recent years, unprecedented climatic variations have been observed in North Africa, with all these changes in climate parameters bound to have adverse impacts on the environment and the socio-economic activity of countries. According to the report by the Intergovernmental Panel on Climate Change (IPCC2021), global warming in North Africa is higher than the global average, with temperatures rising from 0.74C° to 20C° depending on the region. Algeria has not escaped this trend. Indeed, the signs of these variations have become increasingly significant in recent years. The aim of this study is to analyze temperature trends in northeastern Algeria. Six stations with a common measurement period of sixty years (1962 to 2022) were chosen for this study.
Keywords: Climate change, meteorology, rainfall, drought, temperature.

ENHANCING CUSTOMER TRUST THROUGH ISLAMIC DIGITAL MARKETING: AN EMPIRICAL STUDY

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ABSTRACT
This study explores how Islamic digital marketing fosters customer trust among Muslim consumers. Employing a qualitative research approach, in-depth interviews will be conducted with a targeted group of participants. Thematic analysis will be used to examine participants' experiences and perceptions of Islamic digital marketing practices. The research aims to uncover the key elements that build trust within this specific marketing approach and how it resonates with Islamic values. This qualitative approach will provide rich insights into the subjective experiences and decision-making processes of Muslim consumers in the digital marketplace. The findings will contribute to a deeper understanding of how Islamic digital marketing can be strategically utilized to build trust and establish stronger customer relationships.
Keywords: Islamic Digital Marketing, Customer Trust, Transparency, Islamic Values, Ethics.

COMPARATIVE STUDY OF WATER EXCELLENCY FOR THE TWO DISTINCT WATER BODIES OF RANCHI, JHARKHAND

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ABSTRACT
The evaluation of water quality is needed for maintains the fresh potable water. For preventing the water born diseases, fresh drinking water is required. The objective of this paper is to comparative study of the assessment of quality of water among two distinct water bodies of Ranchi, Jharkhand. The assessment of distinct hydrological parameters will assist to identify the sources of pollutant. The analytical assessment of the water sample has been made by using different instrument/experiment. The obtained result shows that some of the hydrological parameters are exists within standard prescribe limit of BIS and some are beyond the limit of BIS. The multivariate statistical tools have been used to evaluate the quality of water. In based of statistical tools water quality index used to identify the distinct classes of water quality. The comparative study of two water bodies shows distinct excellency categories of water. Also, this present study are used to maintain and management of water quality.
Keywords: Water Quality index (WQI), Total Coliform, physical constraints, chemical constraints, BIS standard.

COCCIDIOSIS OF PARTRIDGES (PERDIX PERDIX) IN SERBIA

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ABSTRACT
Partridge or field partridge (Perdix perdix) is a species of bird from the pheasant family (Phasianidae). It inhabits areas with a moderate climate, but it can rarely be found on mountain plains and higher altitudes. It lives in Europe and the western part of Asia, and it has been successfully settled in North America as a hunting bird. Diseases of parasitic etiology represent a major health problem for partridges. Among them is coccidiosis. Coccidiosis is considered the single most common disease in gamebird production; this intestinal parasite is transmitted in faeces by single celled organisms called oocysts. The production and spread of this parasite is very fast, one oocyst can reproduce resulting in millions of oocysts. If left undetected coccidia can cause waves of very ill birds and numerous deaths. When oocysts are within the faeces or environment moisture and warmth causes them to sporulate making them "infective". The birds then ingest these oocysts and the cycle within the intestinal tract starts, multiplying and causing illness. The most common coccidia species found in partridges reared in the Serbia are: *Eimeria kofoidi*, *Eimeria caucasica* and *Eimeria legionesis*. *Most abundant species are E. kofoidi. E.kofoidi* invades duodenum and jejunum, however heavy infections cause the parasite to spread to the ileum. White spots can be seen from the outside of the intestine, the duodenum contains think mucus and white streaks, thick green or yellow mucus is found in the upper intestine. *E.caucasica* invades the duodenum and and the lesions spotted from the outside of the intestine are pinkish/reddish spots. *E.legionesis* mainly invades the caecae. Petechial hemorrhaging is common inside the folds of the caecae with no normal caecal contents present, instead there are cheesy white cores sometimes in fragments but with heavy infections it is seen as one whole core.
Keywords: partridge, *Perdix perdix*, coccidiosis, Serbia

FOOTSTEP POWER GENERATOR

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ABSTRACT

The growing demand for portable and sustainable power sources has led to significant research in energy harvesting technologies. Footstep power generators, which convert kinetic energy from human footsteps into electrical energy, offer a promising solution for powering low-power electronic devices. This paper presents a review of footstep power generator designs, focusing on piezoelectric energy harvesting mechanisms. The working principle of piezoelectric materials and their suitability for footstep power generation are discussed. Distinctive design considerations, such as material choice, generator configuration, and power management circuitry, are explored. The paper also analyzes the challenges and opportunities associated with footstep power generators, including efficiency improvement, energy storage integration, and practical applications. Finally, the prospects of footstep power generation technology are discussed. The increasing miniaturization and portability of electronic devices have intensified the need for efficient and sustainable power sources. Batteries, the conventional power source, have limitations such as finite lifespan, environmental impact, and the requirement for periodic replacement. Energy harvesting technologies offer a promising alternative by extracting energy from ambient sources such as vibrations, solar radiation, and thermal gradients. Footstep power generation is a type of energy harvesting technology that converts the kinetic energy of human footsteps into electrical energy. This technology can power a variety of wearable and portable electronic devices, reducing reliance on batteries and promoting sustainable energy use. Piezoelectric materials show a unique property where mechanical stress applied to the material induces an electric charge. This phenomenon can be exploited to convert the pressure exerted during a footstep into electrical energy. Piezoelectric ceramics, such as lead zirconate titanate (PZT), are commonly used materials for footstep power generators due to their high piezoelectric coefficients. The design of a footstep power generator involves several key considerations: Material Selection: The choice of piezoelectric material is crucial for efficient energy conversion. Factors such as piezoelectric coefficient, mechanical properties, and cost need to be considered. Generator Configuration: The arrangement of piezoelectric elements within the generator significantly changes the output voltage and power. Different configurations, such as cantilever beams and stacked plates, are explored to perfect power generation. Power Management Circuitry: The harvested electrical energy is often in the form of low voltage spikes. Power management circuitry is essential to rectify, regulate, and store the harvested energy for efficient use by the target device. Footstep power generation technology faces several challenges: Efficiency Improvement: Enhancing the efficiency of energy conversion from footsteps stays a primary focus. Research efforts are directed towards improved material properties, optimized generator designs, and advanced power management techniques. Energy Storage Integration: Integrating energy storage devices, such as capacitors

or batteries, is crucial for storing the harvested energy and providing a stable power supply for electronic devices. Practical Applications: Developing practical applications for footstep power generators requires addressing factors such as user comfort, durability, and cost-effectiveness. Despite these challenges, footstep power generation presents exciting opportunities: Sustainable Power Source: Footstep power generators offer a sustainable and environmentally friendly alternative to batteries, reducing reliance on non-renewable resources. Wearable Electronics: Integration with wearable electronics can power devices such as health trackers, smartwatches, and fitness monitors. Wireless Sensor Networks: Footstep-generated power can be used to power wireless sensor nodes, enabling perpetual operation in remote or inaccessible locations. Footstep power generation technology holds immense potential for powering low-power electronic devices in a sustainable and efficient manner. Advancements in material science, improved generator designs, and innovative energy storage solutions are expected to enhance the efficiency and practicality of this technology. As research progresses, footstep power generators have the potential to revolutionize the way we power our wearable and portable devices, contributing to a more sustainable future. Footstep power generators offer a promising solution for powering low-power electronic devices by converting the kinetic energy of human footsteps into electrical energy. Piezoelectric materials play a vital role in this energy conversion process. This paper has reviewed the working principle of footstep power generators, design considerations, challenges, and opportunities. Future advancements in this technology hold the potential to create a change in thinking towards sustainable and wearable power solutions.

Keywords: Footstep power generator, piezoelectric energy harvesting, renewable energy, sustainable power

IMPACT OF CLIMATE CHANGE ON VULNERABLE PEOPLE IN BANGLADESH: A STUDY IN SUNAMGANJ

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ABSTRACT
The effects of climate change disproportionately affect vulnerable populations worldwide, especially in low-lying and densely populated areas like Bangladesh. This study focuses on the district of Sunamganj, which is in Bangladesh's northeast and is particularly vulnerable to climaterelated disasters like floods, cyclones, and riverbank erosion. Primary data was gathered from a variety of governmental and non-governmental organizations and through field level questionnaire surveys. Peer-reviewed books, research papers, journals, and databases have all provided secondary data. This study explores the complex effects of climate change on the lives and livelihoods of vulnerable communities in Sunamganj by thoroughly examining primary and secondary data sources. The research indicates that the local population faces health risks, food insecurity, displacement, and asset loss because of climate change exacerbating pre-existing vulnerabilities. Furthermore, the study emphasizes the significance of integrated approaches to mitigating and adapting to climate change, stressing the necessity of policy interventions as well as community-based initiatives to strengthen adaptive capacity and build resilience in vulnerable areas like Sunamganj. This research adds to the current conversation on climate resilience and sustainable development in Bangladesh and beyond by offering empirical data and insights into the localized effects of climate change.
Keywords: Climate change, Vulnerable populations, Disproportionate effects, Climate-related disasters, Adaptation, Community-based initiatives

DETERMINANTS OF BONE MINERAL DENSITY AFTER SPINAL CORD INJURY

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ABSTRACT
Spinal cord injury (SCI) is a neurological disorder that causes serious dysfunctions of the whole body. The results of studies describing the determinants and the rate of BMD loss in people after SCI are inconclusive. The study covered 50 young Caucasian men after spinal cord injuries. Forearm bone mineral density (BMD), bone mineral content (BMC) and T-score in distal (dis) and proximal (prox) part was measured by densitometry. Somatic measurements and body composition measurements were taken. To assess smoking, the following were used on the Global Adult Tobacco Survey questionnaire. Muscle strength was measured using a Jamar dynamometer. Active male smokers after SCI had significantly lower BMD dis, BMC dis and prox male non-smokers after SCI. Physical activity was a significant positive predictor for BMC prox. Predictor of interactions of physical activity and fat mass was significant for BMC dis (positive direction). It was also found that the predictor of interactions of four variables: physical activity, fat mass, hand grip strength (positive direction), and years of active smoking (negative direction) was significant for BMD dis. The predictor of interactions of age at injury (additive direction) and the number of cigarettes smoked per day (negative direction) was significant for T-score prox. Non-smoking physically active men after SCI had the most advantageous values of mean forearm BMD. Active smoking may reduce the protective role of physical activity for bone health in young men after SCI.
Keywords: bone mineralization, spinal cord injury, smoking, muscle strength, body composition

POLITICAL IMMIGRATION IN THE ARBERESH AREAS IN ITALY, TURKEY AND ARGENTINE, FROM 1945 TO 1990

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ABSTRACT
Anti-Communism political emigration had originated from the end of World War II in Albania. Waves of immigration to western countries started in the last months of the war and continued with intensity immediately after its termination. Anti-Communism immigration was nationwide almost from all regions of the country,but in terms of political Albania, the largest groups of immigrants were from North and South Albania. While political emigration from Central Albania was relatively low. This expansion was related to the intensity and extent of the armed conflict among Albanians in these areas. The political immigration was established as consequence of various reasons:First, as a result of the establishment of the communist dictatorship in Albania. This was the main reason, which not only did not create opportunities and chances for national reconciliation after conflict dramatic developments that Albanians had among themselves during World War II, but the establishment of the communist dictatorship was a source of deepening hostilities. Secondly, the political emigration of a large number of Albanians was a result of the Civil War that took place in Albania from autumn 1943 to November 1944. In this context,
Keywords: Migration, Diaspora, political immigration, albanian migrants

THE IMPACT OF POLITICAL PRESSURE ON JUDICIAL INDEPENDENCE: A COMPARATIVE ANALYSIS OF INDIA AND THE UK

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ABSTRACT
The concept of judicial independence is very important for keeping the rule of law, democracy, and the protection of human rights. This paper aims to study how political pressure affects judicial independence, with a focus on India and the UK. For our study, we use a qualitative method. This includes looking at case studies, legal documents, times when politics interfered with the courts, and talking to or getting opinions from experts in law. In India, we see political pressure in several ways. For example, the government might change laws that affect how judges are chosen or speak against judges in public. This can make it hard for judges to make decisions freely. In the UK, there are systems meant to protect judges from such pressures. For instance, the Judicial Appointments Commission helps in choosing judges without political influence. However, even with these systems, there are still challenges that need attention. When we compare India and the UK, we notice both differences and similarities in how they keep their courts free from political pressure. Each country has its own way of dealing with this issue, influenced by its culture, laws, and history. Some methods work well in protecting judges, while others may not. From our study, we learn how important it is to keep the judiciary independent in democracies. Political pressures can threaten this independence, but there are ways to protect it. We suggest some ideas for making sure judges can work without fear of political interference. In conclusion, our paper shows how political pressure can challenge the independence of the judiciary in both India and the UK. It's crucial for democratic societies to keep an eye on this issue and take steps to protect the freedom of their courts. This way, judges can make fair decisions, which is important for everyone's rights and for democracy itself.
Keywords: India, UK**,** protection of human rights

HUMAN ACTIVITY RECOGNITION USING RNN

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ABSTRACT
Human Activity Recognition (HAR) is a pivotal component in the development of intelligent systems for various applications, ranging from healthcare to surveillance. This paper presents a comprehensive exploration of Human Activity Recognition using Recurrent Neural Networks (RNNs), leveraging their temporal modeling capabilities to capture sequential patterns in sensor data. The proposed methodology involves the acquisition of sensor data, such as accelerometers and gyroscopes, followed by a feature extraction process to distill relevant information from the raw data. An optimized RNN architecture is then employed to learn temporal dependencies and patterns in the sequential data. The model is trained on diverse labeled datasets, ensuring adaptability to a wide range of human activities.
Keywords: HAR,RNN, Datasets, Feature Extraction etc.

ARDUINO BASED AUTONOMOUS VEHICLE USING VOICE RECOGITION

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ABSTRACT
The advent of autonomous vehicles has revolutionized transportation, offering enhanced safety, efficiency, and convenience. This research paper presents an Arduino-based autonomous vehicle system that integrates voice recognition technology with Google Assistant, aiming to address the need for intuitive control mechanisms in autonomous vehicles. The Arduino Uno is interfaced with the motor driver and Bluetooth module, while the ultrasonic sensor is connected to both the motor driver and servo motor. The Google Assistant on an Android device serves as the interface for voice commands, providing seamless interaction with the autonomous vehicle. The paper aims to address the demand for smart and efficient transportation systems by combining Arduino-based automation with voice recognition capabilities. The integration of voice recognition technology enhances user interaction and accessibility, paving the way for intuitive control interfaces in future transportation solutions. This research highlights the potential of Arduino-based platforms in prototyping and developing advanced automation systems for diverse applications. In conclusion, the Arduino-based autonomous vehicle system utilizing voice recognition technology presents a promising avenue for the advancement of intelligent transportation systems. By leveraging the capabilities of Arduino and Google Assistant, the research paper demonstrates a scalable and adaptable solution for creating efficient and user-friendly autonomous vehicles.
Keywords: Autonomous, Voice Recognition, Arduino-based, User interaction, Smart Transportation.

MICROSTRUCTURAL ENHANCEMENT OF CVD COATINGS FOR MACHINING APPLICATIONS

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ABSTRACT
Chemical Vapor Deposition (CVD) coatings are widely used in machining applications due to their ability to withstand at high temperatures and exhibition desirable properties such as high hardness, wear resistance, and chemical stability. This paper investigates the significance of microstructure in determining the performance of CVD coatings applied to cemented carbide cutting tools. The microstructure, influenced by the C/(C + N) ratio, plays essential role in the coating's characteristics and performance during cutting operations.Many studies have proved that the combination of elements like B or Si into the coating composition can enhance both hardness and microstructure, thereby improving cutting performance. The CVD process involves thermally-induced chemical reactions conducted at elevated temperatures in an atmosphere-controlled reactor. Thin-film coatings are formed through reactions between gaseous phases and the heated substrate surface. Different gases injected into the reactor lead to the formation of these thin film layers of the coatings. For instance, TiN and titanium carbide (TiC) are formed through specific chemical reactions involving precursor gases such as $TiCl_4$, N_2, CH_4, and H_2. The resulting coatings exhibit a hard, wear-resistant with strong bonds to the substrate. Understanding and optimizing the microstructure of CVD coatings offer a promising way for enhancing the performance and durability of cemented carbide cutting tools in machining applications. This current paper aims to extreme-understand of CVD coating technology and its applications in improving the efficiency and increase lifetime of cutting tools in machining processes.
Keywords: Chemical Vapor Deposition (CVD), microstructure optimization, cemented carbide cutting tools, wear resistance.

ALL WHEEL PARKING BRAKE USING COMMERCIAL VEHICLE SPRING ACTUATOR

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ABSTRACT
This project focuses on the design, development, and implementation of an innovative all-wheel parking brake system for commercial vehicles. The proposed system leverages the reliability and efficiency of a spring actuator commonly found in commercial vehicles, aiming to enhance the overall safety and parking functionality of the vehicle. The primary objective of the project is to create a parking brake system that can effectively engage and disengage all wheels simultaneously, providing robust and secure immobilization of the vehicle during parking. The methodology involves a comprehensive study of existing parking brake systems, a detailed analysis of commercial vehicle spring actuators, and the design and prototyping of a novel mechanism to synchronize the engagement of all wheels. The project aims to address challenges related to the simultaneous actuation of multiple wheels, ensuring uniform and reliable braking force distribution.
Keywords: Parking Brake, Spring actuator, Parking functionality, Secure immobilization

YEŞİL EKONOMİ VE SÜRDÜRÜLEBİLİR BÜYÜME İLİŞKİSİ

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ÖZET
Bu makalenin amacı, son dönemlerde hızla yükselmekte olan "Yeşil Ekonomi"ye doğru geçişin sürdürülebilir büyüme üzerindeki etkisini analiz etmektir. Yeşil ekonomi, çevresel riskleri ve ekolojik kıtlıkların azaltılmasını desteklemektedir. Sürdürülebilir büyüme ise, gelir eşitsizliğinin azaltılması ile birlikte ekonomik istikrar ve refahı korumaktadır. Ekonomik büyüme, bir ekonomide mal ve hizmet üretimi miktarında olan artıştır. Dünyada nüfusun hızla artması ve artan nüfusla birlikte hızla artan üretim ile birlikte daha hızlı bir tüketim eğiliminin oluşmasına neden olmuştur. Çevrenin ve ekolojik düzenin korunması için "yeşil ekonomi" yaklaşımı daha yaygın hale gelmeye başlamıştır. Uluslararası düzeyde belirli politikalar üretilmeye başlanmıştır. Yeşil ekonomi; açık yeşil ekonomi, orta yeşil ekonomi ve ileri yeşil ekonomi olarak üçe ayrılmaktadır. Açık yeşil ekonomi, devlete karşı çıkmışlardır. Orta yeşil ekonomi, devlet müdahalesini savunmaktadır. İleri yeşil ekonomi ise, devlet müdahalesini rolü azdır. Yeşil ekonominin amacı, eşitlik ve adalet, refah ve kalkınmadır. Solow'un neoklasik büyüme modeli üç önemli iddia ortaya atmaktadır. Birincisi, teknolojik gelişmeler olmadığında, daha az kaynak ve üretim mümkün kılacaktır. İkincisi, ekonominin kilit kaynağı yatırım ve tasarruftur. Üçüncüsü ise, daha az gelişmiş ekonomiler sermaye miktarını istikrarlı hale getirene kadar gelişmiş ekonomilerden daha hızlı büyüyecektir. Sonuç olarak ise, uygulanan politikaların uzun dönemde büyüme ve yeşil ekonomi arasında pozitif ve olumlu bir ilişki olduğu görülmüştür. Artan teknolojik ilerleme ve uzmanlaşma ile kısa dönemde de sürdürülebilir büyüme üzerinde pozitif sonuçların ortaya çıkacağı kaçınılmaz olarak görülmektedir.
Anahtar Kelimeler: Yeşil Ekonomi, Ekonomik Büyüme, Sürdürülebilir Büyüme

THE RELATIONSHIP BETWEEN GREEN ECONOMY AND SUSTAINABLE GROWTH

ABSTRACT
The purpose of this article is to analyze the impact of the transition towards the rapidly rising "Green Economy" on sustainable growth. The green economy supports the reduction of environmental risks and ecological scarcities. Sustainable growth, on the other hand, aims to maintain economic stability and welfare while reducing income inequality. Economic growth refers to an increase in the quantity of goods and services produced in an economy. The rapid increase in population worldwide, coupled with increasing production, has led to a faster trend in consumption. The approach of "green economy" has become more widespread to preserve the environment and ecological balance. Certain policies have begun to be formulated at the international level. The green economy is divided into three categories: open green economy, middle green economy, and advanced green economy. The open green economy opposes government intervention. The middle green economy advocates for government intervention. The advanced green economy minimizes the role of government intervention. The aim of the green economy is equality and justice, welfare, and development. Solow's neoclassical growth model makes three important claims. First, technological advancements will make it possible to produce more with fewer resources. Second, the key sources of the economy are investment and savings. Third, less developed economies will grow faster than developed economies until they stabilize the capital stock. As a result, it has been observed that the policies implemented have a positive and beneficial relationship between growth and the green economy in the long run. It is inevitable that with increasing technological progress and specialization, positive outcomes will emerge for sustainable growth in the short term as well.
Keywords: Green Economy, Economic Growth, Sustainable Growth.

SİNEMADA APOKALİPTİK ANLATIMLAR: APOCALYPTO FİLMİNDE BİR MEZOAMERİKAN UYGARLIĞI OLAN MAYALARIN SİYASİ, DİNİ VE KÜLTÜREL VARLIĞI

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ÖZET
Distopya sözcüğü ile yakın anlamlı olan apokaliptik kelimesi insanlığın sonunu getirecek olan son ve önlenemez felaket/kıyamet anlamında kullanılır. Yönetmenliğini Mel Gibson'ın yaptığı, 2006 yılında gösterime giren film *Apocalypto,* Maya uygarlığının 7. yüzyıldaki çöküş dönemine odaklanmasıyla birlikte, uygarlık hakkında siyasi, kültürel ve dini bilgilerde sunar. Kolomb öncesi Amerikan uygarlıklarından biri olan Maya uygarlığı, binlerce yıl boyunca Meksika'nın güneydoğusundan, Honduras, El Salvador ve Guatemala'ya kadar uzanan Mezoamerika bölgesinde hüküm sürmüştür ve bu yüzden film, Meksi'da Veracruz'un güneyindeki Catemaco ve Los Tuxtlas çevresinde çekilmiştir. *Apocalypto* filminde Yukatek Mayacası kullanılmış ve tüm gösterime girdiği ülkelerde dublaj yasaklanmış, sadece İngilizce altyazı ile gösterilmektedir. Film, köylerinde mutlu bir şekilde yaşayan Maya halkının hayatlarından kesitlilerle başlar ve köye gelen bir grup asker köyü yağmalar ve kadınları köle, erkekleri ise Maya geleneğine göre kurban etmek üzere esir alırlar. Sonrasında esir yerli halkı zorlu ve sonunun ne olduğunu bilmedikleri bir yolculuk bekler ve filmin yaklaşık kırk dakikalık bölümünü içeren ve seyirciyi de merak içinde bırakan bu yolculuk sonrası zigguratları ve insan kurbanı ayinleri ile ünlü Maya başkentine ulaşırlar. Kuraklığın problem olduğu bölgede kurban törenleri yapılmakta ve esir alınan köy halkını da bu akıbet beklemektedir. Filmin yayınlamasıyla birlikte tarih eleştirmenleri, tarihsel çelişkilerle dolu olduğu ve gerçeği yansıtmadığı gerekçesiyle Maya uygarlığının diğer mezoamerikan uygarlıkları Mayalar İnkalara Azteklerle birbirine karıştırıldığı ve taraflı bir bakış sunduğunu iddia etmişlerdir. Tüm bu eleştirilere rağmen *Apocalypto* filmi kurgusal tasvirleriyle Maya medeniyetinin çöküşünün yakın olduğu bir dönemde, çöküşün getirdiği çaresizlik ve beraberinde yaygınlaşan zulüm, kabileler arası iç savaş, salgın hastalıklar, yabancıların istilası gibi konulara apokaliptik bir bakış açısıyla bir dönemim en görkemli medeniyetinin yok oluşunu anlatır.
Anahtar Kelimeler: Mezoamerika Uygarlıkları, Kurban Ritüeli, Apokaliptik Dönem

APOCALYPTIC NARRATIVES IN CINEMA: THE POLITICAL, RELIGIOUS AND CULTURAL PRESENCE OF THE MAYA, A MESOAMERICAN CIVILIZATION IN THE MOVIE "APOCALYPTO"

ABSTARCT
The term "apocalyptic," closely associated with "dystopia," refers to the ultimate and inevitable catastrophe or apocalypse that will result in the extinction of humanity. Directed by Mel Gibson and released in 2006, *Apocalypto* centers on the collapse of the Mayan civilization in the 7th century and provides political, cultural, and religious information about the civilization. The Mayan civilization, an ancient American culture that existed for thousands of years, exerted control over the Mesoamerican region, spanning from southeastern Mexico to Honduras, El Salvador, and Guatemala. Therefore, the movie was filmed in the vicinity of Catemaco and Los Tuxtlas, located south of Veracruz in Mexico. The movie *Apocalypto*, which was shot with Yukatek Mayaca, was banned from dubbing in all countries where it was released and was released only with English subtitles. The movie opens by depicting the lives of the Mayan populace, who reside contentedly in their community. Upon the troops' arrival in the village, they engage in looting and seize the women as slaves, while capturing the men to be sacrificed in conformity with the Mayan tradition. The captive locals then embark on a challenging and unpredictable journey to the Mayan capital, famous for its ziggurats and human sacrifice rituals, which lasts for about forty minutes of the movie and leaves the audience in suspense. In the drought-stricken region, sacrifice ceremonies are executed, and the captured people anxiously await their inevitable destiny. Following the premiere, historians criticized it for including several historical discrepancies and failing to accurately depict reality, arguing that the movie gave a skewed perspective of the Mayan civilization, often conflating it with other Mesoamerican civilizations such as the Incas and Aztecs. Despite all these criticisms, the movie *Apocalypto* narrates the downfall of the Maya civilization during a period when its collapse was imminent, depicting the desperation brought by the collapse, the widespread oppression that followed, inter-tribal warfare, epidemic diseases, and the invasion of foreigners, all from an apocalyptic perspective, portraying the demise of one of the most magnificent civilizations of its time.
Keywords: Meseoamerican Civilizations, Sacrificial Ritual, Apocalyptic Period

MAKİNE ÖĞRENMESİ TEKNİKLERİ KULLANILARAK OBEZİTE TAHMİN MODELİ ÖNERİSİ

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ÖZET
Obezite, dünya genelinde giderek artan bir sağlık sorunudur ve etkileri üzerine yapılan araştırmalar büyük önem taşımaktadır. Çalışmada, farklı bir sentetik veri üretme tekniği ile birlikte, Palechor ve Manotas (2019) araştırmasında yer alan veriler kullanılarak farklı makine öğrenmesi tekniklerinin performans karşılaştırması yapılmıştır. Palechor ve Manotas (2019) çalışmasında uyguladığı teknikten farklı olarak bu çalışmada SMOTE-NC (Synthetic Minority Over-sampling Technique for Nominal and Continuous) veri üretme yöntemi bazı farklı koşullarda uygulanmıştır. Yaş, cinsiyet, yeme alışkanlıkları ve fiziksel aktivite gibi çeşitli özellikler kullanılarak obezite riskini belirlemek üzere elde edilen bu veri setinde dengesiz veri problemini gidermek için SMOTE-NC tekniği kullanılmıştır. Bu yöntem, azınlık sınıfların örneklerini sentetik olarak artırarak dengesizliği giderip modelin daha dengeli ve güvenilir sonuçlar üretmesinin yanında, SMOTE tekniğinden farklı olarak, veri setinde hem sürekli hem de kategorik değişkenlerin olması durumunda kullanılması önerilen bir yöntemdir. Çalışmada, hem ham veri hem de veri çoğaltıldıktan sonra, Naive Bayes, Lojistik Regresyon, Rastgele Orman, Karar Ağaçları, K-En Yakın Komşu Algoritması ve Destek Vektör Makineleri (SVM) sınıflandırma algoritmalarının karşılaştırması sunulmuştur. Python programı kullanılarak yürütülen bu çalışmada, algoritma performansları doğruluk(accuracy), kesinlik (precision), duyarlılık (recall) ve F1 skor (F1 score) değerlerine bakılarak değerlendirilmiştir. Ayrıca, özellikle sağlık verilerinde sıkça karşılaşılan bir sorun olan dengesiz veri problemine işaret eden bu çalışma TÜBİTAK tarafından desteklenmektedir.
Anahtar Kelimeler: Obezite, Python, Makine Öğrenmesi, SMOTE-NC

OBESITY PREDICTION MODEL PROPOSAL USING MACHINE LEARNING TECHNIQUES

ABSTRACT
Obesity is an increasingly prevalent health issue worldwide, and research on its effects is of great importance. In the study, the performance comparison of different machine learning techniques is carried out with the data presented in the Palechor and Manotas (2019) research, along with a different synthetic data generation technique. Unlike the technique employed by Palechor and Manotas (2019), this study applies the SMOTE-NC (Synthetic Minority Over-sampling Technique for Nominal and Continuous) data generation method under different conditions. SMOTE-NC technique is used to eliminate the problem of unbalanced data in this data set, which is obtained to determine the risk of obesity by using various features such as age, gender, eating habits and physical activity. This method mitigates imbalance by synthetically increasing samples of minority classes, leading to a more balanced and reliable model performance. Additionally, unlike the SMOTE technique, SMOTE-NC is recommended for datasets containing both continuous and categorical variables. The study presents a comparison of classification algorithms including Naive Bayes, Logistic Regression, Random Forest, Decision Trees, K-Nearest Neighbors Algorithm, and Support Vector Machines (SVM) on both raw and augmented data. Conducted using Python programming, the performance of algorithms is evaluated based on metrics such as accuracy, precision, recall, and F1 score. Moreover, this study, which highlights the commonly encountered issue of imbalanced data in health data, is supported by TUBITAK (The Scientific and Technological Research Council of Turkey).
Keywords: Obesity, Python, Machine Learning, SMOTE-NC

MUZ ÜRETİMİNDE GİRDİ KULLANIMI VE BRÜT KAR ANALİZİ (MERSİN İLİ ÖRNEĞİ)

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ÖZET
Bu çalışmada, Mersin ili Anamur ilçesinde muz üretiminde girdi kullanımı brüt kar analizinin belirlenmesi amaçlanmıştır. Çalışmanın ana materyalini Mersin ili Anamur ilçesinde muz üretimi yapan 251 üreticiden anket yöntemiyle elde edilen veriler oluşturmuştur. Araştırma alanında toplam muz üretim alanı 210,30 ha ve ortalama muz üretim alanı alan 0,83 ha olarak hesaplanmıştır. Toplam üretim miktarı 16.195,00 ton olarak belirlenmiş, ortalama muz verimi 77.009,03 kg/ha olarak bulunmuştur. Gayri safi üretim değeri 847.099,33 TL/ha, değişken masraflar 256.318,63 TL/ha ve brüt kâr 590.780,70,08 TL/ha olarak bulunmuştur. Muz üretiminde enerji eşdeğerleri, sera gazı emisyonları ve değişken masraflar içerisindeki en yüksek payı gübre girdisinin aldığı sonucuna ulaşılmıştır.
Anahtar Kelimeler: Brüt kâr, girdi kullanımı, muz üretimi, Mersin
Not: Bu çalışma Kader AYDIN'nın Yüksek Lisans Tezinden derlenmiştir.

INPUT USAGE AND GROSS PROFIT ANALYSIS IN BANANA PRODUCTION (MERSİN PROVINCE EXAMPLE)

ABSTRACT
In this study, energy use and greenhouse gas emissions in greenhouse banana production in Anamur district of Mersin province were determined and gross profit analysis was conducted. The main material of the study was the data obtained from 251 banana producers by survey method. In order to calculate energy equivalents, the amounts of inputs used in banana production were found and these input data were multiplied by energy equivalent coefficients. The total banana production area in the research area was calculated as 210.30 ha and the average banana production area was calculated as 0.83 ha. The total production amount was determined as 16,195.00 tons and the average banana yield was 77,009.03 kg ha-1. Gross production value, variable costs and gross profit were found as 847,099.33 TL ha-1, 256,318.63 TL ha-1 and 590,780.70.08 TL ha-1. It was concluded that fertilizer input had the highest share in energy equivalents, greenhouse gas emissions and variable costs in banana production. Energy use efficiency higher than 1 indicated that inputs were used efficiently.
Keywords: Gross profit, input use, strawberry production, Mersin
Note: This study was compiled from Kader AYDIN's Master's Thesis.

ERKEN CUMHURİYET DÖNEMİNDE LAİKLİK ÜZERİNE DEĞERLENDİRMELER

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ÖZET
Yüzyıllar boyunca egemenliğin tek bir kişide toplanması, özellikle de bu makamın halifelikle birleşmesi çağdaşlık önünde bir engel teşkil eden sorun haline gelmiştir. Bu nedenle ulu önder Türkiye Cumhuriyeti'ni kurarken emin adımlarla bazı inkılaplar yapma yoluna gitmiştir. Laiklik, halifelik makamını da elinde tutan bir egemen güçten sonra belki de en önemli ve gerçekleştirilmesi en zor olan inkılap olarak karşımıza çıkmaktadır. Temelsiz bir zemine dayanmadan gerçekleşmeyecek laiklik için belli adımların atılması gerekiyordu. Öncelikle saltanatın kaldırılması ve halifenin değişiminden sonra herhangi bir siyasi gücü ve önemi kalmayan halifelik makamı 3 Mart 1924'te kaldırıldı. Böylece laik devlet için en önemli adım atıldı. Bu önemli iki adımdan sonra eğitim, hukuk ve askeri alanlarda da değişimler yaşandı ve dinin etkisi bu kurumlarından üzerinden kaldırıldı. Tevhit-i Tedrisat kanunu ile eğitimde ikilikler ortadan kalkmış ve dinin etkisinden ayrılmıştır. Seriye ve Evkaf Vekâleti ve Erkan-ı Harbiye-i Umumiye Vekâletlerinin Kaldırılması da vakıflar ve askeriyenin laikleşme çalışmalarından biri olmuştur. Bu bahsettiğimiz aşamalardan sonra en son olarak Laiklik anayasaya girmiş ve Türkiye Cumhuriyeti laik devlet olarak anayasada yer almıştır. Cumhuriyet'i kuran kadro ve özellikle Atatürk, yönü Batı olan bir ulus devleti için çabalamıştır. Hem Batı'ya ayak uyduran hem de milliyetçilik bilincinde olan yeni bir devletin var olabilmesi ve ayakta kalabilmesi için laiklik çok önemlidir. Eğer laiklik ilkesine sadece din ve siyaset perspektifinden bakarsak hem kuruluş felsefesini anlayamayız hem de devletimiz ve milletimiz için laikliğin anlamı eksik kalmış olur. Orta Asya steplerinden beri dine dayalı bir yönetim anlayışına sahip olan bir millet için alışması, kabullenmesi zor olan laiklik günümüzde bile en çok tartışılan konuların başında gelmektedir. Bu çalışmamızda laiklik kavramı anayasaya girene kadar hangi aşamalardan geçildi, hangi adımlar atıldı ve bu yapılanlara karşı gösterilen tepkiler neler oldu sorularının cevapları irdelenmiştir.
Anahtar Kelimeler: Laiklik, Değişim, Bilinç, Halifelik

EVALUATIONS ON SECULARISM IN THE EARLY REPUBLICAN PERIOD

ABSTRACT
For centuries, the concentration of sovereignty in a single person, especially the combination of this office with the caliphate, has become a problem that poses an obstacle to modernity. For this reason, the great leader took firm steps towards making some reforms while establishing the Republic of Turkey. Secularism appears as perhaps the most important and most difficult revolution to realize after a sovereign power that also holds the office of caliphate. Certain steps had to be taken for secularism, which could not be achieved without being based on a baseless basis. First of all, the office of caliphate, which no longer had any political power or importance after the abolition of the sultanate and the change of the caliph, was abolished on March 3, 1924. Thus, the most important step for the secular state was taken. After these two important steps, changes also took place in the fields of education, law and military, and the influence of religion was removed from these institutions. With the Tevhit-i Tedrisat law, dualities in education were eliminated and separated from the influence of religion. The abolition of the Ministry of Seriye and Foundations and the Ministry of Erkan-ı Harbiye-i Umumiye was also one of the secularization efforts of the foundations and the military. After the stages we mentioned, secularism was finally included in the constitution and the Republic of Turkey was included in the constitution as a secular state. The team that founded the Republic, and especially Ataturk, strived for a nation-state whose orientation was Western. Secularism is very important for the existence and survival of a new state that keeps pace with the West and is nationalist-conscious. If we look at the principle of secularism only from the perspective of religion and politics, we cannot understand the founding philosophy and the meaning of secularism for our state and nation will be missing. Secularism, which is difficult to get used to and accept for a nation that has had a religion-based management approach since the Central Asian steppes, is one of the most discussed topics even today. In this study, the answers to the questions of what stages were passed until the concept of secularism was included in the constitution, what steps were taken and what were the reactions to these actions were examined.
Keywords: Secularism, Change, Consciousness, Caliphate

ANADOLU COĞRAFYASINDA MAHALLİ İDARE AMİRLERİNİN MÜLKİ İDARE ANLAYIŞI

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ÖZET
Anadolu coğrafyasında geçmişten gelen ülkedeki taşra yönetimi idare hukuku ekseninde mülki idareye dayanmaktadır. Ülkenin her noktasındaki toprakların yönetimi taşra dediğimiz bölgede temsilciler aracılığıyla yerine getirilmektedir. Taşradaki temsilciler olan mülki idare amirleri ilde vali, ilçede kaymakamlar olarak bu görevi kesintisiz bir şekilde yerine getirmektedirler. Mülki idare amirleri egemen olduğu bölgesinde toplumun güvenliğinden eğitimine yaşantısından sosyal ve ekonomik durumuna bir çok alanında muhafazasını sağlamakla yetkili ve sorumludurlar.Bu hizmet görevinin geçmişi çok eskiye dayanmakla beraber kendine özgü bir süreçle tarihsel özgeçmişe sahiptir.Tarihten gelen görev ve sorumluluklar ile beraber çok önem arz eden br konum olmakla beraber günümüzde büyük özveriye dayanan bir meslek dalıdır.Ondan ötürü günümüzde mahalli idare amirlerinin göreve başlangıç aşamasında uzun eğitim süreçleri olup toplum ve dünyayı tanıma ve anlama üzerinde uygulamalı ve teorik eğitimleri söz konusudur.Bunun yanısıra dünyadaki kamu yönetimlerindeki yeni düzenleme ve uygulamaların benimsenmesine yönelik değişimlerle birlikte mülki idare açısından örgütlenme konusunda büyük önem arz etmektedir.Bu çalışma günümüz Anadolu cografyasında mülki idare amirlerinin görev bilinci ve anlayışı doğrultusunda görev ve sorumluluklarına değinilecek olup toplum tarafından bakış açıları ve talepler doğrultusunda meslek işlev ve görevlerine göre incelenecektir.Bunun yanı sıra mahalli idare amirlerinin yetişme süreci ve toplum beklentileri meslekteki yeni düşünce ve algılar,mesleğin yeniden yorumlanma gereklilikleri toplum nazarında ifade edilecektir.Toplumun taşradaki yeni talepleride mahalli idare amirleri açısından değerlendirilecektir.
Anahtar Kelimeler: Taşra, Halk, Toplum, İhtiyaçlar, Sosyal Yapı

UNDERSTANDING OF PUBLIC ADMINISTRATION OF LOCAL ADMINISTRATORS IN ANATOLIAN GEOGRAPHY

ABSTRACT
In the Anatolian geopraphy,the administration from the past is based on provincial administration and corrupt çivil administration.The management of the lands in each region of the country is carried out through regional representatives in the provinces.The çivil administrators,who are the representatives in the provinces,constantly fulfill this purpose as governors in the province and district governors in the districts.Civil administrators are authorized and responsible for ensuring the preservation of social life,education,life and many socally and economically operated areas in the region they dominate.Although the history of this service duty dates back to ancient times, it has a traditional CV with a unique process. Togetherness with duties and responsibilities coming from history is very important. It is currently a professional branch based on great dedication. Therefore, today, local government chiefs have long training sessions and practical and theoretical training on global and global recognition and understanding during their induction into office. The civil administration plan along with the expenses is of great importance in planning. This study will touch upon the duty awareness and understanding of the civil administration chiefs in today's Anatolian geography, the duty plan duties and responsibilities, and the perspectives and demands of the society will be examined according to their professional functions. In addition, the development of the local administration chiefs The process of expressing the process and social relations, new thoughts and perceptions in the professions, and the requirements for reinterpretation of the profession in the eyes of society. The collapse of society in the provinces will be evaluated again from the perspective of local administrators.
Keywords: Provincial, People, Society, Needs, Social Structure

PATRICK CAULFIELD İLLÜSTRASYONLARINDA MİNİMALİST YAKLAŞIM

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ÖZET
20. yüzyılın önde gelen ressamlarından bir olan Patrick Caulfield, minimalist bir sanatçı olarak kabul edilmektedir. Çalışmalarında, grafik tasarım alanlarından biri olan vektörel illüstrasyonu kullanmaktadır. Cauldfield'in çalışmalarında illüstrasyonun ve iç mekânın bütünleşmesi görülmektedir. Mekânın bütünleşmesinde çizgisel formlar ve renkler kullanılmış olmakla birlikte, çalışmaları iki boyutlu ve üç boyutlu bir etkiye sahiptir. Çizgisel olarak oluşturulan figürler ve formlar mekân içinde devamlılığı sağlayan basit geometrik şekillerle oluşturulmaktadır. Caulfield'in tasarım yaklaşımı, soyut dışavurumculuğa karşı olarak oluşmuş bir akım olan minimalizmdir. Minimalizm üslubu; sade bir dil kullanarak basit anlatımı hedeflemektedir. Akım, 1960'lı yıllarda popülerleşmeye başlamış, soyut bir anlatımda ilerlemiştir. Minimalizm akımının yaklaşımında geometrik figürlerin, soyutlanmış formların, basit sade ve keskin hatlarla aktarıldığı gözlenmektedir. Patrick Caulfield'in tasarım yaklaşımında; İngiliz sanatını minimalist yaklaşım üzerinden ele alan ve vektörel tabanlı illüstratif uygulamaların çoğunluklu olduğu görülmektedir. Bu araştırmada kapsamında Caulfield'in vektörel tabanlı illüstratif yaklaşımlı uygulamalarındaki minimalist tavır incelenecektir. Araştırmada nitel araştırma yöntemlerinden betimsel tarama modeli kullanılacak olup, grafik tasarım alanlarından biri olan vektörel illüstrasyon alanı adı altında Patrick Caulfield'in minimalist yaklaşımlarının İngiliz sanatında nasıl bir rol oynadığı açığa çıkarılmaya çalışılacaktır.
Anahtar Kelimeler: Grafik Tasarım, İllüstrasyon, İngiliz Sanatı, Minimalizm, Vektörel İllüstrasyon

MINIMALIST APPROACH IN PATRICK CAULFIELD ILLUSTRATIONS

ABSTRACT
One of the 20th century's leading painters, Patrick Caulfield is considered a minimalist artist. In his works, he uses vector illustration, one of the fields of graphic design. In Cauldfield's works, the integration of illustration and interior space is seen. Although linear forms and colors are used in the integration of space, his works have a two-dimensional and three dimensional effect. The figures and forms created linearly are formed with simple geometric shapes that provide continuity in space. Caulfield's design approach is minimalism, a movement formed in opposition to ABSTRACT expressionism. Minimalism style aims for simple expression by using a plain language. The movement started to become popular in the 1960s and progressed in an ABSTRACT expression. In the approach of the minimalism movement, it is observed that geometric figures, ABSTRACTed forms are conveyed with simple, simple and sharp lines. In Patrick Caulfield's design approach; it is seen that there is a majority of vector-based illustrative applications that deal with British art through a minimalist approach. Within the scope of this research, the minimalist attitude in Caulfield's vector-based illustrative applications will be examined. In the research, the descriptive survey model, one of the qualitative research methods, will be used and it will be tried to reveal how Patrick Caulfield's minimalist approaches play a role in British art under the field of vector illustration, one of the graphic design fields.
Keywords: Graphic Design, Illustration, British Art, Minimalism, Vector Illustration

(2 + 1)-BOYUTLU CALOGERO-BOGOYAVLENSKİİ-SCHİFF DENKLEMİNİN RASYONEL (G'/G) GENİŞLETME YÖNTEMİYLE SOLİTON ÇÖZÜMLERİ

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ÖZET
Adi ve kısmi diferansiyel denklemler, fiziksel, biyolojik ve kimyasal süreçleri matematiksel olarak modellemek için en güçlü araçlardır. Lineer olmayan kısmi diferansiyel denklem sistemlerinin tam çözümleri için çeşitli yaklaşımlar geliştirilmiştir. Yakın zaman içerisinde ortaya çıkan rasyonel (G'/G) açılım yöntemi ele alınarak (2+1) boyutlu Calogero – Bogoyavlenskii – Schiff denklemi için uygun dalga dönüşümü altında adi diferansiyel denkleme indirgenerek kesin ve soliton dalga çözümleri elde edilmiştir. Son yıllarda bulunan Rasyonel (G'/G) açılım metodu ise, trigonometrik, rasyonel ve hiperbolik fonksiyonlara dizilen uygun biçimlerde çeşitli soliton çözümlerin elde edilmesinde kullanılmaktadır. Rasyonel (G'/G) açılım metodu, etkin, özlü ve sonraki çalış malarda ele alınabilecek diğer lineer olmayan modellere analitik çözümler bulabilen bir yöntemdir. Lineer olmayan kısmi diferansiyel denklemlerin kesin çözümlerini bulmak için Maple hesaplama programı kullanılmıştır. Program sayesinde karmaşık cebirsel hesaplamaları daha kolay bulunmuştur.
Anahtar Kelimeler: Lineer olmayan kısmi diferansiyel denklemler, Rasyonel (G'/G) açılım metodu, Calogero – Bogoyavlenskii – Schiff denklemi.

SOLITON SOLUTIONS OF (2 + 1)-DIMENSIONAL CALOGERO-BOGOYAVLENSKII-SCHIFF EQUATION WITH RATIONAL (G'/G) EXPANSION METHOD

ABSTRACT
Ordinary and partial differential equations are the most powerful tools for mathematically modeling physical, biological, and chemical processes. Various approaches have been developed for the exact solutions of nonlinear partial differential equation systems. The rational (\left(G’/G\right)) expansion method, which emerged recently, has been considered and exact and soliton wave solutions have been obtained by reducing the (2+1) dimensional Calogero – Bogoyavlenskii – Schiff equation to an ordinary differential equation under an appropriate wave transformation. The Rational expansion method found in recent years is used to obtain various soliton solutions in suitable forms arranged to trigonometric, rational, and hyperbolic functions. The Rational expansion method is an effective, concise method that can find analytical solutions to other nonlinear models that can be addressed in subsequent studies. The Maple computation program was used to find the exact solutions of nonlinear partial differential equations. Thanks to the program, complex algebraic calculations were found more easily.
Keywords: Nonlinear Partial Differential Equations, Rational expansion method, Calogero – Bogoyavlenskii – Schiff equation.

ZAKHAROV-KUZNETSOV BİRLEŞİK SİSTEMİ İÇİN DEĞİŞTİRİLMİŞ SARDAR ALT DENKLEM YÖNTEMİNİN UYGULANMASI

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ÖZET
Kısmi diferansiyel denklemler, fizik, mühendislik, matematik ve diğer bilim alanlarında yaygın olarak kullanılır. Lineer olmayan kısmi diferansiyel denklem sistemlerinin tam çözümleri için farklı yaklaşımlar bulunmuştur. Yakın zaman içerisinde ortaya çıkan modifiye edilmiş Sardar alt denklem yöntemi kullanılarak Zakharov - Kuznetsov (ZK) denklem çifti denklemini uygun dalga dönüşümleri altında adi diferansiyel denkleme indirgeyerek kesin ve soliton dalga çözümleri elde edilmiştir. Modifiye edilmiş Sardar alt denklem metodu, klasik ve kesirli dereceden lineer olmayan kısmi diferansiyel denklemler için karanlık, parlak, W - şekilli, karışık karanlık-parlak, tekil, karışık tekil solitonlar, periyodik ve diğer çözümler de dahil olmak üzere çok sayıda soliton çözümü üretmek için kullanılabilecek güçlü ve sağlam bir yaklaşımdır. ZK denklemleri, Korteweg - de Vries (KdV) denkleminin iki boyutlu genellemesidir. Bu çalışma, lineer olmayan ZK denkleminin çözümlerinin ayrıntılı bir sayısal incelemesini sunar. Lineer olmayan kısmi diferansiyel denklemlerin kesin çözümlerini bulmak için Maple hesaplama programı kullanılmıştır. Böylelikle karmaşık cebirsel hesaplamaları daha kolay bulunmuştur.
Anahtar Kelimeler: Lineer olmayan kısmi diferansiyel denklemler, modifiye edilmiş Sardar alt denklem yöntemi, Zakharov - Kuznetsov (ZK) denklem çifti.

APPLICATION OF THE MODIFIED SARDAR SUB EQUATION METHOD FOR ZAKHAROV-KUZNETSOV COUPLED SYSTEM

ABSTRACT
Partial differential equations are widely used in physics, engineering, mathematics, and other scientific fields. Different approaches have been found for the exact solutions of nonlinear partial differential equation systems. Recently, using the modified Sardar sub-equation method, exact and soliton wave solutions have been obtained by reducing the Zakharov - Kuznetsov (ZK) equation pair to an ordinary differential equation under appropriate wave transformations. ZK equations are a two-dimensional generalization of the Korteweg-de Vries (KdV) equation. This study presents a detailed numerical examination of the solutions of the nonlinear two-dimensional ZK equation. The Maple computation program has been used to find exact solutions for non-linear partial differential equations. Thus, complex algebraic calculations have been found more easily.
Keywords: Nonlinear Partial Differential Equations, Modified Sardar Sub-equation Method, Zakharov - Kuznetsov (ZK) Equation Pair.

VOLATILITY ANALYSIS OF ESG INDICES AND CONVENTIONAL STOCK MARKET INDICES: A COMPARATIVE STUDY

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ABSTRACT
The incorporation of Environmental, Social, and Governance (ESG) considerations into investment decisions has accelerated significantly in the dynamic world of modern finance. Benchmark indexes are crucial measuring sticks for evaluating the performance of the market. This study investigates the volatility dynamics of Environmental, Social, and Governance (ESG) indices in comparison to conventional stock market indices. Volatility analysis is crucial for investors seeking to manage risk and optimize portfolio performance. We employ a comprehensive dataset spanning a significant timeframe from 2010 to 2023 to capture diverse market conditions. Through statistical methodologies and econometric techniques, we analyze the volatility patterns, assess the impact of ESG factors on market fluctuations, and explore potential correlations with conventional indices. Our findings offer insights into the relative stability and risk characteristics of ESG investments compared to traditional market benchmarks, contributing to informed decision-making in sustainable investing and risk management strategies.
Keywords: ESG, Volatililty, Conventional stock market indices

A BIBLIOMETRIC REVIEW OF LITERATURE IN URBAN VEGETATION STUDIES OVER THE LAST FIVE YEARS

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ABSTRACT
Urban vegetation is a basic component and cornerstone of urban ecosystems. Consequently, a better comprehension of the temporal and spatial patterns of change of this vegetation is essential for more efficient environmental management of the urban environment, to improve the urban habitat, and to mitigate the damaging effects of accelerated urbanization. This review explored research from articles indexed in the Scopus database on the topic of urban vegetation between 2018 and 2023. A process of selection, filtering, and refining in the Scopus database generated 683 articles. Once exported in CSV format, the data was analyzed using Scopus Analytics, VOSviewer, and MS Excel. The aim was to offer guidance on current topics and predict future tendencies in research on this theme. The results of this analysis show that 60,32% of articles were published in the last three years (2021, 2022, and 2023). China is the country most interested in this topic, with 195 articles (28.55%). Over the last five years, researchers from several different disciplines have taken an interest in urban vegetation. The field of environmental sciences contributed the most, with 33.56% of papers published. In terms of sources, the journal Urban Forestry and Urban Greening came out on top with 58 articles and 982 citations. The topic of urban vegetation has gained significant attention from researchers with diverse scientific backgrounds. This analysis argues that, given the concerning state of environmental issues, the promotion of vegetation in urban environments—which provides a multitude of ecosystem services and helps create biologically diverse and better-balanced urban ecosystems—can become a fundamental pillar for a more sustainable future city.
Keywords: urban vegetation, bibliometric analysis, ecosystem services, urban biodiversity.

OPTIMAL DIRECTIONS FOR ENSURING FINANCIAL SECURITY AT THE ECONOMIC ENTITY LEVEL

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ABSTRACT
In modern economic market conditions, all enterprises face financial risks, insufficient financial resources, a high level of competition and other internal and external threats. In order to operate stably and ensure sustainable development in this situation, it is necessary to create a financial security system for the enterprise.The financial security of an enterprise is based on the financial policy of the enterprise, which guarantees an effective increase in production, in which the enterprise will become independent of financial and credit institutions.In order to obtain economic benefits, an economic entity must competently and rationally manage financial resources, and this presupposes the presence of the necessary level of financial security. The specificity of this component of economic security is due to the fact that financial security, along with financial relations in general, is included in all areas of economic activity and acts as a necessary condition for the development and successful operation of an economic entity.
Thus, the relevance of the chosen research topic is that financial security is an important part of economic security and has a significant impact on the current state of an economic entity, and assessing the level of financial security allows us to identify and neutralize threats that lead to the deterioration of the state his finances.
Keywords: financial security, financial resources, financial policy, indicators of financial security

AYNI DİL AİLESİNE MENSUP OLAN İKİ DİLİN ÜNSÜZLERİNİN KARŞILAŞTIRILMASI DÜZEYİ

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ÖZET
İki ve ikiden fazla dilin biçimbilgisel yapısında ve leksikolojik anlamında ortak özelliklerinin gözlemlenmesi söz konusu dillerin çoğunlukla jeneolojik açıdan akraba diller olduğunu ve kendilerinin bir ortak kaynaktan, "kök dil" adlandırabileceğimiz bir ortak dilden türendiğini kanıtlar. Araştırmamızın konusu Hint-Avrupa dilleri ailesinin İran dilleri öbeğine ait olan Farsça ve Peştu dillerinin ünsüz sesleridir.Çok eski tarihe sahip Farsça Doğu`da oldukça büyük alanda yaygınlaşmış , klâsik eserlerin yazıldığı Hint-Avrupa dil ailesinin İran dilleri öbeğine aittir. Söz konusu dil İran İslam Cumhuriyetinin resmi devlet dilidir.Hint-Avrupa dillerinin İran dilleri öbeğine ait olan Peştu dili Peştunların ana dili olarak genellikle bütün Güney və Güneydoğu Afganistan`da, Kuzey Batı ve Batı Pakistan`da yaygınlaşmıştır. Darice ile beraber Afganistan`da resmi devlet dili olarak bilinir. Her iki dile yazıda Arap alfabesini kullanmakla Arap alfabesinin mevcut bulanan harflerine, dillerine uygun çeşitli harfler, , diakritik işaretler eklenilmiştir. Farslar Arap alfabesine 4 grafik örnek , Peştunlar ise 18 grafik örnek ekleyerek telâffuzlarına uygun olarak alfabelerini geliştirmişler.Peştu ve Farsça dilleri aynı dil grubuna ait olmalarına rağmen ünsüz ve ünlü seslerinin sayılarına göre birbirlerinden esaslı olarak farklıdırlar. Farsçada 23 ünsüz , 6 monoftong ünlü ve 1 diftong bulanmasına karşın Peştucada 30 ünsüz,9 ünlü, 7 monoftong ünlü ses bulunmaktadır. Sonuçta Farsçada harf sayısının 30 şema örneği şeklinde belirlenmesine rağmen Peştucada harf sayısı toplam olarak 46`dır. Peştu dilinde harf sayısının çoğunluk oluşturması Peştunların telâffuzunda monoftong, diftongların sayıca yeğlik oluşturması ,aynı zamanda ünlü ve ünsüzlerin birçoğunun burun sesleri özelliklerini alabilmesi *(ing.: nasal vowel; nasal consonant)* ve söz konusu dildeki özel ünsüzlerin bulunmasının sonucudur.
Anahtar Kelimeler: Hint-Avrupa dilleri ailesi, İran dilleri, Peştu dili, ünlü sesler, ünsüz sesler.

CONSONANTS IN TWO LANGUAGES OF THE SAME LANGUAGE FAMILY WITHIN COMPARATIVE STUDY

ABSTARCT
If two or more languages have common features in their grammatical structure and lexical composition, these languages are genetically related languages and they are descended from one common source, conventionally called the “root language”. The object of our research is the consonant sounds of the Persian and Pashto languages belonging to the Iranian group of the Indo-European language family.Widespread in the East with classical works written on it the Persian language which has an ancient history, belongs to the Iranian group of the Indo-European language family. This language is the official state language of the Islamic Republic of Iran.The Pashto language, which belongs to the Iranian group of Indo-European languages, as the mother tongue of the Pashtuns, is mainly spread throughout southern and southeastern Afghanistan, as well as in northwestern and western Pakistan. It is the official state language in Afghanistan along with Dari language. By using the Arabic alphabet in writing, both languages have added different letters and diacritical marks to the existing letters of the Arabic alphabet. The Persians added 4 graphic samples to the Arabic alphabet: the Pashtuns added 18 and improved their alphabet according to their pronunciation.Although Pashto and Persian belong to the same language group, they differ significantly in terms of the number of consonants and vowels. In Persian there are 23 consonants, 6 monophthong vowels and 1 diphthong; while Pashto has 30 consonants, 9 vowels and 7 monophthong vowel sounds. Thus, if the letters of the Persian language are identified in the form of only 30 graphic patterns, the total number of letters in the Pashto language is 46. This happens mainly due to the presence of many monophthongs and diphthongs in Pashtun pronunciation, as well as the nasalization of many vowels and consonants (nasal vowel; nasal consonant) and the presence of special consonants of this language.
Keywords: Indo-European language group, Iranian languages, Pashto language, vowel sounds, consonant sounds.

AN OVERVIEW OF FOOD ENGINEERING BRANCHES: FROM CHEMISTRY TO PACKAGING

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ABSTRACT
Food engineering encompasses various branches that focus on different aspects of food production, processing, and preservation. One key area is food chemistry, which delves into the composition, structure, and properties of food molecules. Understanding these elements helps in creating new food products, enhancing flavour, and improving nutritional value. Food microbiology is another vital branch, studying the role of microorganisms in food spoilage, fermentation, and foodborne illnesses. This knowledge aids in developing methods to prevent contamination and extend shelf life. Food process engineering involves designing and optimizing equipment and processes for food production, such as mixing, heating, and packaging, to ensure efficiency and safety. Food biotechnology explores the use of biological systems, such as enzymes and microorganisms, to enhance food quality, production, and sustainability. Meanwhile, food safety and quality assurance focus on implementing regulations and standards to ensure that food products meet safety and quality criteria throughout the supply chain. Finally, food packaging engineering involves designing packaging materials and systems that protect food from physical, chemical, and microbial damage, while also considering environmental sustainability. Overall, these branches of food engineering work together to innovate and improve the way we produce, process, and consume food.
Keywords: food engineering, branches, food chemistry, food microbiology, food process engineering, food biotechnology, food safety, quality assurance, food packaging engineering

ADVANCEMENTS IN SMART WASTE MANAGEMENT SYSTEMS: A COMPREHENSIVE OVERVIEW

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ABSTRACT
We meticulously gathered insights from reputable journals, enriching our app development process with evidence-based research and ensuring a foundation rooted in the latest advancements in urban waste management. M. Karthik & co authors (2023) devised a solution for overflowing trash cans using a budget-friendly embedded device with ultrasonic sensors. It monitors in real-time, alerting collectors when limits are reached for timely city sanitation, promoting a healthier environment. S. Subburaj & co authors (2023) proposed a smart waste collection system optimizing routes during peak hours, ensuring road safety via a user-friendly app and real-time public map updates. Soumyabrata Saha & co author (2023) introduced a tailored smart waste management system for urban areas, emphasizing efficiency through regular sterilization, and incorporating dynamic scheduling and route optimization for improved service quality .Pardeep Kumar & co author (2023) developed a model for smart trash bins, focusing on reliability metrics and identifying critical components for timely maintenance. Minhaz Uddin Sohag & co author (2020) present a smart IoT waste management system for urban areas, utilizing Arduino Uno and sensors to monitor and alert authorities when bins are full, reducing manpower and ensuring cost-effective and efficient waste management.
Keywords: urban waste management, smart waste collection system

RETIREMENT ANXIETY AND JOB PERFORMANCE AMONG SECONDARY SCHOOL TEACHERS

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ABSTRACT
The study examined retirement anxiety and job performance towards secondary school teachers in Eleme Local Government of Rivers State, Nigeria. The study adopted correlational research design. Three research questions and three hypotheses guided the study. The population consisted of 400 teachers in senior/Junior secondary schools in Eleme, Rivers State, Nigeria. A sample of 200 respondent selected using Taro Yamane formular was used for the study. The instrument for data collection was a questionnaire titled: Retirement Anxiety and Job Performance (RAJP). Data collected were analyzed using Pearson Product Moment correlation method for both the research questions and hypotheses with the use of the statistical packaged for social sciences (SPSS). The instrument was structured using Likert type of response with Strongly Agree (SA), Agree (A) Disagree (D) and Strongly Disagree (SD) options respectively. The instrument was validated by experts in measurement and evaluation.A reliability of 0.86 was obtained using Cronbach"alpha formula.The results of the study revealed that (1) there is a perfect positive correlation and where is a significant relationship between retirement anxiety and job performance towards secondary school teachers in Eleme River State.(2) there is a high positive correlation and where is a significant relationship between retirement anxiety and job performance of male towards secondary school teachers in Eleme Rivers State. (3) there is a low positive correlation and there is significance relationship between retirement anxiety and job performance of female towards secondary school teachers in Eleme Rivers. It was recommended that Pension Administrations in conjunction with Nigeria Union of Teachers (NUT) Should organize regular enlightenment programs that can improve employees knowledge and behaviors towards retirements planning

Keywords: Retirement, Anxiety, Job Performance

COMPREHENSIVE OVERVIEW OF ALL BRANCHES OF FOOD ENGINEERING: INNOVATIONS, CHALLENGES, AND FUTURE PROSPECTS

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ABSTRACT
Modular arithmetic, a foundational mathematical concept, plays a pivotal role in ensuring the security of cryptographic systems. This abstract explores the significance of modular arithmetic in cryptography, focusing on its key applications and contributions.In public-key cryptography, modular arithmetic forms the backbone of algorithms like RSA, introducing complexity through the challenge of factoring large numbers and thereby securing key exchange and digital signatures. In symmetric key cryptography, modular arithmetic facilitates the development of robust block ciphers and stream ciphers, ensuring secure data encryption and decryption processes. The Diffie-Hellman key exchange protocol relies on modular arithmetic for establishing confidential communication channels. Furthermore, modular arithmetic is instrumental in cryptographic hash functions, essential for maintaining data integrity through the generation of fixed-size hash values. This abstract emphasizes the enduring importance of modular arithmetic as an essential tool in cryptographic systems, fostering secure communication and information protection.
Keywords: Modular arithmetic**,** cryptographic systems

EXPLORING CONNECTIVITY IN FUZZY GRAPHS: APPLICATIONS IN NETWORK ANALYSIS AND DECISION MAKING

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ABSTRACT
Fuzzy graph theory serves as a powerful tool for modeling ambiguous networks prevalent in various domains such as finance and social interactions. This paper delves into the examination of connectivity within fuzzy graphs, elucidating its pivotal role in network analysis. Through the establishment of key properties, we investigate the connectivity status of vertices, shedding light on fundamental aspects of network characteristics. Furthermore, we propose novel methodologies for quantifying and analyzing connectivity patterns, contributing to a deeper understanding of network dynamics. Additionally, we explore practical applications, including the consolidation of banking institutions to enhance financial stability and resilience, and the identification of central nodes affected by infectious diseases for effective disease control and mitigation strategies. By leveraging fuzzy graph theory, this study provides valuable insights into complex network structures, offering tangible solutions for real-world challenges in diverse domains.
Keywords: Network Problem, Fuzzy logic, Graph based techniques, Decision-Making.

ECOFRIENDLY FIBRES FOR SUSTAINABLE TEXTILE PRODUCTION

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ABSTRACT
Fast-paced development and industrialization pose a significant threat to the environment. Textile industries and products play a crucial role in deteriorating environmental conditions. Therefore, it is imperative to focus on the sustainability of textile industries and products. Biodegradability and eco-friendly processes are key criteria for ensuring sustainable products. The fiber serves as the fundamental unit for yarn manufacturing, determining the sustainability and functionality of the end product. Hence, there is a growing demand to incorporate eco-friendly and biodegradable fibers into yarn production. While conventional cotton and petroleum-derived fibers are not sustainable, organic natural fibers and regenerated cellulose fibers can contribute to eco-friendliness. In addition to sustainability, functionality is an essential attribute of yarn. Aesthetic, physiological, and tactile functions represent the functional behavior of yarn. Various fibers such as organic cotton, natural colored cotton, bamboo, Tencel, Seacell, Smartcell, Lyocell, soybean protein, and synthetic polyester based on PLA obtained from corn are environmentally friendly options. Melange yarn made from these fibers offers high aesthetic value with excellent thermal and moisture transmission properties. This paper discusses the literature on eco-friendly fibers used in melange yarn manufacturing and their functional behavior. Bamboo fiber possesses biodegradable, natural anti-bacterial, UV resistance, and comfort properties. The manufacturing process of Lyocell is a closed-loop and direct dissolving process that does not release any chemicals. Seacell is a combination of seaweed in the Lyocell manufacturing process, containing vitamins, amino acids, carbohydrates, and minerals, resulting in fibers that promote health and offer skincare benefits. Silver particles are added to produce Seacell active fiber, which is degradable, antibacterial, and breathable. Alginate is an eco-friendly fiber produced from alginic acid obtained from marine brown algae, with suitable applications in the medical field.
Keywords*:* Sustainability, Biodegradability, Seacell, Smart cell

HYBRID INVERTER WITH SOLAR BATTERY CHARGING

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ABSTRACT
The global push towards renewable energy sources has intensified in response to climate change concerns and the necessity for sustainable energy solutions. Among these, solar photovoltaic (PV) systems have emerged as a prominent player in the renewable energy landscape. However, the intermittent nature of solar power generation presents challenges for grid stability and energy reliability. Hybrid inverters with solar battery charging capabilities offer a promising solution by efficiently managing solar energy generation, storage, and distribution. This abstract explores the design, operation, and benefits of hybrid inverters with solar battery charging, highlighting their pivotal role in advancing renewable energy integration. Hybrid inverters represent a significant evolution in power conversion technology, combining the functionalities of grid-tied and off-grid inverters. By seamlessly integrating multiple energy sources, including solar PV systems, batteries, and the grid, hybrid inverters offer enhanced flexibility and reliability in managing energy flow. The integration of solar battery charging functionality enables these inverters to store excess solar energy during periods of high generation and discharge it during times of low generation or high demand, thereby optimizing self-consumption and reducing reliance on the grid. Designing hybrid inverters with solar battery charging involves intricate control algorithms and power electronics to efficiently manage energy flow. Key components include maximum power point tracking (MPPT) algorithms for solar energy harvesting, battery management systems (BMS) for charge/discharge control, and grid synchronization circuits for seamless grid interaction. Advanced communication interfaces enable remote monitoring and control of the hybrid inverter system, allowing users to monitor energy generation, storage levels, and consumption patterns in real-time. Operationally, hybrid inverters with solar battery charging offer numerous benefits for residential and commercial applications. By harnessing solar energy and storing it in batteries, these inverters help reduce electricity bills by offsetting peak demand charges and providing backup power during grid outages. Furthermore, they contribute to grid stability and resilience by reducing strain on the utility infrastructure and facilitating the integration of variable renewable energy sources into the grid. In conclusion, hybrid inverters with solar battery charging represent a transformative technology in the transition towards a sustainable energy future. Their ability to efficiently manage solar energy generation, storage, and distribution makes them indispensable for maximizing self-consumption, reducing carbon emissions, and enhancing energy independence. As the adoption of renewable energy systems continues to grow, hybrid inverters with solar battery charging will play an increasingly vital role in shaping the future of energy generation and distribution.
Keywords: Hybrid inverters, battery management systems

COSMIC SOLAR: REVOLUTIONIZING ENERGY

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ABSTRACT
In the ongoing pursuit of sustainable energy solutions, the concept of Cosmic Solar Revolutionizing Energy (CSRE) emerges as a transformative initiative leveraging innovative solar technologies to harness the power of the cosmos. With the sun as our cosmic powerhouse, CSRE envisions a future where every corner of the globe can access clean and renewable solar energy, transcending the limitations of traditional solar panels dictated by daylight hours and weather conditions. Central to CSRE's vision are cutting-edge technologies aimed at pushing the boundaries of solar power generation. Space-based solar power (SBSP) stands out as a pioneering approach, involving the capture of solar energy directly in space and its transmission to Earth via wireless power transmission systems. By situating solar panels in orbit around the Earth, SBSP enables the continuous capture of sunlight, untethered by atmospheric interference. Additionally, the development of quantum dot solar cells represents another revolutionary stride, utilizing nanoscale semiconductor particles to capture a broader spectrum of sunlight and enhance energy conversion efficiency, even in low-light conditions. The global impact of CSRE could be profound, with the potential to alleviate energy poverty and drive sustainable development by providing clean and reliable energy access to remote and underserved communities worldwide. Furthermore, by diminishing reliance on fossil fuels, CSRE contributes significantly to mitigating climate change and preserving the planet's health for future generations. Despite its ambitious vision, CSRE faces challenges such as cost, technological feasibility, and regulatory obstacles. However, through continued investment in research and development, alongside collaboration between governments, industries, and academia, these challenges can be navigated and overcome. In conclusion, Cosmic Solar Revolutionizing Energy embodies a bold and visionary approach towards a brighter and more sustainable future. By tapping into the boundless energy of the cosmos, CSRE opens new pathways for progress and prosperity while safeguarding the planet. With innovation, determination, and collective commitment, CSRE has the potential to reshape the global energy landscape, ushering in an era of sustainable abundance for all.
Keywords: Cosmic Solar Revolutionizing Energy, Space-based solar power

QR-ENHANCED PILL BARCODE SCANNER FOR SAFER MEDICATION MANAGEMENT

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ABSTRACT
The basic precaution that is taken after experiencing a little symptom of abnormal actions in our body is medicine. These medicines are used for precautionary purposes or to tackle abnormal activities inside the host. The usage of medication creates a complex experience for the patients and the doctors, as the medicines are valid for a certain period of time (i.e., the expiration date), and the identification of various classifications of the same kind of medicine makes the task more vigorous. The medicines in the form of pills are available in the same shape with different components, so the knowledge of differentiating between those medicines is only available to professionals. Since the medicines are being used by people who do not have knowledge of them, the identification of these medicines is made much simpler by adding a certain Quick Response (QR) code that specifies the expiry date, type of medicine, nearest available medical stores, and caution along with the medicine for side effects and allergy identification. Some existing applications with these features lack proof along with the medication recommendation. A survey emphasizes that people get afraid of wrong information from some unknown application regarding a life-related recommendation, so valid proof is required for people to follow such recommendations. Hence, this idea is aimed at providing the necessary real-time possible outcomes of those medicines so as to avoid fear. This method of identification is possible only when the manufacturing of these medicines is done in a fashion so as to regulate certain codes for certain pills. This method makes the task of identification much easier. Along with precautions and side effects information about those medicines, people taking medications place a strong faith in the search results provided.
Keywords: Medication Safety, QR Code, Pill Barcode Scanner, Evidence-Based Recommendations.

SMART REMOTE

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ABSTRACT

SmartView introduces a pioneering system designed to revolutionize television control by integrating intelligence and seamless interaction. At the forefront of this innovation is the SmartView Remote, which promises to redefine conventional methods of television control. This groundbreaking solution combines advanced software algorithms with cutting-edge hardware components to deliver an unparalleled level of control and convenience. SmartView's SmartView Remote features a sleek and intuitive Fully displayed touchscreen interface that replaces traditional remotes. Users can effortlessly navigate channels, adjust volume levels, customize settings, and access additional features with simple gestures and taps. This intuitive interface aims to streamline the user experience, providing enhanced control and convenience.One of the key features of SmartView is its seamless connectivity. By leveraging wireless technologies such as Bluetooth and Wi-Fi, the SmartView Remote establishes robust communication with television sets, eliminating the constraints of traditional infrared-based remotes. This allows users to control their TVs from anywhere within range, without the need for line-of-sight.Accessibility is also a priority with SmartView. The system includes features such as voice control, tactile feedback, and customizable accessibility settings, ensuring that users of all abilities can easily interact with their television sets.With its forward-thinking design and commitment to innovation, SmartView promises to redefine television control, ushering in an era of intuitive, personalized, and accessible viewing experiences for users around the world.

Keywords: SmartView, Television Control, Intelligent Interaction, Software-Hardware Integration, Seamless Connectivity, Personalization, Accessibility, Future-proof Design.

HARNESSING BIOTECHNOLOGY FOR SUSTAINABLE FOOD PRODUCTION

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ABSTRACT
Agricultural biotechnology is a multidisciplinary field that applies principles of biology and technology to enhance agricultural productivity, sustainability, and food security. This technology involves the use of genetic engineering, molecular biology, and other advanced techniques to develop crops with desirable traits such as resistance to pests and diseases, tolerance to environmental stresses, and improved nutritional content. One of the key areas of focus in agricultural biotechnology is the development of genetically modified (GM) crops. GM crops are engineered to express specific traits that confer advantages such as increased yield, reduced pesticide use, and enhanced nutritional value. For example, scientists have developed GM crops that are resistant to herbicides, allowing farmers to control weeds more effectively without harming the crop plants. Another important application of agricultural biotechnology is the development of genetically modified organisms (GMOs) for animal agriculture. GMOs can be engineered to produce pharmaceuticals, vaccines, or other valuable products in their milk, eggs, or meat. Additionally, GMOs can be used to improve animal health and welfare by reducing the incidence of diseases and improving the efficiency of feed conversion. In addition to genetic engineering, agricultural biotechnology also encompasses other technologies such as markerassisted breeding, tissue culture, and nanotechnology. These technologies enable scientists to accelerate the breeding process, develop disease-resistant varieties, and improve the efficiency of nutrient uptake in plants. Overall, agricultural biotechnology holds great promise for addressing some of the most pressing challenges facing modern agriculture, including the need to feed a growing global population while minimizing environmental impact. By harnessing the power of biotechnology, farmers can produce more food with fewer resources, reduce the use of chemical inputs, and mitigate the effects of climate change on agricultural production.
Keywords: Agriculture biotechnology, genetic engineering, genetically modified crops, sustainability, food security, pest resistance, environmental stresses, nutritional enhancement, marker-assisted breeding, animal agruculture.

SIGNAL PROCESSING USING DIFFERENTIAL ALGEBRA

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ABSTRACT
Signal processing involves the manipulation and analysis of signals to extract relevant information. Differential algebra, a branch of mathematics, offers a powerful framework for signal processing tasks. This ABSTRACT explores the application of differential algebra in signal processing. Differential algebra provides tools for describing the behavior of signals in terms of differential equations and algebraic equations. By representing signals as mathematical functions, transformations such as differentiation and integration can be applied to analyze their properties. Moreover, differential algebra facilitates the modeling of signal systems, enabling the design and optimization of filters, controllers, and other signal processing components. One key advantage of using differential algebra in signal processing is its ability to handle complex signals with nonlinear dynamics. Through techniques like Taylor series expansions and differential elimination, nonlinear signal processing problems can be efficiently solved. Additionally, differential algebra aids in signal estimation and prediction by formulating dynamic models that capture the underlying dynamics of the signals. In summary, differential algebra offers a versatile framework for signal processing tasks, including analysis, modeling, and estimation. Its application enables the development of efficient algorithms for a wide range of signal processing applications, from communications and audio processing to biomedical signal analysis and beyond.
Keywords: Signal processing, differential algebra, mathematical techniques, biomedical signal analysis, audio processing, image processing.

ENGINEERING SCIENCE: USING MATHEMATICS IN IMAGE PROCESSING

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ABSTRACT
Mathematics forms the cornerstone of image processing, providing a robust framework for analyzing, manipulating, and interpreting digital images across various domains. This ABSTRACT delves into the multifaceted applications of mathematics in image processing, elucidating its pivotal role in transforming raw pixel data into actionable insights. At the core of image processing lies linear algebra, facilitating operations such as image transformation, enhancement, and compression. Matrices and vectors represent images, while linear transformations enable geometric alterations such as rotation, scaling, and translation. Additionally, Fourier analysis harnesses the power of mathematics to decompose images into frequency components, enabling techniques such as Fourier filtering and edge detection. Convolution, a fundamental operation in image processing, utilizes mathematical kernels to perform tasks such as blurring, sharpening, and edge detection. Moreover, mathematical morphology facilitates shape-based analysis and object extraction, while histogram analysis offers insights into pixel intensity distributions for contrast enhancement and segmentation. The advent of advanced mathematical concepts has revolutionized image processing. Wavelet transforms provide a multi-resolution analysis framework, enabling compression, denoising, and feature extraction. Partial differential equations play a crucial role in image restoration and inpainting, preserving image structures while suppressing noise and artifacts. In recent years, machine learning and deep learning techniques have leveraged mathematical principles to achieve state-of-the-art performance in image processing tasks. Neural networks, convolutional architectures, and optimization algorithms harness mathematical optimization and statistical methods for tasks such as image classification, object detection, and image generation. In essence, mathematics serves as the bedrock of image processing, empowering engineers and researchers to unravel the intricacies of digital images and unlock their full potential across diverse applications, from medical diagnostics and remote sensing to computer vision and digital art.

Keywords: Image processing, Mathematics, Linear algebra, Fourier analysis, Convolution, Mathematical morphology, Histogram analysis, Wavelet transforms, Partial differential equations, Machine learning, Deep learning, Neural networks, Convolutional architectures, Optimization algorithms, Digital images, Geometric transformations, Frequency components, Edge detection, Compression, Denoising

CARCINOID TUMORS OF THE APPENDIX

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ABSTRACT
Introductıon: Neuroendocrine tumors, formerly called "Carcinoid Tumor", which can be seen in areas where neuroendocrine cells are present, are most commonly seen in the appendix. However, it is the most common tumor of the appendix. Its incidence in other organs is 23% in the ileum, 13% in the rectum and 11.5% in the bronchi. Although it is most often seen between the ages of 30-40, it can also be seen in children. 71% of them are located at the tip of the appendix, and 70% are smaller than 1 cm. The rate of carcinoid tumors in patients with appendectomy is 0.3-0.9%. In our study, a patient diagnosed with carcinoid tumor after appendectomy is presented. CASE: A 22-year-old female patient admitted to the emergency department with severe abdominal pain. In the physical examination, abdominal guarding and rebound tenderness were present and in the blood tests, the WBC was 17,000. The patient's computed tomography was reported as "appendix diameter is 12 mm, its surroundings are dirty and there is appendicolith in the lumen". The patient was taken into operation with the preliminary diagnosis of acute appendicitis. The patient underwent laparoscopic appendectomy. There were no problems in the follow-up of the patient and the patient was discharged in full recovery on the first postoperative day. The patient then came to the outpatient clinic with the pathology result. The patient's pathology result was "appendix carcinoid tumor". According to the report, the tumor was at the tip of the appendix and the distance of the tumor to the root of the appendix was 4 cm. Since the tumor was at the tip of the appendix, the medical oncology department was contacted and the patient was followed up. No problems requiring reintervention were encountered during follow-up. Conclusıon: Carcinoid tumours of the appendix often occur with the clinical picture of acute appendicitis. In most cases, they are found incidentally during appendectomies and the diagnosis of carcinoid tumor is rarely suspected before histopathological diagnosis. Although life expectancy is good, imaging should be emphasised in the close follow-up of this group of patients because of the high rate of concomitant colorectal tumours.
Keywords: Appendectomy, Carcinoid Tumor, Laparoscopy

MIRIZZI SYNDROME AND CHOLEDOC INJURY ENCOUNTERED DURING CHOLECYSTECTOMY OPERATION

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ABSTRACT
Introduction: Cholecystectomy is one of the most frequently performed operations in general surgery clinics all over the world. Complications that may occur after cholecystectomy are the nightmares of general surgeons due to the difficulty of management and the need for experience and knowledge. In particular, bile duct injuries can lead to serious problems that can lead to loss of life if not recognised during the operation. In our study, the case management of biliary tract injury caused by Mirizzi Syndrome during the cholecystectomy operation performed on a patient diagnosed with chronic cholecystitis is presented. CASE: It was learned that a 44-year-old female patient was admitted to a Tertiary Health Facility and received medical treatment as a result of an acute cholecystitis attack approximately 12 years ago. When the patient's medical records were examined, the hepatobiliary ultrasound performed on the patient revealed many calculus in the gallbladder, increased wall thickness and increased pericholecystic fluid. After the patient recovered with medical treatment and his pain disappeared, he was discharged and invited for surgery 6 weeks later. However, it was learned that the patient avoided the operation due to fear of surgery. The patient had 4 more attacks in a 12-year period and received treatment at various health centers. After medical treatment, the operation was planned for the patient who was admitted to our hospital during his last attack, and the patient was prepared for the operation under elective conditions. The operation was started laparoscopically and it was observed that the patient's omentum and transverse colon were rigidly adherent to the gallbladder. The gallbladder was opened in a controlled manner and it was seen that the gallbladder was attached to the bile duct. After controlled dissections, it was understood that the gallbladder was fistulized into the bile duct (Mirizzi type 4). Since the adhesions were severe, it was decided to continue the operation with laparotomy. In this case, the gallbladder was separated from the bile duct and cholecystectomy was completed. A T-tube was placed in the bile duct, and the integrity of the bile ducts was seen in the subsequent choledochography. The procedure was terminated by placing a drain. The patient's T-tube was removed after 20 days, and the patient was discharged in full recovery, as there was no problem in the post-operative follow-up. Conclusion: Biliary tract injuries are one of the most feared complications of cholecystectomy operations and are a headache for surgeons due to the difficulty of management and the problems that may develop afterwards. The most important process is to recognize this situation at the time of the surgery and make a decision about what to do.
Keywords: Mirizzi Syndrome, Cholecystectomy, Complication

HEIDEGGER'İN TEKNİK KAVRAMI ÜZERİNDEN *METROPOLİS* FİLMİNİN BİR ANALİZİ

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ÖZET
Bu çalışmada Fritz Lang'ın 1927 yapımı "*Metropolis*" adlı sinema filminde işlenen temalar hakkında detaylı bir analiz sunulmaktadır. Filmde teknolojik gelişmelerin hayata nasıl yansıdığı, insanların kapitalist ve proletarya olarak adlandırabileceğimiz şekliyle iki sınıfa ayrılması, yer altı ve yer üstü şehirleri arasındaki ayrım, düşünmeyi kışkırtan unsurlar, teknolojinin hayat üzerindeki olumsuz ve yıkıcı etkileri gibi konular ele alınmaktadır. Tüm bu işlenen konular Heidegger'in teknik kavramına yüklemiş olduğu anlamı akıllara getirmektedir. Heidegger'ın teknik kavramına yönelttiği eleştirileri göz önünde bulundurduğumuzda film, onun düşünme kavramıyla da bize bir şeyler söylemektedir. Heidegger, teknik sözcüğünün kökenini araştırdığında Grekçe Tekhnikon yani tekhne'ye ait olan anlamına geldiğini görür. Buradan hareketle teknik ve tekhne arasında bağ kurmaya başlar. Tekhne hem el becerisi el sanatları anlamında hem de zihinsel sanatlar anlamında kullanılmaktadır. Bu durumda tekhnede asıl olan şey poiesis'tir, yani öne çıkarmadır. Ona göre amaç ve araç, açığa çıkmanın alanına girer ve araç olan tekniğin özüne inmeye çalıştığımız zamanda gizini açma ile karşı karşıya kalırız. Bu durumda teknik sadece bir araç değildir, gizini açmanın ve hakikatin alanına da girmektedir. Bu anlamda Heidegger, düşünmeyi de tekniğe ulaşmada önemli görür. Çünkü bir şeyi görünüşe getirmenin dibinde kök salan şey "düşünmedir". Heidegger, modern insanın doğaya ve varlığa bakışını eleştirmekte ve bunun teknikle bağlantısı olduğunu düşünmektedir. Ona göre tekniğin yanlış yorumlanması insanın doğayla olan ilişkisini bozmakta ve onu doğanın bir parçası olarak görmek yerine onu kontrol etmeye çalışan bir varlık haline getirmektedir. Heidegger'in teknik konusundaki eleştirileri ve asıl anlamda tekniğin özünün düşünme olduğunun unutulması bakış açısıyla filmdeki karakterlerin düşünme süreçleri, teknolojinin insanlar üzerindeki etkileri çalışmamızda detaylı bir şekilde incelenmektedir. Ayrıca filmdeki hakikat arayışı, düşünme eyleminin önemi, teknolojinin gizemli yönleri ve insanın bu süreçteki rolü gibi konulara odaklanıldığı zaman tüm bunlarda Heidegger'in izlerini bulmak mümkündür. Sonuç olarak bu çalışmada Heidegger'in teknik kavramı aracılığıyla *Metropolis* filmindeki teknolojinin yıkıcı boyutları, karakterlerin yaşadığı deneyimler, düşünme süreçleri ve hakikat arayışlarının bir analizi sunulmuştur.
Anahtar Kelimeler: Metropolis, Heidegger, Teknik, Düşünme, İnsan.

AN ANALYSIS OF THE MOVIE METROPOLIS THROUGH HEIDEGGER'S TECHNICAL CONCEPT

ABSTRACT
In this study, a detailed analysis is presented about the themes in Fritz Lang's 1927 movie "*Metropolis*". The film deals with topics such as how technological developments are reflected in life, the division of people into two classes that we can call capitalist and proletariat, the distinction between underground and aboveground cities, elements that provoke thought, and the negative and destructive effects of technology on life. All these topics bring to mind the meaning Heidegger gave to the concept of technique. Considering Heidegger's criticisms of the concept of technique, the film also tells us something with his concept of "thinking". When Heidegger investigates the origin of the word technique, he sees that it comes from the Greek word Technikon, meaning belonging to tekhne. From this point on, he begins to establish a connection between technique and techne. Tekhne is used both in the sense of manual dexterity and in the sense of mental arts. In this case, the main thing in techne is poiesis, that is, bringing to the fore. According to him, the purpose and the means enter the field of revelation, and when we try to get to the essence of the technique, which is the tool, we are faced with revealing the secret. In this case, technology is not just a tool, it also enters the field of revealing and truth. In this sense, Heidegger sees thinking as important in achieving technique. Because what is rooted at the bottom of bringing something into appearance is "thinking". Heidegger criticizes modern man's view of nature and existence and thinks that this has a connection with technology. According to him, misinterpretation of technique disrupts man's relationship with nature and turns him into an entity that tries to control nature rather than seeing it as a part of nature. In our study, the thinking processes of the characters in the film and the effects of technology on people are examined in detail from the perspective of Heidegger's criticisms of technology and forgetting that the essence of technique is thinking. In addition, when the film focuses on topics such as the search for truth, the importance of the act of thinking, the mysterious aspects of technology and the role of humans in this process, it is possible to find traces of Heidegger in all of these. As a result, in this study, an analysis of the destructive dimensions of technology, the experiences of the characters, their thinking processes and their search for truth in the movie *Metropolis* is presented through Heidegger's technical concept.
Keywords: Metropolis, Heidegger, Technique, Thinking, Human.

MONEYPAY UYGULAMASI İÇİN FİNTECH TEKNOLOJİLERİNİN GELİŞTİRİLMESİ

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ÖZET
MoneyPay uygulaması, Migros'un finansal hizmetler alanında sunduğu yenilikçi bir proje olarak öne çıkmaktadır. Farklı altyapılarda olan ödeme platformlarından gelen talepler doğrultusunda ödeme sistemleri için yazılım dili ve işletim sisteminden bağımsız uygulama geliştirme platformlarının oluşturulması ile dijital ürün-hizmet satış ve tahsilat sürecini uçtan uca kontrol edilmesi bu çalışmanın başlatılma gerekçesini oluşturmaktadır.Bu doğrultuda yapılan çalışmalarda hem ulusal hem de uluslararası finans sektörlerinde katma değer yaratmak için otomasyonun ve matematiksel modellemenin gücünden faydalanmak zorunlu bir hale gelmiştir. Çalışma kapsamında Fintech ürünlerine başvuran müşterilerin en doğru, en karlı ve en hızlı şekilde tahsilat sürecinin yönetilmesi sağlanmıştır. Üretilen ve analiz edilen bilgilerin doğrultusunda müşteri edinim ve satış süreçlerinin verimlilikleri arttırılmıştır. Ayrıca birçok alt birimden meydana gelen bu pazarlama sisteminin veri bütünlüğünü ve doğru işleyişini otomatik testlerle kontrol altında tutmak çok önemlidir.Yapılan çalışma sonucunda geliştirilen akıllı platform ile dijital ürün satışı, elektronik cüzdana bakiye yükleme, tüm pos cihazlarında QR ile ödeme, NFC ile ödeme, Migros kasalarında hızlı ödeme, 7/24 para transferi, fatura ödeme, altın, gümüş, platin gibi kıymetli maden ve döviz yatırımları, oyun ve e-pin kodu satın alma, alışveriş ve ihtiyaç kredilerinden yararlanabilme, kullanıcının yapay zeka algoritmaları ile skorlanması sonucunda kazanacağı mikro kredi limiti ile birlikte harcama yapabilmesi süreçlerinin gerçekleştirilmesi sağlanmıştır. Farklı farklı ödeme seçenekleri ve mikro krediyle kasada ödeme adımında zincir mağazalara sunulan çözümlerle analitik olarak planlanması ve hızlı çözüm sunulması, kasada ödeme sistemleri için bir ilk niteliğindedir.
Anahtar Kelimeler: MoneyPay, Ödeme Sistemleri, Fintech

DEVELOPMENT OF FINTECH TECHNOLOGIES FOR MONEYPAY APPLICATION

ABSTRACT
MoneyPay application stands out as an innovative project offered by Migros in the field of financial services. The reason for starting this study is to create application development platforms independent of the software language and operating system for payment systems in line with the demands from payment platforms with different infrastructures and to control the digital product-service sales and collection process end-to-end.In studies carried out in this direction, it has become necessary to benefit from the power of automation and mathematical modeling to create added value in both national and international financial sectors. Within the scope of the study, it was ensured that the collection process of customers applying for Fintech products was managed in the most accurate, most profitable and fastest way. In line with the information produced and analyzed, the efficiency of customer acquisition and sales processes has been increased. In addition, it is very important to keep the data integrity and correct functioning of this marketing system, which consists of many subunits, under control with automatic tests.With the smart platform developed as a result of the study, digital product sales, balance loading to electronic wallet, payment with QR on all POS devices, payment with NFC, fast payment at Migros cash registers, 24/7 money transfer, bill payment, precious metals such as gold, silver, platinum and Foreign exchange investments, purchasing games and e-Pin codes, benefiting from shopping and consumer loans, and allowing the user to spend with the micro credit limit he will earn as a result of scoring with artificial intelligence algorithms have been carried out. Analytical planning and providing quick solutions with the solutions offered to chain stores at the checkout step with different payment options and micro credit is a first for payment at the checkout systems.
Keywords: MoneyPay, Payment Systems, Fintech

PORSELEN LAMİNATE VENEER RESTORASYONLARIN BAŞARISINI ETKİLEYEN FAKTÖRLER

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ÖZET
Dental tedavilerde hastaların artan estetik beklentileri diş hekimlerini daha estetik materyal kullanmaya ve daha hassas uygulamalara yönlendirmektedir. Hastaların estetik kaygılarının giderilmesi için porselen laminate veneer uygulamaları tercih edilen tedavi yöntemlerinden biri olmuştur. Porselen laminate veneerler (PLV), özellikle estetik alandaki pozisyon veya şekil bozukluğu olan, renklenmiş, travmaya sonucu kırılmış ya da aşınmış dişlerde kaybedilen estetiği rehabilite etmek amacıyla son yıllarda oldukça popüler hale gelmiş bir tedavi seçeneğidir. Günümüzde bu restorasyonlar marjinal bölgedeki kırılma dayanımı, uzun dönem renk stabilitesi ve aşınmaya karşı direncinden dolayı sıklıkla kullanılmaktadır. Diş dokusunda minimal preparasyon ya da preparasyonsuz şekilde uygulanan porselen laminate veneerler sağlıklı diş dokusunu da korumasıyla diş hekimliğinde oldukça sık uygulanan bir tedavi olmuştur. Bu restorasyonlarda tanısal mumlama yöntemi hem preparasyondan önce bitim aşamasının planlanabilmesine hem de geçici restorasyonun hazırlanabilmesine imkân sunar. Porselen laminate veneerlerde önemli başarı faktörlerinden biri klinisyenin tecrübesi ve kontrollü diş dokusunun kaldırılmasıdır. Minede tamamlanan preparasyon rezin simanın bağlanma dayanıklılığını artırırken dentinde tamamlanan restorasyonlar ise mikrosızıntı oluşturmaktadır. Günümüzde laminate veneeler için kullanılan materyaller, toz-likit fırınlama yöntemi ile üretilen feldspatik seramikler, cam seramikler, oksit seramikler ve cad-cam yöntemi ile hazırlanan seramiklerdir. Porselen laminate veneerlerin uzun dönem klinik başarısını etkileyen etkenler, diş yüzeyinin yapısı, preparasyon derinliği, porselen tipi ve kalınlığı, rezin siman ve dental adezivinin tipi, diş morfolojisi, fonksiyonel ve parafonksiyonel çene hareketleridir. Bu restorasyonların en önemli başarısızlık nedenleri ise kırılma, mikrosızıntı ve diş yüzeyinden ayrılmalarıdır. Bu derlemenin amacı; porselen lamine veneerler hakkında kullanılan güncel yapım teknikleri, materyalleri ve klinik başarı parametrelerini değerlendirmektir.
Anahtar kelimeler: Porselen, laminate restorasyonlar, klinik başarı

FACTORS AFFECTING THE SUCCESS OF PORCELAIN LAMINATE VENEER RESTORATIONS

ABSTRACT
The increasing aesthetic expectations of patients in dental treatments lead dentists to use more aesthetic materials and perform more precise applications. Porcelain laminate veneer applications have become one of the preferred treatment methods for addressing patients' aesthetic concerns. Porcelain laminate veneers (PLVs) have become increasingly popular in recent years as a treatment option for rehabilitating poor aesthetics in teeth with positional or shape abnormalities, discoloration, fractures due to trauma, or wear. These restorations are frequently used today due to their fracture resistance in marginal regions, long-term color stability, and resistance to wear. Porcelain laminate veneers, whether applied with minimal preparation or no-preparation have become a commonly used treatment in dentistry while also preserving healthy dental tissue. The diagnostic wax-up method in these restorations allows for planning the final stage before preparation and the preparation of temporary restorations. One of the important success factors for porcelain laminate veneers is the clinician's experience and controlled removal of dental tissue. Preparation completed in enamel enhances the bond strength of resin cement, while restoration completed in dentin creates microleakage. Materials used for laminate veneers today include feldspathic ceramics produced by the powder-liquid firing method, glass ceramics, oxide ceramics, and ceramics cad-cam manufacturing method. Factors influencing the long-term success of porcelain laminate veneers include the structure of the tooth surface, depth of preparation, type and thickness of porcelain, type of resin cement and dental adhesive, tooth morphology, and functional and parafunctional jaw movements. The most significant causes of failure in these restorations are fracture, microleakage, and debonding from the tooth surface. The purpose of this review is to evaluate current fabrication techniques, materials, and clinical success parameters used in porcelain laminate veneers.
Keywords: Porselen, laminate restoration, clinical success

KINNOW WASTE UTILIZATION: ESSENTIAL COMPOUNDS, EXTRACTION AND UTILIZATION

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ABSTRACT
The peel and pomace portion of Kinnow mandarin (*Citrus reticulata*) rich in polyphenols, flavonoids like naringin, carotenoids, pectin, and essential oils, which makes up 30–40% of the fruit weight, is the main waste product of the kinnow juice industry. These bioactive substances are highly valuable in food processing, pharmaceutical, and biofuel manufacturing industries, and they are also nutritionally sound. The valuable components can be extracted with a variety of very effective methods and utilized for a variety of purposes. The Kinnow peel, otherwise a waste, is more valuable to the industry since it is readily available and inexpensive, and it serves multiple purposes. This organic waste holds a great potential to be converted into nutritious value-added products, using various extraction approaches. Extraction helps in isolation of bioactive phytochemicals from the by-products that could be used as nutritional supplements in food systems. This study was carried out to separation of bioactive compounds from kinnow peel. The crude extract obtained was analyzed for total phenolic content as well as antioxidant activity, using UV-Spectrophotometer analysis.
Keywords: Kinnow; By-products; Peel; Antioxidants; Bioactive compounds; UV-Spectrophotometer

MATHEMATICAL MODELING OF NEURAL NETWORKS FOR PREDICTIVE ANALYSIS IN HEALTHCARE

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ABSTRACT
During the process of the treatment of COVID-19 hospitalized patients, physicians still face a lot of unknowns and problems. Despite the application of the treatment protocol, it is still unknown why the medical status of a certain number of patients worsens and ends with death. Many factors were analyzed for the prediction of the clinical outcome of the patients using different methods. The aim of this paper was to develop a prediction model based on initial laboratory blood test results, accompanying comorbidities, and demographics to help physicians to better understand the medical state of patients with respect to possible clinical outcomes using neural networks, hypothesis testing, and confidence intervals.
Keywords: Classification, covid-19, machine learning, neural networks, prediction

NEW ERA IN TOURISM SERVICE DELIVERY BY MERGING QUALITY AND SAFETY

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ABSTRACT
Research background: Safety and quality are fundamental factors in tourism influencing tourists' overall experience. Ensuring a safe environment and offering high-quality services are crucial for maintaining the positive reputation of a destination and fostering repeat visits. The contribution investigates the theoretical bases of the issues in the field of quality and risk assessment in tourism, analyzing how the perception of risk and quality has evolved in response to various global events and disasters. Purpose of the research: The purpose of the research is to explore the theoretical foundations of quality and risk assessment in tourism, understand how the perception of these factors has changed over time due to global events, and highlight the importance of preparedness and adaptation to changing global risks. Its goal is to discuss various assessment methods and emphasize the need to integrate internal and external aspects of the business for effective quality and risk management, which is essential for achieving a sustainable and competitive environment in tourism. Methods: The research provides brief comparisons and identifies common features between these areas. It mentions models or methods suitable for both risk and quality assessment. It also discusses the importance of having general standards for effective evaluation and comparison in the tourism sector. Additionally, techniques such as brainstorming, the Delphi technique, self-assessment, and gap analysis are highlighted as part of the evaluative processes. Findings & Value added: The research suggests a multidisciplinary approach is necessary for a comprehensive understanding and effective management of quality and risk in a dynamic, global context, particularly in tourism. This approach enables a thorough understanding and effective management, emphasizing the growing focus on social and environmental responsibility. It points out the need to integrate different perspectives and methods in the evaluation of quality and risk to achieve sustainable outcomes and ensure the prosperity of tourism now and in the future.
Keywords: Destination reputation, Risk assessment, Quality, Safety measures, Sustainable tourism.

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DEVELOPMENT OF CRISPR-Cas9 TECHNOLOGY

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ABSTRACT
CRISPR-Cas9 technology has emerged as a powerful tool for precise gene editing and has significantly advanced the field of genetic engineering. The development of this technology began with the discovery of clustered regularly interspaced short palindromic repeats (CRISPR) and the associated Cas9 protein in bacteria. These CRISPR sequences were found to play a role in the bacterial immune system by recognizing and cleaving foreign DNA. The CRISPR-Cas9 system consists of two main components: the guide RNA (gRNA) and the Cas9 protein. The gRNA is designed to specifically bind to the target DNA sequence of interest, while the Cas9 protein acts as a molecular scissor, cutting the DNA at the targeted location. The simplicity and versatility of the CRISPR-Cas9 system have revolutionized genetic engineering. Compared to previous gene editing techniques, such as zinc finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs), CRISPR-Cas9 is more efficient, cost-effective, and easier to implement. It allows scientists to precisely modify DNA sequences by either introducing specific changes or deleting and inserting genetic material. The applications of CRISPR-Cas9 technology are vast and span across various fields. In biomedicine, CRISPR-Cas9 holds great promise for the treatment of genetic disorders. By correcting disease-causing mutations, researchers aim to develop novel therapies for conditions such as cystic fibrosis, sickle cell anemia, and muscular dystrophy. Additionally, CRISPR-Cas9 has been used to engineer immune cells for cancer immunotherapy, enhancing their ability to target and eliminate cancer cells. In agriculture, CRISPR-Cas9 offers opportunities for developing crops with improved traits, such as resistance to pests, diseases, and environmental stresses. This technology can also be used to enhance crop yield and nutritional content, contributing to global food security. Furthermore, CRISPR-Cas9 has revolutionized basic scientific research, allowing scientists to study gene function and understand the underlying mechanisms of diseases. By selectively modifying genes in model organisms, researchers can gain insights into the roles of specific genes and their impact on biological processes. Despite its immense potential, there are still challenges associated with CRISPR-Cas9 technology. Off-target effects, where Cas9 mistakenly edits unintended DNA sequences, are a concern and efforts are being made to improve the specificity of the system. Ethical considerations regarding the use of CRISPR-Cas9 in human germline editing and potential unintended consequences also need to be carefully addressed. In conclusion, the development of CRISPR-Cas9 technology has opened up new possibilities in genetic engineering and biotechnology. Its simplicity, efficiency, and versatility have paved the way for advancements in medicine, agriculture, and scientific research. Ongoing research and technological improvements will continue to refine and expand the applications of CRISPR-Cas9, ultimately shaping the future of genetic manipulation and its impact on various fields.
Keywords: CRISPR-Cas9, DNA, zinc finger nucleases

MAPPING THE LANDSCAPE OF SERVICE QUALITY

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ABSTRACT
Service quality plays a pivotal role in the success of businesses across diverse sectors, making it a topic of enduring interest in scholarly circles. This bibliometric study offers a thorough examination of the changing landscape of service quality research. By systematically reviewing academic literature from the past decade, the aim is to provide insights into publication trends, key contributors, social networks, and emerging themes within the realm of service quality. The analysis demonstrates a significant uptick in publications related to service quality research, indicating its growing impact on the field. Notably, this research is prominently featured in esteemed academic journals, with the United States being the primary source of scholarly contributions. Furthermore, collaborations between academics in the United States and those in China are prevalent. Additionally, researchers predominantly concentrate on evaluating service quality alongside other factors such as customer satisfaction and loyalty.
Keywords: Mapping, bibliometric study

FROM TRADITION TO TRENDS: THE EMERGENCE OF FOLK ART INNOVATION BY RURAL ENTREPRENEURS OF UTTAR DINAJPUR

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ABSTRACT
Rural entrepreneurship initiates transformative change in villages through innovative activities aimed at achieving economic gains. In the era of globalization, Indian villages are becoming increasingly interconnected with the global world. The traditional characteristics of Indian villages are rapidly evolving because of various local and global factors. Technological and communication advances, including mobile phones, the Internet, roads, and transportation, serve as connective mechanisms linking each village to the global landscape. The study states that the culture of folk art or pottery in the rural areas of North Dinajpur is experiencing revival and coexistence with global culture rather than decline. The research employs ethnography as a methodological paradigm for a deeper understanding of entrepreneurial activities, emphasizing field data collected through methods such as observation, in-depth unstructured interviews, and case studies. Two villages in the district were selected purposively and studied rigorously to understand the context of the study. Theoretically, Howard E. Aldrich aligns with the three main sociological concerns of entrepreneurship. First, "entrepreneurs can both reproduce and challenge existing social orders." Second, "Entrepreneurship ensures the reproduction of existing organizational populations and creates a basis for the creation of new populations depending on the diverse perspectives and skills of the founders, as well as the socio-political context in which it is created." Third, "entrepreneurs influence the level of stratification and inequality in society by shaping the life chances of founders and their employees." The findings highlight that social forces such as modernization and globalization have brought about radical changes in the craft, upending the status of traditional potters. Folk art coexists with the larger global culture, creating cultural hybrids to revitalize it. Through adaptations such as online marketing and payment modes, traditional artisans are being integrated into the larger capitalist system. Field observations reveal a diverse division of labor involving members of other races, technologies, and communication facilities. Various social processes act as driving factors, bringing about changes in the means of production, inspiring new marketing strategies, and creating employment opportunities for rural dwellers.
Keywords: Folk Art, Rural Entrepreneurs, İnnovation, Mobilisation, Cultural Hybridity, Diversification Of Labour

RARE EARTH ELEMENT DOPED COBALT NICKEL FERRITES FOR TREATMENT OF SYNTHETIC DYES FROM WASTEWATER

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ABSTRACT
One of the main advantages of ferrites is their high surface area, which provides a large number of active sites for the catalytic degradation of dyes. The presence of iron in ferrites also makes them effective catalysts for the oxidation of various organic pollutants, including dyes. Ferrites are iron oxide materials that contain iron (Fe) and other metallic cations such as nickel (Ni), cobalt (Co), zinc (Zn), manganese (Mn), and others. There are several methods used to synthesize ferrites, including Sol-gel, co-precipitation, solid state, hydrothermal, and microemulsion. In the proposed study, the sol-gel technique will be adopted to synthesize the Cobalt Nickel ferrites. The suggested method involves the hydrolysis of metal alkoxides to form a gel-like precursor, which will then be heated to form ferrite particles. Synthesized ferrites were characterized by using SEM, XRD, VSM FTIR, and UV-visible spectroscopy. The synthesized ferrites were then tested for the photocatalytic degradation of methyl orange MO and methylene blue MB under Visible light irradiation.
Keywords: Cobalt nickel ferrites, Methyl orange, Methylene blue

ANALYSIS OF DEVELOPMENT OF A THREE-DIMENSIONAL CONSTITUTIVE MODEL FOR SIMULATING SHAPE MEMORY ALLOYS – A REVIEW

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ABSTRACT
This project is an analytical endeavor to develop a three-dimensional constitutive model for Shape Memory Alloys (SMAs), considering the complex interplay of mechanical stress, temperature, and phase transformation. The goal is to accurately simulate SMAs' unique thermo-mechanical behaviors, which have been challenging due to their ability to revert to their original shape upon heating. The model will be implemented via a user material subroutine in a commercial finite element package, enabling diverse scenario simulations. This initiative aims to address existing simulation challenges, thereby enhancing the potential use of SMAs in various engineering applications and contributing to the field's advancement.
Keywords: Shape Memory Alloys, engineering applications

DEEP LEARNING IN ANALYSIS OF TWO-DIMENSIONAL SIGNALS IN PHYSIOLOGICAL SCIENCES

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ABSTRACT
Two-dimensional signals in experimental and clinical physiology can be analyzed in various ways. In recent years, a particularly popular approach includes the application of contemporary computational methods for the quantification of changes in resolution unit values and the use of the obtained features to train and test deep learning models. The features can be quantified using fractal analysis, by calculating fractal dimension and lacunarity, as well as through textural analysis. When quantifying texture, one can use approaches based on the gray-level co-occurrence matrix or run-length matrix, as well as the discrete wavelet transform. All of these quantifiers can be applied as input data for the development of complex artificial neural networks. The output data of the networks may include the state of the patient, the diagnosis, prognosis, or a status of a cell or tissue. Such deep learning models, based on multilayer perceptrons or convolutional neural networks, may in some cases achieve relatively high classification accuracy and other performance indicators. Here, we present our recent data on yeast cell models related to the creation of machine learning algorithms for the classification of sublethal cell damage induced by various chemical stimuli. We suggest that it may be possible to create a useful and affordable model that can be applied in future cell physiology, pathophysiology, and pathology research.
Keywords: Signal, cell, neural network, machine learning, AI.
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UNDERSTANDING THE RISING THREAT OF CYBERCRIME AGAINST WOMEN IN INDIA

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ABSTRACT:
Cybercrime is recognized as a global problem, with a substantial number of people falling victim to it. However, the severity of this issue is predominantly experiencing by women, posing a threat to their social lives. This research has delved into the intricate relationship between gender in cyberspace and the state, with a specific focus on gender identity that shapes the nature of cybercrime against women in the patriarchal social structure in India. Methodologically, the study focuses on secondary data, including various committee reports published by the Government of India, particularly those from the National Crime Records Bureau (NCRB), as well as books, journal articles, publications, national and international research papers, newspapers, and magazines. These sources were utilized to investigate the intersectionality of these phenomena. The study employed intersectionality as a theoretical paradigm to understand how different identities of women in terms of age, religion, caste, and class, contribute to vulnerable situations to them in the cyber world. The theory also have been used to understand the experiences of women who suffer from different kinds of cyber-attacks. The study classifies various forms of cybercrimes against women in its recent trend. İt tries to analyse the effectivity of cyber laws and law enforcement processes that projects a different scenario of women's status in cyber landscape. The study also highlights the patriarchal influences, gender socialization, gender inequality, and societal discrimination against women that lead to more cyberattacks, especially targeting minor girls. In addition to this, numerous other factors, such as the dynamics of power inequalities in every sphere of life, inherent evils of social structure, gender stereotypes, rigid masculinity, patriarchal social structure, and control over women's sexuality, are also responsible for cyber-attacks against women in India. However, it emphasizes that women, particularly in the cyber world, are vulnerable and bear a significant burden of cyberattacks.
Keywords: Cybercrime, Cyberlaws, Women, Identity, Patriarchy

SYNTHESIS AND CHARACTERIZATION OF CU DOPED ZNO THIN FILMS PREPARED BY SOL-GEL DIP COATING TECHNIQUE

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ABSTRACT
ZnO is a common semiconductor II-IV with a band gap energy (EG) of 3.1–3.4 eV that shows good electrical, optical, and chemical properties. At room temperature, it possesses an extremely significant excitation binding energy of 60 meV.In this work, synthesis of Zinc oxide (ZnO) thin film as a starting material by sol-gel method and then deposited on glass substrate to form thin layers of ZnO by dip-coating technique. This film of ZnO was annealed at 450 ◦C. The structural and optical properties of prepared ZnO thin film were measured by X-ray diffraction (XRD), Ultraviolet spectroscopy (UV-visible) respectively. These results; it was shown that thin film is polycrystalline with ZnO hexagonal wurtzite crystal structure and P63mc space group (JCPDS card no. 00-036-1451) and no secondary phases were observed, UV-visible transmittance spectra of the prepared film revealed good transparency in the visible region, the FESEM image revealed morphology nanorod nanoparticle with smaller grain size and the EDX verified the elemental composition and uniform of the film
Keywords: Sol-gel method, dip-coating, ZnO Thin film, X-ray diffraction, UV, EDX, FESEM.

IMMUNOTHERAPY FOR CANCER USING CHIMERIC ANTIGEN RECEPTORS (CARS)

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ABSTRACT
Chimeric antigen receptors (CARs) are designed receptors that target cancer cells by combining an immune cell with a novel specialization. These immune cells could be either natural killer (NK) cells or T lymphocytes. Chimeric antigen receptors (CARs) have proven to be an effective way to amplify and reroute the natural characteristics of both CD8+ and CD4+ T lymphocyte subsets, based on the efficacy of targeting CD19 in B cell malignancies. Dual-signalling CARs allow for the quick production of tumor-specific drugs for each individual cancer patient by reprogramming T cells' effector, metabolic, and survival capabilities in addition to redirecting and activating them. Cell-based therapy has undergone a significant change as a result of this strategy. Rather than relying on the discovery and growth of uncommon naturally occurring T cells with therapeutic potential, it now produces optimal T cell products through genetic engineering. An important part of the immune system, NK cells are essential for innate immunity. For CAR engineering, NK cells provide an alternative to T-cells. NK-cells have the potential to be a source of allogeneic "off-the-shelf" cellular therapy because they do not induce GVHD or other alloimmune or autoimmune toxicities. They can mediate significant anti-tumor effects without causing potentially fatal alloreactivity like GVHD. Researchers are currently investigating the use of CAR-engineered NK cells for the treatment of various haematological and non-haematological malignancies due to the several distinct benefits of NK cells. NK-cells, on the other hand, are only authorized for preclinical studies, in contrast to CAR-Tcells.
Keywords: Chimeric antigen receptors (CARs),Cancer ,Immunotherapy, Natural killer (NK) cells, T lymphocytes

STUDYING THE EFFECTS OF SCREEN TIME AND DIGITAL DEVICES ON CHILDREN'S ENDOCRINE AND METABOLIC HEALTH

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ABSTRACT
There are many different cognitive effects of screen use, both good and bad. It may enhance young children's abilities and capacity for creative thought in the same way that it can enhance schooling and learning. Reading electronic books and using learning-to-read apps can help kids become more proficient readers and thinkers. But screen timing should be the only thing it does. Excessive screen usage can impact cognitive domains like executive functioning, sensory motor development, and academic performance. Additionally, it negatively impacts social, cognitive, physical, spoken language, and social development. A child's language development is impacted by the reduction of screen time in quality time and interaction with parents, caregivers, teachers, and elders. It detracts from psychological health. Metabolic syndrome is also a result of excessive screen time (MetS). The term "Mets" refers to a group of conditions that include obesity, type 2 diabetes mellitus, cardiovascular disease, various chronic illnesses, and early mortality. Features including abdominal obesity, elevated blood pressure, elevated fasting glucose, elevated triglycerides, and low HDL cholesterol may be considered clinical criteria for Metabolic Syndrome. It increases obesity and decreases physical activity. it increasing higher energy intake like sugar-sweetened beverages and high fat dietary intake cause increased secretion of insulin, and increases the amount of fat stores in the body which can lead to obesity. A child's body is less sensitive to insulin than an adult's, which causes insulin resistance and insulin-insensitive tissues, also known as type 2 diabetes mellitus. Parents or other caregivers should pay close attention to the timing of screen time because it might cause additional conditions that are detrimental to a child's development.
Keywords: young children's abilities, metabolic syndrome

THE IMPACT OF ANGER MANAGEMENT TRAINING ON ANGER AND ODD BEHAVIOR: A STUDY AMONG UNIVERSITY STUDENTS IN PAKISTAN

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ABSTRACT
The study investigated the impact of anger management training on the levels of anger and odd behavior among university students. The main objective of this study was to evaluate the effectiveness of therapeutic interventions for reducing Anger and Odd Behavior among the student population in Pakistan. The study recruited those with higher scores on both anger and odd behaviors. The Quzai experimental design was used, and the sample consisted of 80 students aged between 18 to 25 from both genders of male and female students from different universities in Pakistan. Anger management training was provided to the experimental group. The level of aggression was measured before and after anger the training. The study found a significant difference in anger and odd behavior scores of the participants in the experimental group and the control group after receiving the intervention Anger management training had a great impact on student's life to lessen their anger and odd behavior It enables the students to manage their negative emotion and its' expression more acceptably.
Keywords: Anger, odd behavior, anger management training, students.

THE BEHAVIOR OF BARLEY IN A CHANGING ENVIRONMENT

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ABSTRACT
Cereal farming in Algeria faces off climatic and technical constraints, with barley production remaining low and above all variable in space and time compared to the real potential of these agro-ecological zones.Production in semi-arid zones must involve the adoption of relatively more adapted varieties which use less intensive techniques and tolerate a variable climate.For this, the selection of more efficient varieties is necessary to ensure production stability and improved yields.Our study consists of testing eight lines of Barley in the Sidi Bel Abbès region and comparing them with two control varieties.
Keywords: Barley, Semi-arid, Sidi Bel Abbès, Climate, Varieties, Cereal.

THE THIRD EYE FOR THE BLIND

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ABSTRACT
The third eye for blinds is an innovation that helps blind people to navigate with speed and confidence by detecting the nearby obstacles using the help of ultrasonic waves and notifying them with a buzzer sound or vibration.and the spectakles would detect the person or things that is before them. They only need to wear this device as a bandor cloth. The vibration intensity and rate of beeping increase with a decrease in distance; this is a fully automated device. It will be wearable technology for the blinds. One of the main peculiarities of this device is that it will be affordable. The Arduino Pro Mini 328-15/16 MHzboard is worn like a device. It will be equipped with ultrasonic sensors consisting of modules. Using the sensor, the visually impaired can detect the objects around them and travel quickly .When used on a large scale, with improvements in the prototype, it will drastically benefit the community. Thus, this device will be of great use for the blinds and help them travel to different places.
Keywords: Arduino UNO, Ultrasonic sensor, Vibration motor, Buzzer

A COMPARITIVE ANALYSIS OF ENFORCEMENT OF INVESTMENT ARBITRATION AWARDS IN INDIA, UK AND USA:

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ABSTRACT

This research paper aims to compare different mechanisms associated with the recognition and enforcement of international investment awards under distinct jurisdictions, specifically focusing on the legal landscapes of India, the United Kingdom, and the United States. Principally, India has not participated in the ICSID Convention, thereby absolving it from any obligation to attend to investment arbitral awards on par with domestic court judgements as stated under Article 54. In addition to this, India has referred to the commercial reservation provision of Article I(3) within the Convention on the Recognition and Enforcement of Foreign Arbitral Awards, that is the "New York Convention". Subsequently, there is a restriction on the application of New York Convention in India solely to foreign awards arising from commercial relationships under the Indian law as elucidated by Section 44 of the Act. This paper aims to branch out and delve into how Indian courts interpret this provision, thereby acknowledging its applicability and potentially excluding investment arbitral awards from its scope at the same time. Unlike India, the regime in the United States of America is oriented towards a pro-enforcement stance, as far as investment arbitration awards under ICSID are concerned. The enforcement of such awards is governed by the provisions of the Federal Arbitration Act (FAA) and the New York convention. The FAA lays down a framework for the enforcement of arbitration agreements and awards, encompassing both, domestic as well as international awards. Section 207 of this act deals particularly with ICSID awards, giving them the same status as final judgments of a U.S court as far as enforcement and recognition are concerned. The country is also a party to the New York Convention. Chapter-2 of the FAA ensures that it is implemented. As enshrined in Article-III of the convention, the US enforces and recognizes ICSID awards. Enforcement of ICSID awards however can be refused if one of the grounds mentioned in Article-V, such as a breach of public policy or procedural irregularities are found. The United Kingdom member of the International Centre for Settlement of Investment Disputes (ICSID) and is a signatory to the New York Convention on the Recognition and Enforcement of Foreign Arbitral Awards. Further, the United Kingdom adheres to the United Nations Commission on International Trade Law (UNCITRAL) Model Law on International Commercial Arbitration. The enforcement of an award depends on the country in which the seat of arbitration is situated and is governed by the rules followed in that country. In the UK, arbitration awards can be enforced by invoking the Arbitration Act 1996, the New York Convention, the Geneva Convention 1927, the Administration of Justice Act 1920, the Foreign Judgments (Reciprocal Enforcement) Act 1933, and Common Law. There are two procedures to enforce an arbitral award. The first method is to seek the leave of the Court to enforce the award, and the second is to seek the same relief from the national Courts as set out in the arbitral

award. The enforcement of the award can be challenged on the limited grounds laid down in the New York convention. The National Court can refuse to enforce the award if the Court opines that enforcement of the award would violate public policy. Arbitral proceedings dealing with complex issues of law can be appealed to the Supreme Court; this process can take approximately two years. There is a specified time limit in which the award is to be enforced. Non-compliance with an award is considered a violation of the arbitration agreement.
Keywords: Arbitration, enforcement, ICSID, New York Convention, Award

COMPUTATIONAL STUDY ON HYPERTHERMIC CANCER TREATMENT: EVALUATING PRISTINE AND COATED NANOSTRUCTURES THROUGH FINITE ELEMENT ANALYSIS

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ABSTRACT
As a potential cancer treatment strategy, hyperthermia involves selectively raising the temperature in affected tissues while sparing healthy tissues nearby. The aim of this study was to experiment with various geometries of silver, copper, and gold nanostructures, such as nanorods, spheres, and ellipses, to incorporate into hyperthermia-based medical treatment of cancerous tumors. In order to induce the destruction of malignant cells, the ambient temperature of these metal nanostructures was raised from 42 to 46 ℃, and the time taken for them to reach this temperature was calculated. In the spherical zone of malignant tissue, metallic nanostructures were analyzed using COMSOL Multiphysics heat transport module. The thermal responses of metallic nanostructures were assessed in various ways. In order to reach optimal treatment temperatures, different geometries showed varying degrees of heating over time. In contrast to other forms, nanorods specifically, silver nanorods coated in gold exhibited quick temperature attainment. Anticipating future uses in cancer treatment, this study offers important new insights into the role of metallic nanoparticles in hyperthermia.
Keywords: Nanotechnology; Hyperthermia; Nanoparticles; Nanorods; Nanospheres; Nanoellipsoid

AWARENESS OF ERGONOMICS AMONG OIL PALM OFFICE WORKERS

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ABSTRACT
Ergonomics in the workplace is the science of adapting tasks and work environments to workers. It reviews how well employee tasks can be completed without straining their body and without risking long-term health. As a result, ergonomic principles play an essential role in ensuring employee's safety, health, comfort, effectiveness, quality, and well-being in their work environment. However, public awareness on this matter is still at a low level. This situation has led to an increase in the statistics of accidents and injuries occurring in the workplace. Thus, this study aims to investigate ergonomics awareness in a company in Lahad Datu, Sabah. A qualitative research method was used to obtain information from the respondents. This study gathered 12 respondents using interviews and observation. The interview questionnaire structure consisting of several questions such as demographics, ergonomics awareness amongst oil palm office workers, office furniture and workstation, office environment, posture adjustment, office arrangement and the best way to create awareness in employees to practice ergonomics in the office. Hence, the observation was using Nordic Body Map (NBM) and Rapid Upper Limb Assessment (RULA). The study's findings show that the respondents still lack awareness of the importance of ergonomics implementation. As for the performance, it can be concluded that it is still in the unfavourable stage. Therefore, the need for improvement is required by the proposed improvement of implementation of ergonomics programs.
Keywords: Awareness, Ergonomics, Nordic Body Map (NBM), Rapid Upper Limb Assessment (RULA)

PHARMACOLOGICAL AND TOXICOLOGICAL ASPECTS OF DATURA

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ABSTRACT
Datura, a genus of medicinal herbs from the Solanaceae family, has both toxic and medicinal properties. Different plant parts of the Datura plant, especially D. stramonium L., commonly known as Datura or jimson weed, exhibit potent analgesic, antiviral, antidiarrheal and anti-inflammatory activities, due to its wide range of bioactive components. With these pharmacological activities, D. stramonium can potentially be used to treat many human diseases, including ulcers, infections, wounds, rheumatism, gout, bruises, swellings, sciatica, fever, toothache, asthma, and bronchitis. Preliminary phytochemical studies on the plant extract of Datura revealed alkaloids, carbohydrates, cardiac glycosides, tannins, flavonoids, amino acids, and phenolic compounds. It also contains toxic tropane alkaloids, including atropine, scopolamine, and hyoscamine. Although some studies on D. stramonium have reported possible pharmacological effects, information about toxicity remains almost entirely uncertain. Furthermore, frequent use of D. stramonium for recreational purposes has resulted in toxic syndromes. Therefore, it becomes necessary to be aware of the toxic aspects and potential risks associated with its use. The present review aims to summarize the phytochemical composition, pharmacological and toxicological aspects of Datura plant.
Keywords: Datura stramonium, alkaloids, atropine, cardiac glycosides, hyoscamine, Ayurveda.

KALKINMA PLANLARINDA ÇEVRE-KALKINMA İLİŞKİSİNİN DEĞERLENDİRİLMESİ

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ÖZET
1970'li yıllardan bu yana önemli çevre sorunlarına maruz kalan dünya ülkeleri, sorunları çözmek için çesitli kurumlar oluşturmuş, yasalar çıkarmış ve planlar hazırlamıştır. Sosyal, kültürel ve ekonomik açıdan dengeli büyümeyi ve hızlı gelişmeyi hedef alan ve ülke kaynaklarının daha verimli kullanılması amacıyla bir dizi kalkınma planları oluşturulmuştur. Nitekim her beş yılda bir düzenlenen kalkınma planları, çevre ile ilgili düzenlemeleri içeren ve çevre politikalarına yön vermede önemli bir belirleyicidir. Nitekim çevre politikasının etkinliği, toplumun çevre ile olan ilişkisiyle doğrudan ilgidir. Dolayısıyla çevre politikası, toplumun çevreyle olan ilişkisini düzenlemek amacıyla belirlenen hedefler doğrultusunda çevrenin korunması ve geliştirilmesine yönelik faaliyetlerin geliştirilmesidir. Bu bağlamda çalışmada 1963-2023 yılları arasındaki kalkınma planlarında, çevre sorunları, çevre kirliliği, çevre yönetimi, kentleşme ve konut politikası, insan sağlığı, sürdürülebilir kalkınma ve ekonomik politikalar çevre ile ilişkisi bağlamında ele alınarak çevre politikası değerlendirmeye alınmıştır. Çevre sorunlarının çözümü için uygulanan bu politikalar hem Avrupa Birliği hem de uluslararası standartlar çerçevesinde egemen politik-yönetsel bir anlayışın hakim olduğu görülmektedir. Ayrıca kalkınma planlarında ortaya konan hedefler ve ilkeler doğrultusunda ilk aşamada "çevreyi dışlamayan kalkınma" anlayışı hakim olurken daha sonra "sürekli ve dengeli (sürüdürlebilir) kalkınma" anlaşıyışının hakim olduğu sonucuna varılmıştır. Çevrenin korunması açısından etkili sonuçlar elde edilebilmesi için çevre politkalarının tutarlı ve kararlı şekilde benimsenip uygulanması çevre-kalkınma ilişkisinin etkinliğini de artırmaktadır.
Anahtar Kelimeler: Çevre Sorunları, Çevre Politikaları, Kalkınma Planları

EVALUATION OF THE ENVIRONMENT-DEVELOPMENT RELATIONSHIP IN DEVELOPMENT PLANS

ABSTRACT
Countries around the world, which have been exposed to significant environmental problems since the 1970s, have established various institutions, enacted laws and prepared plans to solve the problems. A series of development plans have been created to target socially, culturally and economically balanced growth and rapid development, and to use the country's resources more efficiently. As a matter of fact, development plans prepared every five years are an important determinant in guiding environmental policies and containing environmental regulations. As a matter of fact, the effectiveness of environmental policy is directly related to society's relationship with the environment. Therefore, environmental policy is the development of activities aimed at protecting and improving the environment in line with the targets determined to regulate society's relationship with the environment. In this context, in the study, environmental problems, environmental pollution, environmental management, urbanization and housing policy, human health, sustainable development and economic policies were evaluated in the context of their relationship with the environment in the development plans between 1963 and 2023. These policies implemented for the solution of environmental problems seem to be dominated by a dominant political-administrative approach within the framework of both the European Union and international standards. In addition, in line with the targets and principles set out in the development plans, it was concluded that while the understanding of "development that does not exclude the environment" dominated in the first stage, the understanding of "continuous and balanced (sustainable) development" dominated later on. In order to achieve effective results in terms of environmental protection, the consistent and determined adoption and implementation of environmental policies also increases the effectiveness of the environment-development relationship.
.**Keywords:** Environmental Problems, Environmental Policies, Development Plans

MATERNAL-PERİNATAL ENFEKSİYONLARDA BAKIM VE DANIŞMANLIK

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ÖZET
Günümüzde anne ölümlerinin dünya çapında önemli bir halk sağlığı sorunu olduğu bilinmektedir. Bu ölümlerin nedenleri, ülkelerin gelişmişlik durumlarına bağlı olarak belirgin şekilde değişmekte olup büyük kısmının önlenebilir nedenlere bağlı olarak geliştiği görülmektedir. Sağlık Bakanlığı tarafından yayınlanan raporda 2015-2019 yılları arasında gerçekleşen anne ölümlerinin %45'inin önlenebilir nedenlerden kaynaklandığı belirtilmektedir. Bu önlenebilir nedenler incelendiğinde, enfeksiyonun anne ölüm oranında önemli bir paya sahip olduğu tespit edilmektedir. Prekonsepsiyonel dönemde gelişen riskli davranışlar ve enfeksiyon etkenlerine maruziyet durumundan kaynaklı olarak gebelikte görülen maternal ve perinatal enfeksiyonlar, hem anne hem de fetüs için ciddi morbidite ve mortaliteye neden olmaktadır. Bu enfeksiyonlar gebelikte abortusa, intrauterin ölüme, fetusta konjenital anomaliye ve neonatal enfeksiyona neden olmaktadır. Maternal ve perinatal enfeksiyonlar sadece gebeliği etkilemekle kalmayıp aynı zamanda doğum sonu neonatal süreçte malformasyonlara da neden olabilmekte hatta asemptomatik olan yenidoğanlarda belirti ve bulgular ile yaşamın ilerleyen sürecinde de etkileri görülebilmektedir. Amerikan Obstetri ve Jinekoloji Birliği (ACOG-American College of Obstetrics and Gynecology), Kanada Obstetri ve Jinekoloji Birliği (SOGC-Society of Obstetricians and Gynocologists of Canada) ve Hastalık Önleme ve Kontrol Merkezi (CDCP-Centers for Disease Control and Prevention) maternal perinatal enfeksiyonların tespiti için tüm gebelerden 35-37. gebelik haftasında tarama amacıyla vajinorektal kültür alınmasını önermektedir. Oldukça önemli bir halk sağlığı sorunu olan bu enfeksiyonların gelişmesinin önüne geçme ve etkilerinin önlenebilmesi için gerekli bakım ve danışmanlığın sağlanması elzemdir. Doğum öncesi bakım ve danışmanlıkta amaç enfeksiyon etkenlerine karşı kişileri korumak ve olası problemlere karşı önlem almaktır. Bu bakım ve danışmanlık multidisipliner olarak sağlık profesyonellerince verilmekte olup ebeler ve hemşirelerin rollerinin oldukça önemli olduğu bilinmektedir.
Anahtar Kelimeler: Maternal, Perinatal, Enfeksiyon, Bakım, Danışmanlık

CARE AND COUNSELING IN MATERNAL-PERINATAL INFECTIONS

ABSTRACT
Today, it is known that maternal deaths are an important public health problem worldwide. The causes of these deaths vary significantly depending on the development level of the countries, and most of them appear to be due to preventable causes. The report published by the Ministry of Health states that 45% of maternal deaths between 2015 and 2019 were due to preventable causes. When these preventable causes are examined, it is determined that infection has a significant share in the maternal mortality rate. Maternal and perinatal infections during pregnancy, caused by risky behaviors and exposure to infectious agents during the preconception period, cause serious morbidity and mortality for both the mother and the fetus. These infections cause abortion during pregnancy, intrauterine death, congenital anomalies in the fetus, and neonatal infection. Maternal and perinatal infections not only affect pregnancy, but also can cause malformations in the postpartum neonatal period, and their effects can even be seen in asymptomatic newborns with signs and symptoms later in life. American College of Obstetrics and Gynecology (ACOG), Canadian Society of Obstetrics and Gynecology (SOGC) and Centers for Disease Control and Prevention (CDCP) maternal perinatal 35-37th week of all pregnant women to detect infections. recommends taking a vaginorectal culture for screening purposes during the gestational week. It is essential to provide the necessary care and consultancy to prevent the development of these infections, which are a very important public health problem, and to prevent their effects. The aim of prenatal care and counseling is to protect people against infectious agents and take precautions against possible problems. This care and consultancy is provided by multidisciplinary health professionals, and it is known that the roles of midwives and nurses are very important.
Keywords: Maternal, Perinatal, Infection, Care, Counseling

THE ROLE OF MEDIA IN DICTATORSHIPS: HISTORICAL PERSPECTIVE AND IMPLICATIONS

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ABSTRACT
Throughout history, the media has been one of the most effective tools of political leaders and regimes in influencing society. Dictatorships, in particular, tend to manipulate the media for their own purposes. Such authoritarian regimes have used the media to maintain control over society and consolidate their power. This paper aims to find the role of media in dictator propaganda and its effects on nation. Dictators have become adept at spreading their propaganda through the media. They have manipulated public perception by controlling state-sponsored media outlets, producing content praising their leadership, and suppressing dissenting voices. This serves to present leaders in a sacred image and legitimize dictatorships. Censorship and repression aremethods frequently used by dictatorships to consolidate their control over the media. With practices such as closing down independent media outlets, putting pressure on journalists, and even imprisoning them, dictators have silenced opposing voices while ensuring the dissemination of the information they want. This situation has led to distortion of facts, misinformation and society's alienation from reality. As seen in many examples throughout history, dictators such as Stalin, Mussolini, and Hitler manipulated the media for their own interests. These leaders used the media to support their ideologies and policies, shaping society's mindset and suppressing dissenting voices. As a result, the role of the media in dictatorships has a huge impact on shaping society's perception, controlling the flow of information and restricting freedom of thought. In this context, protecting media freedom and diversity is of critical importance for strengthening democratic values.
Keywords: Dictator, Media, Politics

PDA ESASLI MELAMİN SÜNGERLERİN HAZIRLANMASINDA KATALİZÖR ETKİSİNİN İNCELENMESİ

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ÖZET
Endüstriyel, mesleki ve evsel faaliyetler gibi farklı kaynaklar sebebiyle petrol, yağ ve organik çözücüler gibi kirleticiler tarafından oluşturulan su kirliliği tüm canlıları ve çevreyi olumsuz etkilemektedir. Bu sorunun çözümüne yönelik olarak, suyun yağsı kirleticilerden etkin bir şekilde arındırılması için bir dizi çalışma yapılmaktadır. Bu çalışmaların bir kısmı, polimerik üç boyutlu sorbentlerin hazırlanması ve yüzey modifikasyonu üzerinedir. Özellikle, yüzey modifikasyonu kullanılarak malzeme yüzeyinin pürüzlülük ve yüzey enerjisi parametreleri ele alınıp su temas açısının 90 ila 150°'nin üzerine çıkarılması ile hidrofobik/süperhidrofobik malzemeler elde edilmesi amaçlanmaktadır. Yaptığımız çalışmanın odak noktası, gelişmiş malzemelerin tasarımı ve uygulaması için etkin bir yaklaşım olan yüzey modifikasyonudur. Bu amaç doğrultusunda, dopaminin alkali sulu ortamda oksidatif polimerizasyonu ile oluşan polidopamin (PDA) ticari melamin sünger üzerine eş zamanlı kaplanmıştır. Oluşturulan PDA esaslı yüzeyde malzemeye ileri modifikasyonlara olanak tanıyan fonksiyonel gruplar da kazandırılmıştır. Bununla birlikte, dopaminin polimerizasyonuyla ilgili olarak substrat yüzeyinde birikimde sıklıkla karşılaşılan sorunlar ele alınmıştır. Bu sorunların başında, uzun birikim-reaksiyon süresi ve kaplamanın zayıf stabilitesi gelmektedir. Bu problemlerin üstesinden gelinebilmesi için polimerizasyon ortamında reaktif oksijen türleri üretebilecek bir katalizör sisteminden yararlanılmıştır. İlk olarak polimerizasyon süresine katalizör etkisinin incelenmesi için $CuSO_4$, H_2O_2 ve farklı molar oranlarda $CuSO_4$ ve H_2O_2 karışımı reaksiyon ortamına eklenmiştir. Çözeltilerin renk değişimleri ve UV-Vis absorbansları takip edilerek elde edilen sonuçlara göre ortamdaki H_2O_2 miktarı arttıkça PDA için karakteristik olan pikin absorbans değeri artmıştır. Daha sonra, değişen Cu^{2+}/H_2O_2 katalizör oranlarında sentezlenen PDA ile kaplanmış melamin süngerler hazırlanmıştır ve katalizör oranının mekanik özellikler üzerindeki etkisi incelenmiştir. Bu çalışmanın sonucunda elde edilen ürün, yapısal olarak kararlı bir ara ürün olarak değerlendirilmiş ve ileri modifikasyonlara uygun olduğu tespit edilmiştir. Bu bulgu, su kirliliği sorununa etkili bir çözüm sunma amacıyla literatüre bir katkı yapmayı hedeflemektedir.
Anahtar Kelimeler: dopamin, melamin, katalizör sistemi, mekanik davranış

INVESTIGATION OF CATALYST EFFECT IN THE PREPARATION OF PDA BASED MELAMINE SPONGES

ABSTRACT

Water pollution from various sources, such as industrial, commercial and domestic activities, containing pollutants such as crude oil, oil and organic solvents, adversely affects all living organisms and the environment. In order to address this problem, a number of studies have been carried out to effectively purify water from oily pollutants. Some of these studies focus on the preparation of three-dimensional polymeric sorbents and surface modification. Specifically, the aim is to achieve hydrophobic/superhydrophobic materials by controlling parameters such as surface roughness and surface energy through surface modification, resulting in a water contact angle of 90 to 150° or higher. The focus of our study is on surface modification, which is an effective approach for the design and application of advanced materials. For this purpose, polydopamine (PDA) formed by oxidative polymerisation of dopamine in an alkaline aqueous medium was simultaneously coated onto a commercial melamine sponge. Functional groups were also introduced onto the PDA-based surface to allow further modification of the material. However, the problems often encountered in the deposition on the substrate surface related to the polymerisation of dopamine have been addressed. The main problems are the long deposition-reaction time and the poor stability of the coating. In order to overcome these problems, a catalyst system capable of generating reactive oxygen species in the polymerisation environment was used. Firstly, $CuSO_4$, H_2O_2 and a mixture of $CuSO_4$ and H_2O_2 at different molar ratios were added to the reaction medium to investigate the effect of the catalyst on the polymerisation time. According to the results obtained by monitoring the colour changes and UV-Vis absorbance of the solutions, the absorbance value of the peak characteristic for PDA increased with the increased amount of H_2O_2. Subsequently, melamine sponges coated with PDA synthesised at different Cu^{2+}/H_2O_2 catalyst ratios were prepared and the effect of the catalyst ratio on the mechanical properties was studied. The product obtained as a result of this study was evaluated as a structurally stable intermediate and found to be suitable for further modifications. This finding is expected to make a contribution to the literature in order to provide an effective solution to the problem of water pollution.

Keywords: dopamine, melamine, catalyst system, mechanical behaviour

ANALYSIS OF VORICONAZOL IN PHARMACEUTICAL PREPARATIONS USING ASSISTED UV-VISIBLE REGION SPECTROPHOTOMETRY METHOD

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ABSTRACT
Voriconazole is an antifungal medication effective against fungal infections and is often used to treat serious infections such as systemic fungal infections. Voriconazole belongs to the triazole class of antifungal drugs and, by its chemical structure, aims to control infections by inhibiting the growth and proliferation of fungal cells. Voriconazole is commonly used to treat serious fungal infections, especially aspergillosis. It is also effective in treating invasive candidiasis and other fungal infections. Voriconazole may also be used in the prophylactic treatment of patients with immunodeficiency conditions. In the literature review, studies on the quantity determination of voriconazole in pharmaceutical preparations were found. Changing industry technologies and quality control needs increase the need for faster, reliable and repeatable analytical methods in the analysis of pharmaceutical active ingredients. The aim of this study is to develop methods different from the methods in the literature for the quantification of the active ingredient Voriconazole in pharmaceutical preparations, to validate them, and at the same time to show that these methods can be applied by making quantification in pharmaceutical preparations containing the active ingredient Voriconazole.This study aims to analyze voriconazole in pharmaceutical preparations using the assisted UV-visible spectrophotometry method. Voriconazole is a triazole antifungal agent effective in the treatment of invasive fungal infections. This study aims to develop an analytical technique that will allow voriconazole to be measured in a simple and cost-effective manner. The method is based on the reduction of voriconazole by reaction with thionine under alkaline conditions.
Keywords: Voriconazole, Pharmaceutical Preparations, Spectrophotometry, Analytical Technique

DOĞUM MÜDAHALELERİNİN KARŞILANMIŞ DOĞUM BEKLENTİSİ VE MEMNUNİYETE ETKİSİ

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ÖZET
Bu araştırmanın amacı doğum müdahalelerinin karşılanmış doğum beklentisi ve memnuniyete etkisini incelemektir. Çalışma; analitik- kesitsel tipte, Eylül 2021- Eylül 2022 tarihleri arasında yapıldı. Bu çalışmanın evrenini Şehir Hastanesine doğum yapmak için başvuran gebeler, örneklemini ise normal doğum için başvuran 422 primipar gebe oluşturdu. Verilerin toplanmasında "Tanıtıcı Bilgi Formu", "Doğum Eylemi İzlem Formu", "Doğum Beklentisi ve Doğum Deneyimi Ölçeği" kullanıldı. Verilerin değerlendirilmesinde tanımlayıcı istatistikler, dağılımın normalliği için Shapiro- Wilk testi, Mann Whitney U Testi, değişkenler arasındaki ilişkinin değerlendirilmesinde stepwise metodu ile çoklu linear regresyon analizi kullanıldı. Kadınların yaş ortalaması 25,78±3,95 olup, %44,8'inin lise mezunu olduğu, %82,7'sinin isteyerek gebe kaldığı, %97,6'sının gebelik döneminde sağlık kontrolüne gittiği saptandı. Kadınlara uygulanan başlıca doğum müdahalelerinin; sürekli elektro fetal monitorizasyon (%95,7), epizyotomi (%90,3), indüksiyon (%81,3), vakum uygulaması (%4,0) olduğu görüldü. Yapılan bu çalışma ile doğumda uygulanan müdahalelerden analjezik kullanımının doğum beklentisi ve doğum memnuniyetine pozitif yönde, vakum uygulamasının ise negatif yönde etkilendiği saptandı. Epizyotomi, indüksiyon, yeme içmeyi kısıtlamak, antispazmolitik kullanımı ve sürekli elektro fetal monitör kullanımının da doğum memnuniyetini negatif yönde etkilediği görüldü. Araştırmada kadınlara uygulanan doğum müdahalelerinden kadınların karşılanmış doğum beklentilerini ve memnuniyetlerini etkilediği tespit edildi.
Anahtar Kelimeler: Doğum beklentisi, Doğum memnuniyeti, Doğum müdahalesi, Ebelik

THE EFFECT OF BIRTH INTERVENTIONS ON MET BIRTH EXPECTATIONS AND SATISFACTION

ABSTRACT

The aim of this thesis is to examine the effect of birth interventions on met birth expectancy and satisfaction. This study is an analytical-cross-sectional study conducted between September 2021 and September 2022. The population of this study consisted of pregnant women who applied to City Hospital to give birth, and the sample consisted of 422 primiparous pregnant women who applied for normal delivery. "Descriptive Information Form", "Birth Action Follow-up Form", "Birth Expectation and Birth Experience Scale" were used to collect the data. Descriptive statistics were used to evaluate the data, Shapiro-Wilk test, Mann Whitney U Test for normality of distribution, and multiple linear regression analysis with stepwise method were used to evaluate the relationship between variables. It was determined that the mean age of the women was 25.78±3.95, 44.8% of them were high school graduates, 82.7% of them got pregnant voluntarily, and 97.6% of them went to health check-ups during pregnancy. Birth interventions applied to women; continuous electro fetal monitoring (95.7%), episiotomy (90.3%), induction (81.3%), vacuum application (4.0%). In this study, it was determined that the use of analgesics, which is one of the interventions applied at birth, affects the expectation of birth and birth satisfaction positively, and the application of vacuum negatively affects the birth satisfaction. In the study, it was determined that the birth interventions applied to the women affected the fulfilled birth expectations and satisfaction of the women.

Keywords: Birth expectation, Birth satisfaction, Birth intervention, Midwifery

A STUDY ON THE CAUSAL IMPACT OF WORLD CRUDE OIL PRICES ON INDIAN STOCK MARKET

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ABSTRACT
This research delves into exploring the causal relationship between world crude oil prices and the Indian stock market, employing a combination of Granger Causality tests and regression analysis. Data from the West Texas Intermediate (WTI) crude oil prices and the National Stock Exchange (NSE) of India are carefully examined over a ten-year period that includes both short-term volatility and long-term trends. Finding the direction of causation between these factors and assessing the effect of changes in the price of crude oil on the Indian stock market are the main goals. To determine if variations in the price of crude oil cause subsequent movements in the Indian stock market, or vice versa, Granger Causality tests are employed. Regression analysis is also used to measure the strength and importance of this relationship. This study attempts to provide light on the complex dynamics underlying the interaction between global crude oil prices and the Indian stock market by analysing the data at both macro and local levels. These findings provide useful information for politicians devising economic policies, investors navigating the Indian market, and scholars delving further into the complex relationships between the global oil markets and the Indian economy. The study emphasizes how important it is to take the volatility of oil prices into account when making investments and formulating economic policies.
Keywords*:* Granger Causality, Regression, Oil Price Volatility, Indian Stock Market, Sensex, Nifty

IMAGE SEGMENTATION METHOD FOR CHECKING THE EFFECTIVENESS OF VITILIGO TREATMENT

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ABSTRACT
There are various method used for Vitiligo Scoring in literature. All this methods needs human interventions to calculate the grades. Image Segmentation is an important part of Image Preprocessing where interested region for the images can be taken out for further processing. Image segmentation is used to find the interested region in the image. In the proposed work Image Segmentation algorithm was used to check the effectiveness of Vitiligo treatment for a pateient. Images of same patients are used in different intervals to compare the effectiveness of the treatment. This method was compared with the existing methods and gave more accurate results.
Keywords: Watershed Segmentation, Image Pre Processing, Vitiligo Grading, Vitiligo Score

SUSTAINABLE UTILIZATION OF BIO-WASTE COMPOST FOR FARADIC AND NON -FARADIC TYPE ENERGY STORAGE APPLICATIONS

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ABSTRACT
The goal of this work is to study Capacitive and non-Capacitive charge storage in a symmetric device configuration. This is because the world is searching for new types of bio-materials for storing renewable energy and compost is easily available for its bio-circular economy, in which bio-waste can be easily converted into compost. Despite the complexity of compost this work has used a symmetric two electrode device to explore both faradic and non-faradic processes. These studies are done with different type of compost and current collectors using distilled water as an aqueous media. Generally three main techniques namely Galvanostatic charge-discharge studies (GCD), Cyclic voltammetry (CV) and electrochemical impedance spectroscopy (EIS) are used to evaluate parameters such as charging and discharging time, specific capacitance, specific capacity etc. In addition, chrono-amperometery studies are done to study the stability of the device. Also the efficiency has been significantly affected by electrode material (compost) and electrolytes. The results demonstrate the charge storage's multifunctional behavior in compost as a bio-media. These researches provide the groundwork for novel, environmentally friendly bio-media that can be used to store charge.
Keywords: Compost, Charge Storage, Non-Faradic, Faradic, Stability,

THE EFFECTIVENESS OF PILATES AND BIRTHING BALL EXERCISES ON LOWER BACK PAIN AND SELF-EFFICACY IN PREGNANT WOMEN IN THE THIRD TRIMESTER AT THE BATU ANAM COMMUNITY HEALTH CENTER, SIANTAR DISTRICT. SIMALUNGUN REGENCY

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ABSTRACT
Changes in body shape during pregnancy are an adaptation of the body to the pregnancy process. Shifting the mother's center of gravity to the back of the legs causes the body to experience progressive lordosis, and not infrequently, there is an increase in mobility of the sacroiliac and sacrococcygeal joints, which can cause lower back pain. One relaxation technique to facilitate labor is using a birth ball, which is also commonly known in Pilates exercises as using a birthing ball. This research uses a quasi-experimental design with a pretest-posttest group design approach. A pretest was carried out in the intervention group and control group regarding self-efficacy before carrying out Pilates exercises, and the posttest was carried out for 1 hour. This study also measures the perception of low back pain in the third trimester of pregnancy and will compare the intervention group and the control group. A comparison of the degree of pain before and after the intervention given to the intervention group showed that there was a significant difference ($p<0.05$). After the intervention was given, the degree of self-efficacy showed that there was a significant difference ($p<0.05$) in the intervention group, which was classified as high self-efficacy at 94%. It needs to be promoted as an alternative to pregnancy exercise in midwifery service units, especially in basic-level service units, so that complaints of persistent musculoskeletal pain can be prevented and all pregnant women can make maximum use of basic-level services.
Keywords: Pilates Exercise, Birthing Ball, Lower Back Pain, Self-Efficacy, Gravida Trimester III

STUDY OF A BEAM REINFORCED WITH GLASS FIBER AND CARBON FIBER COMPOSITES

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ABSTRACT
Since its invention, concrete has always been considered the construction material par excellence for civil engineering structures. Concrete's main quality is its excellent compressive strength, but its main drawback is its low tensile strength. Most structures have been, are and will be for a long time built using concrete as their main constituent, but concrete is a relatively fragile material, so concrete constructions experience several problems in their life cycle, which can have a detrimental effect on the construction. A number of steps are required to make good use of the structure, with rehabilitation and reinforcement methods differing according to the nature of the problem. A significant percentage of structures require reinforcement or repair to ensure user safety before they reach the end of their useful life The strengthening of existing structures, adapted to additional operating constraintsInvolves the development of new and innovative methods, including the addition of traditional or composite bonded reinforcements. The present article deals with the behavior of a beam strengthened by the addition of bonded composite reinforcements.
Keywords: beam, reinforced concrete reinforcement or repair, composite materials (fiberglass, carbon fiber).

ICARIIN RESCUED DEOXYNIVALENOL-INDUCED INTESTINAL INJURY IN MICE VIA NRF2 SIGNALING PATHWAY

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ABSTRACT
Deoxynivalenol (DON) is one of the most prevalent agricultural contaminants and has devastating effects on the health of animals and humans. Recently, the ability of bioactive compounds to regulate oxidative stress and apoptosis has received much attention. This study

investigates the intestinal-damaging effect of DON and the potential shielding effects of icariin in mice. In this regard, forty-eight mice were randomly assigned into four groups (n = 10): 1) Control (CON), 2) 100 mg/kg BW icariin (ICA), 3) 3 mg/kg BW DON (DON), 4) 3 mg/kg DON + 100 mg/kg BW icariin (DON + ICA). The experimental groups were treated with DON or ICA for 11 days. The results showed that DON significantly reduced average daily feed intake, average daily gain and triggered intestinal damage and barrier dysfunction as reflected by decreased TEER and increased DAO activity, as well as down-regulated tight junction proteins (claudin-1 and occludin). However, oral administration of ICA significantly attenuated these changes. ICA significantly alleviated DON-induced oxidative stress by scavenging ROS and MDA generation and increasing the antioxidant enzyme activities (T-SOD, CAT, and GSH-Px). Moreover, ICA markedly up-regulated mRNA and protein expression of Nrf2 and its downstream genes induced by DON. Taken together, ICA may serve as a potential mitigator against DON-induced intestinal injury and could be helpful for the development of novel treatments to combat gut diseases in humans and/or animals.
Keywords: Deoxynivalenol, Icariin, Oxidative Stress, Intestine, Mice

IMPLICATIONS OF PROFESSIONAL STRESS ON PREGNANCY COMPLICATIONS

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ABSTRACT
There has been growing research to investigate the proportional relationship between higher workload and pregnancy complications. It is hypothesised that occupational stressors that hamper physical and psychological health have detrimental effects on fertility and pregnancy. Over the years evaluation in various female-dominated professions for associated high-risk pregnancies have revealed disturbances in ovulation and complications such as 1. Premenstrual syndrome, 2. Dysmenorrhea, 3. Preeclampsia, 4. Low birth weight, 5. Early pregnancy loss and 6.Hyperemesis gravidarum. In general female workers are more sensitive to stressors such as noise, heat, dust and vibrations in workstations. Exposure to Whole-Body or Hand-Arm vibration (WBV) has been reported to cause abnormal uterus positioning and anomalies in foetal position. Workstations like law firms, nursing assistants etc. that require long-standing, repetitive work result in risks of miscarriage and preterm labour due to restriction in movements. Asynchrony in circadian rhythm is faced by expecting women working in fixed night shifts often resulting in spontaneous abortions. Shockingly evaluation of female employees working in factories formulating oral contraceptives revealed experiencing symptoms associated with hyperestrogenism and episode of intermenstrual bleeding due to elevated levels of plasma ethinyl estradiol , following it occupational exposure of teratogens such as carbon-based organic solvents in workplaces like pharmaceuticals and dry cleaning industry increase the risk for stillbirth and “specific birth defects.”Subsequently pregnancy complications are higher in physicians due to chronic stress, exposure to anaesthetic gases and antineoplastic drugs. Although a number of publications indicate that occupational irritants adversely affect stages of pregnancy, more studies are needed to establish their mechanisms and how work stress should be decreased or eliminated during preconception and early pregnancy.
Keywords: Premenstrual syndrome, Dysmenorrhea, Preeclampsia

PRODUCTION OF BIO-PLASTIC AND ITS CHARACTERIZATION USING BANANA PEEL

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ABSTRACT
At present the chemical industry is searching for substitute to decrease usage of petroleum-based non-degradable conventional plastics. In spite of their many uses and attractive properties, petroleum based conventional plastics have also many disadvantages such as production problems, landfill disposal, incineration, plastic recycling, and their adverse effect on biodiversity. Bioplastic are plastics derived from renewable biomass sources, composed of cellulose, starches, biopolymers, and a variety of other materials. In this research a starch based substrate banana peel was used and subjected to alkali and acid hydrolysis to convert it into bioplastic film. Synthesis of bioplastic was carried out in two phases. In first stage the process parameters pH and hydrolysis time was changed over a range of values. In this stage the pH of neutral range gave the best results for tensile strength analysis 0.552N/mm2 with optimum residence time (10 minutes). In the second stage, commonly available plasticizer like glycerin, sorbitol and urea was added and compared. The sorbitol, gave maximum tensile strength (34.310 N/mm2) with 41.434 N loads in this comparison. EDS analysis shows that C K was the highest element (6.73%) with 5.32 App conc and 0.7918 intensity concentration present in the biopolymer film.
Keywords: Bio-Plastic, Plastic recycling, Banana Peel, pH.

EVALUATION OF MEDICAL DEVICE REPROCESSING, AS PART OF A QUALITY IMPROVEMENT PROJECT

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ABSTRACT

Medical devices (MD) are a significant source of healthcare associated infections. Therefore, to break this chain, it is crucial to have an effective reprocessing of reusable medical devices (RMD. From this perspective, this study aimed to evaluate the steps of reprocessing RMD in Habib Bourguiba University Hospital (HBUH) as part of a quality improvement project and establish recommendations. This was an exhaustive cross-sectional study conducted during the period between July and September 2023 in all units involved in the sterilization process in HBUH Sfax Southern Tunisia. We used an observational checklist to evaluate the practice of different steps of reprocessing of RMD. We conducted one audit pass for each enrolled unit. This study included 10 operating units and a sterilization unit. The median value of the global conformity score (GCS) was 48/100 (IQR=[43.6-56]). We noted that 7 operating units (70%) had a poor level of conformity and 3 (30%) had a fair level of conformity. For the reprocessing environment evaluation, the median GCS was 30/100 (IQR= [20 – 50]). Seven units (70%) had a poor level of conformity. As for of pre-disinfection, the median GCS was 40/100 (IQR=[40 – 60]). We noted that 7 operating units had a fair level of conformity (70%). The median conformity score of cleaning was 90/100 (IQR= [70 – 92]). All operating units had a high conformity score for the section of cleaning. We noted that the median GCS of HLD was 50/100 (IQR= [45.83 – 75]). The median of GCS of sterilization was 66.6/100 (IQR= [16.6-100]). This audit has highlighted the majority of poor conformance scores that indicate significant flaws in the HBUH 's reprocessing of MD. It has become imperative to implement corrective measures, plan the centralization of the sterilizing unit.

STUDENTS' KNOWLEDGE OF THE HEALTHCARE ASSOCIATED INFECTION PREVENTION CLIMATE IN THE PRACTICE

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ABSTRACT

Healthcare-associated infections (HAIs) are the most common complications in the healthcare delivery process, and they have emerged as a significant public health problem due to their impact on patients and the healthcare system. Our study aimed to investigate the knowledge of nursing students regarding the climate for HAI prevention. We conducted a descriptive study among students from higher nursing institutes between February and March 2021. A pre-established self-administered questionnaire in French language was used for data collection. The data were analyzed using SPSS version 25 software. A total of 150 students responded to the questionnaire. The majority (57.3%) defined HAI as a hospital-acquired infection occurring after at least 48 hours. Only 40% of the students were aware of the different types of HAIs. The most commonly identified type was urinary tract infection (68.3%), and more than half (58.8%) identified staphylococcus as the most frequently implicated pathogen. Almost all students (94%) recognized poor asepsis as a leading cause of HAI development. The main mode of transmission identified was through materials and instruments (46%). The majority of students (90.7%) emphasized the importance of taking preventive measures while handling infected patients, and they acknowledged that standard precautions should be followed for all patient care (66.7%). A minority (12%) reported receiving hygiene training at their institute. The majority (83.3%) and nearly half (47.3%) acknowledged the effectiveness of hand hygiene in preventing HAIs. Additionally, most students were familiar with the types of handwashing and when to perform it. However, less than half (41.3%) indicated that hydro-alcohol friction could

replace simple handwashing. Nurses are required to take multiple precautions to prevent the occurrence and transmission of healthcare-associated infections. Therefore, enhancing their knowledge and skills is crucial in effectively preventing these infections.
Keywords: Healthcare-associated infections, SPSS

EVALUATION OF HEALTH PROFESSIONALS' KNOWLEDGE ON SEPTIC ISOLATION: RESULTS OF A QUASI-EXPERIMENTAL STUDY

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ABSTRACT
The measures to be taken during septic isolation (SI) aim to avoid the transmission of a pathogenic germ or a multidrug-resistant one from one patient to another. This requires a good level of knowledge of isolation techniques. In this context, we conducted this study to assess the level of knowledge of healthcare professionals (HCP) on SI before and after a training cycle. We conducted a quasi-experimental study among HCP working at the Hedi Chaker University Hospital in Sfax. A self-questionnaire on SI knowledge was completed by the participants before and after a training cycle. Then, a knowledge score was calculated. A total of 106 HCP participated in the study. The participants were female in 50.9% of cases (n=54). The median professional seniority was 7 years (interquartile range (IQR)= [3-13.25]). Fifty-three participants were physicians (50%). Twenty-five health workers received training on septic isolation (23.6%). An isolation room was available in 55 cases (51.9%). The different types of isolation report were available according to the statements of 30 HCP (28.3%). Personal protective equipment was available in the medical departments in 60 cases (56.6%). The declaration of healthcare-associated infections was made in 38 cases (35.8%). According to the sections, 61 HCP thought that sterile gloves should not be worn in the event of contact with an infected patient (57.5%) and 35 HCP stated that a single room was not obligatory in the event of illness transmitted by contact (33%). The median knowledge score on the SI significantly improved after the training (60/100 (IIQ= [53.3-73.3]), versus 66.6/100 (IIQ= [46.6 -60]), p=10-3). This improvement was significantly clearer in men compared to women (7.6 (IIQ=[2.3-10.5]) versus 6.6 (IIQ=[0-13.3]), p=10- 3) and clearer among the paramedical staff compared to the medical staff (6.5 (IIQ=[3.5 – 7.8]) versus 4.4 (IIQ=[3.7- 5.9]), p =0.023). This study suggests a significant improvement in HCP knowledge through training. It is part of a

process of continuous quality improvement concerning clinical evaluation by the HCP (predominant role of the HCP). More precisely to improve the quality of care.

Keywords: septic isolation, HCP

POST-COVID IRRITABILITY IN THE TUNISIAN POPULATION 2022 – PREVALENCE AND PREDICTIVE FACTORS

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ABSTRACT
The scientific community is increasingly focusing on long COVID due to the economic and health challenges it raised. Indeed, it is a new disease whose mechanisms and various manifestations are not yet fully understood. Irritability is one of the psychiatric manifestations of long COVID. The objective of the study is to determine the prevalence of post COVID irritability and to study its predictive factors. This is a cross-sectional study conducted in February 2022 on the Tunisian population infected with COVID-19 between March 2020 and February 2022. A self-administered questionnaire was developed and shared on social networks. Post-COVID irritability is defined as irritability that develops during or after a COVID-19 infection, present for more than twelve weeks. In total, 1887 participants were included. The majority were women (80%) and aged between 30 and 39 (42.2%). The prevalence of Long COVID was 34.4% and the prevalence of post COVID irritability was 33.5%. The majority experiencing post COVID irritability were women (88.5%) and aged 30-39 (46.8%). Multivariate analysis showed that age between 40 and 49 (OR=1.85; 95%CI[1.07-3.19]; p=0.026), initial severity (intensive care hospitalization) (OR =6.48; 95%CI[1.06-39.34]; p=0.042), nausea in the acute episode (OR=1.82; 95%CI[1.17-2.82]; p=0 .07), and myalgia (OR=1.49; 95%CI[1.00-2.22]; p=0.048) were the main predictive factors. Irritability is a frequent manifestation of post COVID. In our study, its main risk factors were age between 40-49 years old, the severity of the initial presentation, nausea and myalgia in the acute episode.
Keywords: COVID, economic and health challenges

ASSESSMENT OF THE ROLE OF ART IN THE BUILT ENVIRONMENT AND ENHANCEMENT OF EDUCATION: AN EXAMPLE OF THE FEDERAL POLYTECHNIC, ILARO

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ABSTRACT
Artistic elements have historically been marginalized, lacking a comprehensive understanding of their contribution to the overall ambiance and educational experience. The identified problem within educational institutions highlights a prevalent undervaluation of the potential benefits and challenges associated with intentionally integrating art into learning spaces. This study addresses a significant gap in recognizing the pivotal role of art within the built environment and its impact on educational enhancement, focusing on the Federal Polytechnic, Ilaro. Utilizing a qualitative analysis approach involving in-depth interviews, observational studies, and document analysis, the research delves into the intricate relationship between art, architecture, and education. This research aims to fill this void by exploring the nuanced influence of artistic interventions within academic institutions. Findings underscore a substantial positive impact resulting from the strategic incorporation of art into the built environment. Beyond aesthetics, art enhances creativity among students, fostering a dynamic and engaging educational setting. The intentional inclusion of artistic elements also cultivates a profound sense of identity within the academic community, creating a more meaningful and inspiring learning atmosphere. However, the study highlights significant challenges, with budget constraints emerging as a critical factor hindering the full realization of art's potential benefits within educational infrastructure. Divergent perceptions regarding the relevance of art in educational contexts pose additional obstacles. In conclusion, this research advocates intentional and holistic approaches to integrate artistic elements into educational infrastructure planning. Emphasizing the intrinsic value of art in elevating the overall educational experience and shaping vibrant learning environments, the study recommends allocating sufficient resources, fostering collaboration, implementing awareness programs, and establishing a sustainable framework for ongoing assessment and adaptation of art installations. Envisioning a future where the integration of art becomes integral and celebrated within educational institutions, the research aims to contribute significantly to the holistic development of students and foster a more inspiring and dynamic learning environment.
Keywords: Art Education, Built Environment, Educational Enhancement, Holistic Learning Environment, Institutional Infrastructure, Qualitative Analysis

Relevance of the Study to the United Nations SDGs

This study aligns with several United Nations Sustainable Development Goals (SDGs), notably SDG 4 (Quality Education) through art's impact on learning, SDG 11 (Sustainable Cities) by exploring art in the built environment, and SDG 10 (Reduced Inequalities) by fostering inclusivity. It also supports SDGs 9, 13, and 17 through innovation, climate awareness, and collaborative partnerships.



THERAPEUTIC POTENTIAL OF SAREEHN (*ALBIZIA LEBBECK*) SEEDS EXTRACT AGAINST TOXIC EFFECTS OF GRAPHENE NANOSHEETS IN MORI (*CIRRHINUS MRIGALA*)

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ABSTRACT
This research investigated the therapeutic potential of Sareehn (*Albizia lebbeck*) seed extract in alleviating graphene nanosheets (GNS) toxicity in *Cirrhinus mrigala* and addressed concerns about GNS effects on aquatic organisms. For experimental purposes, fish were collected and kept in the lab with all standard aquatic parameters maintained. During Phase I of the experiment, mortality rates were observed after oral GNS doses ranging from 0, 250, 500, 750, 1000, 1250, and 1500 mg/L, monitored at 96-hour intervals, resulting in an LC50 value of 121.37 mg/L. Three fractions of LC50 were made, including Fraction 1 (121.37 mg/L), Fraction 2 (60.58 mg/L), and Fraction 3 (40.45 mg/L). The medium fraction was used in Phase II of the experiment. The experimental groups included the Control (A) group with no exposure to GNSs and plant extract, Test Group B exposed to 60.58 mg/L of GNSs with no extract, Test Group C with 60.58mg/L of GNSs + 25 mg/L extract, Test Group D with 60.58mg/L of GNSs + 50 mg/kg extract, and Test Group E with 60.58 mg/L of GNSs + 75 mg/kg extract, with each group observed for 96 hours. Fish organ histology was assessed to show GNS impact: the liver histopathological changes included Pyknotic nuclei or karyomegaly, Atrophy, Acute Cellular swelling, melanomacrophage centers (MMC), hepatic vacuolation, sinusoid dilation, Hydropic degeneration, Necrosis, Perivascular degeneration were observed. However, Intestinal histology shows changes such as intestinal damage (Id), Collapsed Epithelial layer (CL), intestinal interior architecture damage (Ad), atrophy (A), bigger intercellular gaps, and Degenerated Goblet cells (DG). D: shows bigger intercellular space (IS) and kidney histology shows tubular necrosis (Tn), Severe Congestion (SC), tubular dilatation, Bowman capsule dilution (DBS), Destroyed Intestinal Integrity, Glomerulopathy (G), Hemocytic Infiltration (HI), hematopoietic tissue degradation, Vasodilatio (WL), Constricted NT lumen (CL). The therapeutic effect of Albizia lebbeck was also noted in mitigating GNS toxicity. High-performance liquid Chromatography (HPLC) analysis identified several bioactive components in Albizia lebbeck, including Ferulic acid, Chlorogenic acid, Gallic acid, P-coumaric acid, Quercetin, Caffeic acid, Sinapic acid, Kaempferol, oxalic acid, malic acid, Citric acid, Fumaric acid, Succinic acid, with Methylmalonic acid being the most abundant. The findings suggest that *Albizia lebbeck* seed extract offers protection against GNS toxicity in Cirrhinus mrigala, providing a potential solution for mitigating GNS-related environmental concerns.
Keywords: *Albizia lebbeck* seeds, Graphene nanosheets toxicity, *Cirrhinus mrigala*, Therapeutic potential

KURUMSAL İFLAS VE YENİDEN YAPILANMA: MALİ SIKINTILARA HUKUKİ YAKLAŞIMLAR

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ÖZET
Kurumsal iflas ve yeniden yapılanma, işletmelerin yaşam döngüsünde, alacaklılardan çalışanlara ve hissedarlara kadar uzanan paydaşlar için derin sonuçlar doğuran kritik dönemeçleri temsil etmektedir. Bu makale, iflas işlemlerinin ve yeniden yapılandırma çabalarının doğasında bulunan mekanizmalar ve zorluklar hakkında kapsamlı bir anlayış sağlamayı amaçlayan, şirketlerin karşılaştığı mali sıkıntılara yönelik hukuki yaklaşımları ele almaktadır. Bu çalışmanın amacı, kurumsal mali sıkıntının çözümünde kullanılan çeşitli yasal çerçeveleri ve stratejileri analiz etmektir. Doktrinsel hukuki araştırma, iflas yasalarının yargı bölgeleri arasındaki karşılaştırmalı analizi ve örnek olay incelemelerinin bir kombinasyonu yoluyla bu araştırma, kurumsal iflas ve yeniden yapılandırma süreçlerinin inceliklerini aydınlatmayı amaçlamaktadır. Bu çalışmadan elde edilen temel bulgular, kurumsal mali sıkıntının çok yönlü doğasını ve iflas işlemlerinin yönetilmesindeki karmaşıklıkları vurgulamaktadır. Araştırma, iflas, tasfiye, borcun yeniden yapılandırılması ve resmi iflas işlemleri de dahil olmak üzere sıkıntıda olan şirketlerin yararlanabileceği çeşitli yasal mekanizmaları belirliyor. Ayrıca alacaklılar, hissedarlar, çalışanlar ve düzenleyici otoriteler gibi paydaşların iflasın ve yeniden yapılandırma çabalarının sonucunu şekillendirmedeki rolünü araştırıyor. Bu çalışmanın önemi, politika yapıcılar, hukuk uygulayıcıları, şirket yöneticileri ve kurumsal mali sıkıntı sorunlarıyla boğuşan akademisyenler için pratik çıkarımlarda yatmaktadır. İflas ve yeniden yapılandırmaya yönelik hukuki yaklaşımlara ilişkin bilgiler sağlayan bu araştırma, değeri korumayı, paydaşların çıkarlarını korumayı ve ekonomik istikrarı teşvik etmeyi amaçlayan karar alma süreçlerine bilgi sağlar. Ayrıca, alacaklı hakları ile borçlunun rehabilitasyonu arasında bir denge kuran, kurumsal dirençlilik ve büyümeye elverişli bir ortamı teşvik eden sağlam yasal çerçevelerin öneminin altını çiziyor.
Anahtar Kelimeler: iflas, tasfiye, borçların yeniden yapılandırılması, resmi iflas işlemleri, ekonomik istikrar.

CORPORATE INSOLVENCY AND RESTRUCTURING: LEGAL APPROACHES TO FINANCIAL DISTRESS

ABSTRACT
Corporate insolvency and restructuring represent critical junctures in the life cycle of businesses, with profound implications for stakeholders ranging from creditors to employees and shareholders. This paper delves into the legal approaches to financial distress faced by corporations, aiming to provide a comprehensive understanding of the mechanisms and challenges inherent in insolvency proceedings and restructuring efforts. The aim of this study is to analyze the diverse legal frameworks and strategies utilized in addressing corporate financial distress. Through a combination of doctrinal legal research, comparative analysis of insolvency laws across jurisdictions, and examination of case studies, this research seeks to elucidate the intricacies of corporate insolvency and restructuring processes. Key findings from this study highlight the multifaceted nature of corporate financial distress and the complexities involved in navigating insolvency proceedings. The research identifies various legal mechanisms available to distressed companies, including bankruptcy, liquidation, debt restructuring, and formal insolvency proceedings. Furthermore, it explores the role of stakeholders such as creditors, shareholders, employees, and regulatory authorities in shaping the outcome of insolvency and restructuring efforts. The relevance of this study lies in its practical implications for policymakers, legal practitioners, corporate executives, and scholars grappling with issues of corporate financial distress. By providing insights into legal approaches to insolvency and restructuring, this research informs decision-making processes aimed at preserving value, protecting stakeholders' interests, and promoting economic stability. Moreover, it underscores the importance of robust legal frameworks that strike a balance between creditor rights and debtor rehabilitation, fostering an environment conducive to corporate resilience and growth.
Keywords: bankruptcy, liquidation, debt restructuring, formal insolvency proceedings, economic stability.

EFFECT OF PYRAMID SHAPED ABSORBER PLATE AND COTTON FINS ON THE SOLAR STILL

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ABSTRACT
In this study, the performance of a solar still having pyramid-shaped absorber plate is investigated and compared with the conventional one. The studies were carried out on a uniform basin area of one square meter and a water depth of 1 cm. In addition, the effect of cotton fabric covering the fins on the performance of the solar still is reported. It is concluded that the performance of pyramid shaped absorber plate with cotton cloth on fins display better performance than conventional solar still, due to the capillary effect.
Keywords: pyramid-shaped, cotton, solar still

RESEARCH ON FACTORS AFFECTING THE DEVELOPMENT DIRECTION OF INDEPENDENT CLINICAL LABORATORIES IN CHINA IN THE POST EPIDEMIC ERA

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ABSTRACT
An independent clinical laboratory (or independent medical testing laboratory) refers to a medical institution with independent legal person qualifications that conducts medical testing on specimens from the human body for the purpose of providing relevant information for the diagnosis, management, prevention and treatment of human diseases, or health assessment (Humphries et al., 2023). Independent clinical laboratories started late in China, but during the new coronavirus pneumonia epidemic, independent clinical laboratories grew rapidly, filling the service gaps of public healthcare institutions with socialized professional strength (Reportlinker, 2019). China's independent clinical laboratories played an important role in early diagnosis, early isolation, early treatment and preventing the spread of the epidemic, and made significant contributions to the national epidemic prevention and control efforts (Chen et al., 2021). However, after entering the post-epidemic era, the amount of testing required by the epidemic has dropped significantly, and the development direction of a large number of independent clinical laboratories set up during the epidemic due to the need for prevention and control is faced with the decision of life and death (Rodgers et al., 2021). At the same time, due to reasons such as the speed of development and regional differences, there are great differences in the business model and profit level of individual laboratories (Andreini, Bettinelli, Foss, & Mismetti, 2021). During the large-scale development of independent clinical laboratories, general testing programs have reached the break-even point, despite the huge stock market of general testing programs in healthcare institutions and the large number of routine samples (Kaur et al., 2022). The low profitability of such testing programs, homogenized competition, and low prices for outsourced services have become common in the industry with weak profitability (Azhari et al., 2022). Despite better profit margins for specialized testing programs, such programs require more physical space, equipment and facilities in the laboratory and the level of testing personnel (Pathmanathan et al., 2022). There are still some problems in the development of independent clinical laboratories, such as "price wars" and other vicious competition, costs and other reasons, which increase the risk of declining service quality, and the lack of appropriate standards for long-distance specimen transportation, which expose clinical laboratories to new business risks (Ahmed et al., 2022). These three directions involve corporate profitability, new profit growth points, cost control, etc. And can play a vital role in the survival and development of independent clinical laboratories (Khalil et al., 2023). Therefore, it is very necessary to conduct comprehensive research on these important aspects of independent clinical laboratories (Rahim et al., 2023). In this paper, by reviewing the

academic information and research results of independent clinical laboratories at home and abroad, and by combining the perspectives of medical, sociological, and managerial disciplines, we adopt the literature research method, analytical modeling, and case study as the research methodology of this paper (Aveyard & Bradbury-Jones, 2019). Combined with the analysis of the development status and business models of representative medical laboratories at home and abroad, and the current situation of the institutional reform of domestic medical institutions under the epidemic, the influential factors affecting the development direction of independent clinical laboratories (ICLs) have been deeply excavated, and a suggested operation plan has been put forward (Ramdani, Binsaif, & Boukrami, 2019). This study contributes to advancing the knowledge and practice of ICL business model optimization and provides valuable insights for policy makers, ICL leaders, and stakeholders in the greater healthcare industry (Fei et al., 2024; Osman et al., 2024). It also contributes to the development of faster clinical diagnostics, precision and personalized medicine, and ultimately, to improving the prognosis of patients (Wang & Shi, 2021). In addition, the findings provide policymakers with innovative management decision-making tools to improve the healthcare ecosystem and promote the development of China's large health industry (Wai et al., 2024).
Keywords: independent clinical laboratory; business model; influencing factors; development direction; post epidemic era

THE EXPERIENCE OF RAISING CHILDREN AS A SINGLE MOTHER: THE GOAT AND HER THREE CHILDREN FABLE

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ABSTRACT
This study analyses the gender representation in Victor Canache's horror movie, The Goat and Her Three Kids, which is based on the fable of Canache's film is based on Ion Creangă's fable of the same name. The fable discusses the importance of obedience in child education and the consequences of its absence. Ion Creangă, a Moldovan/Romanian writer, was a teacher who wrote this fable. The story has very few characters. The protagonist is the mother goat and her 3 little boys. The antagonist is the old wolf, the godfather of the kids. The only female character in the story is the mother who is trying to raise her 3 baby boys in her house in a desolate and secluded land. She is a widow and a lonely woman. While raising her children, she tries to protect them from outside dangers. The adult male character, the wolf, is the danger from outside. The godfather is traditionally supposed to protect the children, but the story shows the opposite. Canache's work is a direct adaptation of this fable. The goats and the wolf are replaced by humans. The story, which mainly deals with the importance of parental obedience with its frightening consequences, also presents a sharp gender representation.
Keywords: Gender, Romanian Horror, Victor Canache, Ion Creangă

ROMATİZMAL HASTALIKLARIN TEDAVİSİNDE SIKLIKLA KULLANILAN BİTKİLER VE BİTKİSEL ÜRÜNLER

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ÖZET
Romatizma tam olarak iyileştirici tedavisi olmayan kronik hastalıklardandır. Ağrı, tutukluk, fonksiyon kaybı gibi belirgin ve ağırlaşan semptomlar, kesin tanı konulmasının zorluğu, ilaç tedavisinin yetersizliği gibi nedenlerden ötürü hastalar alternatif tedavi yöntemlerine yönelmektedirler. Sıcak ve soğuk uygulamalar, akupunktur, kaplıca gibi birçok alternatif tedavi yöntemlerinin yanı sıra Türkiye'de en çok tercih edilen yöntem bitkilerle ve bitkisel ürünlerle tedavidir. Bu alanda bitkisel tedavi amaçlı birçok ürün piyasada bulunmaktadır. Bu çalışmada en çok kullanılan ürünler, ürünlerde yer alan bitkiler ve bu bitkilerin romatizma tedavisinde etkinliği bilimsel olarak incelenmiştir. İnsan yaşamının başlangıcından bu yana, bitki türleri önemli bir ilaç kaynağı olmuştur. Terapötik ilaçların yeni gelişimi için bir kaynak olarak çeşitli bitkiler tanımlanmıştır. Bitkisel ilaçların kapsamı son yıllarda önemli ölçüde artmıştır. Ayrıca, hem gelişmekte olan hem de gelişmiş ülkelerde halkın tıbbi bitkilere olan ilgisi ve kabulü önemli ölçüde artmıştır. Dünya Sağlık Örgütü'ne göre, dünya nüfusunun yaklaşık %80'i temel sağlık ihtiyaçları için tıbbi bitki türlerinden elde edilen bileşikleri içeren geleneksel ilaçları kullanmaktadır. Bu nedenle, özellikleri, güvenlikleri ve etkinlikleri hakkında daha iyi bilgi edinmek için bu bitkiler üzerindeki araştırmaları derinleştirmek gerekir. Romatizma tedavisinde medikal tedavi, fizik tedavi yöntemleri, egzersiz vb. yöntemlerin yanı sıra romatizma türüne uygun olarak uygun doz ve sıklıkta bitkisel ürünler de destek tedavi olarak kullanılabilir. Bu çalışmada romatizmada yaygın olarak kullanılan bitkilere değinmeye çalıştık. Bu bitkiler incelendiğinde özellikle *Capsicum annuum, Harpagophytum procumbens, Rosa canina, Nigella sativa, Equisetum arvense, Sesamum indicum, Silybum marianum, Brassica oleracea, Hypericum perforatum, Rosmarinus officinalis* gibi türlerin kullanıldığı görülmektedir. Bu bitkiler üzerine daha çok deneysel ve klinik araştırmalar yapılmıştır. Bu çalışmada 43 bitkiden bahsedilmiştir. İncelenen bitkiler genellikle Asteraceae familyasına aittir. Bu bitkiler genellikle romatizmal, kronik enflamatuar ve kas-iskelet sistemi hastalıklarının giderilmesinde kullanılmıştır. Bitkilerin farklı kısımları tedavi amacıyla kullanılmaktadır; Rizomları, kökleri, kök sapları, yaprakları, çiçekleri, meyveleri vs.
Anahtar Kelimeler: Romatizma, romatizma tedavisi, bitkisel ürün, bitkilerle tedavi

PLANTS AND HERBAL PRODUCTS FREQUENTLY USED IN THE TREATMENT OF RHEUMATIC DISEASES

ABSTRACT
Rheumatism is one of the chronic diseases that does not have a full curative treatment. Patients turn to alternative treatment methods due to reasons such as obvious and worsening symptoms such as pain, stiffness, and loss of function, the difficulty of making a definitive diagnosis, and the inadequacy of drug treatment. In addition to many alternative treatment methods such as hot and cold applications, acupuncture and spa, the most preferred method in Turkey is treatment with plants and herbal products. Many products for herbal treatment in this field are available on the market. In this study, the most commonly used products, the plants included in the products, and the effectiveness of these plants in the treatment of rheumatism were scientifically examined. Since the beginning of human life, plant species have been an important source of medicine. Various plants have been identified as a source for the novel development of therapeutic drugs. The scope of herbal medicines has increased significantly in recent years. Additionally, public interest and acceptance of medicinal plants has increased significantly in both developing and developed countries. According to the World Health Organization, approximately 80% of the world's population uses traditional medicines containing compounds derived from medicinal plant species for their basic health needs. Therefore, it is necessary to deepen research on these plants to gain better knowledge about their properties, safety and effectiveness. Medical treatment, physical therapy methods, exercise, etc. are used in the treatment of rheumatism. In addition to methods, herbal products can also be used as supportive treatment in appropriate doses and frequencies according to the type of rheumatism. In this study, we tried to mention plants commonly used in rheumatism. When these plants are examined, it is seen that species such as *Capsicum annuum, Harpagophytum procumbens, Rosa canina, Nigella sativa, Equisetum arvense, Sesamum indicum, Silybum marianum, Brassica oleracea, Hypericum perforatum, Rosmarinus officinalis* are used. More experimental and clinical research has been conducted on these plants. 43 plants were mentioned in this study. The plants examined generally belong to the Asteraceae family. These plants have often been used to relieve rheumatic, chronic inflammatory and musculoskeletal diseases. Different parts of plants are used for therapeutic purposes; Rhizomes, roots, stems, leaves, flowers, fruits, etc.
Keywords: Rheumatism, treatment of rheumatism, herbal product, treatment with plants.

FARKLI YEREL ZEMİN SINIFLARINDAKİ AYAKLI KÖPRÜLERİN SİSMİK ANALİZİ

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ÖZET
Köprüler tarihin uzun dönemleri boyunca kullanılmış olan ve genellikle nehir, vadi veya diğer engelleri geçmek için kullanılan yapılardır. Köprüler uzun açıklıkları birbirlerine bağladığından ve ulaşımı kolaylaştırdıklarından uzun yıllar maruz kaldıkları dış etkenlere karşı dayanmaları amaçlanır. Deprem dayanımları açısından incelendiklerinde köprülerin deprem analizleri doğrudan bina deprem analizleri gibi yapılmaz. Köprüler binaların aksine yatay doğrultuda uzun açıklıklara sahip olacak şekilde tasarlanır. Köprülerin uzun açıklıklara sahip olması durumunda, ayaklarının bulunduğu zemin koşullarında değişkenlik gözükebilir. Yerel zemin koşulunun değişmesi, ayaklara gelen deprem ivmesinin de farklılaşacağı anlamına gelir. Yerel zemin koşulunun değişmesine bağlı olarak köprü ayaklarında oluşan deprem ivmelerinin farklı büyüklüklere sahip olmasına "değişken zemin etkisi" denir. Bu etkinin olduğu köprüler yapı analiz programlarında doğrudan mod birleştirme yöntemiyle çözülemezler ve daha detaylı analiz aşamları gerektirir. Analiz yöntemi olarak 3 farklı çözüm yöntemi kullanılabilir. İlk yöntemde değişken zemin etkisi göz önünde bulundurulmaz. Köprü boyunca bulunan yerel zemin sınıflarından en zayıf olanı seçilir ve üniform deprem yer hareketi kabulü yapılır. İkinci yöntemde zaman tanım alanında deplasman analizi yapılır. Belirli bir sayıda deprem yer kayıtları seçilir ve bu kayıtların oluşturduğu deplasmanlar köprünün ayaklarına tekil yükler olarak etki ettirilirler. Üçüncü yöntem olarak da, değişken zemin etkisi göz önünde bulundurularak mod birleştirme yapılır. Bu son yöntemde modal katkı çarpanları bulunurken köprü ayaklarına birim deplasmanlar etki ettirilerek hesap yapılması gerekmektedir. Her bir ayaktaki zemin sınıfı için tasarım tepki spektrumu çıkartılır ve analizde her bir tepki spektrumunun kullanılması gerekir. Dolayısıyla bu işlem doğrudan yapı analiz programlarında yapılmaz. Bu çalışma kapsamında 3 metod da incelenecek ve yapının elastomer mesnetlerinde meydana gelen deformasyonlar ile köprü ayaklarında meydana gelen kesme kuvveti-moment değerleri birbirleriyle karşılaştırılacaktır.
Anahtar Kelimeler: Köprü, Deprem, Değişken Zemin Etkisi, Üniform Deprem Yer Hareketi, Değişken Deprem Yer Hareketi, Zaman Tanım Alanında Deplasman Analizi, Mod Birleştirme Analizi

SEISMIC ANALYSIS OF BRIDGES WITH PIERS ON DIFFERENT LOCAL SOIL CLASSES

ABSTRACT
Bridges are structures that have been used throughout history and are typically used to cross lakes, valleys, or other obstacles. Bridges are designed to withstand external factors for many years as they connect long spans and facilitate transportation. When examined in terms of earthquake resistance, bridges are not analyzed directly like buildings. Unlike buildings, bridges are designed to have long spans horizontally. In cases where bridges have long spans, variability may appear in the ground conditions where the piers are located. The change in local ground conditions means that the earthquake accelerations at the piers will also vary. The varying earthquake accelerations at the bridge piers due to the change in local ground conditions are referred to as "variable ground effect". Three different solution methods can be used as analysis methods. In the first method, the variable ground effect is not considered. The weakest local ground class along the bridge is selected, and uniform earthquake ground motion is assumed. In the second method, displacement time history analysis is performed. A certain number of earthquake ground records are selected, and the displacements generated by these records are applied as unit loads on the bridge piers. As the third method, modal superposition is performed considering the variable ground effect. In this method, modal participation factors are found, and calculations must be made by applying unit displacements to the bridge piers. Design response spectra are produced for each soil class at each pier, and each response spectrum must be used in the analysis. Therefore, this process can not directly performed in structural analysis programs. Within the scope of this study, three methods will be examined, and the deformations occurring at the elastomeric bearings of the structure and the shear force-moment values occurring at the bridge supports will be compared.
Keywords: Bridge, Earthquake, Variable Ground Effect, Uniform Earthquake Ground Motion, Variable Earthquake Ground Motion, Displacement Time History, Modal Superposition Method.

ANALYSIS OF A TRADITIONAL AND A FUZZY LOGIC ENHANCED PERTURB AND OBSERVE ALGORITHM FOR THE MPPT OF A PHOTOVOLTAIC SYSTEM

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ABSTRACT
This paper presents the results of applying two different methodologies for maximum power point tracking (MPPT) to a photovoltaic (PV) system comprised of five solar panels connected in series. Initially, we considered a traditional Perturb and Observe (P&O) algorithm. Secondly, we integrated a Fuzzy Logic Controller (FLC) that utilizes fuzzy logic principles to enhance the traditional P&O algorithm. Both algorithms were integrated into a boost converter. The main aim of this paper is to study if an artificial intelligence (AI) based maximum power point tracking (MPPT) method can outperform a traditional MPPT method in terms of efficiency, stability, and adaptability under varying environmental conditions such as solar irradiation and temperature and also to analyze their behaviour in steady state conditions. The proposed FLC in this study demonstrated superior performance compared to the controller using the traditional P&O algorithm. This superiority can be attributed to the FLC adaptive step size, which enables it to quickly adapt the photovoltaic system to changing environmental conditions. As a result, the FLC can more rapidly identify the correct maximum power point (MPP) and achieve lower oscillations in steady state conditions. The simulations in this study were performed using MATLAB/Simulink.
Keywords: photovoltaic (PV); boost converter; maximum power point (MPP); maximum power point tracking (MPPT); Perturb and Observe (P&O); fuzzy logic controller (FLC)

SYNTHESIS AND EVALUATION OF SILVER NANOPARTICLES FROM ETHANOLIC LEAF EXTRACT OF *TRIDAX PROCUMBENS*.L

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ABSTRACT
In recent science Nanotechnology is a burning field for the researchers. Nanotechnology deals with the Nanoparticles having a size of 1-100 nm in one dimension used significantly concerning medical chemistry, atomic physics, and all other known fields. Silver nanoparticles were synthesized using aqueous extract of *Tridax procumbens* leaves, and silver nitrate. XRD, SEM, FTIR, Optical absorption were measured and analyzed. The synthesized AgNps exhibits lowest energy absorption band at 400 nm. Synthesis of Nanoparticles may involve various routes including physical, chemical and biological approaches. Traditionally these are manufactured by wet chemical methods which require toxic and flammable chemicals. Nanoparticles thus formed are confirmed and characterized by using UV-Visible Spectroscopy, SEM, FTIR, Zeta Analysis, XRD measurements. Further, these green synthesized Nanoparticles showed bactericidal activity against multidrug-resistant human pathogenic bacteria. The AgNps formed were found to have enhanced antimicrobial properties and showed zone of inhibition against isolated bacteria (Escherichia coli) from garden soil sample. In totality, the AgNps prepared are safe to be discharged in the environment and possibly utilized in process of pollution remediation. AgNps may also be efficiently utilized in agricultural research to obtain better health of crop plants as shown by our study.
Keywords: Silver nanoparticles; FTIR; SEM; Antimicrobial Activity; *Tridax procumbens.*

ADDED VALUE OF OVER-RIPED BANANAS FRUIT BECOME DRIED-SOGGY *SALE-PISANG*

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ABSTRACT
Very ripening bananas are unsuitable for fresh eating; they are usually thrown away. Even though overripe bananas can still be used and consumed again if they are processed by drying in the sun to become Sale-Pisang sweetened banana chips, apart from reuse, Sale-Pisang has a high shelf life. It will last even longer and become a delicious and nutritious snack if it is further processed, such as frying it in flour. Over-ripe bananas experience an increase in glucose when dried in the sun, so they taste sweeter than fresh bananas. This research was conducted to provide information on the added value of over-ripe banana waste if it is processed into Sale-Pisang (banana sunlight drying) in Tasikmalaya Regency. This quantitative study uses the Hayami Method Added Value analysis of the wet and dry sale-banana production process (wet sale-bananas fried in flour). This research aims to determine the added value of over-ripe banana waste to produce soggy bananas. This research showed that 3,333 kg of overripe bananas cost IDR 2,000 to 1 kg Sale-Pisang, and the price per kilogram is IDR 60,000. Conversion factor 0.3. The added value ratio is 87.44% for the Ambon (Cavendish) banana type. The output value is 18,000 per kg, and the added value is 15,739.25. The rate benefit level is 82.21%. The margin of benefit is IDR 16,000. This result showed that banana sale products provide very significant benefits. From the added value ratio, it can be seen from these two products that the banana sales business is relatively high because the resulting ratio is more excellent than 50%. Processing over-ripe bananas can create business opportunities, increase income and welfare, and resolve environmental problems by reducing banana waste.
Keywords: Banana Sale, Home Industry, Added Value**.**

INSULIN RESISTANCE AND IRON METABOLISM IN DIABETES

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ABSTRACT
Iron is an important trace element for living organisms as it participates in a range of metabolic processes, such as oxygen transport, energy metabolism, nucleotide synthesis, and electron transport, Although vital, excessive amounts of iron can be toxic, therefore, its concentration needs to be maintained within an ideal range. Iron homeostasis is regulated and maintained by iron metabolism. Thus, iron metabolic homeostasis is required for the optimal functioning of fundamental physiological processes. Iron homeostasis in humans is regulated by balancing iron uptake with intracellular utilization and storage. Dietary iron is absorbed by duodenal enterocytes and binds to transferrin in the plasma. Transferrin limits the production of toxic free radicals and is responsible for ferric-ion delivery into cells. The iron homeostasis system maintains transferrin saturation at physiological levels.
Keywords: Diabetes, Insulin resistance, Iron metabolism

CHARACTERIZATION AND DIAGNOSTIC DETERMINATION OF PHYSIOLOGICAL CHANGES OF PERSISTENT HYPERPLASIA OF THE THYMUS GLAND

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ABSTRACT
Thymic hyperplasia could be true thymic or lymphoid hyperplasia. It is usually found incidentally or could present with compressive symptoms or systemic symptoms due to autoimmune disease like myasthenia gravis. The diagnosis is made through a chest CT or MRI. Treatment for symptomatic patients is mostly thymectomy. This activity describes pathophysiology, evaluation, and management of thymic hyperplasia and highlights the role of the interprofessional team in the evaluation and treatment of patients with thymic hyperplasia. The production of functional T-cell is choreographed by thymic epithelial cells that guide them in proliferation, maturation, and survival. The thymic epithelial cells are compartmentalized into two main populations medullary thymic epithelial cells and cortical thymic epithelial cells. These populations are further segregated into distinct subpopulations having specific molecular and functional roles. There are two major etiologies of thymic hyperplasia. It could be congenital or acquired. The congenital thymic hyperplasia can be hypo functioning or hyperfunctioning and is found to be the result of neuroendocrine disturbances, usually within the hypothalamic-hypophyseal system. Thymic hyperplasia with hypo functioning thymus would lead to immune deficiency. Hyperfunctioning thymic hyperplasia could lead to autoimmune diseases, most commonly myasthenia gravis, but the relationship has also been found with graves' disease and collagen vascular disorders. Acquired thymic hyperplasia can also result in hypo functioning or hyperfunctioning thymus.
Keywords: Thymus gland, Persistent hyperplasia, Physiological changes, Diagnosis

PATHOPHYSIOLOGY, CLINICAL MANIFESTATIONS AND ADIPOSE TISSUE DYSFUNCTION OF METABOLIC COMPLICATIONS ASSOCIATED WITH ADIPOSOGENITAL OBESITY

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ABSTRACT

Obesity is a critical risk factor for the development of type 2 diabetes (T2D), and its prevalence is rising worldwide. White adipose tissue (WAT) has a crucial role in regulating systemic energy homeostasis. Adipose tissue expands by a combination of an increase in adipocyte size (hypertrophy) and number (hyperplasia). The recruitment and differentiation of adipose precursor cells in the subcutaneous adipose tissue (SAT), rather than merely inflating the cells, would be protective from the obesity-associated metabolic complications. In metabolically unhealthy obesity, the storage capacity of SAT, the largest WAT depot, is limited, and further caloric overload leads to the fat accumulation in ectopic tissues (e.g., liver, skeletal muscle, and heart) and in the visceral adipose depots, an event commonly defined as lipotoxicity. Excessive ectopic lipid accumulation leads to local inflammation and insulin resistance (IR). Indeed, overnutrition triggers uncontrolled inflammatory responses in WAT, leading to chronic low-grade inflammation, therefore fostering the progression of IR. Severe obesity is associated with elevated risks of adverse health consequences. The prevalence of obesity is rising worldwide, and if the trend continues, global prevalence will reach 18% in men and 21% in women by 2025 . A positive energy balance between energy intake and energy expenditure results in weight gain and obesity . Many factors, including genetics, epigenetics, and lifestyle factors, have been

implicated in obesity pathogenesis. In most cases, no single factor is exclusively responsible for the development of obesity.

Keywords: Adipozogenital obesity, Metabolic complications, Pathophysiology, Clinical manifestations, Adipose tissue

1,3-BISISOPROPYLXANTHOGENATESULFOPHENOL AS AN EXTREME PRESSURE ADDITIVE FOR TRANSMISSION OILS

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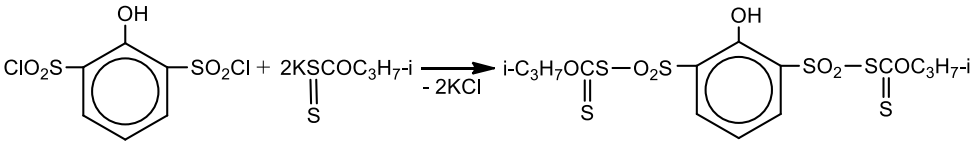
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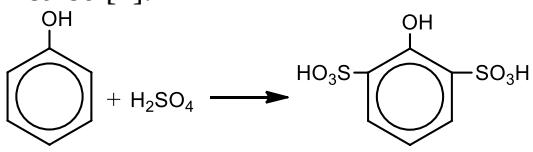
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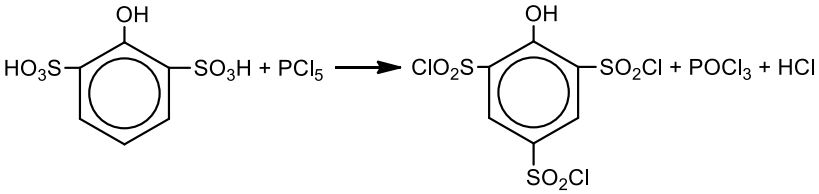
ABSTRACT

At the present stage of development of mechanical engineering, the need for the creation of highly efficient transmission oils is growing from year to year. To develop them, it is important to add high-quality additives to base oils that can protect transmission systems from wear, increasing their durability. Such additives include compounds containing sulfur, nitrogen, phosphorus and other elements. The authors of this work synthesized 1,3-isopropylxanthate sulfophenol as an extreme pressure additive for transmission oils. The compound was obtained by reacting phenol bissulfonyl chloride with potassium isopropyl xanthate:



The reaction was carried out in an aqueous medium or isopropyl alcohol at a temperature of 50-600C. The starting compounds for the synthesis of 1,3-isopropylxanthate sulfophenol were obtained by the authors of this work according to the following schemes using a well-known method [1]:





The structure of the synthesized compound was proven by studying the elemental composition and using IR spectroscopy. Extreme pressure properties were studied on a four-ball friction machine (FFM-1). The evaluation of extreme pressure properties was carried out according to the load wear index (LW_I), according to the critical load (CL) and according to the welding load (WL). The studies were carried out in comparison with the structurally similar compound 5-methyl-2-phenylcarbonylmethyl ester of diisopropylxanthogenic acid [2] and the well-known extreme pressure additive ethylene bisisopropyl xanthate (Lz-23k) [3]. As follows from the results of the study, 1,3-bisisopropylxanthate sulfophenol surpasses known compounds in extreme pressure properties. As a result, it can be used as an extreme pressure additive for transmission oils.

Keywords: xanthates, extreme pressure properties, transmission oil.

PHYSIOLOGICAL STUDY OF ADRENAL CORTEX DRUG DEFICIENCY

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ABSTRACT
The role of the adrenal glands in your body is to release certain hormones directly into the bloodstream. Many of these hormones have to do with how the body responds to stress, and some are vital to existence. Both parts of the adrenal glands the adrenal cortex and the adrenal medulla perform distinct and separate functions. Cortisol is a glucocorticoid hormone produced by the zona fasciculata that plays several important roles in the body. It helps control the body's use of fats, proteins and carbohydrates; suppresses inflammation; regulates blood pressure; increases blood sugar; and can also decrease bone formation. This hormone also controls the sleep/wake cycle. It is released during times of stress to help your body get an energy boost and better handle an emergency situation. Adrenal glands produce hormones in response to signals from the pituitary gland in the brain, which reacts to signaling from the hypothalamus, also located in the brain. This is referred to as the hypothalamic pituitary adrenal axis. As an example, for the adrenal gland to produce cortisol, the following occurs: The hypothalamus produces corticotropin-releasing hormone (CRH) that stimulates the pituitary gland to secrete adrenocorticotropin hormone (ACTH). ACTH then stimulates the adrenal glands to make and release cortisol hormones into the blood. Normally, both the hypothalamus and the pituitary gland can sense whether the blood has the appropriate amount of cortisol circulating. If there is too much or too little cortisol, these glands respectively change the amount of CRH and ACTH that gets released. This is referred to as a negative feedback loop. Excess cortisol production can occur from nodules in the adrenal gland or excess production of ACTH from a tumor in the pituitary gland or other source.
Keywords: Adrenal gland, Shell layer, Medicinal failure

STRESS-INDUCED DISRUPTION OF THE ADRENAL GLANDS, ONE OF THE MOST IMPORTANT ORGANS FOR PREGNANCY

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ABSTRACT
The Hypothalamic-pituitary-adrenal (HPA) axis is comprised of the hypothalamus, pituitary gland, and adrenal glands. It regulates the body's adaptive response to stress. Stress is a huge factor as it can mess up every single hormone. In particular progesterone, one of the most important hormones for fertility and pregnancy, is not only produced by the corpus luteum of the ovary, but is also produced by the adrenal glands. This means that if you are under a lot of stress then your adrenal glands may have shut down your production of progesterone in favour of stress hormones such as cortisol and adrenaline. I really believe this was a huge factor in my fertility journey and is likely to be a major factor with a lot of women in this day and age. When we are under stress our body tends to shut down our reproductive hormones as getting pregnant is not essential for our survival. The stress response serves to prioritise survival over less essential physiological functions, inclusion growth, and reproduction.
Keywords: Pregnancy, Adrenal glands, Stress, Pathology

EXPLORING THE ECOLOGICAL AND MEDICAL BENEFITS OF DILL (ANETHUM GRAVEOLENS) AS AN ALTERNATIVE TO SPIRULINA (*arthrospira platensis*): A COMPARATIVE STUDY

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ABSTRACT
Dill (Anethum graveolens) is a plant species traditionally used for culinary and medicinal purposes. This study aims to explore the ecological and medicinal benefits of dill compared to Spirulina (Arthrospira platensis). By examining the ecological effects of dill in natural habitats, the plant's impact on habitat diversity and ecosystem health In addition, focusing on the medical potential of dill, its pharmacological effects such as antioxidant and anti-inflammatory properties were investigated. The possible benefits and therapeutic potential of these effects on human health were evaluated. Compared with Spirulina, the nutritional content and biological properties of dill were analyzed. The use of dill as a potential alternative for human health has been examined, with particular emphasis on its effects on digestive health and metabolic balance. This comprehensive comparative study makes an important contribution to understanding dill's potential for both ecological balance and human health. However, it should be noted that the medicinal use of dill needs further research and clinical studies. In conclusion, this study investigating the potential advantages of Anethum graveolens as an alternative source is an important step to promote and evaluate the versatile use of the plant. Dill presents numerous advantages over spirulina. Primarily, dill is widely accessible and can be easily grown in diverse climates, rendering it more sustainable and attainable for widespread utilization. Additionally, dill boasts abundant essential oils such as carvone and limonene, renowned for their antimicrobial attributes and supportive role in digestive wellness. Moreover, dill is a notable source of vitamin C, pivotal for immune function and collagen synthesis, an attribute absent in spirulina. Furthermore, dill's culinary adaptability facilitates its integration into an extensive array of dishes, enriching both taste and aroma, unlike spirulina, which may be limited in culinary applications due to its pronounced taste and scent. Lastly, dill holds a longstanding tradition as a medicinal herb in various cultures, offering potential therapeutic advantages that extend beyond its nutritional composition. In the comparison between dill and spirulina, it is seen that dill is economically more suitable. In addition, the ecological effects of dill have been determined to be more sustainable and less harmful to nature. Medically, dill's traditional uses and health benefits are similar to spirulina.

Keywords: Dill *(Anethum graveolens)*, spirulina *(Arthrospira platensis)*, ecological benefits, medical advantages

STUDY OF RESPIRATION INTENSITY AND REDUCING ACTIVITY IN DIFFERENT BARLEY AND WHEAT GENOTYPES UNDER SALT STRESS CONDITIONS

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ABSTRACT

Respiration intensity and reducing activity of different concentrations of NaCl, Na_2SO_4 salts (25-100 мМ) in "Garabagh-22", "Dayanatli" genotypes of barley *(Hordeum Vulgare)* and in "Layagatli", "Gobustan" genotypes of wheat *(Triticum durum L.)* have been studied using polarographic method and spectrophotometric method respectively.The amount of oxygen absorption by the roots of 7-day-old barley sprouts is found to be lower than that of wheat sprouts. Although the different plant seedlings germinated in water are differed in the amount of oxygen absorption, the kinetics were similar and were characterized by a single-phase curve. Oxygen absorption was also studied in plants germinated in different concentration salt solutions. It turned out that during the long-term exposure to salts, the weakening of oxygen absorption by roots occurs already at low concentrations (25 мМ), and oxygen absorption decreases more sharply in sulfate salinity than in chloride salinity.The studies revealed that the reducing activity in the roots of wheat sprouts was higher than that of barley sprouts, and with the increase in the salt concentration, the reduction activity decreased sharply. According to the reducing activity and the amount of oxygen absorption, plants can be arranged in the following order:

Gobustan > Layagatli > Dayanatli > Garabagh-22.An inverse correlative relationship was determined between salt resistance of plants and respiration intensity and reducing activity.If

to compare the effect of isocationic salts on respiration intensity and reducing activity, the negative effect of SO_4^{-2} ion was higher than that of Cl^-.It was found out that the stability of the studied plant genotypes is in the Garabagh-22 > Dayanatli > Layagatli > Gobustan sequence and Garabagh-22 and Dayanatli barley genotypes can be planted in weak saline soils.Based on the obtained result, the method of determination of the reducing activity of the root system can be recommended to be used as an express biological test to determine the sale tolerance of the plants.

Keywords: oxygen absorption amount, reducing activity, respiration intensity, salt resistance.

DESIGN OPTIMIZATION AND MECHANICAL CHARACTERIZATION OF ADDITIVELY MANUFACTURED LATTICE STRUCTURES

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ABSTRACT
Additive manufacturing (AM) has emerged as a transformative technology, allowing the creation of complex geometries with design freedom. In this study, we study the design optimization and mechanical characterization of lattice structures manufactured using fused deposition modeling (FDM). Lattice structures, known for their lightweight and high-strength properties, offer enormous potential for various engineering applications. This study investigates the impact of lattice unit cell selection, material choices, and topology optimization on the mechanical performance of a produced parts, with evaluation of the influence of varying lattice densities and geometries on the final mechanical properties, such as tensile strength, compressive strength, and stiffness. The methodology adopted includes the use of CAD tools for generating the lattice geometries, pursued by FDM technology using the equipment in laboratory. Material properties of the lattice structures are determined through mechanical testing and validated using simulations to ensure precision. The results obtained reveal important insights into the relationship between lattice design parameters and mechanical behavior. We observe that specific lattice unit cell configurations demonstrate superior mechanical properties compared to conventional solid structures. Additionally, the effects of FDM process parameters and material selection on the global performance of the lattice structures are discussed. This study contributes to the advancement of design for additive manufacturing, providing valuable guidelines for engineers and designers to leverage the full potential of lattice structures in diverse engineering applications.
Keywords: Additive Manufacturing, Fused Deposition Modeling (FDM), Lattice Structures, Design Optimization, Topology Optimization.

IMMUNE SYSTEM ACTIVATION IN THE PATH MORPHOLOGY OF SARS-COV

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ABSTRACT
Diagnostic determination of immune system biomarkers during COVID-19 is of great importance. The main task of the immune system is to protect the body from allergens, bacteria and virus attacks. At this time, the immune system kills the mutated cells and protects health.

The main manifestations of immune activation during COVID-19 are characterized by an increase in the concentration of neutrophils, IL-6 and C-reactive protein in the blood serum, and a decrease in the concentration of lymphocytes. Our goal is to share our achievements by studying the role of immune system biomarkers in Covid-19 infection. According to the extract epicrisis of the medical history we investigated, on 21.05.2020 (***MediClub Hospital,*** M/h No. pc-110457), during the computer tomographic examination of the patient who was admitted to the hospital with the diagnosis "Viral pneumonia of the lungs. Lung respiratory distress syndrome. 80% damage of lung parenchyma, "frosted glass" was found. Looking at the immunological laboratory indicators, it was found that lymphocyte-14%; CRP-461.99 mg/l; IL-6 was 539.0 pg/ml. Concentration of immune system biomarkers in 2 stages: Stage I - when entering the Intensive Care Department; Stage II, was studied on the 5th-7th days of the disease.C-reactive protein, an "acute phase" protein that increases to high concentrations and stimulates the body's immune responses, activates defence systems, has been studied in both phases. Although CRP was 461.99 mg/l in stage I, this indicator decreased sharply by 4.85 times ($p<0.01$) in stage II but remained 19.1 times higher than the norm. The main protective biomarker of the immune system is lymphocytes, some of which are involved in the synthesis of antibodies, others fight against infection, and some prevent its spread. The last moment enables the formation of an immune response. The concentration of lymphocytes was 11.2±0.5% in stage I, and in stage II this indicator increased 1.64 times ($p<0.01$) and reached the lower limit of the norm and is statistically honest. Assessment of cytokine production in COVID-19 disease, particularly interleukin-6 concentrations as a pro-inflammatory cytokine that enhances the immune response, has also been studied. In stage I, IL-6 was high, 4.28 times ($p<0.01$) more than the control group. In the II stage, this indicator decreased by 7.51 times ($p<0.001$) to the level of the control group, the normal range. In the II group, it was very high in the I stage, it was 12.95 times more than the control group, and 3.03 times more than the I group ($p<0.01$). Although it was 2.8 times more compared to the control group in the II stages, it decreased by 4.63 times ($p<0.05$) compared to the I stage, but it was 4.91 times more ($p<0.001$) compared to the I group and it is statistically honest.Even if a person's body overcomes the coronavirus disease, the body is still highly susceptible to various types of infections. This is associated with the weakening of the immune system in the human body. 83% of the patients diagnosed with coronavirus were found to have lymphopenia in the literature we researched. Assessment of cytokine production in COVID-19, particularly interleukin 6 as a pro-inflammatory cytokine that enhances the immune response, was studied, with IL-6 at 10 pg/ml as the norm. In stage I, IL-6 was high - 539 pg/ml, 54 times higher than normal. In stage II, Actemra 8 mg/kg was infused iv to patients and this indicator decreased by 4.63 times ($p<0.05$); however, it remained 12 times more than the norm ($p<0.001$) and is statistically honest.According to our results, it is appropriate to use high doses of immunoglobulins to limit the effect of antibodies, determining the severity of the disease based on the concentration of interleukin-6 in the blood of COVID-19 patients. Thus, Anakinra, which has an immunosuppressive activity that blocks interleukin-1 receptors, has a high effect during the use of IVIG drugs during Postcovid syndrome. IL-6 concentration decreased dynamically. Thus, when we compare our results with the research conducted by world scientists, it is known that IL-6 concentration of all immune system biomarkers increased dramatically during COVID-19 disease and lymphopenia was detected. Based on the concentration of these markers, certain considerations can be made about the severity of the disease, the principles of treatment, and the percentage of lethality.

Keywords: Covid-19, interleukin-6, lymphocytes, immune system biomarkers, IVIG, cytokines

THE PROBLEM OF COMPETITION FOR CLEAN AGRICULTURAL PRODUCTS AND SOLUTION FOR AN INTEGRATED VALUE-ADDED MODEL FOR CLEAN AGRICULTURE IN KHANH HOA, VIETNAM

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ABSTRACT
Agriculture, Forestry and Fisheries sector accounts for almost 12% of the Vietnamese economic structure in 2023 (General Statistics Office of Vietnam, 2023). The agricultural sector of Khanh Hoa in particular and Vietnam in general is facing several challenges due to the pollution of the production environment as well as serious deterioration of farmers' health due to the heavy use of chemical pesticides, herbicides and other toxicity in the farming process (World Bank, 2023). The number of clean, sustainable agro production farms is still very low. Surprisingly, despite the fact that organic produces have superior safety and quality, there is a heartbreaking reality: the prices of these clean agricultural products in Vietnam in general and Khanh Hoa in particular are still very cheap, compared to those made by counterparts in Thailand, China, etc. This has led to decreasing income and unstable livelihood of clean production farmers (Khanh Hoa Farmers' Association, 2023).Along with that worsening production situation, Vietnamese consumers' confidence has also seriously declined as agro produces are chemically grown everywhere, causing increasing health risks from alarming food safety issues (Vietnam's Ministry of Agriculture and Rural Development, 2023). This article analyzes the root causes of this whole scenario and proposes solutions by using a clean agriculture model that incorporates service agriculture thinking to create added value for Vietnamese agricultural products, and regain the trust from Vietnamese consumers, thereby promoting clean agro products nationwide and proceeding to exportation.
Keywords: clean agriculture, clean produce, service agriculture, sustainable development

PROPOSING A MODEL OF EXPERIENTIAL EDUCATION THROUGH SOCIAL IMPACT PROJECTS IN VIETNAM

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ABSTRACT
With the current educational context in Vietnam, there are few educational environments for students to practice and apply what they learn into real life. Therefore, a trend in recent years is that many university graduates are unemployed, while businesses are always having headaches finding quality labor. In addition, society's production and business activities are creating countless serious consequences for the environment, ecosystem and sustainable development of society. This article proposes an experiential education model through projects that create social impact at the local level to solve the above problems, contributing to creating a generation of graduates who actually do what they say, do it effectively and sustainably.
Keywords: experiential education, sustainable education, innovative teaching, learning by doing

INSIGHTS INTO THE CORROSION INHIBITION PERFORMANCE OF THREE NATURAL HETEROCYCLIC DIAZEPINES FOR CARBON STEEL EL IN 1M HCL MEDIUM

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ABSTRACT
Despite of its susceptibility to corrosion, carbon steel (CS) is widely used in industry and machinery. It has excellent mechanical properties as well as good physical and chemical characteristics. During the process of steel manufacturing, steel may get into contact with an aqueous solution of hydrochloric acid, causing it to corrode. One effective process for protecting steel from corrosion with hydrochloric acid is by using organic compounds as inhibitors. Large numbers of organic compounds were studied and are being studied to investigate here corrosion inhibition potential. Generally, the inhibitor which possesses many heteroatoms, such as O, S and N atoms, always exhibits better inhibition performance than those that possesses individual O, S or N atoms. But, most of them are highly toxic to human beings and has the potential to degrade the environment. The known hazardous effects of most synthetic organic inhibitors and restrictive environmental regulations have compelled and motivated researchers to focus on the need to develop cheap, non-toxic and environmentally benign natural products as corrosion inhibitors.Three new heterocyclic diazepines (CC–diCl, CC–Cl and CC–F) were synthesized for the first time from the natural product curcumin and evaluated as non-toxic corrosion inhibitors for carbon steel (CS) in 1 M HCl. Polarization curves showed that the three compounds behave as mixed-type inhibitors. EIS spectra exhibit one capacitive loop and confirm the inhibitive ability. A complete thermodynamic study was also performed on the diazepine with the highest efficiency CC–diCl to gain a better understanding of the inhibition process. The adsorption of the diazepines onto CS surface obeyed a Langmuir adsorption isotherm.
Keywords: Corrosion, Steel, Inhibitors, Diazepines, Langmuir.

EXPERIMENTAL EVALUATION OF 2-HYDROXY-1-(2-HYDROXY-4-SULFO-1-NAPHTHYLAZO)-3-NAPHTHOIC ACID AS A NOVEL CORROSION INHIBITOR FOR C38 STEEL IN HYDROCHLORIC MEDIUM

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ABSTRACT
The corrosion of steel is a fundamental academic and industrial concern that has been receiving a considerable amount of attention. The inorganic acids are widely used in many processes such as pickling, cleaning and descaling; therefore corrosion prevention has critical importance. The use of inhibitors is the most practical methods of protection against corrosion, especially in acidic solutions. Large numbers of organic compounds were studied and are being studied to investigate here corrosion inhibition potential. Generally, the inhibitor which possesses many heteroatoms, such as O, S and N atoms, always exhibits better inhibition performance than those that possesses individual O, S or N atoms. Consequently, the 2-hydroxy-1-(2-hydroxy-4-sulfo-1-naphthylazo)-3-naphthoic acid (HHSNNA) is an ordinary organic compound containing O, S and N atoms. In addition it possesses four aromatic rings and multiple bonds, which probably meet certain desirable characteristics of corrosion inhibitors.The corrosion inhibition properties of HHSNNA for C38 steel in HCl 1 M solution were analyzed by electrochemical impedance spectroscopy (EIS), potentiodynamic polarization. Polarization curves showed that the HHSNNA behave as mixed-type inhibitors. EIS spectra exhibit one capacitive loop and confirm the inhibitive ability. The effect of concentration for the inhibitor on the corrosion behavior of carbon steel in 1M HCl was also studied and a Langmuir adsorption isotherm was found. It was found that the presence of HHSNNA hugely decreases the corrosion rate, while its inhibition efficiency (E%) increases with concentration to attain 93.8 % at 10^{-3} M.
Keywords: Corrosion, Steel, Inhibitor, HHSNNA, Langmuir.

SUSTAINABLE URBAN DEVELOPMENT IN PAKISTANI CITIES: CHALLENGES, OPPORTUNITIES, AND POLICY IMPLICATIONS

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ABSTRACT
Urbanization is a global phenomenon with profound implications for sustainable development, particularly in rapidly urbanizing countries like Pakistan. This research explores the challenges, opportunities, and policy implications of sustainable urban development in Pakistani cities, focusing on key themes such as population growth, infrastructure development, socio-economic dynamics, and environmental sustainability.The findings reveal that Pakistani cities face significant challenges related to environmental degradation, inadequate infrastructure, and social inequalities, which hinder the progress of sustainable urban development initiatives. Rapid population growth and urban expansion strain existing infrastructure, leading to traffic congestion, air pollution, and inadequate access to basic services such as housing and utilities. Moreover, socio-economic disparities exacerbate social inequalities, limiting access to education, healthcare, and employment opportunities for marginalized communities.Despite these challenges, the research identifies several opportunities for promoting sustainable urban development in Pakistani cities. Policy interventions, such as integrated urban planning and renewable energy initiatives, can enhance the resilience and sustainability of urban infrastructure. Community engagement and participatory development approaches empower local communities and promote inclusive decision-making processes, ensuring that development initiatives are responsive to their needs and priorities.Drawing lessons from successful case studies in Pakistani cities and international best practices, the research provides valuable insights into effective strategies and approaches for sustainable urban development. It emphasizes the importance of adopting holistic, inclusive, and environmentally sustainable approaches to urban planning and development, prioritizing the well-being of urban residents and the long-term sustainability of Pakistani cities.In conclusion, this research contributes to the growing body of knowledge on sustainable urban development and provides practical recommendations for policymakers, urban planners, and stakeholders to promote sustainability in Pakistani cities. By addressing the challenges, leveraging opportunities, and integrating sustainability principles into practice, Pakistani cities can strive towards achieving resilient, inclusive, and sustainable urban futures for all residents.
Keywords: Sustainable urban development, Pakistani cities, challenges, opportunities, policy implications.

CATALYTIC CONVERSION OF MIXED-DENSITY PLASTICS INTO COMBUSTIBLE FUEL THROUGH MICROWAVE PYROLYSIS

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ABSTRACT
Plastic waste has emerged as a serious environmental problem, prompting the creation of novel technologies for its effective management and transformation into valuable resources. Using microwave pyrolysis, this work investigated the in situ catalytic conversion of mixed-density plastics into combustible fuel, providing a feasible method for valuing plastic waste and generating energy. Different mixed-density plastics werepyrolyzed with different catalysts, temperatures, and residence times to yield liquid fuel, syngas, and structured carbon residue.The effect of inputs on the product type, yield and compositions was statistically evaluated using ANOVA, which showed an F value of 4.108 and a p-value of 0.098 (>1.00). FTIR and GC-MS revealed that the oil product consisted of C_{13+} fractions in the form of alkanes, alkenes, and aromatics. The microscopic analysis of the residue confirmed the formation of carbon nanotubes along with other amorphous products. The presence of impurities in the solid product was further analyzed through XRD analysis. The pyrolytic liquid fuel revealed the presence of conjugated aromatic structure and carbonyl group in their concentration. In the gaseous product, hydrogen, carbon dioxide, carbon monoxide, and hydrocarbons up to C_4 such as methane, ethane, ethene, propane, propene, butane, and butene were the most common hydrocarbon gases observed. This research demonstrated that the conversion of mixed-density plastics using sodium zeolite, aluminum oxide, and nickel oxide catalysts yields 84% valuable products confirming wasted plastics as a lucrative energy feedstock for the production of hydrogen and high-value carbon compounds.
Keywords: GC-MS, ANOVA, XRD analysis

ELECTROMAGNETIC SURFACE WAVES BETWEEN TWO DISSIMILAR MEDIA FOR HIGH FREQUENCY APPLICATIONS

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ABSTRACT
Theoretically analysis has been accomplished for the propagating electromagnetic surface waves (EMSWs) at proposed planar interface of ferrite-graphene-ferrite waveguide structure. Different boundary conditions were utilized for the current problem to acknowledge the response of EMSWs. The properties of the materials are determined then used in the Comsol software for the simulation. The properties defined are relative permittivity, relative permeability, and the electrical conductivity. The characteristics curves are analyzed for the normalized phase constant $Re\left(\frac{\beta}{k_o}\right)$ and attenuation phase constant $Im\left(\frac{\beta}{k_o}\right)$ against the operating frequency in the terahertz region. The impact of chemical potential, relaxation time, number of graphene layers, and dielectric constant, applied magnetic field and saturation magnetization of ferrite medium were observed on the normalize phase and attenuation phase constant. In response to these parameters the structured waveguide exhibits the convenient propagation of electromagnetic surface waves with minimal propagation loss in the terahertz frequency region. The proposed waveguide avails the position in nanophotonic devices, terahertz filters, highly integrated terahertz devices and the communication systems.
Keywords: electromagnetic surface, the Comsol software, simulation

FACTORS AFFECTING WATER QUALITY- A PCA APPROACH

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ABSTRACT
Due to the fact that water is the most essential natural resource, the quality of water is a major issue for the human race. In contrast, the unplanned expansion of both rural and urban regions in rapidly developed countries such as India is having an adverse effect on the quality of the water. In this research, the Variables that contribute to water pollution of five different water Lakes Which are basically contaminated we are assessed and demonstrated. Principal component analysis (PCA) was used in order to conduct an analysis of the water quality data spanning the beginning in January 2013 and continuing through December 2014, this research was carried out on a monthly basis. Variations in the physicochemical properties of water in Chh. Sambhaji Nagar, both spatially and temporally for 19 parameters are considered for present study. Three of the most important factors affecting the hydro-chemistry of lake water identified by principal component analysis (PCA) which accounts for 99 % of the total variation. The water quality of the Lakes in (Chh. Sambhaji Nagar) has been found to be drastically reduced due to a multitude of human activities, the most prominent of which is agricultural waste runoff.
Keywords: Water quality, principal component analysis, waterassessment

SYNTHESIS AND CHARACTERIZATION OF SILICA-CHITOSAN DECORATED MAGNETIC NANOSTRUCTURE FOR WASTEWATER TREATMENT

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ABSTRACT
Magnetic nanoparticles (MNPs) possess extraordinary magnetic properties and serve as effective absorbents for heavy metals in wastewater treatment. Coating the surface of magnetic nanoparticles improves their adsorption efficiency, recyclability, and hydrophilicity. The proposed study will be focused different ferrite magnetic nanoparticles efficiently coated with silica chitosan for the elimination of heavy metals in the treatment of wastewater. Superparamagnetic cobalt ferrite, nickel ferrite, and cupper ferrite nanoparticles will be synthesized using a simple co-precipitation technique. The magnetic cores of $CoFe_2O_4$, $NiFe_2O_4$, and $CuFe_2O_4$ magnetic nanoparticles will be decorated with a silica shell through tetraethyl orthosilicate (TEOS) hydrolysis. Subsequently, the silica-coated ferrite magnetic nanoparticles will be further coated with chitosan. Atomic adsorption spectroscopy employed to determine the extent of metals removal from the water. The magnetic properties, structure analysis, identification of functional groups, and morphology of the prepared adsorbents analyzed before performing adsorption experiments. The kinetics and adsorption isotherms of the adsorbents examined using different chemical models.
Keywords: Magnetic nanoparticles, through tetraethyl orthosilicate

ANALYSIS OF GENERALIZED BESSEL-MAITLAND FUNCTION AND ITS PROPERTIES

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ABSTRACT
In this paper, we present the generalized Bessel-Maitland function (EGBMF) by using extended beta function and obtain some interesting properties of it. Then, we show interesting relationships of this function with Laguerre polynomials and Whittaker functions. Further, the Mellin transform of this function is evaluated in terms of generalized Wright hypergeometric function and Euler transform is also evaluated. Finally, we used the Gaussian quadrature and Laguerre-Gauss quadrature method to derive several graphical representations and it was shown that the numerical and theoretical simulations are consistent. Besides, the derived results are applied to find potentially useful in several fields notably physics, applied mathematics and engineering.
Keywords: generalized Bessel-Maitland function, extended beta function, fractional derivative, Mellin transform, Laguerre polynomials, Whittaker functions, Wright generalized hypergeometric functions

SYNTHESIS OF SILVER NANOPARTICLES BY CHEMICAL REDUCTION OF $AgNO_3$ WITH $NaBH_4$

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ABSTRACT
Nanoparticles are the center of attraction in field of science and technology from past few years. Nanoparticles show interestingly different properties from respective bulk materials. Silver nanoparticles (AgNPs) gain more attention due to their various physical and chemical properties. In this research work the chemical reduction method was followed for the synthesis of AgNPs. Silver nitrate (AgNO3) was used as metal precursor and sodium borohydrate (NaBH4) served as a reducing agent. The chemicals contributing in the reaction was taken in measured proportion. Suitable stabilizing agent was used to stabilize the growth process as well as to control agglomeration of AgNPs. The particle size and structure have be characterized by using different techniques such as X-ray diffraction (XRD), Scanning electron microscopy (SEM) and UV-Visible spectroscopy. It was found that size of AgNPs was range from 16.9nm to 19.5nm. in this study the effect of concentration and the method of preparation on size and of AgNPs was studied. XRD analysis shows that the size of particles is slightly effected by both concentration and preparation method. It was observed that the particle size increasing the consentration. UV-Visible spectrum show that the plasmon resonance at 460 to 520.
Keywords: Silver nanoparticles (AgNPs), Sodium borohydrate (NaBH4), Silver nitrate (AgNO3), XRD, SEM, UV-Visible.

IMMUNOTHERAPY FOR CANCER USING CHIMERIC ANTIGEN RECEPTORS (CARS)

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ABSTRACT
Chimeric antigen receptors (CARs) are designed receptors that target cancer cells by combining an immune cell with a novel specialization. These immune cells could be either natural killer (NK) cells or T lymphocytes. Chimeric antigen receptors (CARs) have proven to be an effective way to amplify and reroute the natural characteristics of both CD8+ and CD4+ T lymphocyte subsets, based on the efficacy of targeting CD19 in B cell malignancies. Dual-signalling CARs allow for the quick production of tumor-specific drugs for each individual cancer patient by reprogramming T cells' effector, metabolic, and survival capabilities in addition to redirecting and activating them. Cell-based therapy has undergone a significant change as a result of this strategy. Rather than relying on the discovery and growth of uncommon naturally occurring T cells with therapeutic potential, it now produces optimal T cell products through genetic engineering. An important part of the immune system, NK cells are essential for innate immunity. For CAR engineering, NK cells provide an alternative to T-cells. NK-cells have the potential to be a source of allogeneic "off-the-shelf" cellular therapy because they do not induce GVHD or other alloimmune or autoimmune toxicities. They can mediate significant anti-tumor effects without causing potentially fatal alloreactivity like GVHD. Researchers are currently investigating the use of CAR-engineered NK cells for the treatment of various haematological and non-haematological malignancies due to the several distinct benefits of NK cells. NK-cells, on the other hand, are only authorized for preclinical studies, in contrast to CAR-Tcells.
Keywords:
Chimeric antigen receptors (CARs), Cancer, Immunotherapy, Natural killer (NK) cells, T lymphocytes

SOCIAL FORESTRY: SOLUTIONS FOR RESOLVING TENURIAL CONFLICTS IN FOREST AREAS IN SOUTH SULAWESI, INDONESIA

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ABSTRACT
Forests as one of the determinants of the life support system and source of prosperity of the people, have recently experienced shrinkage and are very worrying as a result of deforestation, forestry conflicts, forestry corruption and so on that occur in South Sulawesi Province. Therefore, sustainable and sustainable forest management is needed, one of the efforts made by the government is through the Social Forestry Program. However, unfortunately, the existence of social forestry in South Sulawesi Province is currently not optimal and not in accordance with the target set by the government. This study aims to analyze obstacles in social forestry management so far in South Sulawesi Province and analyze the enforcement of sanctions against perpetrators of social forestry violations. The research method used is normative-empirical research with qualitative and quantitative approaches. The results showed that obstacles in social forestry management in South Sulawesi Province were the lack of budget provided, long and convoluted licensing and administration, errors in setting social forestry targets based on area, difficulty determining land locations, sometimes the land given to the community was very difficult to reach, commodities offered to the community were not economically valuable. Enforcement of sanctions has not been optimal due to the difficulty of obtaining evidence and collusion with law enforcement officials.
Keywords: social forestry, tenure conflict, forest area

HALAL BEHAVIOR IN MEDIA TECHNOLOGY SYSTEM

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ABSTRACT
The development of this modern era, which has entered society 5.0, makes it easier for humans to use technology easily. The growth of this technology can be profitable for various purposes that can be done quickly. However, there are negative impacts that will occur if humans use technology to be misused. One example of the negative impact that exists is the opening of someone's privacy that can be tracked only by using today's modern technology systems. Therefore, efforts must be made to prevent the technology system from being used for useful things only. With the development of technology, of course, human intelligence also increases, for this reason, digital literacy or ethics is needed in using anything related to public technology. Behavior and traits that are formed can be from environmental factors or oneself. Prioritize teaching from an early age about the correct and wise use of technology through formal education or learning moral ethics from the people around you.
Keywords : halal behavior, teknologi , and information

MAPPING THE EVOLUTION OF THE GIG ECONOMY: A COMPREHENSIVE REVIEW OF SCIENTIFIC LITERATURE AND TRENDS

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ABSTRACT
The gig economy has arisen as a dynamic and revolutionary force, changing the traditional employer-employee relationship and reshaping the entire environment of work itself, in an era marked by unparalleled technology innovation and shifting paradigms of work. Short-term contracts, freelance work, and the use of online platforms for labour exchange are all characteristics of the gig economy, which has grown in prominence over the past few years. The publication of Gig Economy has grown steadily, and the trends have been increasing consistently. As a result, the study focuses on examining the scientific literature on Gig Economy. The purpose of this study is to evaluate the evolution of the concept. It also aims at analysing which academics, countries, and journals are most interested in this area, the most relevant affiliations and collaborations, and which research has the greatest influence. Based on the "keywords" search results, the Scopus Database was used to compile literature on Gig Economy. This study included 710 papers that were relevant for the analysis from the Scopus Database. The findings revealed that research into Gig Economy has been strengthened during the last few years. This research draws upon findings and current information to give readers a glimpse into the future of Gig Economy research.
Keywords: Gig Economy; Bibliometric; VOS viewer; Scopus

THE LEVEL OF AWARENESS OF THE YOUNGER GENERATION IN AVOIDING USURY ON INTEREST IN USING SHARIA PRODUCTS IN KENDAL, INDONESIA

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ABSTRACT
ThisThe younger generation is the determinant of progress that will occur in the future... The understanding of the younger generations is very much tied to the surrounding environment in terms of academic, socio-cultural, economic, and even to the realm of regality. Islam is a religion that encompasses everything from the political, social and economic spheres. Especially in terms of Islamic economics, all activities are based on the Qur'an and Hadith. Where it is natural that the Islamic economy prohibits all transactions that are contrary to religious teachings, one of which is usury. This research aims to see how far the understanding and awareness of the younger generation about usury. The research method used in this research is descriptive qualitative method. The data collection techniques used are observation, interview and literature study of the younger generation in Kendal, Indonesia. The results of this study indicate that the younger generation in Kendal, Indonesia still has minimal knowledge and awareness to avoid usury. The percentage of the younger generation uses conventional banks more than Islamic banks.
Keywords: Young generation, Usury, Islamic banking, Islamic economics

FABRICATION OF METAL-ORGANIC FRAMEWORKS BASED SUPERCAPACITORS AND INVESTIGATION OF ITS FARADAIC AND NON-FARADAIC RESPONSE

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ABSTRACT
The advancement of energy storage technologies like batteries and supercapacitors have considerably aided mankind to fulfil a larger portion of their power needs. The prospering advancement of new energy automobile sector and innovative electrode materials with improved ion kinetics are essential for the effectiveness of hybrid supercapacitors**.** Metal-organic frameworks (MOFs) are one of the most talked materials due to their multiple structures, suitable functionalities, and similar metal centers resulting in broad applications, such as semiconductors, supercapacitors, catalysts, and energy storage devices. In this research, one pot synthesis method has been used to synthesized Ag-MOF, NiAg-MOF, and CoAg-MOF and further used in battery type electrode in hybrid supercapacitor. X-ray diffraction analysis confirmed the monoclinic structure with P21/c space group of Ag-MOF and also identification of small peaks of metallic nickel and cobalt. FTIR spectra also confirmed the presence of Ag-O, Ni-O and Co-O bonds in the prepared materials. TEM images depicted the agglomerated nanoclusters, non-spherical shape, and hexagonal shape morphology for Ag-MOF, NiAg-MOF, and CoAg-MOF respectively. Chemical state change and surface area analysis is confirmed through XPS and BET analysis. The cyclic voltammetry showed the highest specific capacitance of 1038 C g^{-1} at a 5 mV/s scan rate for CoAg-MOF. Galvanostatic charging-discharging results depicted higher energy density is 51.61 Wh Kg^{-1} and power density is 7741 W kg $^{-1}$for CoAg-MOF. These electrochemical measurements suggested that CoAg-MOF can be used for pseudocapacitor applications due to the higher discharging time and power density.
Keywords: Ag-MOF, Metal-organic frameworks

REGULATORY PATHWAY OF CLASS I MEDICAL DEVICE ELASTIC BANDAGE OF USA

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ABSTRACT
USFDA is a Regulatory body of medical devices in the globe. According to USFDA medical devices are regulated by centre for devices and radiological health (CDRH). Regulatory pathway of medical devices in USA is varies based on intended use. To identify the specific requirements and documentation needed for the approval of elastic bandages as Class I medical devices. To examine the role of regulatory bodies such as the FDA in ensuring the safety and efficacy of elastic bandages. To provide insights and recommendations for stakeholders navigating the regulatory pathway for elastic bandages. Medical devices in USA divided into three classes based on the risk to the patient. Class-1 medical classes are low risk devices. The example of class -1 medical device Elastic Bandage is having different regulatory pathway and approval process. To get FDA Approval of Elastic Bandage is does not require premarket notification 510(k) and PMA (Pre-Market Approval) due to low risk device class, the steps involved in approval from FDA for class-1 devices are device registration, listing, and fee payment, which are must be renewal for every year. Navigating the regulatory pathway for Class I medical devices, including elastic bandages, in the USA requires adherence to stringent standards and thorough documentation. Manufacturers must demonstrate compliance with regulatory requirements related to safety, performance, and labelling.
Keywords: USFDA, CDRH, Elastic Bandage, class-1 devices.

TESTING OF A CDS/G-C_3N_4/TIO_2 TERNARY PHOTOCATALYSTS FOR PHOTOCATALYTIC APPLICATIONS

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ABSTRACT
This study investigated ternary CdS/g-C_3N_4/TiO_2 heterojunction photocatalysts for the degradation of synthetic dyes and hydrogen production from aqueous media through visible-light-initiated photocatalytic reactions. Graphitic carbon nitride, titanium dioxide, and cadmium sulphide were combined in different mass ratios through a simple sol-gel method to create CdS/g-C_3N_4/TiO_2 composite photocatalysts. The prepared heterojunction catalysts were studied using XRD, FTIR, EDX, SEM, and UV-visible spectroscopy analysis for their crystal structures, functional groups, elemental composition, microtopography, and optical properties. The rhodamine B dye was then degraded using fully characterized photocatalysts. The maximum dye degradation efficiency of 99.4% was noted in these experiments. The evolution rate of hydrogen from the aqueous solution with CdS/g-C_3N_4/TiO_2 photocatalyst remained 2950 $molh^{-1}g^{-1}$, which is considerably higher than CdS, g-C_3N_4, CdS/g-C_3N_4 and g-C_3N_4/TiO_2 catalyzed reactions. This study also proposes a photocatalytic activity mechanism for the tested ternary CdS/g-C_3N_4/TiO_2 heterojunction photocatalyst.
Keywords: CdS/g-C_3N_4/TiO_2, ternary photocatalysts, synthetic dyes, hydrogen production, water splitting.

IMPACT OF THE DIGITAL TRANSFORMATION IN MEDICAL LABORATORIES

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ABSTRACT

Medical laboratories are transformed by digital revolution as the others sectors of science and business. This article shows the advantages, challenges, and opportunities presented by the digital revolution as they relate to medical laboratories. In laboratory medicine, artificial intelligence is being used to improve and optimize diagnostic processes, support clinical judgment, and boost accuracy and efficacy. Automated algorithms examine extensive datasets comprising patient information, test results, clinical outcomes, and result logs to pinpoint risk factors, forecast the progression of a disease, and inform personalized therapy choices. The aim of this study is to look at how medical laboratories are affected by the digital transformation. For this literature review we have searched databases including PubMed, Research Gate, Web of Science, Scopus, and Google Scholar. We collected data from digital transformation in medical laboratories. Automated algorithms examine extensive datasets comprising patient information, test results, clinical outcomes, and result logs to pinpoint risk factors, forecast the progression of a disease, and inform personalized therapy choices. The paper examines the effects of digital transformation on medical laboratories by an extensive analysis of the literature, case studies, and expert perspectives. Automation algorithms to improve the efficiency and accuracy of diagnosis analyze large datasets, such as patient information and test results. Digital systems must have compliance mechanisms in place since medical laboratories are subject to strict rules on the usage and storage of patient data. Digital platforms offer real-time analytics that facilitate ongoing quality improvement programs, stimulating creativity, and streamlining laboratory procedures. Medical laboratories have been profoundly impacted by the digital revolution, which has brought forth a number of benefits, difficulties, and opportunities. In laboratory medicine, artificial intelligence (AI) has become a potent instrument that can help with diagnosis procedures, support for clinical judgment, and general accuracy and efficacy. AI systems use large-scale datasets, including test results, clinical outcomes, and patient data, to identify risk factors, forecast the course of a disease, and guide individualized therapy choices. Furthermore, a large infrastructure investment and continual training for laboratory personnel are necessary due to the complexity of deploying and maintaining digital systems. The digital revolution has created opportunities for increased production and efficiency through the automation of repetitive operations, better patient outcomes through diagnosis that is more precise and individualized treatment regimens, and the possibility of cost reductions in the delivery of healthcare. The results indicate that the digital transformation has led to numerous benefits in medical laboratories, including improved efficiency, accuracy, and accessibility of diagnostic services. With the aid of extensive data sets that include clinical outcomes, patient records, and laboratory results, it is able to predict patient trajectories and provide tailored treatment plans. Ultimately, the study emphasizes the potential benefits of digital transformation, including improved teamwork, customized healthcare, and anticipatory diagnosis. While it offers unprecedented potential to revolutionize healthcare delivery and improve patient outcomes, careful consideration must be given to the integration

of digital solutions into existing workflows and infrastructure. By addressing the identified challenges and leveraging innovative strategies, medical laboratories can harness the full potential of the digital revolution to enhance diagnostic capabilities, optimize resource utilization, and ultimately, provide better care to patients.
Keywords: digital trasformation, medical laboratories, technology, data, diagnostic, patient, automation

CLIMATE CHANGE: A PATHWAY TO THE ECONOMIC PROSPERITY

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ABSTRACT
Climate change can be referred as long-term changes in temperature and weather. These fluctuations may be caused by significant volcanic eruptions or variations in the sun's activity. However, human activity has been the primary cause of climate change since the 1800s, mostly as a result of the combustion of fossil fuels like coal, oil, and gas. Most discussions about climate change focus on the dangers it poses to people and the planet, rather on the benefits it could bring to the economy. Proactive methods to mitigate and adapt to climate change, according to this study, can lead to economic development through encouraging innovation, producing new jobs, and opening up new markets. A fundamental component of this strategy is shifting to renewable energy sources like wind and solar power, which may significantly cut down on emissions of greenhouse gases while simultaneously fostering innovation and job growth in the rapidly expanding green economy. To further demonstrate the economic benefits of climate action, investments in green infrastructure and sustainable urban development improve energy efficiency, resilience, and quality of life. This, in turn, attracts more investment and reduces costs associated with climate-related disasters. Additional economic benefits arise from the optimization of resource usage and the generation of new business models brought about by the transition to a circular economy, which prioritizes waste reduction, recycling, and product lifespan. Importantly, this shift has the potential to bring about substantial societal advantages, such as better public health due to less air pollution, which can lead to lower healthcare expenses and higher productivity. The economic benefits from these programs can be more equitably distributed, helping disadvantaged populations, if climate policy takes an inclusive stance. In light of this, the ABSTRACT maintains that combating climate change is not just a moral but also a financial necessity for a more just and sustainable future.
Keywords: Climate Change, Economic Development, Social Advantages.

ROOM TEMPERATURE FERROMAGNETIC BEHAVIOR OF DILUTED MAGNETIC SEMICONDUCTOR FOR SPINTRONICS APPLICATIONS

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ABSTRACT
Thorough guidance on the control of magnetic states in diluted magnetic semiconductors (DMS) is presented, utilizing ab-initio electronic structure calculations with the Korringa-Kohn-Rostoker method and the generalized gradient approximation. To account for disorder effects, the coherent potential approximation was incorporated. The results unveiled the existence of a stable ferromagnetic half-metallic state within these compounds, emphasizing the promising application of DMS in spintronic contexts.
Keywords: KKR-CPA, Ferromagnetic, Anti-Ferromagnetic, Double exchange interaction, Half-metallic, Curie temperature.

FIRST PRINCIPLE STUDY OF OF HIGH-TC FERROMAGNETISM OF ZNTE FOR SPINTRONIC AND OPTO-ELECTRONIC APPLICATIONS

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ABSTRACT
This research employs ab initio calculations to investigate the magnetism and electronic structure of ZnTe-based diluted magnetic semiconductors (DMSs). A meticulous examination of the stability of the ferromagnetic state in ZnTe-based DMSs is conducted, accompanied by a proposed materials design strategy for achieving ferromagnetic DMSs. The investigation reveals that V- and Cr-doped systems exhibit half-metallic ferromagnetism, while Mn-doped systems display a spin-glass state. Furthermore, the inquiry into carrier-induced ferromagnetism in ZnTe-based DMSs establishes that their magnetic states can be manipulated by adjusting the carrier density. The analysis of the calculated density of states contributes to a discussion on the mechanism responsible for stabilizing the ferromagnetic state in DMSs. Notably, these findings align with the anticipated characteristics crucial for the advancement of spintronics.
Keywords: KKR-CPA, Ferromagnetic, Anti-Ferromagnetic, Double exchange interaction, Half-metallic, Curie temperature.

SPINTRONICS SYSTEM: SPIN POLARIZATION AND MAGNETIC CHARACTERIZATION

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ABSTRACT
We employ a first-principles approach to investigate the electronic structure and magnetic properties of dilute magnetic semiconductors (DMS) with multiple impurities. The Korringa-Kohn-Rostoker coherent potential approximation (KKR-CPA) method, coupled with the generalized gradient approximation (GGA), is employed to compute the electronic structure of DMS. Our analysis encompasses III-V and II-VI semiconductors, both doped and diluted with various magnetic ions. This study offers a comprehensive examination of the electronic structure of transition-metal-doped III-V and II-VI semiconductors, highlighting the intricate interplay between electronic structure and impurity-induced magnetic properties. Furthermore, we delve into the underlying mechanism of ferromagnetism in DMSs from an electronic structure perspective, aiming to establish a unified understanding that elucidates the chemical trends influencing magnetism in these materials. Estimations of critical temperatures for different DMS systems are provided and discussed using the mean field approximation. Consequently, by carefully controlling the doping process, we showcase the manipulation of the magnetic behavior of DMSs, resulting in the observation of ferromagnetism in these semiconductors. The challenges associated with achieving high-temperature ferromagnetic semiconductors are also addressed and elucidated.
Keywords: KKR-CPA, Ferromagnetic, Antiferromagnetic, Polarisation, Double exchange interaction, Half-metallic, Curie temperature.

APPLICATION OF UNCONVENTIONAL LIVESTOCK PRODUCTION AS AN ALTERNATIVE AND SUPPORT FOR RURAL AND SUSTAINABLE DEVELOPMENT

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ABSTRACT
It is well-known that agriculture plays a crucial role in feeding and clothing humanity, as well as providing raw materials for the agricultural industry, and it will continue to maintain its significance. However, the intensification of agriculture brings about problems such as environmental pollution, residues in products, and animal welfare issues. All these factors are the main reasons for turning to unconventional livestock production.As a good practice example, small family farms specializing in rabbit breeding emerge, showcasing fantastic reproductive capabilities, easy maintenance, and nutritionally valuable meat with a refined texture, crucial for the nourishment of convalescents.In line with the recommendations of the European Union, there is an opportunity for small agricultural enterprises to secure additional income by engaging in the breeding of rabbits or other animals within unconventional livestock production. This can contribute to the survival of mini farms, strengthen rural development, sustain smaller communities, and enhance environmental protection.
Keywords: unconventional livestock production, rabbits, sustainable development, mini farms, rural development**.**

REMOVAL OF TEXTILE DYES BY ADSORPTION ON ACTIVATED CARBON SYNTHESIZED FROM THE JUJUBE KERNELS

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ABSTRACT
Activated carbons are the oldest adsorbents used in the field of water treatment because of its high adsorption capacity of organic species. The objective of this study is the preparation of activated carbons from jujube kernels in order to remove textile dyes by adsorption in aqueous media. In the laboratory, chemical activation was carried out using phosphoric acid as an impregnating agent followed by a carbonization step. The choice of chemical activation makes it possible to achieve good quality coals with a very large specific surface area. To arrive at our results, several adsorption tests of two dyes (methylene blue and orange methyl) were carried out taking into consideration the influence of some operating parameters. The results showed that under appropriate conditions, the reduction rate is greater than 95% for each of the two dyes. The kinetics modelling follows the pseudo-second-order model and the Langmuir model correctly describes adsorption isotherms. The activated carbons obtained have interesting properties in terms of adsorption in the liquid phase that will allow a new valorization of jujube kernels.
Keywords: activated Carbone, adsorption, textile dyes, jujube kernels.

THE EFFECTIVENESS OF SCHOOL PLACEMENTS IN FACILITATING STUDENT TEACHER LEARNING AND PROFESSIONAL DEVELOPMENT.

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ABSTRACT
In a recent study (Ayeni, 2013), asserts that, placement refers to the process of connecting the selected person and the employer in order to establish an ongoing employment relationship. In this step the employee is given the activities he/she needs to perform and is told about his/her duties. Again, according to (Ayra, & Kosterelioglu, 2015), it is a period of supervised work, where you'll have the opportunity to experience working in a specific role with a company. Teachers do well in the right placement. School placements are an integral element in teacher education and commonly, both students and teachers consider placements a critical aspect of initial teacher education. Within this context, the contemporary nature of placements and their success in meeting professional development needs, was investigated. The findings of this research indicate that students and teachers share many views and consequently several key experiences and opportunities emerge. Different priorities are, however, also highlighted. Overall perceptions suggest that school placements must be orientated towards a social constructivist paradigm. Given that they are a significant component of initial teacher education, it is imperative that the purpose and benefit of placements is clearly understood and articulated and that the characteristics and elements of successful placements are known and considered. During the last fifty years, several paradigms for teacher education have been developed and promoted. These can be viewed independently of one another, but there are points of contact and overlap. In practice no one paradigm addresses all aspects of teacher education. Each involves the student engaging in practice on professional placement and emphasises different elements of learning to teach, resulting, thereby, in different placement experiences.
Keyword: School placement, Student- teacher learning, and Professional Development

CORPORATE INSOLVENCY AND RESTRUCTURING: LEGAL APPROACHES TO FINANCIAL DISTRESS

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ABSTRACT
Corporate insolvency and restructuring represent critical junctures in the life cycle of businesses, with profound implications for stakeholders ranging from creditors to employees and shareholders. This paper delves into the legal approaches to financial distress faced by corporations, aiming to provide a comprehensive understanding of the mechanisms and challenges inherent in insolvency proceedings and restructuring efforts. The aim of this study is to analyze the diverse legal frameworks and strategies utilized in addressing corporate financial distress. Through a combination of doctrinal legal research, comparative analysis of insolvency laws across jurisdictions, and examination of case studies, this research seeks to elucidate the intricacies of corporate insolvency and restructuring processes. Key findings from this study highlight the multifaceted nature of corporate financial distress and the complexities involved in navigating insolvency proceedings. The research identifies various legal mechanisms available to distressed companies, including bankruptcy, liquidation, debt restructuring, and formal insolvency proceedings. Furthermore, it explores the role of stakeholders such as creditors, shareholders, employees, and regulatory authorities in shaping the outcome of insolvency and restructuring efforts. The relevance of this study lies in its practical implications for policymakers, legal practitioners, corporate executives, and scholars grappling with issues of corporate financial distress. By providing insights into legal approaches to insolvency and restructuring, this research informs decision-making processes aimed at preserving value, protecting stakeholders' interests, and promoting economic stability. Moreover, it underscores the importance of robust legal frameworks that strike a balance between creditor rights and debtor rehabilitation, fostering an environment conducive to corporate resilience and growth.
Keywords: bankruptcy, liquidation, debt restructuring, formal insolvency proceedings, economic stability.

INVESTIGATION OF THE EFFECTS OF NI DOPING ON THE STRUCTURAL, MICROSTRUCTURAL, AND OPTICAL PROPERTIES OF TIN OXIDE FILMS USING PSP METHOD

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ABSTRACT
In this study, we used a pneumatic spray pyrolysis technique at 450°C to deposit Sn1–xNixO2 thin films ($0.0 \leq x \leq 0.10$) on glass substrates. The influence of doping content on the films structural and optical was investigated. Structural characterization by X-ray diffraction indicated that the rutile phase of SnO2 is present in all thin films, and crystallite sizes are estimated to be in the range of 27–47 nm. The optical bandgap energy increases from 3.83 to 4.01 eV as the dopant content increases according to the Burstein-Moss effect. Resistivity is affected by doping and the thickness of thin films.
Keywords: Thin films, X–ray diffraction, Optical properties.

CHEMICAL COMPOSITION, ANTIOXIDANT, AND ANTI-INFLAMMATORY ACTIVITIES OF AQUEOUS EXTRACT OF *PISTACIA LENTISCUS L.* FROM THE EASTERN REGION OF MOROCCO

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ABSTRACT
This study is part of the ongoing quest for novel therapeutic substances of natural origin. It focuses on the in-depth exploration of *Pistacia lentiscus L*, situated in the eastern region of Morocco, with the aim of enhancing our understanding of its medicinal properties. The investigative process involves a meticulous analysis of its chemical composition using UHPLC/LC-MS technology, along with a comprehensive assessment of its aqueous extract, shedding light on its overall antioxidant activity and anti-inflammatory properties. In the anti-inflammatory experiment, Wistar rats were divided into three groups (n=6) and subjected to Carrageenan-induced paw edema. The groups included a Carrageenan Group receiving distilled water, an Aqueous Extract treatment Group administered the extract (400 mg/kg bw), and an Indomethacin treatment Group receiving Indomethacin (20 mg/kg bw). Paw volumes were measured using a plethysmometer at 2, 4, and 6 hours post-carrageenan injection, with the untreated left hind paw serving as a control to calculate the percentage of paw edema. The results from the UHPLC/LC-MS analysis revealed the predominance of catechin gallate and epigallocatechin gallate in the aqueous extract of *Pistacia lentiscus L*, indicating a significant concentration of these compounds. Additionally, substantial levels of epigallocatechin, gallic acid, quercetin-3-O-glucoside, kaempferol-3-O-hexose dehydrohexose, isorhamnetin-7-O-pentose, and luteolin 7-O-glucoside were detected, expanding our understanding of the phytochemical richness of this plant. The evaluation of the total antioxidant capacity of the

aqueous extract of *Pistacia lentiscus L.* resulted in a significant measurement of 124.82 mg AA/g of extract, highlighting robust antioxidant activity. Furthermore, the results from the anti-inflammatory activity demonstrated a substantial reduction ($p < 0.05$) in inflammation at various time intervals following the administration of a dose of 400 mg/kg of the aqueous extract, comparable to the effect of indomethacin. These findings present promising prospects for the potential utilization of *Pistacia lentiscus L.* in the development of new natural therapies.
Keywords: *Pistacia lentiscus L*; anti-inflammatory; antioxidant; chemical composition.

RELIABLE SYSTEMS FOR PROTOTYPE FLY-BY-WIRE AUTOPILOT UAV BUILDING OVERVIEW

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ABSTRACT
Ensuring control safety and reliability in Fly-By-Wire Autopilot UAV/UAS systems necessitates meticulous attention to control units. The cornerstone of reliability lies in the design and implementation of both Active and Passive Control Systems. This study focuses on constructing a robust Control Subsystem for Remote Piloted Aerial Vehicle Systems (RPAVS), emphasizing the critical components and their interconnectivity. It encompasses a comprehensive array of elements, including Flight Management Computer (FMC), Automatic Flight Control System (AFCS/AFGS) consisting of Flight Control Computers (FCC), each serving distinct yet complementary functions. Key entry points in crafting an end-to-end RPAV Control Subsystem include System Overview, Flight Management System (FMS, complex computer system) design, delineating Functional & Non-functional requirements, considerations for Flight Software, and accommodating in situ adjustments. Navigation tasks, critical Guidance systems, software frameworks, and architectural blueprints (CAD or paper) form integral parts, alongside provisions for Backup systems and emergency deployment mechanisms like parachutes. Advanced Ground Control Systems powered by solar-charged battery stations enhance the operational autonomy. Detailed considerations span from circuit board intricacies to component selection, such as the trade-offs in choosing MCUs or MPUs with an OS for primary and Auxiliary Processing Units. Essential sensors, connectors, and power management components populate the FMC PCB stack, emphasizing space optimization (Fritzing/Gerbers) and redundancy. The vital Avionics System integrates FMS (FMC, Navigation by GNSS GPS/Galileo/Glonass and IRS data, AFCS/AFGS, EFIS Instrumentation), Communication, Surveillance, Power Distribution, Health Monitoring, and Mission-specific equipment, ensuring precise operation, safety, and adaptability in autonomous flight. This backbone, with its top-level requirements and critical components, provides a structural framework for seamless integration and high-altitude performance withstanding high-G forces, emphasizing inertial Guidance aided by GNSS, servo control, power supplies, telemetry, and Pyrotechnic systems for payload release and emergency. Navigation relies on a blend of sensors for precision: as well as GNSS, Inertial Navigation Systems (IMU, onboard accelerometers and gyroscopes), Barometric Altitude Sensors, LiDAR (Light Detection and Ranging), Magnetometers, Optical Flow Sensors, Radar Altimeters, RF Transponders, etc. Additionally, provisions for camera gimbal support and advanced camera analysis underscore the versatility and adaptability of the system. Through a unified approach to requirement compilation and iterative design processes, this study underscores the complexity and artistry inherent in hardware integration for autonomous aerial systems.
Keywords: Aerospace, Fly-By-Wire, Autopilot, UAV, RPAVS, Flight Management Systems, Flight Management Computer, Automatic Flight Control System, Flight Control Computers, Guidance systems, Avionics System, GNSS, Inertial Navigation Systems, LiDAR, Optical Flow Sensors, Radar Altimeters, RF Transponders.

YENİDEN İNŞA UYGULAMALARI: LONDRA, TALLINN VE GİRNE'NİN KARŞILAŞTIRMALI BİR ÇALIŞMASI

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ÖZET
Bu makale, iyileştirme için binaların ve sokakların yeniden inşasını, uluslararası deneyimler ve mimari yaklaşımlarla karşılaştırmalar yaparak ele alıyor. İngiltere'deki mevcut en iyi uygulamaları değerlendiriyor ve Estonyalı mimarların yaşlanan binalarla ilgilenirken kullandığı yerel yeniden yapılandırma ve renovasyon tekniklerini, malzemelerini, araçlarını ve topluluk katılım süreçlerini inceliyor. Değişen iklim koşulları ve renovasyon politikaları göz önüne alındığında, eski ve tarihi binaların yeniden yapılandırılması ve rehabilite edilmesine olan talebin artması muhtemeldir. Bu çalışmanın temel amacı, Girne'deki Alsancak bölgesinde, Girne'nin 9 kilometre batısında yer alan (Merkez Girne) bir vaka çalışması olarak yeniden yapılanma potansiyelini araştırmaktır. Bu alan, çeşitli inşaat dönemlerine ve tiplerine sahip 54 binadan oluşmaktadır. Makale, çoğunlukla teorik niteliktedir ve kentsel ortamlardaki yeniden yapılanma ihtiyaçlarının sonuçlarını anlamayı amaçlamaktadır. Yeniden yapılanma sürecinde sürdürülebilir ve akıllı malzemelerin kullanımının zorluklarını ve fırsatlarını tartışmaktadır. Bulgular, özellikle tarihi öneme sahip alanlarda yeniden yapılanmaya artan bir ilgi ve ihtiyaç olduğunu, ancak finansman, düzenleyici çerçeveler ve topluluk katılımıyla ilgili zorlukların da olduğunu göstermektedir. Çalışma, yeniden yapılanma sürecinde çevresel, kültürel ve ekonomik yönleri dikkate alan bütüncül bir yaklaşımın önemini vurgulayarak sonuçlanmaktadır. Sürdürülebilir kentsel gelişim için yeniden yapılanmada yenilikçi çözümler ve en iyi uygulamaları keşfetmek için daha fazla araştırma önerilmektedir.
Anahtar kelimeler: Yeniden yapılanma; Alsancak; Yeniden inşa; Sürdürülebilir malzemeler; Akıllı malzemeler; Binaların rehabilite edilmesi.

RECONSTRUCTION PRACTICES: A COMPARATIVE STUDY OF LONDON, TALLINN AND GIRNE

ABSTRACT
This article examines the concept of reconstructing buildings and streets for rehabilitation, drawing comparisons with international experiences and architectural approaches. It assesses current best practices in the UK and examines examples from Estonian architects dealing with aging buildings, using local restructuring and renovation techniques, materials, tools, and community participation processes. Given evolving climatic conditions and renovation policies, the demand for restructuring and rehabilitating old and historic buildings is likely to increase. The primary aim of this study is to explore the potential for reconstruction in Girne, focusing on the Alsancak area, situated 9 kilometers west of Girne (Central Kyrenia), as a case study. This area comprises 54 buildings of various construction periods and typologies. The article is predominantly theoretical in nature, seeking to understand the implications of reconstruction needs in urban settings. It discusses the challenges and opportunities of utilizing sustainable and smart materials in the reconstruction process. The findings suggest that while there is a growing interest and need for reconstruction, particularly in areas with historical significance, there are also challenges related to funding, regulatory frameworks, and community engagement. The study concludes by emphasizing the importance of a holistic approach that considers environmental, cultural, and economic aspects in the reconstruction process. Further research is recommended to explore innovative solutions and best practices in reconstruction for sustainable urban development.
Keywords: Reconstruction; Alsancak; Rebuilding; Sustainable materials; Smart materials; Rehabilitation of buildings.

TÜRKİYE'NİN AFRİKA BOYNUZUNDA ASKERİ VARLIĞINI GÜÇLENDİRMESİ: SOMALİ ÖRNEĞİ

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ÖZET
Türkiye, son yıllarda Afrika Boynuzu'ndaki askeri varlığını önemli ölçüde artırmış ve bu çerçevede Somali ile kurduğu stratejik ilişkiler öne çıkan bir örnek teşkil etmektedir. Türkiye'nin Somali'deki askeri angajmanı, insani yardım girişimlerinden stratejik eğitime ve kapasite geliştirmeye kadar geniş bir yelpazede faaliyet göstermektedir. Somali'nin karmaşık güvenlik ortamında, Türkiye, Somali ordusuna yönelik eğitim ve donanım sağlayarak bölgesel istikrara önemli bir katkıda bulunmaktadır. Türk Silahlı Kuvvetleri'nin Somali'deki varlığı, terörle mücadele, güvenlik koordinasyonu ve barış operasyonları gibi farklı alanlarda etkili bir rol oynamaktadır. Türkiye'nin Somali'ye yönelik askeri destekleri, bölgedeki terör tehditleriyle mücadelede ortak bir çabanın güçlendirilmesine katkı sağlamıştır. Ayrıca, Türk askeri birimlerinin Somali'de yürüttüğü eğitim programları, Somali ordusunun savunma kapasitesini artırmada önemli bir rol oynamaktadır. Bu askeri iş birlikleri, Türkiye'nin Afrika Boynuzu'nda stratejik bir partner olarak değerlendirilmesine ve bölgesel istikrara olan katkısına vurgu yapmaktadır. Türkiye'nin Somali deneyimi, sadece güvenlik sorunlarına çözüm odaklı bir strateji değil, aynı zamanda bölgesel iş birliğini ve dayanışmayı güçlendirmeye yönelik stratejik bir hamle olarak da ele alınmaktadır. Bu noktada, 2024 yılının şubat ayında Somali ile gerçekleştirilen askeri ve stratejik iş birliği anlaşması ile Türkiye'nin hem Somali'deki hem de Afrika Boynuzu'ndaki varlığı, kapsamını ve etkisini büyük oranda attırmıştır. Bu bağlamda bu çalışma, Türkiye'nin Afrika Boynuzu olarak adlandırılan önemli bir stratejik bölgedeki artan askeri varlığını Somali örneği üzerinden analiz ederek, Türkiye'nin bölgedeki askeri varlığının ne şekilde güçlendiğinin bir analizini ortaya koyacaktır.
Anahtar Kelimeler: Afrika Boynuzu, Askeri Varlık, Türkiye, Somali

TURKEY'S STRENGTHENING MILITARY PRESENCE IN THE HORN OF AFRICA: THE CASE OF SOMALIA

ABSTRACT
Turkey has significantly increased its military presence in the Horn of Africa in recent years, with its strategic relations with Somalia standing out as a prominent example. Turkey's military engagement in Somalia spans a wide range of activities, from humanitarian aid initiatives to strategic training and capacity-building efforts. In the complex security environment of Somalia, Turkey contributes significantly to regional stability by providing training and equipment to the Somali army. The presence of the Turkish Armed Forces in Somalia plays an effective role in various areas, including counterterrorism, security coordination, and peace operations. Turkey's military support to Somalia has contributed to strengthening a joint effort against terrorist threats in the region. Furthermore, the training programs conducted by Turkish military units in Somalia play a crucial role in enhancing the defense capabilities of the Somali army. These military collaborations underscore Turkey's role as a strategic partner in the Horn of Africa, emphasizing its contribution to regional stability. Turkey's experience in Somalia is not merely focused on addressing security issues; rather, it is regarded as a strategic move to enhance regional cooperation and solidarity. In this context, the military and strategic cooperation agreement with Somalia in February 2024 has significantly expanded Turkey's presence and impact in both Somalia and the Horn of Africa. This study aims to analyze Turkey's increasing military presence in the strategically important region known as the Horn of Africa, using the Somali example as a case study, and will shed light on how Turkey's military presence in the region has evolved.
Keywords: Horn of Africa, Military Presence, Turkey, Somalia

MÜZELER ŞEHRİ: BURSA

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ÖZET
Bursa; farklı medeniyetlerden izler taşıyan, Osmanlıya ilk başkentlik yapmış, "tarihî çarşı ve hanlar bölgesi", tarihi külliyeleri, camileri, mescitleri, türbeleri, farklı dönemlerde gerçekleşen göç hareketleri ile zenginleşen kültürel yapısı, doğal değerleri, tarımı, sanayisi, ticareti, turizmi ile öne çıkan, Türkiye'nin güzide şehirlerinden biridir. Bursa, aynı zamanda bu zenginliğin getirdiği birikimle oluşturulan müzeleri ve müze konusunda yapılan çalışmalarıyla dikkat çekmektedir. Müzeler; geçmiş ve gelecek arasında bir köprü görevi gören, bünyesinde somut ve/veya somut olmayan kültürel miras unsurlarını barındıran, toplumun her kesiminden insanların erişmesine ve çeşitli deneyimler yaşamasına fırsat tanıyan mekânlardır. Bu çalışmanın amacı, ayrıntılı bir literatür incelemesi yaparak Bursa'nın müzelerine ilişkin farklı ve nitelikli bir eser ortaya koymaktır. Bu kapsamda çalışmada sırasıyla müze kavramı açıklanmış, Bursa şehri konusunda bilgi verilmiş, ardından Bursa'nın müzeleri ele alınmıştır. Çalışmada son olarak Bursa'nın müzeleri ile ilgili değerlendirmelerde bulunularak çeşitli öneriler geliştirilmiştir.
Anahtar Kelimeler: Müze, Bursa, Bursa Müzeleri.

THE CITY OF MUSEUMS: BURSA

ABSTRACT
Bursa is one of the distinguished cities of Türkiye, bearing traces of different civilizations, having been the first capital of the Ottoman Empire, standing out with its "historical bazaar and inns region", historical complexes, mosques, masjids, tombs, cultural structure enriched by migration movements in different periods, natural values, agriculture, industry, trade and tourism. Bursa also draws attention with its museums created with the accumulation of this richness and the works carried out on museums. Museums are places that serve as a bridge between the past and the future, contain elements of tangible and/or intangible cultural heritage, and allow people from all segments of society to access and experience various experiences. The aim of this study is to present a different and qualified work on Bursa's museums by conducting a detailed literature review. In this context, the concept of museum has been explained, information about the city of Bursa has been given, and then Bursa's museums have been discussed. Finally, in the study, various suggestions have been developed by evaluating Bursa's museums.
Keywords: Museum, Bursa, Bursa Museums.

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ÖZET
Geçmişte askeri, dini, ticari ve sosyal amaçlarla kullanılan birçok ulaşım güzergâhı, bugün daha çok turistik amaçlarla kullanılan güzergâhlar haline gelmiştir. Ziyaretçilere bünyesinde taşıdıkları özgün kültürel ögeleri ile farklı turizm deneyimleri yaşamasına imkân tanıyan kültür rotalarının yerel, bölgesel, ulusal ve uluslararası boyutları söz konusudur. Türkiye, yüzyıllardır çeşitli medeniyetlere ev sahipliği yapmış olması ile zengin bir kültürel mirasa sahip ülkelerden biridir. Bu çalışmanın amacı, kültür rotalarına odaklanarak Türkiye'nin kültür rotalarına ilişkin farkındalık oluşturmak ve literatüre katkı sunmaktır. Bu kapsamda çalışmada sırasıyla kültür rotası kavramı, kültür rotalarının temel özellikleri ve Avrupa'daki kültür rotaları ele alınmış, ardından Türkiye'nin kültür rotaları ile ilgili kapsamlı bilgiler sunulmuştur. Çalışmanın son kısmında ise Türkiye'nin kültür rotaları ile ilgili değerlendirmeler yapılarak çeşitli öneriler geliştirilmiştir.
Anahtar Kelimeler: Türkiye, Kültür, Kültür Rotaları

CULTURE ROUTES OF TURKEY

ABSTRACT
Many transportation routes which were used for military, religious, commercial and social purposes in the past have become routes used mostly for touristic purposes today. Culture routes which allow visitors to experience different tourism experiences through their unique cultural elements, have local, regional, national and international dimensions. Turkey is one of the countries with a rich cultural heritage, having been home to various civilizations for centuries. The aim of this study is to create awareness about Turkey's culture routes by focusing on culture routes and to contribute to the literature. In the study in this context the concept of culture route, the basic characteristics of culture routes and culture routes in Europe have been discussed, and then comprehensive information about Turkey's culture routes have been presented respectively. In the last part of the study various suggestions have been developed by making evaluations about Turkey's culture routes.
Keywords: Turkey, Culture, Culture Routes

MUTFAKTA KÜLTÜREL YOLCULUK: ETİYOPYA MUTFAK KÜLTÜRÜ

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ÖZET
Bir bölgenin yemek kültürü içinde bulunduğu bölgenin coğrafi özellikleri, iklim koşulları, yetiştirilen tarım ürünleri ve farklı bölgelerin yemek kültürleri gibi faktörler tarafından şekillenmektedir. Tarihsel süreç içerisinde yaşanan göçler, diğer mutfaklarla iletişim ve etkileşim gibi nedenlerle yemek kültürleri değişikliklere uğramaktadır. Günümüzde dünyada yaşanan savaş, afet ve ekonomik nedenlere bağlı olarak yaşanan insan hareketlilikleri, insanları farklı kültürlerle ve yemek kültürleri ile tanıştırmıştır. Etiyopya mutfağı da zaman içerisinde çeşitli kültürel etkileşimler sonucunda, zengin bir ürün çeşitliliği kazanmıştır. Ancak, yerel lezzetlerin yeteri kadar tanıtılmaması sebebiyle, bu yöresel ürünler zamanla unutulabilmekte ve kaybolma riskiyle karşı karşıya kalmaktadır. Bu doğrultuda çalışmanın amacı; Etiyopya mutfak kültürü, yemekleri ve özel yemek pişirme yöntemleri, kullandıkları araç-gereçler, yiyecek-içecek ritüelleri, yiyecek-içeceklerinin servis şekilleri hakkında bilgi edinmek ve Etiyopya mutfak kültürünü detaylı bir şekilde yansıtmaktır. Nitel araştırma yöntemi benimsenen çalışmada yarı yapılandırılmış görüşme tekniği kullanılmıştır. Kartopu örnekleme yöntemiyle elde edilen veriler betimsel analiz yöntemiyle analiz edilmiştir. Araştırma sonucunda elde edilen en önemli bulgu; Etiyopya mutfak kültürünün yeteri kadar tanıtılmadığıdır. Bununla birlikte Avrupa ve Amerika'da tüketilen yemeklerin çoğunun kökeninin Etiyopya olduğu düşünülmektedir. Etiyopya mutfak kültürünün korunması için gelecek nesillere aktarımının doğru şekilde sağlanması gerektiği çalışmanın diğer sonuçları arasında yer almaktadır. Yapılan bu çalışmanın Etiyopya mutfak kültürünün tanıtılmasına katkıda bulunacağı düşünülmektedir.
Anahtar Kelimeler: Mutfak Kültürü, Doğu Afrika Mutfak Kültürü, Etiyopya Mutfağı

CULTURAL JOURNEY IN THE KITCHEN: ETHIOPIAN CULINARY CULTURE

ABSTRACT
The food culture of a region is shaped by factors such as the geographical characteristics of the region, climatic conditions, agricultural products grown and food cultures of different regions. Food cultures undergo changes due to reasons such as migrations, communication and interaction with other cuisines in the historical process. Today, human mobility due to wars, disasters and economic reasons in the world has introduced people to different cultures and food cultures. Ethiopian cuisine has also gained a rich variety of products as a result of various cultural interactions over time. However, due to insufficient promotion of local flavors, these local products may be forgotten over time and face the risk of being lost. In this direction, the aim of the study is to obtain information about Ethiopian culinary culture, food and special cooking methods, the tools and utensils they use, food and beverage rituals, and the way their food and beverages are served and to reflect the Ethiopian culinary culture in detail. The qualitative research method was adopted and semi-structured interview technique was used in the study. The data obtained by snowball sampling method were analyzed by descriptive analysis method. The most important finding obtained as a result of the research is that Ethiopian culinary culture is not sufficiently promoted. However, most of the dishes consumed in Europe and America are thought to originate from Ethiopia. Among the other results of the study is that in order to preserve the Ethiopian culinary culture, it should be transferred to future generations in the right way. It is thought that this study will contribute to the promotion of Ethiopian culinary culture.
Keywords: Culinary Culture, East African Culinary Culture, Ethiopian Cuisine

EFFECTS OF INTEREST RATE ON CREDIT ACCESSED BY MAIZE FARMERS IN KUJE AREA COUNCIL OF ABUJA, NIGERIA

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ABSTRACT
This study examined the effects of interest rate on credit accessed by maize farmers in Kuje Area Council of Abuja, Nigeria. Two-stage procedure was used to select 84 respondents into maize farming in the study area. Primary data were collected using structured questionnaire complemented with an interview schedule. Data collected were analyzed with descriptive statistics (frequency count, percentages and mean) and inferential statistics (Cobb-Douglas regression). Findings from the study showed that most (72.6%) of the respondents were male and the predominant age bracket was 31– 40 years with a mean of 39 years. This implies that the maize farmers were young which could influence their desire to access loan credit for farming. Also, most (71.4%) of the respondents were married with a mean household size of 8 people. The respondents were experienced farmers with a mean farming experience of 9 years, but has a mean farm size of about one hectare representing small farm holdings. Only few (28.6%) of the respondents had contact with extension agents, while most (65.5%) of them were member of cooperative society. In terms of access to credit, majority (96.4%) of the respondents had access to credit. Sources of credit and mean volume of credit accessed as indicated by the respondents was from microfinance banks (30.9%; ₦266,538) with an interest rate of 7.32%, family and friend (30.9%; ₦266,538) with an interest rate of 3.97% and money lenders (28.6%; ₦266,538) with an interest rate of 11.96% among others. The mean volume of credit obtained by the respondents was ₦298,095. Meanwhile, variables such as household size (0.1612; $p<0.10$), farm size (0.1785; $p<0.01$), farm income (0.4705; $p<0.01$), credit awareness (0.2164; $p<0.01$) and collateral provision (0.0474; $p<0.10$) had positive and significant effects on the volume of credit accessed by the respondents. The interest rate (-0.1196; $p<0.05$) had negative and significant effects on the volume of credit accessed by the respondents. This shows that as the interest rate increases, the volume of credit accessed will decreases. The study recommends that financial institutions especially Bank of Agriculture (BOA) should be adequately funded by the Government to provide credit loans to farmers at low interest rate in order to ensure greater production that will guarantee food security.
Keywords: Effects, Interest rate, Credit Accesses, Maize farmers

HERBAL ELEGANCE: UNVEILING THE POTENTIAL OF NATURAL INGREDIENTS IN ANTI-DANDRUFF HAIR

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ABSTRACT
Dandruff, a common scalp condition affecting individuals globally, necessitates effective and natural solutions for its mitigation. This study delves into the formulation and evaluation of an anti-dandruff herbal hair mask, exploring the potential of various natural ingredients in combating this persistent concern. The research focuses on the elegance of herbal remedies, aiming to unravel the intricate relationship between botanical elements and their efficacy in promoting scalp health. The methodology involves a meticulous selection of herbal constituents renowned for their anti-dandruff properties. Ingredients such as neem, tea tree oil, aloe vera, and rosemary are meticulously combined to create a harmonious blend. The formulation process considers not only their benefits but also their synergistic effects, aiming for a comprehensive solution that addresses the multifaceted nature of dandruff. Evaluation of the herbal hair mask involves both qualitative and quantitative assessments. Clinical trials on a diverse group of participants gauge the product's effectiveness in reducing dandruff and improving overall scalp condition. Additionally, laboratory analyses delve into the biochemical aspects, shedding light on the mechanisms through which these herbal ingredients interact with the scalp environment.
Keywords: Herbal hair mask, anti-dandruff, natural ingredients, scalp health, botanical remedies, neem, tea tree oil, aloe vera, rosemary, holistic hair care, clinical trials, synergistic effects, biochemical analysis.

KALSİYUM BİYOYARARLANIMINDA PROBİYOTİK VE PREBİYOTİKLERİN ROLÜ

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ÖZET
Kalsiyum, insan vücudunda en çok bulunan mineral olup Plazma kalsiyum homeostazı, iskeletin sürdürülmesi, hormonal sekresyonun düzenlenmesi, sinir impulslarının iletilmesi ve vasküler faaliyetler gibi insan yaşamının sürdürülmesinde hayati bir rol oynar. Prebiyotiklerin kalsiyum emilimine etkisi ise alt bağırsağa ulaşan birkaç tür prebiyotik bitki lifi, kısa zincirli yağ asitlerinin üretimi yoluyla bağırsak mikrobiyomunun değişmesine neden olur. Ortaya çıkan düşük pH ortamının, kalsiyum fosfat oluşumu gibi minerallerin kompleksleşmesini azalttır ve böylece, kemik birikimini veya tutulmasını desteklemek için daha fazla kalsiyum emilecektir. Çalışmalara göre probiyotiklerin kemik koruyucu etkisi barsak geçirgenliğini azaltır, kısa zincirli yağ asitlerini arttırır, barsaktaki inflamasyonu azaltır, kemikteki proinflamatuar sitokinlerin seviyesini düşürür ve osteoklastik kemik rezorpsiyonunu azaltır. Bağırsak mikrobiyotasının kemik sağlığını önemli ölçüde etkiler bağırsak mikrobiyotasi Ca emilimini artırabilir ve kemik hücreleriyle etkileşime girdiğine ve kemik metabolizmasını düzenlediğine bağırsak serotonin üretimini module edebilir.Bağırsak mikrobiyomu, konak genetiği, diyet, yaş, coğrafya, konakçı bağışıklık durumu, seyahet bazı ilaçların kullanımı gibi birçok faktörden etkilenen yaşamın ilk aşamasından itibaren insan vücudu ile etkileşime girer.Lif fermantasyonundan SCFA üretimini arttırdığı bilinen cinslerde bağırsak mikrobiyomunda prebiyotik beslemenin neden olduğu değişiklikler, artan fraksiyonel kalsiyum emilimi (insan ve hayvan modelleri) ve kemik yoğunluğu ve gücü (hayvan modelleri) ile önemli ölçüde ilişkilidir osteoporoz riskini potansiyel olarak azaltmak için anlamlı olduğu kar kabul edilen diyet stratejileridir. Probiyotiklerin mineral emilimi üzerindeki olumlu etkisi, bağırsak mikrobiyomunun bileşimi ve metabolizması ile ilgili olarak umut vericidir. Tahılların fermantasyonu ve mahsullerin ıslatılması ve çimlenmesi, hem insan bağırsağı mikrobiyomunu hem de genel sağlığı sürdürebilen uygun doğal mineral takviyeleri sağlama potansiyeline sahiptir. Fermente gıdalar ve içecekler, çözünür ve biyoyararlı mikro besinlerin seviyelerini artırmada yardımcı olabilir ve "besin takviyesi" görevi görebilir.
Anahtar Kelimeler: probiyotik , prebiyotik, kalsiyum biyoyararlanimi

THE ROLE OF PROBIOTIC AND PREBIOTICS IN CALCIUM BIOAVAILABILITY

ABSTRACT
Calcium is the most abundant mineral in the human body and plays a vital role in maintaining human life in such areas as plasma calcium homeostasis, maintenance of the skeleton, regulation of hormonal secretion, transmission of nerve impulses, and vascular activities. The effect of prebiotics on calcium absorption is that several types of prebiotic plant fibers reaching the lower intestine cause changes in the intestinal microbiome through the production of short-chain fatty acids. The resulting low pH environment reduces the complexation of minerals, such as calcium phosphate formation, and thus more calcium will be absorbed to promote bone deposition or retention. According to studies, the bone-protective effect of probiotics reduces intestinal permeability, increases short-chain fatty acids, reduces inflammation in the intestine, reduces the level of pro-inflammatory cytokines in the bone, and reduces osteoclastic bone resorption. The intestinal microbiota significantly affects bone health. The intestinal microbiota can increase Ca absorption and modulate intestinal serotonin production, where it interacts with bone cells and regulates bone metabolism. The intestinal microbiome is affected by many factors, such as host genetics, diet, age, geography, host immune status, travel, and the use of certain medications. interacts with the human body from the first stage of life. Changes caused by prebiotic feeding in the gut microbiome in genera known to increase SCFA production from fiber fermentation are significantly associated with increased fractional calcium absorption (human and animal models) and bone density and strength (animal models) in osteoporosis. Dietary strategies that are considered meaningful can potentially reduce the risk of The positive effect of probiotics on mineral absorption is promising regarding the composition and metabolism of the gut microbiome. Fermentation of grains and soaking and germination of crops have the potential to provide suitable natural mineral supplements that can sustain both the human gut microbiome and overall health. Fermented foods and beverages can help increase levels of soluble and bioavailable micronutrients and act as a “nutritional supplement.”
Keywords: probiotics, prebiotics, calcium bioavailability

KALILA AND DIMNA" AS A SOURCE OF MORAL-DIDACTIC MOTIVES

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ABSTRACT
Present research studies the idea-thematic features of the immortal monument of Eastern literature "Kalila and Dimna" and its didactic-educational motives, which were analyzed in the context of moral values. "Kalila and Dimna", also called "Karataka, Damanaka" in Sanskrit, which is considered as one of the ultimate examples of the semi-didactic-semi-fictional "genre of literature" containing a complex set of humanitarian knowledge of its time, is a written form of stories and narratives that was orally passed down in India from generation to generation. The origin of "Kalila and Dimna" is closely related to "Panchatantra" (five wisdoms, five laws) originating from Indian folklore. However, as it is seen from the name of Panchatantra, there are only five chapters, while "Kalila and Dimna" was extended to 17-18 chapters as a result of the additions by various translators. Compiled by "the head of the Brahmins", the philosopher Beydaba for the Indian king Dabshalim this work is an invaluable source in terms of reflecting the historical reality, literary norms, and artistic-aesthetic principles of the period in which it was created, in addition to its deep meaning, content, spiritual and humanistic ideas that it preached. The main characters of the work are symbolically two jackals - Kalila, who serves good, and Dimna, who represents evil. The praise of such human qualities as friendship, faithfulness, loyalty, justice, courage and truthfulness, and the exposure of negative aspects such as betrayal, lies, malice constitute the main theme of the work. This work, rich in moral and didactic motives, is read with great interest, "where fun, humor, seriousness, wisdom and philosophy are combined, a vast space for the philosopher, a training ground for the mind, an unforgettable memory for lovers of words, a beautiful book for those who understand the meaning of these all, is a treasure of lessons". Motifs and plots of "Kalila and Dimna" widely spread in the Muslim East, went through a complex evolutionary path and penetrated the European and world literature. Nowadays it is hard to find a fable, an allegorical story where the parallels with this work are not observed in one form or another.
Keywords: "Kalila and Dimna", "Panchatantra", ancient Indian legend, literary genre.

FULL TEXT

SÜRDÜRÜLEBİLİR TARIMDA ORGANİK MADDE VE SOLUCANLARIN TOPRAK SAĞLIĞI İLE İLİŞKİSİ

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Özet
Dünyamızı hızla kirletmemiz nedeniyle meydana gelen atıklar için yeni tavsiyeler ve projelerin ihtiyaç olduğu artık herkes tarafından bilinmektedir. Bu projelerden biri de toprak ve bitki kalite ve randımanının arttırılmasına yönelik solucan dışkılarının yani solucan gübrelerinin kullanılmasıdır. Solucan gübresi; özel diye tabir ettiğimiz solucanların toprakta bulunan veya toprağa sonradan katılan organik maddelerin bitkilere faydalı olabilecek formlara değişimini sağlama işlemi neticesinde oluşan ürünlerdir. Solucanlar; toprak strüktürünü, randımanını ve ürün verimini ciddi şekilde pozitif yönde olacak şekilde tesir edebilmektedirler. Bir başka deyişle söyleyebiliriz ki, vermikompost bitki köklerinin gelişim sağlamasını destekler, kök hastalıklarını önemli bir şekilde sayıca düşürdükleri, çayır ve tarla bitkilerinin randımanını ve bilhassa tahıl kalitesini (örn. protein içeriği) artırdıkları hem laboratuvarda hem de arazide ispatlanmıştır. Sürdürülebilir tarım uygulamaları bilindiği üzere topraklardaki organik maddenin varlığı, kullanımı ve stabilitesi ile doğru orantılı bir şekilde gelişmektedir. Bu sebepten dolayıdır ki toprağın randımanını yükseltmek adına toprağa çeşitli organik gübrelerin ilavesinin sağlanması gerekmektedir. Ancak gübreleme programları genellikle kimyasal gübreler ile yapılmakta ve organik gübreler neredeyse hiç kaile alınmamaktadır. Netice itibariyle, gittikçe çorak hale gelen topraklar geri dönülmez bir kısır döngünün içerisinde canlılıklarını devam ettirmeye çalışmaktadırlar. Öyle ki; Türkiye'de 2022 yılında kullanılan kimyasal gübre miktarı hektar başına 561 kg olarak hesaplanması ve organik gübre ile kıyaslandığında miktar olarak oldukça üst seviyelerde olması, bahsi geçen durumun ne kadar ciddi olduğunu göstermektedir. Bu hususta dikkat edilmeyen bir başka husus ise rakamsal anlamda yüksek olan kimyasal gübrelerin çevre kirliliğine sebep olması ve yüksek azot miktarları nedeniyle yeraltı sularının kirlenmeye başlamasıdır. Buradaki önemli husus, solucanların organik atıkların geri dönüşümü ile ilgili olarak atık yönetiminde yer aldığının bilinmesidir. Tarımsal alanlarda organik madde miktarının yeterli gelmemesi sebebiyle tüketilen kimyasal gübreler toplumun ihtiyacını karşılamakta zorlanmakta dolayısıyla bu gübrelerin bilinçsizce ve hunharca büyük miktarlarda kullanımı yapılan faaliyetin ekonomik olma durumundan çıkmaktadır. Bu bağlamda; organik gübre programlarının düzenlenmesi ihtiyacı doğacağı için söz konusu kimyasalların topraktaki sarfiyat rakamlarını azaltacak ve bitkilerin gübrelerden faydalanma düzeyini yükselterek ekonomik gübreleme yapılmış olacaktır. Hem bitki ile toprak sağlığı hem de halk sağlığı açısından değerlendirildiğinde organik gübreleme çalışmalarının akılcı olduğu sonucuna varılmaktadır.
Anahtar Kelimeler: Toprak Sağlığı, Organik Madde, Solucan Gübresi, Kimyasal Gübre

ORGANIC MATTER IN SUSTAINABLE AGRICULTURE AND THE RELATIONSHIP BETWEEN EARTHWORMS AND SOIL HEALTH

Abstract
It is now well known that new recommendations and projects are needed for the waste generated by the rapid pollution of our world. One of these projects is the use of vermicomposts, i.e., vermicomposts, to increase soil and plant quality and efficiency. Vermicomposts are the products that are formed as a result of the process of transforming the organic substances in the soil or added to the soil into forms that can be beneficial to plants. Earthworms are able to affect the soil structure, yield and crop yield in a seriously positive way. In other words, vermicompost promotes the growth of plant roots, significantly reduces the number of root diseases, improves the yields of meadow and field crops and especially the quality of cereals (e.g. protein content), which has been proven both in the laboratory and in the field. Sustainable agricultural practices are known to be directly proportional to the presence, utilization and stability of organic matter in soils. For this reason, it is necessary to ensure the addition of various organic fertilizers to the soil in order to increase soil fertility. However, fertilization programs are usually carried out with chemical fertilizers and organic fertilizers are almost ignored. As a result, increasingly barren soils continue their vitality in an irreversible vicious circle. In fact, the fact that the number of chemical fertilizers used in Turkey in 2022 is calculated as 561 kg per hectare and is quite high compared to organic fertilizers shows how serious the situation is. Another issue that is not taken into consideration in this regard is that chemical fertilizers, which are high in terms of numbers, cause environmental pollution and groundwater starts to be polluted due to high nitrogen amounts. The important point here is to know that earthworms are involved in waste management regarding the recycling of organic wastes. Chemical fertilizers consumed due to the insufficient amount of organic matter in agricultural areas have difficulty in meeting the needs of the society, so the unconscious and brutal use of these fertilizers in large quantities makes the activity uneconomical. In this context; since the need to organize organic fertilizer programs will arise, it will reduce the consumption figures of these chemicals in the soil and economic fertilization will be made by increasing the level of utilization of fertilizers by plants. When evaluated in terms of both plant and soil health and public health, it is concluded that organic fertilization studies are rational.
Keywords: Soil Health, Organic Matter, Vermicompost, Chemical Fertilizer.

1.Giriş

Yaşadığımız dünyayı hızla kirletiyoruz. Atıklar için yeni öneri ve projelerin gerekliliği tartışılmaz biçimde açığa çıkmıştır. Pazar atıklarını ve evlerimizde meydana gelen meyve-sebze atıkları gibi organik kökenli atıkları artık çöpe atmak yerine vermikompost teknolojisi ile dönüştürmek mümkündür. Solucan gübresini basit bir dille ifade etmek gerekirse, kırmızı Kaliforniya Solucanlarının bitkisel ve hayvansal atıklarını işlemesi sonucu meydana gelen solucan dışkısıdır. Solucan gübresi; mikro florlar ve özel solucanların organik maddeleri hümik maddelere dönüştürme işlemi sonucunda meydana gelen bir üründür. Görünüş olarak siyah toprağa benzer ve itici bir kokusu yoktur. Kırmızı solucanlar namı değer Eisenia fetida gübre üretimi için en iyi solucanlardır. Sıradan toprak solucanlarına göre iç içe ve kalabalık bir nüfus yoğunluğunda yaşamayı sevmektedirler ve ayrıca da saklanmazlar. Doğada hemen hemen her toprağın derinliklerine yönelmiş bir kırmızı solucan bulamazsınız (Anonim, 2014).

Sürdürülebilir tarım uygulamaları büyük ölçüde topraklardaki organik madde dengesine bağlıdır (Dostal, 2002). Son zamanlarda, yüksek kaliteli tarım ürünleri elde etmek ve çevreyi tarımsal uygulamalardan korumak amacıyla organik tarımsal atıkların bitkisel üretimde kullanılmasına ilgi artmaktadır (Vavoulidou ve ark., 2004). Bitki büyümesi, çevresel filtreleme, su düzenleme ve depolama gibi çeşitli işlevlerdeki toprakların performansı, bunların kalitesinin göstergesidir (Larson ve Pierce, 1991). Tarımda toprağın kalitesi ve verimliliği önemli faktörlerdir. Başarılı bir ürün yetiştirme sisteminin zorluklarını hafifletmek için yeterli toprak organik maddesine sahip olmak önemlidir; bu nedenle toprağın verimliliğini artırmak için çeşitli organik gübreler tavsiye edilmektedir (Petkova, 2002). Türkiye'nin gayri safi üretiminin büyük bir kısmı tarımsal faaliyetlerden kaynaklanmaktadır. Bilindiği üzere; tarım sektöründe buğday, arpa, tütün ve pamuk ürünleri üretimi önemli miktarda tarımsal atık oluşmasına neden olmaktadır. Normalde bu atıklar ya yakılmakta ya da çürümeye bırakılmaktadır. Atıkların çevre üzerinde önemli bir etkisi vardır ve her iki durumda da söz konusu atıklar kullanılabilir kaynakların yok olmasına neden olmaktadır (Başçetinçelik ve ark., 2005).

Mineral gübre ve böcek ilacı gibi kimyasal maddelerin kullanılmadığı tarım ve organik maddelerin kullanımını içeren organik üretim, "organik tarımın" temel ilkesidir. Yeşil gübre kullanımı, organik tarımda bitki besin gereksinimlerini karşılamak için organik gübrelerin uygulanmasıyla birlikte şiddetle tavsiye edilen bir yöntemdir. Organik gübreler ve yeşil gübreleme topraktaki biyolojik aktiviteyi artıran uygulamalardır (Çengel ve ark., 2009).

İnsan ihtiyaçlarının karşılanmasında ön sıralarda yer alan tarıma dayalı gıda sanayi, son yıllarda yaşanan ekonomik krizlerden, toprağın analiz edilmeden kaynaklanan yanlış gübre

uygulanmasından ve dolayısıyla bu gübre uygulamasının sebep olduğu toprağın tuzlanması ve asitlenmesi gibi tarımsal faaliyetlerden ve kısmen de olsa artık tüm gerçekliyle kabul edilen iklim değişikliğinin olumsuz etkilerini fark ettirmektedir. Tüm bu hatalar nedeniyle tarımsal arazilerimizin verimliliği maalesef gittikçe azalmaktadır (Bellitürk, 2010).

Tarımsal alanlarımızdaki toprakların organik madde bakımından fakir olduğu herkes tarafından bilinmektedir. Ancak potasyum açısından yeterli, fosfor açısından ise kısmen yeterli olan toprağın nadasa bırakılmamasından ve işlenen ürün tarafından kaldırılması nedeniyle üretim yapılan toprakta zamanla fosfor, potasyum ve organik madde bakımından fakirleşme durumunun yaşanabileceği göz önünde bulundurulmalıdır. Ülkemizde birçok tarım ürününde üretimden tüketime kadar çeşitli sıkıntılar ile karşılaşılmaktadır. Gübreleme programlarının seçiminde sadece çiftçilerinin gözlemlerinin değerlendirilmesi dolayısıyla gübreleme faaliyetlerinin toprak ve yaprak analizine göre yapılmaması da bu sorunlardan biri sayılmaktadır. Özellikle gübre girdilerinin maliyeti dengeli gübreleme programının uygulanması ile kısmen de azaltılabileceği bilinmelidir. Bunu yapmanın tek yolu vardır; o da ekim yapılması planlanan tarım alanının çiftçi tarafından çok iyi tanınmasıdır. Tanınma işlemi, toprağın kimlik kartını çıkartmak gibidir. İçerisinde ne var ne yok bilinmesidir (Bellitürk, 2009).

Türkiye İstatistik Kurumu'nun düzenli olarak yaptığı veri toplama çalışmalarında, 2022 yılı için Türkiye çapında toplam tarım alanı, 238.639.481 dekar olup bunun 165.096.258 dekarı ekilen alan olarak bildirilmiştir. Yine aynı şekilde, toplam tarım alanı 38.482 bin hektar olarak söz konusu kurum tarafından hesaplanmış olup 20.194 bin hektar alan ise toplam işlenen tarım alanı sınıfına girmektedir. Tekirdağ bazında değerlendirildiğinde; işlenen tarım alanı ise 4.153.674 dekar olarak kayıtlara geçmiştir. 2022 yılında çiftçiler tarafından kullanılan kimyasal gübre miktarı toplamda 11.332.709 ton, bunun azotlu olanı, 7.520.871 ton, fosforlu olanı, 3.550.343 ton ve potaslı olanı ise 261.495 ton olarak bulunmuştur. Dolayısıyla; Türkiye'nin 2022 yılı nüfusu da göz önüne alınarak tüm bu veriler değerlendirildiğinde; kişi başına düşen ekilebilir (işlenebilir) tarım alanı 0,24 ha/kişi olduğu görülür. Diğer bir veri ise; hektar başına kullanılan kimyasal gübre miktarı, 561 kg'dır. Bu oldukça yüksek miktar olup tarım sektöründe organik gübre miktarının da en az kimyasal kadar kullanılması gerektiği fikri bilimsel otoriteler tarafından kabul görmeye başlamıştır (TÜİK, 2022).

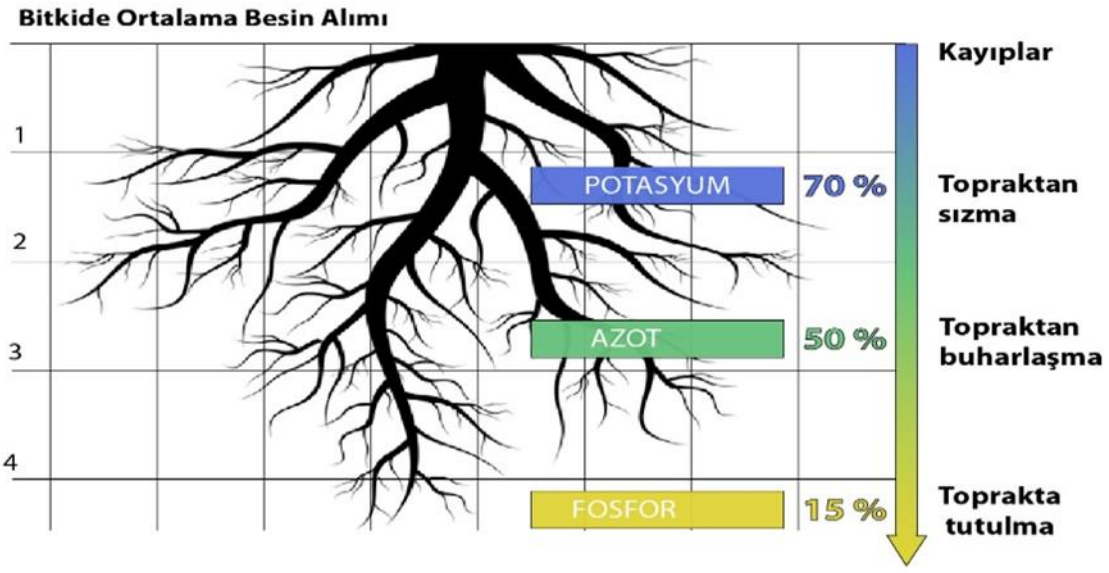
Verimliliği arttırıcı tarım yöntemleri arasında kimyasal gübre kullanımı oldukça önemli bir yer tutmaktadır. Ancak hem dünyada hem de ülkemizde verimliliği artırmak amacıyla yaygın ve oldukça fazla miktarda kullanılan bir gübre türü, kimyasal gübreler olarak adlandırılmaktadır.

Özellikle bilinçsiz ve ihtiyaçtan fazlası olacak şekilde uygulanan gübreleme programlarının ekonomik kayıplara yol açması yetmiyormuş gibi aynı zamanda çevre kirliliğine de yol açmaktadır. Bu sebepten azot kirliliği gibi önemli bir çevre kirliliği unsurunun önlenmesi için azotlu gübrenin sızmasını ve birikmesini önleyecek gerekli teknik önlemlerle yani kısacası araziye bilinçli bir şekilde tatbik edilmesi gerekmektedir. Mineral gübrelerin hiç kullanılmaması ya da kullanımının sınırlandırılması tarımsal üretime negatif bir yönde tesir edeceğinden bu gübrelerin hem doğru miktarlarda hem de aşırıya kaçmadan dengeli bir şekilde tüketilmesi ile birlikte bahsedilen problemin çözülmesi sağlanacaktır (Bellitürk, 2004).

Bilindiği üzere, toprakta yeterli derecede bulunmayan bitki besin elementlerinin kültür bitkileri tarafından daha iyi absorplanması için çeşitli gübreleme programlarının uygulanması gerekir. Yine aynı şekilde, bitki besin elementlerinin toprağa katılması organik ve inorganik kökenli gübrelerin kullanılması ile gerçekleşmektedir. Bu bağlamda; tarımda kullanılan inorganik gübrelerden kaynaklanan çevre kirliliğinin ve bu kirliliğin insan ve halk sağlığı üzerindeki negatif tesirleri son yıllarda oldukça fazla gündeme gelmektedir (Bellitürk, 2005). FAO'nun yapmış olduğu açıklamaya göre; Avrupa'da sıkı (kil yapısı büyük bir çoğunlukta olan) ve derin yapılı tarım topraklarında buğday yetiştirmekten elde edilen gelirin 1/7'si gübreleme maliyetini temsil ederken, benzer karakteristik özelliklere sahip Trakya Bölgesi'nde ise gübreleme maliyetinin 1/4'ü karşılanmaktadır. Yani, buğday ekiminden elde edilen toplam gelir, buğday ekiminden elde edilen gelirin 4/4'ü kadar olup, bunun 1'i gübreleme maliyetini temsil etmektedir. Sebebi ise Trakya'da organik gübrelerin kullanılmaması, ülkemizde ise sadece kimyasal gübrelerin kullanılması olduğu söylenmektedir (FAO, 2019). Bu çalışmayla, sürdürülebilir tarımda organik madde ve solucanların toprak sağlığı ile ilişkisinin tarım ve çevre dostu uygulamalar açısından önemi ortaya konmuştur.

2. Toprak Organik Maddesine Faydası Olmayan Tarımsal Uygulamalar

Topraklarda organik maddenin düşük olması yanında, pH değerinin de nötrün çok altında veya üzerinde olması durumlarında bazı ekstrem (örneğin çay bitkisi asit karakterli topraklarda iyi yetişir) bitkilerin dışında birçok bitki sağlıklı olarak yetişememektedir. Ayrıca toprak organik maddesinin %1 ve altında olması durumunda, özellikle bu tip topraklara uygulanan kimyasal gübrelerdeki N'un yarısı, P'un %70-85'i ve K'un %30 civarı çeşitli sebeplerle bitkiler tarafından alınamamaktadır. Buna ilişkin şekil 1'de verilmiştir.



Şekil 1. Organik madde düzeyi düşük olan topraklardaki N, P, K elementlerinin alınabilir oranları

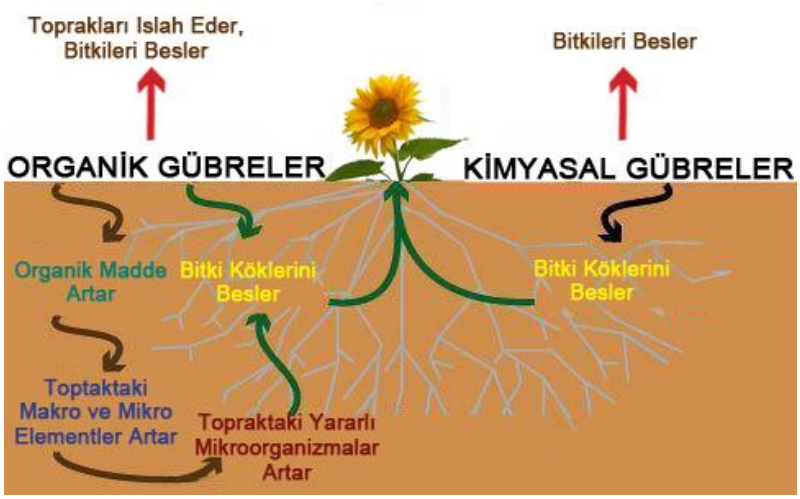
Çay gibi özel bitkilerin dışında, tarımsal amaç için yetiştirilen bitkiler nötr değerinin altında veya üzerinde olan toprak pH'ları varlığında genellikle verim düşüklüğü ortaya çıkartırlar. Bu tip pH bakımından uygun olmayan aynı zamanda düşük organik maddeye sahip tarım topraklarının mutlaka ıslah edilmesi gerekmektedir. Toprak pH değerine göre elde edilen verim oranlarını gösteren örnek Çizelge 1'de sunulmuştur (Halliday ve ark., 1992).

Çizelge 1. Bazı tarla bitkileri ile toprak pH değeri arasındaki ilişki (Halliday ve ark., 1992).

Ürün	pH				
	4.7	5.0	5.7	6.8	7.5
	Ortalama Verim (En iyi: 100; En kötü: 0) (%)				
Mısır	34	73	83	100	85
Buğday	68	78	89	100	99
Soya fasulyesi	65	79	80	100	93
Yulaf	77	93	99	98	100
Arpa	0	23	80	95	100
Yonca	2	9	42	100	100
Çayır otu	31	47	66	100	95
Buğday	34	73	83	100	85

Çizelge 1'den de görüldüğü gibi, örneğin buğday bitkisinden %100 verim alınabilmesi için en uygun pH değerinin 6,8 olduğu görülmektedir. Şekil 2'te organik gübrelerin bitkileri besleme görevinin yanında toprakları ıslah ettiği görülmektedir. Buna karşın kimyasal gübreler, sadece bitki ile ilgilenmekte toprak canlılığına herhangi bir katkıları bulunmamaktadır. Toprak içerisinde organik madde artışı dolaylı yoldan topraktaki makro ve mikro elementlerinin de

miktar olarak yükselmesini sağlamaktadır. İlaveten topraktaki faydalı mikroorganizmaların popülasyonu da artmış olmaktadır. Bitki köklerinin beslenmesi faaliyeti her iki gübrenin temel fonksiyonun arasında bulunmakta ancak faydalanma mekanizması açısından değerlendirildiğinde, organik gübrenin daha kapsamlı bir işlevi olduğu görülmekte ve kimyasal gübreye nazaran toprağa çeşitli avantajlar sunmaktadır.



Şekil 2. Organik gübre ve kimyasal gübre arasındaki farklar.

3. Toprak Organik Maddesine Faydası Olan Tarımsal Uygulamalar

Solucanlar; toprak yapısını, verimliliğini ve ürün verimini ciddi şekilde etkileyebilmektedirler. Besleyici özellikleri ve galeri açıcı fonksiyonları sayesinde genel toprak yapısını olumlu yönde iyileştirebilmekte, su sızmasını artırabilmekte, yüzeye uygulanan organik madde, kireç ve gübrelerin toprağa karışmasını (nüfuz etmesini) hızlandırabilmekte ve toprağın gözenekli yapısını artırabilmektedirler. Ayrıca bitki köklerinin gelişimini destekledikleri, kök hastalıkları sayısını önemli ölçüde azalttıkları, çayır ve tarla bitkilerinin verimini ve özellikle tahıl kalitesini (örn. protein içeriği) artırdıkları hem laboratuvarda hem de arazide kanıtlanmıştır. Bundan başka solucanlar, metabolizmalarının nitrojen (N) içeren ürünlerini ölü dokudaki protein, atık ürünler (idrar) ve epidermal bezler tarafından salgılanan mukoprotein şeklinde toprağa geri döndürdükleri için toprağın nitrojen döngüsünde önemli bir rol oynadıkları da bilimsel otoriteler tarafından bilinmektedir. Pek çok ülkede toprak asitliği dikkate alınması gereken ciddi bir sorundur. Alınmadığı taktirde tarımsal üretimin devamı söz konusu olamamaktadır. Amonyum temelli azotlu gübrelerin kullanımı ve azot bağlayan legüminozlar toprak asitleşmesini önemli bir seviyede arttırdığı kayıt altına alınmıştır. Asitlenmeyi dengelemek için toprak yüzeyine kireç uygulanır. Ancak bu kirecin ihtiyaç duyulan kök bölgesine nüfuzu

genellikle çok yavaştır. Bazı araştırmalara göre, Yeni Zelanda ve Avustralya gibi ülkelerde, bazı solucan türlerinin kirecin toprağa nüfuzunu ve dolaylı olarak pH'ını artırabildiği bildirilmiştir (Mısırlıoğlu, 2017).



(a) **(b)**

Şekil 3. (a)'da kimyasal gübre (b)'de ise solucan gübresi.

Şekil 3 (a)'da bir taban kimyasal gübresi olan DAP (Diamonyum Fosfat) ve Şekil 3 (b)'de organik gübre olan solucan gübresi gösterilmiştir. DAP gübresi, içerdiği fosforun %90'ından fazlası suda eriyebildiğinden, toprağa verildikten hemen sonra toprak içerisinde gerekli nem sağlanırsa bitkilerin yararlanabileceği forma dönüşür. Ayrıca içerisinde bulunan azot, bitkilerin erken olgunluğa ulaşmasını sağlamaktadır. Ancak, toprağı beslememektedir. Halbuki, organik gübreler tam anlamıyla toprak canlandırıcı aşı gibi davranmaktadır.

Solucanlar, toprağın yapısını, randımanını ve bitki üretimini önemli seviyede tesir etmektedirler. Beslenmeleri ve galeri açma faaliyetleri yöntemiyle toprağın stabilitesini olumlu yönde değiştirebilmektedirler. Suyun toprağın içine sızmasını ve toprağın suyun emme kapasitesini yükseltebilirler, toprağın üst kısmına tatbik edilen doğal malzeme, kireç ve gübrelerin toprakla karışımını hızlandırabilirler, toprağın porozitesinin artmasını sağlayabilmektedirler. Bunun yanı sıra bitki kök gelişimini desteklediklerı, kök rahatsızlıkları oranını önemli seviyede azalttıkları, çayır ve ürün rekoltesi ile tahıl standardını üst seviyelere çıkarttıkları gerek laboratuvar gerekse arazi şartlarında oluşturulan çalışmalarla ispatlanmıştır. Pek çok ülkede, topraklara solucanlar enjekte edilmesinin, çayır randımanını %10 ila %75 içinde değişen oranlarda, tahıl bitkilerinin gelişimini %39, tohum rekoltesini %35, tohumun azot içeriğini %12 nispetinde yükselttiği bildirilmiştir. İlaveten oluşturulan sera çalışmalarında,

bitki randımanını bariz biçimde etkiledikleri, bunun yanı sıra buğday ve yonca standart seviyesini yükselttikleri ispatlanmıştır. Mesela *Aporrectodea caliginosa*`nın tahıl ve yonca bitkisi biyokütlesini, sırasıyla %39 ve %21 oranında artırdığı görülmüştür. Yine bu tür solucanın tohum rekoltesini %35, tohum azot içeriğini %14 oranında yükselttiği ispatlanmıştır. Bir başka konu ise, toprak solucanlarının topraktaki azot çevriminde önemli rol oynadıkları bilinmektedir (Mısırlıoğlu, 2011; Tomati, 1995).

Arancon ve ark. (2005)`na bakılırsa az oranda toprağa katıldıklarında bile bitkilerin gelişmelerini önemli seviyede yükselten vermikompost hem çiçekçilikte hem de meyve ile sebze yetiştiriciliğinde faal bir biçimde çiftçiler tarafından kullanılmaktadır. Vermikompostun toprak yapısına kazanılmasının sağladığı bitki besin elementleriyle bitkilerin sadece sağlıklı, kaliteli ve bereketli olmalarını sağlamakla kalmaz, hümik asit ve gelişme hormonlarıyla büyümelerini de düzenli hale getirmektedir. Ayrıca, mikrobiyal aktivite ve mikrobiyal biyokütle seviyelerini de yükselterek toprak randıman ve kalite standardının yükselmesini sağlamaktadır. Bundan başka toprak kaynaklı hastalıkların ve zararlıların hasarlarını da engellemektedir.

Vermikompost bitkilerin gelişmeleri için toprakta olması ihtiyaç duyulan bitki besin elementlerini tedarik etmesi ve toprağı daha da verimli hale getirmesiyle birlikte pH, EC, havalanma, su tutma kapasitesi, partikül büyüklüğü, agregatlaşma şeklinde fizyolojik ve kimyasal niteliklerini düzenli hale getirmektedir (Bryan ve Lance, 1991; Gallagher ve Wollenhaupt, 1997; Gouin, 1998).

Bilinmektedir ki; vermikompost, solucanların kendi öz salgıları ile kazanılmış olduğu özellikler vasıtasıyla bitkilerin gelişmesinde önemli rol oynamaktadır (Shobha, 2008). Yürütülen bir araştırmada vermikompost gübresi tatbik edilmiş topraklarda azotu sabitleyen bakteriler, mikorizal mantarlar ve aktinomisetlerin popülasyonunda bir artma görüldüğü, dolayısıyla topraktaki azot miktarının artışa geçtiği bildirilmiştir (Kale, 1992).

Atiyeh ve ark. (2000a), domates ve marul tohumlarının vermikompost gübresi tatbik edilerek çimlendirilmesi ile alakalı araştırma faaliyetlerinde, büyükbaş hayvan gübresi ile vermikompost mukayese edilmiştir. Netice itibariyle; vermikompostun bitki büyümesi ile ilgili olumlu etkileri sayesinde büyükbaş hayvan gübresi ile mukayese edildiğinde çok daha iyi sonuç alındığı gözlemlenmiştir.

4. Vermikompost ve Toprak Sağlığı

Vermikompostlama, toprak solucanlarının organik madde parçalanması için çok yönlü doğal biyoreaktörler olarak kullanılmasını içeren etkili bir besin geri dönüşüm sürecidir. Solucan gübreleri toprak verimliliğini arttırır, bitki büyümesini arttırır ve besin zenginliği ve mikrobiyal faaliyetler yoluyla bitki patojenlerinin ve haşere popülasyonlarının çoğalmasını önler. Toprak solucanları mikro ve makro besin maddeleri ve mikrobiyal enzimler açısından oldukça verimli bir kaynak olarak değerlendirilebilir (Lavelle ve Martin, 1992).Toprak solucanları bağırsaklarındaki mikroorganizma miktarını beş kata kadar (Edwards ve Lofty, 1977) ve bağırsaklarından geçerken yutulan materyalde bulunan bakteri ve 'aktinomiset' miktarını 1.000 kata kadar artırmıştır (Edwards ve Fletcher, 1988). Benzer bir artış, toprak solucanlarının bağırsaklarından geçerken toplam bakteri, proteolitik bakteri ve aktinomisetlerin plaka sayımlarında da gözlenmiştir (Parle, 1963; Daniel ve Anderson, 1992; Pedersen ve Hendriksen, 1993; Devliegher ve Verstraete, 1995).Mikrobiyal popülasyondaki artışın, toprak solucanının sindirim sisteminde mikropların gelişimi için uygun koşulları ve enerjiyi sağlayan besin maddeleri açısından oldukça verimli olan ve aynı zamanda mikroorganizmaların gelişimi için bir molekülün reaksiyona girmiş hali olarak hizmet eden organik atıkların yutulması nedeniyle mümkün olduğu bildirilmiştir (Tiwari ve ark., 1989).Vermikompost ilavesinin toprak pH'ını, mikrobiyal popülasyonu ve toprak enzim aktivitelerini olumlu yönde etkilediği (Maheswarappa ve ark., 1999) ve ayrıca olası çevre kirliliğine neden olan suda çözünebilir kimyasalların miktarını önemli ölçüde azalttığı bilimsel otoriteler tarafından onaylanmıştır (Mitchell ve Edwards, 1997). Vermikompost ilavesi 50-500 µm arasında değişen makro gözenek alanını genişletmekte, topraktaki hava-su ilişkisini iyileştirmekte ve bitki gelişimini olumlu yönde etkilemektedir (Marinari ve ark., 2000).Ayrıca solucan faaliyetleri toprak yapısını daha iyi bir seviyeye getirmekte ve bu nedenle kimyasalların yüzey sularına akışı azalmaktadır. Solucan kalıntıları yaşlandıkça stabil hale gelir, böylece erozyon riski büyük ölçüde azalmaktadır. Bu bağlamda toprak solucanlarının toprak sağlığı açısından toprak fonksiyonunu olumlu yönde etkilediği anlaşılmaktadır. Onlar sağlıklı, düzgün işleyen bir toprağın işaretleridir (Farenhorst ve ark., 2000).

Toprak solucanlarının organik atık kalıntılarını parçalayarak mikrobiyal bozulmayı teşvik etmek, toprak verimliliğini daha yüksek seviyelere çıkarmak ve toprak agregasyonu gibi toprağın fiziksel niteliklerini iyileştirmek suretiyle toprak kalitesine fayda sağladığı ve yağmur veya sulama suyunun toprak profili boyunca yerçekimi etkisiyle yüzeyden aşağıya doğru

hareketini kolaylaştırdığı kanıtlanmıştır. Ancak, toprak solucanlarının popülasyonunu sınırlayan en önemli faktör gıdanın bulunabilirliğidir. Ürün artıkları ve örtü bitkileri yoluyla gıda üretmek ve bunları korumalı toprak işleme uygulamaları yoluyla toprak yüzeyinde bırakmak, toprak solucanlarının miktarını artırmak için iyi bir alternatiftir (Donahue, 2001)

Dünyanın artan nüfusu, kapsamlı ve yoğun bir tarımsal üretimin ve daha yüksek verimlilik sunan bir ekim sisteminin benimsenmesi ihtiyacını ortaya koymaktadır (Sadowski ve Baer-Nawrocka, 2018). Bu durum, tarımsal kimyasalların yoğun kullanımını zorunlu kılmakta ve sürdürülebilir olmayan uygulamalara ve tahrip olmuş bir çevreye neden olmaktadır (Chou, 2010). Kimyasal gübrelerin aşırı kullanımı, sürdürülebilir üretim için büyük bir tehdit olan toprak toksisitesine ve besin dengesizliğine neden olmuştur. Son olarak, besin zincirindeki bu mevcut dengesizlikten (Rojas ve ark., 2016) çiftlik hayvanlarının yanı sıra insanların da aynı düzeyde (gıda ürünlerindeki tarımsal kimyasal kalıntılarından etkilendiği tespit edilmiştir (Pimental ve ark., 2018; Rasmussen ve ark., 2016). Küresel olarak, hayvancılık, insan ve bitki faaliyetlerinden kaynaklanan toplam organik katı atık miktarı 38 milyar m^3 'ten fazladır (Diacono ve ark., 2019).Büyük miktarlarda üretilen ve hayvanlar için yetersiz yem olan pirinç samanı, yüksek silika ve lingo-selüloz içeriğine sahiptir; yönetilmesi veya tamamen ortadan kaldırılması oldukça zordur (El-Dewany ve ark., 2018). Çoğu çiftçi, bu atıkları tarlada ateşle yok ederek duman gibi hava kirliliğine neden olduklarının farkında olamamaktadırlar (Pimonsree ve ark., 2018).Endüstriler ve eğitim kurumları maksimum miktarlarda kâğıt atık üretmekte ve bu atıklar genellikle düzenli depolama sahalarında bertaraf edilmektedir. Uygun tarımsal ve endüstriyel atıkların geri dönüşümü, toprak sağlığının daha da yüksek seviyelere çıkarılmasında önemli bir rol oynayabilmektedir. Ilıman bölgelerdeki topraklarda organik madde katkısı düşüktür, bu nedenle organik madde katkısı toprak niteliklerinin iyileştirilmesi ve verimliliğin korunması için önemli bir bileşen haline gelmiştir (Hijbeek ve ark., 2017).

Vermikompostlama için etkili bir yönetim stratejisi olarak düşünüldüğünde pirinç samanı, inek gübresi ve kâğıt atıkları potansiyel bir substrat olabilir (Sharma ve Garg, 2018). Solucan gübrelemesi, organik katı atıkların yönetimi ve solucanlar ile mikroorganizmalar vasıtasıyla organik maddenin stabilizasyonu için olası bir alternatif olduğu düşünülmektedir (Thomas ve ark., 2019). Solucan gübresi genellikle ortalama %1,5-2,2 N, %1,8-2,2 P ve %1,0-1,5 K değerlerine sahiptir. Organik karbon %9,15 ile %17,98 arasında değişebilmekte ve mikro besin maddelerini içerebilmektedir (Adhikary, 2012). Bitki besin maddelerinin organik kökenlerinin solucanlar tarafından solucan kompostuna dönüştürülmesiyle (çiftlik gübresi (FYM), ürün artıkları, evsel çöpler ve kâğıt atıkları vb) bitki besin kökenlerinin entegre kullanımı

sağlanmakta, böylece sürdürülebilir tarım yani sürdürülebilir bitkisel üretim açısından büyük ilgi görmektedir (Timsina, 2018).

5. Vermikompostun Bitki Gelişimi Üzerine Etkileri

Vermikompost ismi, farklı toprak derinliklerinde yaşayan ve organik atıkları işleyen solucan gübrelerinin organik atık yığınlarını habitatları haline getiren ve gübreleri organik madde bakımından çok daha zengin olan solucan türlerinin yetiştirilmesinden (kültüre alınmasından) ileri gelmektedir. Başka bir deyişle vermikompost, ortamda bulunan solucanların sindirim sisteminden geçişleri sırasında organik maddelerin (bitki ve hayvan artıkları ve atıklar) hızlandırılmış hümifikasyon, detoksifikasyon ve dezenfeksiyon işleminden kaynaklanan solucan dışkısıdır. Solucan kompostunun toprağa eklenmesiyle tarımsal üretim, verimlilik ve toprak sağlığı açısından oldukça önemli olan organik maddeler zenginleştirilmiş toprağa taşınmakta, besin maddelerinin miktarının ve bitkilere alınabilirliğinin artması gibi faydalar sağlanmaktadır. Bitkiler, bitki büyüme düzenleyicileri ile birlikte bitki hastalıklarını önleyici tedbirler ve mikrobiyolojik tedbirler alırlar. Toprak organik maddesi sadece toprak bitkileri için besin kaynağı olmayıp, aynı zamanda toprağın fizikokimyasal ve biyolojik özelliklerini etkileyen son derece etkili bir maddedir.Toprak organik maddesi, toprakta bulunan veya dışarıdan toprağa giren tüm organik maddelerin mikroorganizmaların faaliyeti sonucu ayrışması ve değişim ürünlerinin toprağa karışması sonucu doğal koşullar altında oluşmaktadır. Tüm toprak süreçlerinde olduğu gibi toprağın organik maddesi ile diğer tüm toprak özellikleri arasında birbirine bağlı bir döngü vardır. Toprakta organik madde içeriğinin artması biyolojik süreçleri doğrudan etkileyip yoğunlaştırırken, mikroorganizma popülasyonunun ve aktivitesinin artması da organik maddenin ayrışmasını hızlandırır. Topraktaki organik madde içeriği mikroorganizmaların sayısını ve türünü etkilemektedir. Tarımsal kullanımın yoğun olduğu alanlarda bulunan topraklardaki organik madde miktarı hızla azalmakta, ilave edilmediği takdirde toprağın verimliliği ve sağlığı kaybolmaktadır. Bu kayıplar toprağın biyolojik, kimyasal ve fiziksel yapısını bozarak toprakta aşındırıcı koşulların oluşmasına zemin hazırlamaktadır. Ülkemiz gibi toprak organik maddesinin çok az olduğu tarım alanlarında, organik maddece fakir topraklara organik madde ilavesi yapılmalı, verimliliğin sürekli olarak artması ve toprak sağlığının sağlanması açısından vazgeçilmez ve önemi yadsınamaz bir öneme sahiptir. Topraktaki organik madde miktarının dikkate alınması tarımsal üretimle uğraşanların sorumluluğundadır. Aynı zamanda ülkemizde çiftçilere kimyasal gübre önerilerinin yanı sıra devletin de organik gübre önerileri yöneltilmeli ve kullanımı teşvik edilmelidir (Türkay, 2016).

6. Vermikompostun Toprağın Fiziksel, Biyolojik ve Kimyasal Özellikleri Üzerindeki Faydalı Etkisi

Toprak solucanları karbon döngüsünde, toprak oluşumunda, selüloz ayrışmasında ve humus depolanmasında önemli bir faktör olarak karşımıza çıkmaktadır. Toprak solucanı faaliyetleri ve çalışmaları toprağın fiziksel, kimyasal ve biyolojik niteliklerini derinden etkilemektedir. Toprak solucanları organik atıkların doymak bilmez besleyicileridir ve gelişimleri için bu atıkların sadece küçük bir kısmını alırlar ve bu atıkların çoğunu yarı sindirilmiş bir şekilde vücutlarından atarlar (Edwards ve Lofty, 1977; Kale ve Bano, 1986; Jambhekar, 1992).

Organik madde solucanın taşlığından geçerken ince bir toza dönüştürülür, ardından sindirim enzimleri, mikroorganizmalar ve bağırsakta ayrışmasına yardımcı olan diğer fermente edici maddeler ve son olarak solucan bağırsağıyla ilişkili mikroplar tarafından küfler olgun bir ürün olan "vermikompost "a dönüştürülerek dış ortama salınırlar (Dominguez ve Edwards, 2004).

Toprak solucanı bağırsağı; yükselen organik karbon, toplam organik karbon ve azot ve nem içeriği, hareketli olmayan mikropların aktivitesi ve endosporların çimlenmesi vb. toprak solucanlarının sindirim sisteminden amilaz, selüloz, proteaz, lipaz, kitinaz ve üreaz gibi çok çeşitli sindirim enzimleri için en uygun habitatı sağlamaktadır. Bağırsak mikroplarının selüloz ve mannoz aktivitelerinden sorumlu olduğu bildirilmiştir (Munnoli ve ark., 2010).Toprak solucanları, toprağın alt tabakasını ayrıştırarak mikrobiyal bozulma için yüzey alanını artırır ve böylece solucan kompostunun aktif aşaması başlamış olur. Bu ezilmiş organik madde; bağırsak geçişi sırasında bağırsak mikropları ve sindirim enzimleriyle karışır ve en sonunda kısmen sindirilmiş, ancak tamamen sindirilmemiş bir formda "kalıplar" olarak ortaya çıkar ve bu mikroplar daha sonra evrim aşamasında ek ayrışma sürecini üstlenmektedir (Lazcano ve ark., 2008). Toprak solucanlarının mikroplarla olan bağlantısının karmaşık olduğu kanıtlanmıştır. Bazı mikrop topluluklarının toprak solucanlarının beslenme programının bir parçası olduğu gösterilmiştir ve bu durum bazı mikropların toprak solucanlarının sindirim sisteminden geçerken yok olmasıyla kanıtlanmıştır. Bu bağlamda, çeşitli mayalar, protozoalar ve *Fusarium oxysporum, Alternaria solani, Drawida calebi* gibi bazı mantar toplulukları toprak solucanları tarafından sindirilmiştir (Edwards ve Fletcher, 1988). Toprak solucanlarının, toprak substratını oksijenlendirirken sıkıştırıp parçaladıkları ve böylece mikrobiyal aktiviteyi ve biyolojik bozunma potansiyelini büyük ölçüde değiştirdikleri için sürecin önemli itici güçleri olduğu vurgulanmaktadır (Fracchia ve ark., 2006; Lazcano ve ark., 2008). Vermikompostlamanın toprak pH'ı, elektriksel iletkenlik (EC), C:N oranı ve diğer besin maddeleri üzerindeki etkileri kanıtlanmıştır. Solucan aktivitesi gübredeki pH ve C:N oranını düşürmüştür (Gandhi ve ark.,

1997; Atiyeh ve ark., 2000b). Kimyasal analizler sonucunda, solucan gübresinin ana materyale kıyasla daha düşük pH, EC, organik karbon (OC) (Nardi ve ark., 1983; Albanell ve ark., 1988; Mitchell, 1997), C:N oranına (Riffaldi ve Levi-Minzi, 1983; Albanell ve ark., 1988) ve daha yüksek miktarda azot, potasyum, toplam fosfor ve mikro besin maddelerine sahip olduğunu göstermiştir (Hashemimajd ve ark., 2004).Vermikompostun pH değerleri geleneksel komposta kıyasla biraz daha düşüktür, azot ve fosfor mineralizasyonu ve organik maddelerin mikrobiyal ayrışma yoluyla ara organik asitlere, fulvik asitlere ve hümik asitlere dönüşümü (Lazcano ve ark., 2008; Albanell ve ark., 1988; Chan ve Griffiths, 1988; Subler ve ark., 1998) ve buna eşlik eden CO_2 üretimi gözlemlenmiştir (Elvira ve ark., 1998; Garg ve ark., 2006).Toprak solucanlarıyla ilgili bakterilerdeki çeşitliliğin faydaları düşünüldüğünde şunlar söylenebilir. Toprak solucanlarında bitki besin maddesi kullanılabilirliğini artırma yeteneğinin muhtemelen toprak solucanı bağırsak mikroflorasının aktivitesine bağlı olduğunu söyleyebiliriz. Toprak solucanları, toprak altlığını ayrışmaya tabi tutarak ve toprak mikroflorasının aktivitesini etkileyerek toprak kimyasal süreç dinamiklerini dolaylı olarak etkilemektedir (Petersen ve Luxton, 1982; Lee, 1985; Edwards ve Bohlen, 1996; Kılbacak ve ark., 2021).

7. Sürdürülebilir Tarımda Vermikompostun Ekonomik ve Çevresel Faydaları

Maji ve ark. (2017) vermikomposttaki hümik asit zenginliğinin bitki boyunu, taze ağırlığı ve kuru ağırlığı miktar olarak artırdığını bildirmiştir. Ayrıca, kimyasal gübreye kıyasla maksimum mikrop (bakteri, mantar) miktarı ve yoğunluğu rapor edilmiştir. Vermikompost üretmek için farklı solucan türlerinin kullanıldığı bilinmektedir. Sürdürülebilir tarım için değerlendirildiğinde; vermikompost, konveksiyonel tarımdaki kimyasal gübre miktarının azaltılmasını sağlayan çok güçlü bir biyogübredir. Buradaki önemli faktör, solucanların organik atıkların geri dönüşümü ile ilgili olarak atık yönetiminde yer aldığının bilinmesidir (Bhat ve ark., 2017).

Sequeira ve Chandrashekar (2015) evsel gıda, kâğıt, sebze ve bahçe atıkları (çim ve yapraklar) ile inek gübresinin *Eudrilus sp*. tarafından vermikomposta dönüştürülmesinin sağlandığını; kompostun yüksek verime ve bakteriler, mantarlar, aktinomisetler, Pseudomonadlar, P-Solubilizatörler ve N_2 Fiksatörlerinden oluşan faydalı mikrobiyal gruplara sahip olduğunu bildirmiştir. Sentetik kimyasalların gelişigüzel kullanımı tarımsal üretim sisteminde birçok soruna neden olmakta ve kullanım amacı dışında organizmalar üzerinde olumsuz etki yaratmaktadır. Vermikompost, organik atıkların solucanlar aracılığıyla, yararlı bakteri

popülasyonunu tehlikeye atmadan, besin maddeleri açısından oldukça verimli olan komposta dönüştürülmesinde kullanılan önemli bir yöntemdir. Son zamanlarda birçok araştırmacı sürdürülebilir tarım için vermikompost üzerine çalışmalarını sıklaştırmıştır. Bu bağlamda; organik atıkların vermikomposta dönüştürüldüğü ve söz konusu kompostun yüksek azot-fosfor-potasyum, karbon-azot, faydalı mikroorganizma ve büyüme hormonu içeriğine sahip olduğu görülmüştür (Adhikary, 2012).Çiftlik hayvanlarının dışkıları vermikompost adı verilen sürdürülebilir bir yöntemle yönetilmeye başlanması çok yeni bir teknolojidir. Bu geri dönüşüm süreci uygulanmaya başlanmadan önce; geleneksel kompostlamadaki enerji ve kullanılan insan gücü sayısı israf edilebilmekteydi. Ancak solucan kullanımı devreye girdiğinde kompost çok hızlı bir şekilde ayrışmaya başlamakta olduğu görüldü ve geri dönüştürülebilir yüksek miktarda besin ve mikrobiyal biyokütleye sahip bir hammadde meydana geldiği de ispatlanmıştır (Nasiru ve ark., 2013). Vermikompostlama, hem solucanlara hem de ilgili mikroplara fayda sağlayan ve geleneksel termofilik kompostlamaya göre birçok avantajı olan uygun maliyetli ve çevre dostu bir atık yönetimi teknolojisidir. Vermikompost olarak adlandırılan organik materyaller, mükemmel biyogübre kaynaklarıdır ve bunların eklenmesi tarım toprağının fizyokimyasal ve biyolojik özelliklerini iyileştirmektedir (Koç ve ark., 2021). Mükemmel fiziko-kimyasal özelliklere ve tamponlama yeteneğine sahip olan ve tüm besin maddelerini bitkilerin kullanabileceği formlara getiren vermikompostlar, antagonistik ve bitki gelişimini destekleyen bakterilerle daha üretken hale gelmekte, aynı zamanda toprak ıslahı, toprak verimliliğinin artırılması, bitki gelişimi ve sürdürülebilir tarım için patojen mikroorganizmaları, zararlıları ve nematodları önlemektedirler. Tüm hastalıklar için tedavi görevi gören muhteşem organik materyallerdir (Pathama ve Sakthivel, 2012). Domates fideleri üzerinde 1. Çiğ süt gübresi ve tütün kalıntısı, 2. Bahçe yaprakları, 3. Arıtma çamuru + pirinç kabuğu, 4. Arıtma çamuru + bahçe yaprakları ve çiğ süt gübresinden elde edilen vermikompost ile bir sera denemesi yapılmıştır; Tüm denemeler tanığa göre anlamlı büyüme göstermiştir (Hasheminajs ve ark., 2006). Lim ve ark. (2014) soya fasulyesi kabuğu ve papaya atıklarının atık yönetimi için çeşitli oranlarda *E. eugeniae* ile çalışıldığını bildirmiştir. Çeşitli 1:1 oranlarının vermikompost için en iyi kombinasyon olduğu bildirilmiştir. Vermikompostun *Petroselinum crispum* üzerindeki etkinliği incelenmiş ve sonuçlar vermikompostun yaprak boyutunu, bitki boyunu ve verimi artırdığını göstermiştir (Peyvast ve ark., 2008).Kaouachi ve ark. (2013) zeytin atıklarının *E. andrei* solucanları kullanılarak vermikomposta dönüştürüldüğünü bildirmiştir. Elde edilen vermikompostun azot-fosfor-potasyum, kalsiyum, magnezyum, sodyum ve gerekli EC ve C/N oranını arttırdığı gözlemlenmiştir.Solucan gübresi suyu ile muamele edilen mısır fideleri

normal su ile karşılaştırıldığında, solucan gübresinde bitki büyümesine yol açan hormonların varlığına işaret eden, tüy uzunluğunda belirli bir değişiklik tespit edilmiştir (Nagavallemma ve ark., 2004).Solucan gübresi uygulamasında sorgum (*Sorghum bicolor*) (Patil ve Sheelavantar, 2000), ayçiçeği (*Helianthus annuus*) (Devi ve ark., 1998), domates (*Lycopersicon esculentum*) (Nagavallemma ve ark., 2004), patlıcan (*Solanum melangona*) (Guerrero ve Guerrero, 2006). Bamya (*Abelmoschus esculentus)* (Gupta ve ark., 2008), sümbül fasulyesi (*Lablab purpureas*) (Karmegam ve Daniel, 2008), üzüm (Buckerfield ve Webster, 1998) ve kiraz (Webster, 2005) yetiştiriciliğinde olumlu sonuçlar gözlemlenmiştir. Vermikompost gübresi ile karıştırılmış toprakta yetiştirilen kırmızı yonca ve salatalığın sürgün dokularında Ca, Mg, Cu, Mn ve Zn gibi mineral içeriklerinde artış gözlenmiştir (Sainz ve ark., 1998). Bunun gibi diğer çalışmalara baktığımızda, vermikompostlanmış ördek atıkları, işlenmemiş atıklara kıyasla domates, marul ve biberde daha iyi büyüme ve gelişme sağlamıştır (Wilson ve Carlile, 1989). *P. brassicae*'nin neden olduğu lahana çürüklüğü, lahana köklerinin kil ve vermikompost kokteyline daldırılmasıyla önlenmiştir (Szcech ve ark., 1993). Vermikompostlanmış inek gübresi marul ve domates bitkilerinin büyümesini teşvik ederken, işlenmemiş ana materyal bitki büyümesini teşvik etmemiştir (Atiyeh ve ark., 2000b).

Sonuçlar ve Öneriler

Tarım arazilerinde organik madde miktarının yetersiz olması nedeniyle kullanılan kimyasal gübreler ihtiyacı karşılayamamakta dolayısıyla kimyasal gübre kullanımı artışa geçmekte ve netice itibariyle ekonomik gübreleme mümkün olmamaktadır. Ancak organik gübre kullanımıyla toprağın organik maddesinin artması, kimyasal gübre kullanımını azaltacak, bitkilerin "gübre faydalanma oranını" daha da üst seviyelere çıkartacak ve ekonomik gübrelemeyi sağlayacaktır. Sadece ekonomik gübreleme sağlanmayacak, aynı zamanda kalite ve verim de artacak, dolayısıyla üreticilerin geliri de artacak, elbette güvenlik artacak ve toprak gelecek nesillere daha verimli ve temiz bir şekilde aktarılacaktır (Bellitürk ve Goldmann Benardete, 2020). Ülkemizde gübrelerin doğru ve sürdürülebilir kullanımını sağlamak için toprak, yaprak ve su analizlerinin yaygınlaştırılması ve kalitesinin iyileştirilmesi gerekmektedir. Bilinçli gübre kullanımının yaygınlaşması ülke ekonomisine önemli katkı sağlayacağı aşikardır. Tarım alanının arttırılmasının mümkün olmaması, nüfusun sürekli değişen ihtiyaçları ve kırsal kesimde yaşayanların sayısının azalması gibi nedenlerden dolayı tüketilen kimyasal gübrelerdeki artışın azaltılmasına yönelik çalışmaların yapılması ayrıca birim alandan daha fazla ürün elde edebilmek için doğru ve bilinçli gübre kullanımının

yaygınlaştırılması gerekmektedir. Aksi halde zamanla kimyasal gübre ve tarım ilaçlarının aşırı ve dikkatsiz bir şekilde sarfiyatı yer altı ve yerüstü su kaynaklarının kirlenmesinde en büyük etken haline gelecektir. Söz konusu kirliliğin insan sağlığına oldukça zararlı olduğunu akıldan çıkartılmamalıdır. Buna göre ülkemizin her bölgesinde iklim ve toprak özelliklerinin farklı olduğu düşünülerek her bölge için bölgenin kendi özelliklerine has (spesifik) araştırmaların yapılmasının gübre kayıplarının ve çevre kirliliğinin önlenmesi açısından şüphesiz yararlı bir yaklaşım olacağı söylenebilir (Bellitürk, 2008).Organik gübrelerin mikro ve makro elementlerinin üzerindeki faydaları görülmektedir. Organik gübreler, toprakta mikrobiyolojik faaliyeti hızlandırarak strüktür, havalanma ve toprakta su tutma kapasitesinin arttırılması yanında makro ve mikro besin maddelerini sağlaması gibi toprağa çok yönlü olumlu katkıları vardır.Toprağın oluşması için geçen süre onun meydana gelmesindeki zorluğu gösterir ki yaşamın devamlılığı ve medeniyetin gelişimi için hayati önem taşıyan önemli bir doğal kaynak olmaya devam etmektedir. Ülkemizde "miktar olarak tarlaya ne kadar çok gübre atarsan, o denli randıman alırsın" mantığı ile gübreleme faaliyetleri gerçekleştirilmektedir. Bunun sonucunda çoğu kez topraklarda, yetiştirilen birçok üretimde ve çevrede istenmeyen problemler meydana gelmektedir.Tarımın asıl amacı, karmaşık bir sistem olan toprakta yüksek bereketli ve ekonomik bitki yetiştirmektir. Günümüzde tarımsal üretimde verimliliği çoğaltmak amacıyla kullanılan üretim girdileri kontrolsüz bir halde artmaktadır. Kullanılan kimyasal gübreler bir taraftan randımanın yükselmesini sağlarken, bir taraftan da çevre ve insan sağlığına da negatif açıdan tesir etmektedir. Örneğin toprağa atılan amonyum nitrat gübresinin fazlası, suda çözülerek mühim bir çevre kirleticisi olabilmektedir (Bellitürk, 2012).Ülkemizde toprak üretim randımanın muhafaza edilmesi ve üst seviyelere çıkartmak için acil bir şekilde yerine getirilmesi ihtiyaç duyulan unsurlar aşağıda sıralanmıştır. Bunlar;

- Bilindiği üzere; ürün rotasyonunun (ekim nöbeti) kullanılması faaliyeti, toprak yorgunluğunun önlenmesinde esastır. Yani tarımsal uygulamalarda, ekim nöbeti faaliyetinin kullanılması,
- Toprağın organik madde miktarının muhafaza edilmesi ve miktar olarak yükseltilmesi (zenginleştirilmesi), dolayısıyla kompost ve vermikompost gibi organik gübrelerin kullanımının yaygınlaştırılmasının sağlanması,
- Topraktaki diğer önemli bitki besin maddelerinin korunması ve miktar olarak yükseltilmesi,

- Pek çok faydaları ile birlikte toprak erozyonunun da düşürülmesi maksadıyla organik gübre kullanımının teşvik edilmesi ve yaygın duruma getirilmesi,
- Devirmeli toprak işlemenin terk edilmesi,
- Bitki artıklarının yüzeye yakın bir yerde depolanması ve anızların yakılmaması,
- Toprağı az sıkıştırma işlemi yapan tarım iş makineleri ve traktörlerden yararlanılması,
- Aşırı kimyasal gübre sarfiyatına bağlı topraklardaki asitleşme ve tuzluluğun ortadan kaldırılması ile ilgili ıslah faaliyetlerinin gerçekleştirilmesi,
- Asit karakterli topraklarda tarım kirecinden yararlandırılması,
- Tarımda denetlenebilen ve çalışma sahasından elde edilen girdilerin uygulanması üzerinde stabil ve teknolojik yenileşim üzerine kurulu tarımsal politikalar gelişmesinin sağlanması,
- Toprağa uygun üretme-ekme işleminin yapılması (asit topraklarda yaban mersini vb. alternatif ürünler gibi) ve bu üretime uygun gübreden yararlandırılması,
- Problemli tarım alanlarının saptanması, bu problemlerin halledilmesine ilişkin ihtiyaç olan ıslah faaliyetlerinin gerçekleştirilmesi,
- Bilgi kirliliğinin mâni olmak ve tarım işinde çalışanlara en doğru bilgilerin verilebilmesi amacıyla güncel ve bilimsel bir tarımsal veri tabanının şekillenmesine ilişkin faaliyetlerin gerçekleştirilmesi,
- Modern tarım yöntemleri kullanılırken, profesyonellere danışılması,
- Bitkilerin gübreden faydalanma oranlarının yükseltilebilmesi için; biyoteknolojinin kullanılması suretiyle bitki köklerince atılan gübredeki bitki besin maddesi emisyonunun yükseltilmesinin sağlanması gerekmektedir (Bellitürk, 2012).

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SIFIR ATIK AMACIYLA ÇEREZLİK AYÇİÇEĞİ ATIĞI VE İNEK GÜBRESİ KARIŞIMI İLE SOLUCAN GÜBRESİ ELDE EDİLMESİ

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Özet
Bu araştırmada, bitkisel kökenli çerezlik ayçiçeği atığı (SW) ve hayvansal kökenli inek dışkısı (CM) atıkları belirli oranlarda karıştırılarak Eisenia fetida yardımıyla laboratuvar koşullarında vermikompost üretilmiştir. Bu amaçla Tekirdağ Namık Kemal Üniversitesi Ziraat Fakültesi Toprak Bilimi ve Bitki Besleme Bölümü'nde bulunan 3 Numaralı laboratuvarda 4 ay süren ve 2 tekerrürlü olarak düzenlenen söz konusu araştırma tamamıyla şansa bağlı deneme planına göre planlanarak yürütülmüştür. Denemede kapaklı özel kaplar kullanılarak 5 farklı uygulama ($SW_{100}CM_0$; $SW_{75}CM_{25}$; $SW_{50}CM_{50}$; $SW_{25}CM_{75}$; SW_0CM_{100}) ve her bir uygulama için de 20'şer adet Eisenia fetida cinsi solucanlar kullanılmış olup nemlendirme ihtiyacı için saf su kullanılmıştır. Deneme sonunda elde edilen 5 farklı vermikompost örneklerinde; pH, nem, organik madde, toplam N, P, K, Ca analizleri yapılmıştır. Denemenin sonunda aynı zamanda solucan sayıları da belirlenmiş ve geçen süredeki değişim değerlendirilmiştir. Araştırma sonuçlarına göre, ortalama en yüksek N, P, K, Ca, Mg ve Zn içerikleri sırasıyla %1.61; 136.0 mg/kg; 488.90 mg/kg; 515.65 mg/kg, 106.25 mg/kg ve 2.50 mg/kg değerleri ile çerezlik ayçiçeğinin en yüksek oranda olduğu $SW_{100}CM_0$ uygulamasında tespit edilmiştir. Ancak en yüksek Fe ve Cu içerikleri ise inek gübresinin en fazla olduğu (SW_0CM_{100}) vermikompost örneklerinde belirlenmiştir. Bütün parametreler göz önüne alındığında ortalama pH ve nem değerleri sırasıyla 8,58 µS/cm ve %57.73 olarak bulunmuştur. Bütün parametreler içerisinde ortalama en yüksek organik madde miktarı %85.08 ile $SW_{75}CM_{25}$ uygulamasında saptanmıştır. Elde edilen sonuçlara göre, araştırmanın son günündeki 2 tekerrürün ortalamasına göre solucan sayısı en fazla 74 adet solucan ile $SW_{75}CM_{25}$ uygulamasında belirlenmiş olup, başlangıca göre sadece 54 adet solucan artışı olduğu gözlemlenmiştir. Proje sonuçları hem tarımsal üretim yapan çiftçiler ve hem de vermikompost üreticileri için önemli bilgiler ortaya çıkarmıştır.
Anahtar Kelimeler: İnek gübresi, çerezlik ayçiçeği, Eisenia fetida, vermikompost, organik madde

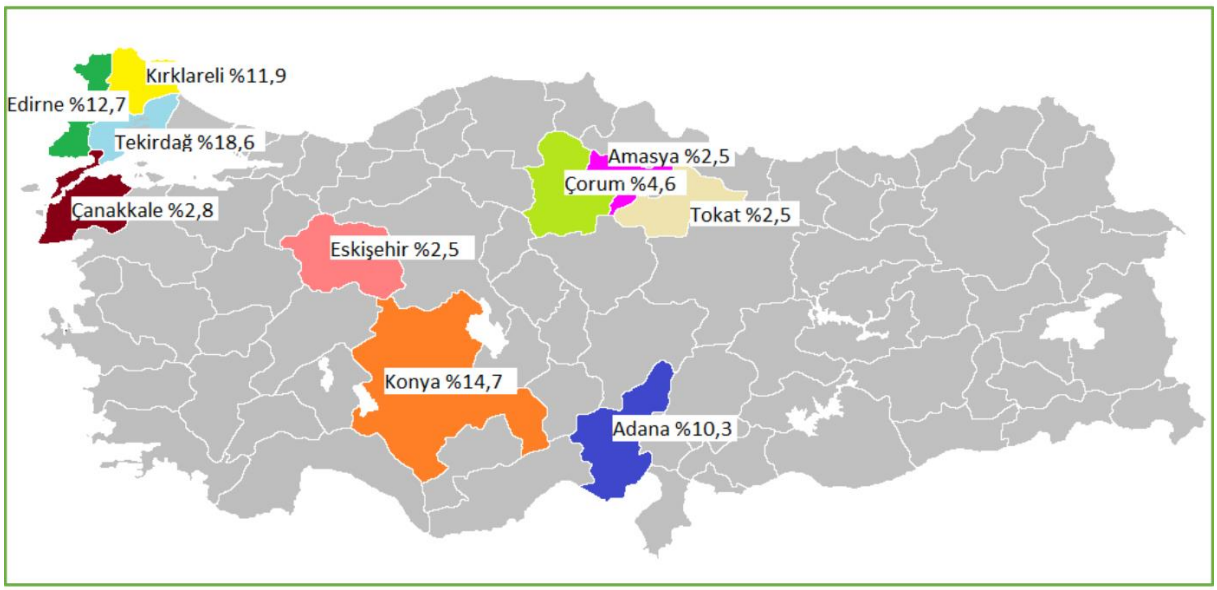
OBTAINING VERMICOMPOSTING FROM MIXTURE OF SNACK SUNFLOWER WASTE AND COW MANURE FOR ZERO WASTE AIM

Abstract
In this research, vermicompost was produced under laboratory conditions with the help of Eisenia fetida by mixing plant-based snack sunflower waste (SW) and animal-origin cow feces (CM) waste in certain proportions. For this aim, the research in question, which lasted 4 months and was organized with 2 replications, was planned and carried out completely according to the random trial plan in the laboratory No. 3 in the Soil Science and Plant Nutrition Department of Tekirdağ Namık Kemal University, Faculty of Agriculture. In the experiment, 5 different applications ($SW_{100}CM_0$; $SW_{75}CM_{25}$; $SW_{50}CM_{50}$; $SW_{25}CM_{75}$; SW_0CM_{100}) were used using special containers with lids, and 20 Eisenia fetida earthworms were used for each application, and pure water was used for humidification. In 5 different vermicompost samples obtained at the end of the experiment; pH, moisture, organic matter, total N, P, K, Ca analyzes were performed. At the end of the experiment, worm numbers were also determined and the change over time was evaluated. According to the research results, the highest average N, P, K, Ca, Mg and Zn contents were determined in the SW_0CM_{100} application, where cow feces were at a high rate, with values of 1,61%; 136,0 mg/kg; 488,90 mg/kg; 515,65 mg/kg, 106,25 mg/kg ve 2,50 mg/kg respectively, where confectionery sunflower was at the highest rate. However, the highest Fe and Cu contents were determined in vermicompost samples (SW_0CM_{100}) where cow manure was the highest. Considering all parameters, average pH and moisture values were found to be 8,58 µS/cm and 57,73%, respectively. Among all parameters, the highest average organic matter amount was detected in the $SW_{100}CM_0$ application with 85,08%. According to the results obtained, according to the average of the 2 repetitions on the last day of the research, the number of worms was determined in the $SW_{75}CM_{25}$ application with the maximum number of 74 earthworms, and it was observed that there was only an increase of 54 number of earthworms compared to the beginning. The project results have revealed important information for both farmers engaged in agricultural production and vermicompost producers.
Keywords: Cow manure, snack sunflower, Eisenia fetida, vermicompost, organic matter.

1.Giriş

Hızla artan dünya nüfusunun besin ihtiyacını karşılamak için tarımsal üretimde de artışlar gerçekleştirilmelidir. Fakat bu artış zorunluluğu, daha fazla kimyasal gübre kullanımına sebep olur. Tarımsal uygulamalarda kullanılan kimyasal maddeler birçok riski de beraberinde getirir, bunun sonucunda toprak, çevre, gıda güvenliği ve insan sağlığı açısından sıkıntıların çıkmasına sebep olur. Toprak organik maddesini korumak ve artırmak, sera gazı emisyonlarını azaltmak ve toprak verimliliğinin sürdürülebilirliği için mineral ve kimyasal uygulamaların yanında, organik tarım uygulamalarına da yer verilmesi gerekmektedir.Ayçiçeği üretimi; Türkiye'de 2020/2021 sezonunda ayçiçeği üretim miktarı bir önceki sezona oranla %1.6 oranında azalarak 2 milyon ton olmuştur. Bunun 1.9 milyon tonu yağlık olarak üretilmiştir. 2020 yılı yağlık ayçiçeği üretiminde Tekirdağ (353 bin ton), Konya (278 bin ton), Adana (195 bin ton), Edirne (240 bin ton) ve Kırklareli (226 bin ton) ilk sıralarda yer almıştır. TÜİK verilerine göre 2021 yılı ayçiçeği üretiminin bir önceki yıla göre %14.7 oranında artarak 2.4 milyon ton olacağı tahmin edilmektedir (TEPGE, 2021) (Şekil 1).Ülkemizde olduğu gibi dünyada da çerezlik ayçiçeği, önemli oranda gelir getiren bir ürün olmasına rağmen, genelde dünya literatüründe yağlık ayçiçeği ile birlikte değerlendirilmektedir. Gerçek anlamda ülkesel bazda yağlık ve çerezlik olarak ayrı ayrı nitelendirilmesine rağmen, ülkelerarası tarım organizasyonlarında (OECD, FAO, ISA. vb.) çerezlik istatistiklerine pek yer verilmemektedir. Başlıca çerezlik ayçiçeği üreticisi ülkeler, ABD, Macaristan, Arjantin, İspanya, İsrail, Çin, Türkiye ve Moldovya gibi bazı Doğu Avrupa ülkelerdir. Bugün dünyada en fazla çerezlik ayçiçeği üreten ülke ABD' dir. Bu ülkenin toplam ekim alanı 200 bin ha olup üretimi de 300 bin ton civarındadır. Dünyada başlıca çerezlik ayçiçeği alıcısı ülkeler, kabuksuz olarak Almanya, Danimarka, Hollanda, Kanada, Meksika, İngiltere ve Belçika, kabuklu olarak da İspanya, Çin, Türkiye, Ürdün, Kanada, Meksika, İsrail, Almanya ve Japonya'dır (Anonim, 2023b). Ancak çerezlik ayçiçeğinin atığının değerlendirilemediği bilinen acı bir gerçektir. Sıfır Atık Yönetmeliği'nde "hammadde ve doğal kaynakların etkin yönetimi ile sürdürülebilir kalkınma ilkeleri doğrultusunda atık yönetimi süreçlerinde çevre ve insan sağlığının ve tüm kaynakların korunmasını hedefleyen sıfır atık yönetim sisteminin kurulmasına, yaygınlaştırılmasına, geliştirilmesine, izlenmesine, finansmanına, kayıt altına alınarak belgelendirilmesine ilişkin genel ilke ve esasların belirlenmesidir" şeklinde ifade edildiğine göre, bu projenin ilgili yönetmeliği de güzel bir örnek olacağı düşünülmektedir (Anonim, 2023c).Dorrel ve Vick (1997)'e göre, diğer bitkilerde olduğu gibi, ayçiçeği kabuğu taneyi kaplar ve onu dış faktörlerden korur. Yağlık ayçiçeği tanesinin toplam ağırlığın yaklaşık %21-30'u kabuktur.

Çerezlik çeşitlerde bu oran %36-50 arasında değişir. Bununla beraber çerezlik ve yağlık çeşitlerin kimyasal bileşimleri arasında, çerezliklerin biraz daha fazla lif içermesi hariç, çok önemli bir fark yoktur. Ayçiçeği bitkisinde tanedeki kabuk ve yağ oranı arasında ters bir korelasyon mevcuttur. Tanedeki yağ oranı arttıkça kabuk oranı düşer. İyi bir yağlık ayçiçeği hibrit çeşidin tanesindeki yağ oranı %50'nin üzerinde ve kabuk oranı ise, %20 civarında olmalıdır.



Şekil 1. Türkiye'de 2020/2021 sezonunda illere göre ayçiçeği üretim yüzdeleri.

Gerek yağlık gerekse çerezlik taneler, yüksek oranda lif (ham selüloz) ve düşük miktarlarda da ham yağ ile kül içerir. Kabuktaki selüloz, lignin, hemi-selüloz miktarları %74-90 olup, geriye kalan kısmı da lipit, protein ve mineral maddelerden ibarettir. Doty (1978) tarafından bildirildiği üzere, ayçiçeği gerek tanesinin tümü gerekse sadece kabuğu, herhangi bir kimyasal maddeyle işlem görmediği sürece, zararlı bir şey içermez. Ancak yakılma işlemi sırasında çıkardığı atmosfere karışan CO_2 ve diğer gazlar, tıpkı diğer yakacak ürünlerinin kullanılmasında olduğu gibidir. Ancak bu ek ürün olarak ortaya çıkan kabuğun, alternatif kullanım alanları da mevcuttur. Ayrıca çerezlik ayçiçeğinde kabuksuz tüketimde ek madde olarak ortaya çıkar. Ancak bu tür tüketim ülkemizde çok yaygın değildir. Kabuk oranı çerezlik ayçiçeği çeşitlerinde yağlıklara nazaran daha fazladır. Yağlık ayçiçeği kabukları çerezlik tiplere nazaran daha yüksek oranda protein ve yağ içerdikleri için, hayvanlar açısından iyi bir yem kaynağı olabilir. Ayçiçeği kabukları büyükbaş hayvan yetiştiriciliğinde saman yerine altlık olarak da kullanılabilir. Çünkü saman ile aynı oranda sıvı emme kapasitesine sahiptir. Ayrıca bu kabuklar kereste endüstrisinde dolgu ve yalıtım maddesi, biyolojik yakıt elde edilmesinde

ve paketleme materyali olarak da kullanımı mümkündür. Ayrıca, Kanada'da silindir şeklinde preslenerek çıra malzemesi ve Rusya'da da etil alkol ve boya malzemesi elde edilmesinde yaygın olarak kullanılmaktadır. Yapılan bir proje çalışmasında kâğıt elde edilmesinde kullanılamayacak kadar iri olan parçalardan oluşan ayçiçeği kabuklarının kurşun içeren atık suları temizlemek için kullanıldığı bildirilmiştir (Anonim, 2023a). Görüldüğü gibi ayçiçeği kabuğu kerestecilik dahil çok çeşitli alanlarda kullanılabilmektedir. Ancak ülkemizde genellikle yakılarak yok edilme yöntemi uygulanmaktadır. Bu çalışmada, ayçiçeği kabuğunun kompost ve/veya vermikompost değerinin olup olmaması da değerlendirilecektir.Yakın geçmişe kadar tarımsal üretimde en çok tercih edilen ahır gübresinin yabancı ot kontrolünde problemlere sebep olması ve hijyenik olmaması gibi problemlerin ortaya çıkmasıyla, 1970'li yıllardan itibaren bilim insanlarının uğraşlarıyla solucanlar kullanılarak ahır gübreleri özel işlemlerden geçirilmiş ve etkisi çok yönlü olan bir yandan bitki besin maddeleri içeren bir yandan toprak ıslah maddesi olarak kullanılan vermikompost ortaya çıkmıştır (Bellitürk, 2017). Kimyasal gübrelerin yerini almak veya kullanımını önemli ölçüde azaltmak için organik gübrelerin kullanılması, sürdürülebilir mahsul üretiminin kalitesinde ve performansında bir artışa yol açar. Vermikompost ve bitki gelişimini teşvik eden bakteriler gibi organik gübrelerin ve biyogübrelerin tarım alanlarında kullanılması, kimyasal gübre uygulamalarının azalmasına neden olmuş ve insan sağlığını tehdit eden kimyasallardan arınmış yüksek kaliteli ürünler elde edilmiştir (Darzi ve ark., 2015). Mevcut organik gübrelerle, kimyasal gübre kullanımı yapmadan, yüksek seviyede verim elde etmek çok zordur. Fakat toprağın sürdürülebilir kullanımı açısından, verimlilik ve devamlılığın organik gübreyle sağlanacağı göz ardı edilmemelidir. Toprağın dengesini bozmadan, durumunun iyileşmesini sağlayacak faktörlerden birisi de vermikompost olarak adlandırılan solucan gübresidir. Solucanlar, sindirim sistemlerinde üretmiş oldukları antibiyotik özellikli maddeleri, aminoasitleri ve vitaminleri dışkılarına karıştırırlar ve oluşan gübrenin biyolojik yapısını iyileştirmektedirler. Ayrıca bileşimlerinde humik ve fulvik asit gibi bitkilerin beslenmesi için önemli derecede etkili olan büyüme düzenleyici maddeler bulunmaktadır. Birçok bitki için faydalı bir materyal olan solucan gübresi, ayrıca değerli bir toprak düzenleyicidir. Solucan gübresinin, ticari gübre olarak üretimi yapılarak çiftçilerin hizmetine sunulması için özel üretim yerlerine ihtiyaç bulunmaktadır. Organik atıkların çürütülmesi veya çiftlik gübresi gibi organik 3 maddelerin kullanılmasıyla solucan gübresi elde edilmektedir (Demir ve ark., 2010; Sarıoğlu ve Doğan, 2018).

Küresel ısınma gibi nedenlere bağlı doğanın ve iklimlerin değişmesi neticesinde, tarım toprakları, bitki büyümesindeki etkili olan bitki besin elementlerini tutamaz hale gelmiş ve verimsizleşme sürecine girmiştir. Toprakların bilinçsizce kullanımı sebebi ile toprak organik maddesinin gün geçtikçe azalması ile %1 seviyesinin altına inmiştir. Toprak organik maddesini artırmak için kimyasal gübre kullanımı tek başına yeterli değildir. Toprakta organik madde miktarını arttırmak için solucan gübresi, çöp kompostu, yarasa gübresi, yeşil gübre, termofilik kompost vb. gübrelerin takviyesi ile sürdürülebilir tarım yapmak mümkündür. Organik gübreler içinde ise yıldızı giderek parlayan vermikompostun iyi bilinmesi hem üretiminin hem de tarımda kullanımının yaygınlaştırılması gerekmektedir (Bellitürk, 2016). Genel bir kural olarak hayvansal ve bitkisel atıkların karışımıyla beslenen solucanlardan elde edilen vermikompostun daha iyi kaliteli bir organik gübre olduğu belirtilmektedir (Bellitürk, 2017). Bu araştırmada, çerezlik ayçiçeği kabuklarının farklı oranlarda inek gübresi ile karıştırılması neticesinde elde edilen materyalin *Eisenia fetida* cinsi solucanlara mama olarak yedirilmesi neticesinde organik gübre olarak bilinen vermikompost üretilmiştir. Üretilen bu vermikompostun bazı fiziksel ve kimyasal analizleri yapılarak, gübre değeri ile birlikte organik atıkların tarımsal amaçlı olarak geri dönüşümüne ilişkin bilimsel değerlendirmeler yapılmıştır.

1.1. Ayçiçeği Kabuğunun İçeriği ve Değerlendirilme Yöntemleri

Ayçiçeği kabuğu bütün bitkilerde olduğu gibi taneyi kaplar ve çevresel etmenlerden korur. Yağlık ayçiçeği tanesinin ağırlığının yaklaşık %21-30'u kabuktan oluşmaktadır. Çerezlik çeşitlerde bu oran %36-50 arasında değişir. Kabuktaki selüloz, lignin, hemi-selüloz (çoğunluğu glucuronoxylan) miktarları %74-90 olup geriye kalan kısmı da lipit, protein ve mineral maddelerdir (Dorrel ve Vick, 1997).

Çizelge 1. Ayçiçeği kabuğunun besin maddesi kapsamının yüzde değerleri (Park ve ark.,1997).

Ayçiçeği Kabuğunun Besin Maddesi Kapsamı	
Kuru Madde	% 85-92
Ham Protein	% 3.5-9
Sindirilebilir Protein	% 2-4
Sindirilebilir Besin Maddesi Toplamı	% 35-45
Ham Selüloz	% 40-50
Lignin	% 13-16
Kül	% 2-3
Yağ	% 0.05-3
Ca	% 0.37
Mg	% 0.15-0.25
P	% 0.12

Yapılan araştırmalarda ülkemizde ayçiçeği işleyen bazı fabrikalarda kabuk tamamen küspe eldesinde kullanılırken bazı fabrikalarda da özellikle yüksek proteinli küspe elde edilmek istendiğinde, yaklaşık %7-12 aralığında bir ek ürün olarak çıkmakta, bu durumda da ısıtma kazanlarda enerji ihtiyacını karşılamak için kömür ile karıştırılarak yakılmaktadır (Kaya, 2024). Ayçiçeği gerek tanesinin hepsi gerekse yalnızca kabuğu, herhangi bir kimyasal maddeyle işlem yapılmadığı müddetçe, zararlı bir madde içermez. Ancak yakılma işlemi esnasında çıkardığı, atmosfere karışan karbondioksit ve diğer gazlar, aynen diğer yakacak ürünlerinin kullanılmasında olduğu gibidir. Ancak bu ek ürün olarak ortaya çıkan kabuğun, alternatif kullanım alanları da mevcuttur. Ayrıca çerezlik ayçiçeğinde kabuksuz tüketimde ek madde olarak ortaya çıkar. Fakat bu tür tüketim şekli ülkemizde çok yaygın değildir. Kabuk oranı çerezlik ayçiçeği çeşitlerinde yağlıklara göre daha fazla olmaktadır. Yağlık ayçiçeği kabukları çerezlik tiplere kıyasla daha yüksek oranda protein ve yağ içerdiklerinden dolayı hayvanlar için iyi bir yem maddesidir. Ayçiçeği kabukları sığır yetiştiriciliğinde saman yerine altlık olarak kullanılabilir. Çünkü saman ile aynı oranda sıvı absorbe kapasitesine sahiptir. Ayrıca bu kabuklar kereste endüstrisinde dolgu ve yalıtım maddesi, biyolojik yakıt eldesinde ve paketleme materyali olarak da kullanılmaktadır. Ayrıca, Kanada'da silindir şeklinde preslenerek çıra malzemesi ve Rusya'da da etil alkol ve boya malzemesi eldesinde kullanılır (Doty, 1978).Ayçiçeği kabuğunun bir diğer kullanım alanı da özellikle bazı türlerin kabuğunda içerdiği antociyanin olarak bilinen kırmızı boya maddesi sebebiyle gıdalarda doğal katkılı boya olarak kullanılmasıdır. Bilindiği üzere gıda sektöründe kullanılan sentetik renklendiricilerin yan etkileri üzerine, kırmızı ve pembe renk veren doğal antociyanin kaynakları oldukça önemli olmuştur. Yine yapılan araştırmalarda, dana ve sığır besiciliğinde %50'ye kadar ayçiçeği kabuğu içeren ancak en az %15 ham protein içeren rasyonlarda herhangi bir beslenme bozukluğu görülmemiştir. Ancak yine %50 ayçiçeği kabuğu, %50 üre katkılı mısır silajı ve 1,4 kg/baş arpa tanesi içeren rasyonlarda, hazım zorluğu sebebiyle beslenme periyodu boyunca meydana gelen bazı sığır ölümleri görülmüştür (Park ve ark.,1997). Bu nedenle aynı araştırıcılar, herhangi beslenme veya hazım problemi ile karşılaşmamak için besicilikte %30, süt besi rasyonlarında ise ayçiçeği kabuğu katkısının % 10'u geçmemesi gerektiğini belirtmişlerdir. Ayçiçeği kabuğu yüksek oranda selüloz içerir ancak düşük bir besin maddesi kapsamına sahiptir ve sindirimi zor ve tadı güzel değildir. Yine pelet haline getirilmiş ayçiçeği kabuğu briket haline getirilmiş saptan daha yüksek ısı içeriğine sahiptir. Ancak bu pelet haline getirilmiş kabuğun yanma sırasındaki aşırı ısınmayı ve fazla dumanı önleyen yeterli hava alım hızı düşüktür. Peletlerin ortalama yanma randımanı %62'dir. Kül oranı ve külün diğer

özellikleri odundan farklı değildir. Ancak sap briketinin kül oranı %10,8 iken kabuk peletlerinin ise %3,6'dır (Park ve ark., 1997). Yine ayçiçeği kabuğunun yakıt değeri 8300 - 8500 BTU / pound civarında değişmektedir. ABD'de ayçiçeği işleme tesisleri, okullar gibi bazı kuruluşlar, elde ettikleri bu kabukları fırınlarda yakacak olarak kullanmaktadır. Yine ayçiçeği kabuğundan yapılan briketlerin, ABD'de bazı yerlerde şöminelerde kömür yerine kullanımı oldukça yaygındır (Lilleboe, 1991). ABD'de, ayçiçeği işleyen fabrikaların nakliye maliyetlerinde ayçiçeği kabuğunun belirli bir boyut teşkil ettiğinden, genelde kabuğunun çıkartılması daha tasarruflu olmakta ve ayçiçeği kabuğu yakılarak ısı enerjisi elde edilmesi de tesislere artı bir değer getirmektedir. Ancak fırınlarda yakılması sırasında kabukların fazla miktarda kül bırakması olumsuz bir sonuçtur. Yine bu tür tesislerin yakınlarına kurulan tavukçuluk ve hayvancılık tesislerinde ayçiçeği kabukları hayvanların altlarına serilmektedir (Kaya, 2024).
Ayçiçeği kabukları tonu 30$'a kadar alıcı bulmaktadır (Dorrel ve Vick, 1997). Ayçiçeği kabuğunun değerlendirilmesi konusunda birçok araştırmalar yapılmasına rağmen çok az bir kısmı uygulamaya sokulmuştur. Ligno-selülozik bir madde olarak ayçiçeği kabuğu, fermentasyon yoluyla şeker üretiminde, bazı kimyasallara ve değerli bileşiklere dönüşümde oldukça ekonomik bir kaynaktır. Örneğin ayçiçeği kabuğunun asit veya celulase enzimleriyle hidrolizi, kabukta şeker oranını arttırarak besi değerinin artmasına ve yine maya için gerekli maddelerin oluşumuna yol açmaktadır. Ayçiçeği kabuğunun hücre duvarlarında karbonhidratlarla birlikte bulunan lignin maddesi, enzimlerin bu karbonhidratları şekerlere dönüştürmesini sınırlandırmaktadır. Ancak kabukların sodyum hidroksit ile 1,5 saat 120 ºC de muamelesi lignin maddesinin %55 oranında azalmasına ve %39 oranına kadar polisakkaritlerin şekerlere dönüşmesine yol açmaktadır (Kaya, 2024).Ayçiçeği, altı kıtada yetiştirilen ve toplam üretimi 54,42 milyon ton olan bir bitkidir. Türkiye'de 728 bin hektar alanda 2 milyon ton ayçiçeği tohumu üretilmektedir (Anonim, 2024b). Ayçiçeği üretiminin %40-65'ini oluşturan ayçiçeği kabuğu, tarımsal bir yan üründür (Perea-Moreno ve ark., 2018). Ayçiçeği kabuğunun geri kazanımında başlıca yöntemler, yakıt amaçlı ayçiçeği kabuğundan pelet üretimi ve kıyılmış olarak samanın yerine hayvan yeminde kullanılması karşımıza çıkmaktadır (Binboğa, 2019; Bala-Litwiniak, 2020).

1.2.İnek Gübresi ile İlgili Yapılan Çalışmalar

Köse (1998), 1996-1997 yıllarında mineral gübrelemeye alternatif olarak organik gübrelemenin (mikoriza, kompost ve ahır gübresi) biber bitkisinin besin elementi alımı üzerindeki etkilerini

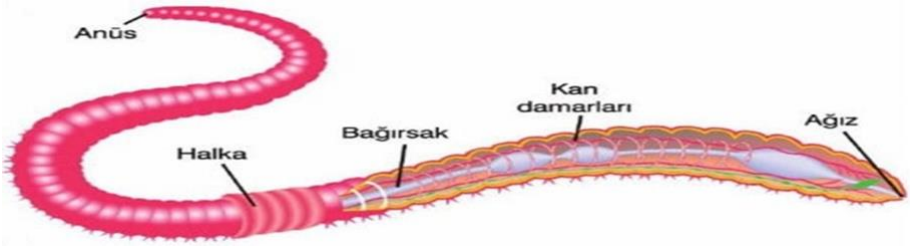
araştırmak üzere, Çukurova Bölgesinde 2 yıl boyunca yaptığı çalışmasında her iki yılda da mikorizal inokülasyon, kompost ve ahır gübresi uygulamasının, mineral gübreleme ve kontrole göre yaklaşık 2 kat daha fazla artış sağladığını belirtmiş, biber veriminin ilk yılda kompost, ikinci yılda ise mikoriza parsellerinde yüksek olduğunu belirtmiştir. Besin elementi içerikleri yönünden ise kompost, mikoriza ve ahır gübresi uygulanmış parsellerde P, Mn, Cu, Fe ve Zn, içeriklerinin mineral gübre uygulamasına göre genelde daha yüksek olduğunu bulmuştur. Camberato ve ark. (1996) tarafından ahır gübresinin arazide uygulanması üzerine yapılan bir çalışmada, katı gübrenin gereken önlemler alınmadan ve yağmur suyu ile yıkanmaya maruz bırakılmış bir şekilde depolandığında, gübre içinde bulunan N ve K2O miktarının azalmasına neden olduğunu bulmuşlardır. Ayrıca yanlış depolanan gübreden N'in süzülmesinin yüzey ve yeraltı sularında kirliliğe sebep olduğunu, bundan dolayı işlenmek ve araziye uygulanmak üzere depolanan gübrenin gerekli önlemler alınarak korunması gerektiğini belirtmişlerdir. Karaman (2005), tarafından Tokat yöresinde hayvancılık işletmelerindeki barınaklardan kaynaklanan çevresel etkiler ve ilgili yapıların özelliklerini incelemek, yeterliklerini ve geliştirilebilme olanaklarını saptamak amacı ile farklı yapı ve teknik özelliklere sahip değişik kapasiteli ahırlara sahip 76 işletmede yapılan çalışmada, işletmelerin %87'sinde katı atıklar tarım alanlarına serilerek, %5'inde komşu çiftliklere verilerek, %7'inde satılarak değerlendirilmektedir. Gübreliği bulunmayan işletmelerin %98'inde gübre araziye yığılmaktadır. Gübre bu işletmelerin %3'ünde taş döşeme üzerine, diğerlerinde toprak zemine yığılmakta, iki işletmede ise doğrudan nehre boşaltılmaktadır. Elde edilen gübrenin değerlendirme şekli bakımından 1-5 baş hayvanı olan tesislerin %15 inde gübrenin tezek olarak kullanıldığı, %45'inin kendi arazisinde biriktirdiği, %28'inin sattığı, %12'sinin ise yol kenarları veya boş alanlara rastgele attığı, 6-10 baş hayvana sahip işletmelerde ise %45'inin sattığı, %33'ünün kendi arazisinde biriktirdiği, %2'sinin boş araziye attığı, 11 baş ve üstü işletmelerde ise %40'ının kendi arazisinde biriktirdiği, %60'ının sattığı saptanmıştır. Gübrenin bekletilme süresi ise tüm gruplarda 2 ay ile 1 yıl arasında olduğu belirlenmiştir.Son yıllarda hayvan gübresine uygulanan işlemlerle (havalandırma, biogaz üretimi, kompost yapma ve kurutma) çevreye daha az zarar vermesi ve tarlada organik gübre olarak daha etkin olması olanakları oluşturulmaktadır. Nitekim belirtilen işlemlerle çevreye yayılan pis koku azaltılmakta, hastalık etkenleri öldürülmekte, atık madde, hidrojen içeriği belirli düzeyde tutulmakta veya düşürülmekte, gübre ağırlığı ve hacmi bakımından anlamlı bir azalma sağlanmaktadır (Ergül, 1989). Hayvansal üretim hem insan beslenmesinin gereklerinden hem de tarımın vazgeçilmezlerindendir. Fakat yapılan her tarımsal faaliyet gibi hayvansal üretimde çevre kirliliğine neden olmaktadır.

Hayvansal üretim sonucu ortaya çıkan gübre ve idrar atıkları, gaz, koku, toz, ölen hayvanların cesetleri, kesimhane atıkları çevreye ve insana zarar oluşturabilmektedir. Hayvansal üretim sonucu çevreye olumsuz etkisi olan başlıca etmenler aşağıda ifade edilmiştir. Hayvancılık faaliyetine bağlı olan çevre kirliliğinde başlıca atıklar hayvanlardan doğrudan kaynaklanan sıvı (idrar) ve katı (gübre) atıklardır. Bu atıklar işletmelerde kaldırılmalı, depolandıktan belli bir zaman sonra tarım arazilerinde kullanılmaktadır (Parlakay ve ark., 2015).

1.3. Kompost ve Vermikompost İle İlgili Yapılan Çalışmalar

Geleneksel tarım yöntemi daha fazla ürün elde etme esasına dayanır. Yapılan çalışmalar göstermiştir ki; bu anlayışla gerek gübrelerin gerekse tarımsal ilaçların bilinçsizce kullanımı, bitkisel üretimde miktar artışının yanında kalitesiz ve insan sağlığını tehdit edecek ürünlerin ortaya çıkmasına neden olmaktadır. Sanayileşmeden kaynaklanan çevre kirliliğinin de etkisiyle soframıza gelen tarımsal ürünlerin doğallığı ve güvenilirliği neredeyse kalmamıştır. Son yıllarda günümüz tarımında kullanılan kimyasal ilaçların ve gübrelerin neden olduğu çevre kirliliği ve bu kirlenmenin insan sağlığı üzerindeki etkileri yoğun bir biçimde tartışılmaktadır (Bellitürk, 2005; Bellitürk, 2008; Bellitürk ve ark., 2015; Shrestha ve ark., 2019). Hızlı nüfus artışı, plansız kentleşme, plansız endüstrileşme, doğal kaynakların ölçüsüz kullanılması kirliliğin en önemli faktörleridir. Doğal çevreyi oluşturan toprak, su ve havanın kimyasal özelliklerinin canlıların hayati faaliyetlerini ve aktivitelerini olumsuz yönde etkileyecek biçimde bozulması “kimyasal kirlenme”dir. Çevremizde ne kadar çok kimyasal madde varsa sağlığımız o ölçüde tehlikeye girmektedir. Çeşitli fabrika katı ve sıvı atıklarının verimli tarım arazilerine veya akarsu ve nehirlere boşaltılması söz konusu tarım topraklarının, akarsu ve göllerinin zararlı ağır metallerle kirlenerek kimyasal kirlenmeye maruz kaldığını gösterir (Özsavaş, 2015). İnsan sağlığını etkileyen tüm ekosistem düşünüldüğünde çevre kirliliğinin hava, toprak ve su kirliliği olarak üçlü bir kombinasyonda ele alınarak yapılacak çalışmaların bu doğrultuda ele alınması gerekir (Çağlarırmak ve Hepçimen, 2010). Sürekli artan dünya nüfusu ile ters orantılı olarak tarım topraklarının azalması insanoğlunu açlık gibi büyük bir tehditle karşı karşıya getirmiştir. Artan besin ihtiyacımızı karşılamak amacıyla, tarımsal uygulamalarda bilinçsizce kullanılan kimyasal gübre ve kimyasal ilaçlar, tarım topraklarımızın sürdürülebilir verimliliğini olumsuz etkilemekle birlikte doğal dengeyi de bozmaya başlamıştır. Bu sorunlar karşısında tarımı sadece topraktan yararlanarak her türlü kimyasal gübre ve ilacı kullanarak üretim yapmak yerine, doğaya zarar vermeden, toprağın sürdürülebilir verimliliğini

ve doğal dengeyi koruyarak, insan sağlığını tehdit etmeyen, çevreyle dost olan organik ürünlerin kullanımını hedefleyen tarımsal üretim sistemlerini uygulanmalıdır. Organik gübreler; hayvan atıklarından ve benzer doğal yollarla oluşan maddelerden üretilerek, hiçbir kimyasal madde ile etkileşim içerisinde olmadan elde edilir. Bunun en güzel örneklerinden birisi solucan gübresidir. Vermikompost, belirli bir solucan türü kullanılarak, organik atık ve artıkların kısa sürede elde edilen yüksek kaliteli bir biyoteknolojik kompost çeşitidir. Ticari ve ekolojik açıdan yüksek değere sahip ürünler elde ettiğimiz vermikompost tekniği yoğun olarak tüm dünyada uygulanmaktadır. Ürün kalitesi olarak termofilik kompost ürünlerine göre vermikompost ürünleri fiziksel, kimyasal ve biyolojik özellikleriyle daha üstün niteliktedir ve ekonomiktir. Son ürününde vermikompostun insan sağlığını tehdit edecek patojenler olmadığı için uygulayıcılar vermikomposta çıplak elle dokunabilir (Erşahin Yılmaz, 2007). Bellitürk ve ark. (2018)'nın bildirdiğine göre, Türkiye'de son yıllarda zeytin bahçelerinin gübrelenmesinde kullanılan kimyasal gübrelere ilaveten vermikompost, çöp kompostu, yosun gübresi gibi organik gübrelerin de ilave edilmesi, bu konuya verilen önemin farklı bir göstergesidir. Kimyasal gübrelerle yapılacak gübrelemenin etkinlik derecesi, diğer faktörlerin yanında toprağın organik madde içeriği ile pH değerine de bağlı bulunmaktadır. Zeytin yetiştiriciliğinde tam başarının sağlanabilmesi için belli esaslara dayalı olarak kimyasal gübrelerin organik gübreler ile desteklenmesi gerekmektedir (Bellitürk ve ark., 2015). Vermikompost tek başına iyi bir organik gübre olmasının yanında, kimyasal gübreler ile birlikte kullanıldığında hem kimyasal gübrenin etkinliğini artırmakta ve hem de miktarının azalmasına sebep olarak üretim maliyetlerinin azalmasına sebep olmaktadır. Bunun dışında vermikompost çevreyle dost ve üretilen ürünlerin kalitesinin artırılmasına büyük katkı sağlayan organik tarımda kullanımı kabul edilen iyi bir organik gübredir. Solucanların kullanılmasıyla kompost elde edilmesi, açık alanlarda basit yığınlarda, kasalarda ya da otomasyonlu kompleks kapalı sistemlerde gerçekleştirilmektedir (Edwards, 2004). Üretimde yararlanılan solucanların optimum koşullarda yaşatılması, vermikompost verimliliğini ve kalitesini etkileyen en önemli faktörlerdendir (Neuhauser ve ark., 1998). Üretim aşamasındaki vermikompost için pH, sıcaklık, ışık, koku, nem, karbondioksit, oksijen, yatakların derinliği gibi parametrelere dikkat edildiği durumda, kaliteli bir solucan gübresi elde edilebilir ve solucan kültürünün sürdürülebilirliği sağlanır (Li, 2011).



Şekil 2. Solucanın morfolojik yapısı ve vücut anatomisi.

Vermikompost için belirlenen kalite parametreleri yüksek tuz içeriği halinde bitkide toksik etkiye neden olur, besin değerinin belirlenmesi durumunda Ca, Mg, SveB elementlerinin önemli olduğu belirtilmektedir (Hepşen Türkay, 2016). Vermikompost içeriğinde bulunanbesin elementlerinin %97' si ve özellikle N, P ve K gibi besin elementleri büyüme esnasında bitki tarafından doğrudan alnabilir formdadır (Barley, 1961). (Bellitürk ve ark., 2015; Bellitürk, 2018; Aslam ve ark., 2020; Aslam ve ark., 2021a; Aslam ve ark., 2021b; Kılbacak ve ark., 2021; Koç ve ark., 2021). Vermikompost üretiminde birçok bitkisel ve hayvansal atık kullanıldığı bilinmektedir (Bellitürk ve ark., 2014; Bellitürk, 2016). Çeşitli organik atıklar kullanarak vermikompostlar elde ederek solucanlara verilen besin maddesinin vermikompost içeriği üzerine etkisinin önemli olduğunu belirtmiştir. Solucanlara verilen besin maddesi haricinde, vermikompostun üretildiği ortam şartları ve solucan türü de önemli faktörler arasındadır (Bellitürk, 2016). Zaller (2007) yaptığı bir çalışmada, Eisenia fetida türü solucanlara pamuk ve yemek artıkları verilerek üretilmiş olan vermikompostu, torf ile %0, 20, 40, 60, 80, 100 (v/v) oranları ile karıştırmıştır. Sera koşullarında yapılan çalışmada, domates (Lycopersicon esculentum Mill.) tohumlarının çimlenmesine, büyüme ve biyokütleye olan etkisine, araziye aktarılmış olan fidelerin domates verimi ve kalitesi, domates çeşitleri arasındaki etkiler değerlendirilmiştir. Vermikompost etkisi, domates çeşitlerinin tamamında çimlenme ve fide gelişimini önemli derecede etkilemiştir. Amerika Birleşik Devletleri, Çek Cumhuriyeti ve Japonya gibi ülkelerde yapılan vermikompost uygulaması sonucunda buğday veriminde %15-20, patates veriminde %50-80, yaprakları yenen pancar veriminde %15-20, mısır veriminde %30-50, hıyar, domates ve biber verimlerinde %20-30, üzüm ve şeftali verimlerinde %80-100, çilek veriminde %30-35 oranında artışlar olduğu tespit edilmiştir (Anonim, 2013).

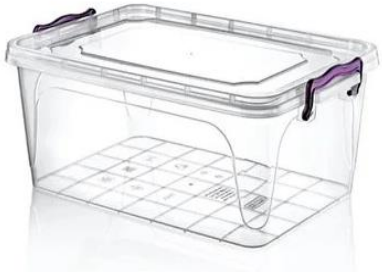
2. Materyal ve Yöntem

2.1.Materyal

2.1.1. Deneme Kullanılan Materyaller Denemede bitkisel kaynaklı ayçiçeği atıkları (SW), hayvansal kaynaklı inek gübresi (CM), Kırmızı Kaliforniya Solucanı olarak bilinen Eisenia fetida türü solucanlar, saf su, plastik kilitli kaplar kullanılmıştır (Şekil 5 ve Şekil 6).



Deneme İçin Gelen Solucanlar



Kullanılan Kap



Çerezlik Ayçiçeği Atığı



Öğütme İşlemi



Öğütülmüş Atık



İnek Gübresinin Hazırlanması

Şekil 3. Denemede kullanılan materyaller.

2.1.2. Denemenin Planlanması ve Yürütülmesi

Bu projede kullanılan çerezlik ayçiçeği atıkları, Manisa ili Kırkağaç ilçesi merkezinden temin edilecek ve Tekirdağ Namık Kemal Üniversitesi, Ziraat Fakültesi, Toprak Bilimi ve Bitki Besleme Bölümü'ne ait olan Vermikültür Laboratuvarı'nda ön fermantasyon işlemi yapılmıştır. Denemede kullanılan hayvansal kökenli olan inek gübresi (CM) üniversitemiz hayvancılık işletmesinden temin edilecek ve ön fermantasyonu da gübrenin temin edileceği işletmenin uygun alanında kontrollü koşullarda yapılmıştır.



Atığın Tartılması İşlemi



Gübrenin Tartılması İşlemi



Atık ve Gübrenin Karıştırılması



Çalışma



Etiketlerin Yazılması



Etiketlerin Yapıştırılması



Çürütülme İşlemine Hazırlama



Çürütülme İşlemine Hazırlama



Çürütme İşleminin Başlatılması



Karıştırma İşlemi



Karıştırma İşlemi



Deneme İçin Gelen Solucanlar



Solucanların Ayıklanması



Solucanların Ayıklanması



Solucanların Sayılması



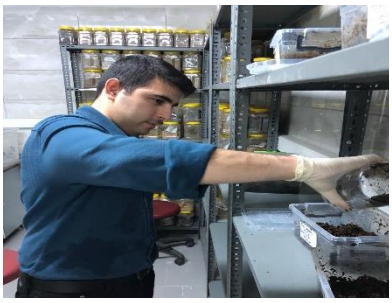
Solucanların Sayılması



Solucanların Sayılması



Deneme İçin Sayılan Solucanlar



Solucanların Kaplara Eklenmesi



Solucanların Kaplara Eklenmesi



Solucanların Kaplara Eklenmesi



Kaplara Eklenmiş Solucanlar

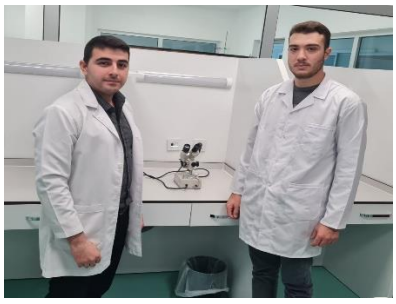


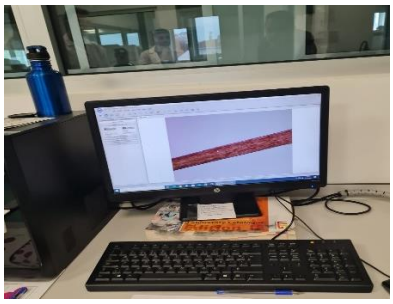
Kabın Kontrol Edilmesi



Kabın Neminin Ayarlanması


Laboratuvar


Laboratuvar


Laboratuvar

Şekil 4. Deneme analizinin planlanması ve yürütülmesi ile ilgili süreci.

İnek gübresinin toplam N'u %1, pH değeri 8.55, organik madde içeriği ise % 33 olarak analiz edilmiştir. Denemede Toprak Bilimi ve Bitki Besleme Bölümü'nde özel olarak yetiştirilen Eisenia fetida cinsi gübre kırmızı Kaliforniya solucanları kullanılmıştır. Deneme kurulduktan sonra vermikompost üretilmesi için gerekli olan süre 2 ay (60 gün) olarak tamamlanmıştır (Dominguez ve Edwards, 2004). Deneme 3 litrelik, özel olarak delikler açılmış kapaklı plastik kaplarda kurulmuştur (Şekil 5). Deneme (5 uygulama x 2 tekerrür) 10 adet plastik kaplarda yapılmıştır. Denemede ayçiçeği (SW) ve inek gübresi (CM) atıklarının farklı dozları tesadüf blokları deneme desenine göre kurulmuş ve yürütülmüştür.



Şekil 5. Deneme deseni.
Denemede parametreleri (uygulamalar) aşağıdaki gibi planlanarak yürütülmüştür:
1. %25 İnek Gübresi (CM) + %75 Çerezlik Ayçiçeği Atığı (SW) + 20 ad. solucan (*Eisenia fetida*) x 2 tekerrür
2. %50 İnek Gübresi (CM) + %50 Çerezlik Ayçiçeği Atığı (SW) + 20 ad. solucan (*Eisenia fetida*) x 2 tekerrür
3. %100 İnek Gübresi (CM) + %0 Çerezlik Ayçiçeği Atığı (SW) + 20 ad. solucan (*Eisenia fetida*) x 2 tekerrür
4. %0 İnek Gübresi (CM) + %100 Çerezlik Ayçiçeği Atığı (SW) + 20 ad. solucan (*Eisenia fetida*) x 2 tekerrür
5. %75 İnek Gübresi (CM) + %25 Çerezlik Ayçiçeği Atığı (SW) + 20 ad. solucan (*Eisenia fetida*) x 2 tekerrür



SW_0CM_{100} (1)



SW_0CM_{100} (2)



$SW_{25}CM_{75}$ (1)



$SW_{25}CM_{75}$ (2)



$SW_{50}CM_{50}$ (1)



$SW_{50}CM_{50}$ (2)



$SW_{25}CM_{75}$ (1)



$SW_{25}CM_{75}$ (2)



$SW_{100}CM_0$ (1)



$SW_{100}CM_0$ (2)

Şekil 6. Her bir uygulamada kullanılan materyallerin detayları.

Denemenin kurulduğu odanın ve kaplarda bulunan solucanların beslenme ortamı sıcaklık kontrolü haftalık olarak kontrol edilerek kaydedilmiştir. Bu amaçla proje bütçesi ile alınan seyyar termometreler kullanılmıştır. Deneme süresince, kaplar içerisinde azalan nem oranı, %70 civarına getirilerek saf su ile tamamlanmıştır.

2.2. Yöntem

2.2.1. Yapılan Fiziksel ve Kimyasal Analiz Yöntemleri

Deneme başlangıcında çerezlik ayçiçeği atığı (SW) ile inek gübresi (CM) numunelerinin ayrı ayrı olacak şekilde (fermente edildikten sonra) bazı analizleri (pH, organik madde, N, P, K, Ca, Mg, Fe, Zn, Cu) yapılmıştır. Projeye ilişkin deneme sonrasında elde edilen olan vermikompost örneklerinde yapılan analizlere ilişkin detaylı bilgiler aşağıdaki şekildedir:
pH: TS 9104'e göre 3 g kompost örneği üzerine 50 ml saf su konularak yarım saat beklenir ve pH metre cihazı ile belirlenmiştir (TSE, 1991).
Nem: Örnekler 60^{o}C'de 24 h bekletilerek nem değerleri belirlenmiştir (Sağlam, 2012).
Organik Madde: TS 9103'e göre 5 g kompost örneği kül fırınında 650 C°'de 4 saat yakılarak gravimetrik olarak belirlenmiştir (TSE, 1991).
Toplam Azot: Makro Kjeldahl Metodu ile belirlenmiştir (Kacar ve İnal, 2008; Sağlam, 2012).
Yarayışlı Diğer Makro (P, K, Ca, Mg) ve Mikro (Fe, Zn, Cu) Element Analizleri: Kompost örnekleri H2O2 + HNO3 ile mikro dalga yakma cihazında yakılıp elde edilen süzükte ICP-OES cihazı ile belirlenmiştir (Zarcinas ve ark., 1987).

3. Bulgular ve Tartışma

3.1. Vermikompost Analiz Sonuçları

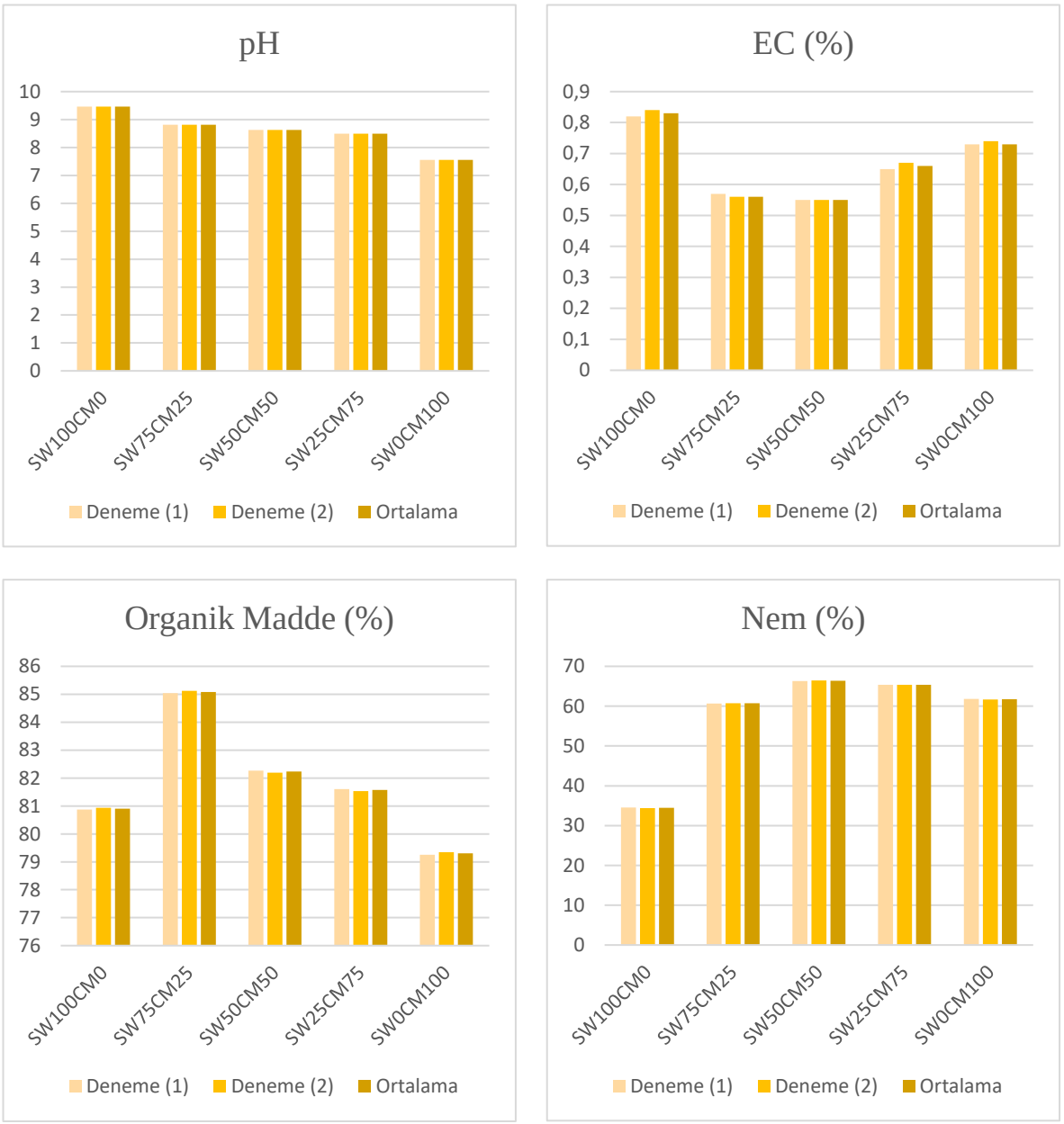
Denemeden elde edilen vermikompost örneklerine ait pH, EC, Nem, Organik Madde, N, P, K, Ca, Mg, Fe, Zn ve Cu analiz değerleri, 1. tekerrür, 2. tekerrür ve ortalama değerler Çizelge 2 ve Çizelge 3'te topluca gösterilmiştir.

Çizelge 2. Üretilen vermikompostun pH, EC, nem ve organik madde içerikleri.

Uygulama	Tekerrür	pH	EC (%)	Org. Mad. (%)	Nem (%)
$SW_{100}CM_0$	1	9,46	0,82	80,87	34,51
	2	9,46	0,84	80,93	34,39
	Ortalama	9,46	0,83	80,90	34,45
$SW_{75}CM_{25}$	1	8,81	0,57	85,04	60,68
	2	8,81	0,56	85,12	60,76
	Ortalama	8,81	0,57	85,08	60,72
$SW_{50}CM_{50}$	1	8,63	0,55	82,27	66,32
	2	8,63	0,55	82,19	66,46
	Ortalama	8,63	0,55	82,23	66,39
$SW_{25}CM_{75}$	1	8,49	0,65	81,61	65,35
	2	8,49	0,67	81,53	65,40
	Ortalama	8,49	0,66	81,57	65,37
SW_0CM_{100}	1	7,55	0,73	79,25	61,83
	2	7,55	0,74	79,35	61,66
	Ortalama	7,55	0,74	79,30	61,74

Çizelge 2'ye göre inek gübresi olmayıp sadece ayçiçeği atıklarının bulunduğu kaplardaki ($SW_{100}CM_0$) pH oranı ortalama 9.46 olarak bulunmuştur ve bunun deneme kaplarındaki en yüksek pH değeri olduğu görülmüştür. Dominguez ve Edwards (2011)'e göre ideal bir vermikompostun pH değerinin 5 ve 9 arasında olması gerekmektedir. Deneme sonunda elde edilen $SW_{100}CM_0$ haricindeki tüm örneklerin ortalama değerlerinin izin verilen değerler arasında olduğu görülmektedir. Organik gübrelerden özellikle vermikompost gübresinin pH değerinin 7.5 değerinin üzerinde olduğu bildirilmektedir (Edwards, 2004; Bellitürk, 2017). Bu projede pH değeri açısından 7.5 değerine en yakın sonuç "SW_0CM_{100}" uygulamasından elde edilmiştir.Deneme sonunda vermikompost örneklerinde, en yüksek ve en düşük tuz

değerlerinin sırası ile %0,83 ve %0.55 olarak ölçülmüştür. Tüm örneklerin ortalaması ise %0.66 olarak hesaplanmıştır. Vermikompost örneklerinin tuz içerikleri %1 değerinin altında bulunmuştur. Bellitürk ve Soytürk (2020) fındık kabuğu ve inek dışkısından elde ederek ürettiği vermikompost çalışmasında en düşük %0.02 ve en yüksek %0.3 tuz değerini elde etmişlerdir. Dolayısıyla yapılan bu çalışma ile vermikompost örneklerinin tuz içerikleri açısından benzerlik olduğu anlaşılmaktadır.Deneme sonunda vermikompost örneklerindeki tekerrür ortalamalarının değerleri dikkate alındığında en yüksek organik madde içeriği $SW_{75}CM_{25}$ uygulamasında %85.08 olup en düşük organik madde içeriği ise SW_0CM_{100} uygulamasında %79,30 olarak belirlenmiştir. Tarımda kullanılan organik ve mineral içerikli gübrelere dair yönetmelik taslağındaki değerlere göre vermikompostun en az %20 düzeyinde organik madde içermesi gerekmektedir (Anonim, 2024a). Bu durumda proje kapsamındaki denemeden elde edilen tüm vermikompost örneklerinin ilgili yönetmeliğe uygun olduğu görülmektedir. Bellitürk ve Soytürk (2020) tarafından fındık kabuğu ile yapılan benzer bir çalışmada en yüksek organik madde miktarı %41,11 olarak bulunmuştur. Dolayısıyla her iki çalışma karşılaştırıldığında, ayçiçeği atıklarının fındık kabuğu atıklarına göre vermikompostun organik madde içeriğini daha fazla artırdığı görülmüştür. Bu durumda vermikompost üreticileri solucanları beslemek için rahatlıkla ayçiçeği kabuğunu kullanabilir ve yüksek organik maddeli vermikompost üretebilirler.Çalışma sonucu elde edilen vermikompostlarda $SW_{100}CM_0$'nin nem oranı yaklaşık %35, diğer örneklerin ise %60-66 aralığında nem oranı çıkmıştır. Fakat Tarımda kullanılan organik ve mineral içerikli gübrelere dair yönetmelik taslağındaki değerlere göre vermikompostun nem değeri maksimum %35 olmalıdır (Anonim, 2024a). Bu sebeple ayçiçeği atıkları ile yapılan vermikompost çalışmalarından elde edilen ürünlerin nem miktarlarının ideal yüzdeye ulaşabilmesi için kurutulmaları gerektiği görülmüştür. Edwards (2004) tarafından bildirildiğine göre solucanların gübre üretirken en verimli olduğu nem değeri %70 civarında sabit tutulmalıdır. Ancak üretilen ve paketlenerek pazara gitmesi gereken organik gübrenin nem içeriği kurutma yöntemine göre düşürülmelidir. Bu projede üretilen gübre, pazarlanacak olsaydı nem içeriğinin düşürülmesi gerekirdi. Ancak bu derecede yüksek oranda nem içeriğine sahip vermikompost, satış amaçlı değil, araştırma amaçlıdır. Dolayısıyla araştırma sonucunda üretilen vermikompost, kurutma aşamasından geçmemiştir.



Şekil 7. Üretilen vermikomposttaki pH, EC, nem ve organik madde içerikleri

Elde edilen vermikompostlarda yapılan analizler sonucunda en yüksek azot içeriğinin %1,61 ortalama ile SW100CM0 uygulamasında, en düşük azot yüzdesinin ise %0,62 ortalama ile SW25CM75 uygulamasında olduğu görülmüştür. Bu sonuçlar, ayçiçeği atık oranı artıkça azot içeriğinin de arttığını göstermektedir Arancon ve Edwards (2011)'ın yaptığı bir çalışmaya göre inek gübresi vermikompostunun toplam %N değeri %1,9 olmalıdır. Organik atıklarla vermikompost üretiminde azot elementi hedef alındığında, bu atıkların başarılı bir şekilde kullanılabileceği görülmektedir. Bellitürk ve ark. (2015a) tarafından yapılan bir başka çalışmada kağıt atıkları ile inek gübresi karışımı kullanılmış olup, bu çalışmada

vermikompostun ortalama N değeri %1,11 olarak bulunmuştur. Lange (2005), gıda ve bahçe atıkları karışımı ile vermikompost üretmiş ve ortalama N değerini %1,81 olarak bulmuştur. Bu ve benzeri birçok çalışmada elde edilen vermikompost örneklerinin ortalama N düzeyi %1,0 civarında tespit edilmiş olup, bu değerin artmasının gübrenin kalitesini de artırdığı anlaşılmaktadır.

Çizelge 3. Üretilen vermikompost örneklerindeki N, P, K, Ca, Mg, Fe, Zn ve Cu içerikleri.

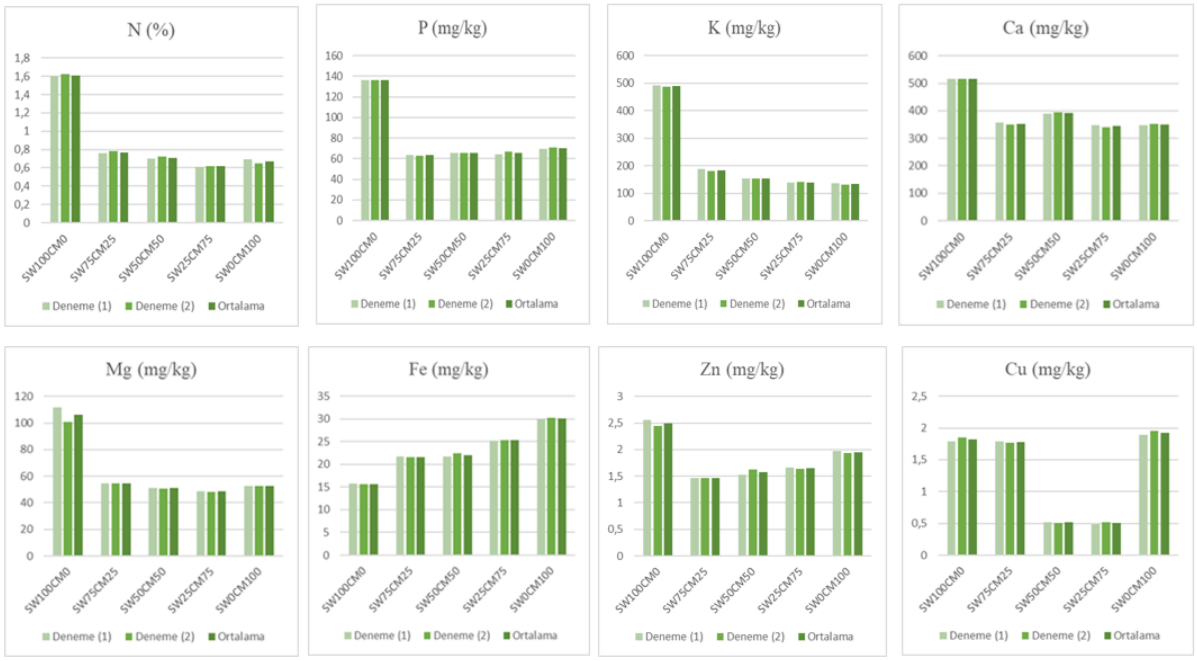
Uygulama	Tekerrür	N	P	K	Ca	Mg	Fe	Zn	Cu
		%	mg kg^{-1}						
$SW_{100}CM_0$	1	1,60	136,0	491,20	515,50	111,80	15,80	2,55	1,79
	2	1,62	136,0	486,60	515,80	100,70	15,60	2,45	1,85
	Ortalama	1,61	136,0	488,90	515,65	106,25	15,70	2,50	1,82
$SW_{75}CM_{25}$	1	0,76	63,80	187,00	356,50	54,40	21,70	1,46	1,79
	2	0,78	62,70	180,20	350,40	54,70	21,50	1,46	1,77
	Ortalama	0,77	63,25	183,60	353,40	54,55	21,60	1,46	1,78
$SW_{50}CM_{50}$	1	0,70	65,20	153,80	389,60	51,30	21,70	1,53	0,52
	2	0,72	65,40	152,10	395,50	50,80	22,40	1,63	0,51
	Ortalama	0,71	65,30	152,95	392,55	51,05	22,05	1,58	0,52
$SW_{25}CM_{75}$	1	0,61	64,50	137,40	347,60	48,80	25,20	1,66	0,49
	2	0,62	66,60	139,90	340,40	48,20	25,40	1,64	0,52
	Ortalama	0,62	65,55	138,65	344,00	48,50	25,30	1,65	0,51
SW_0CM_{100}	1	0,69	69,30	135,70	347,60	52,40	30,00	1,97	1,89
	2	0,65	70,80	130,60	351,60	52,60	30,20	1,94	1,95
	Ortalama	0,67	70,05	133,15	349,60	52,50	30,10	1,95	1,92

Tarım ve Orman Bakanlığı (eski adı Gıda, Tarım ve Hayvancılık Bakanlığı)'na ait "Tarımda Kullanılan Organik, Mineral ve Mikrobiyal Kaynaklı Gübrelere Dair Yönetmelik"te belirtildiği üzere, ülkemizde kullanılan solucan gübresinin toplam N içeriği en az %0,5 olmalıdır (Resmi Gazete, 2018). Deneme sonucunda elde edilen vermikompostların azot değerlerinin tümünün yönetmelikte geçen %0,5 oranını geçtiği görülmektedir. Bu da üretilen vermikompostların yönetmeliğe uygun olarak kullanıma uygun olduklarını göstermektedir. Yapılan vermikompost

çalışmasında elde edilen analiz sonuçlarına göre en yüksek fosfor miktarı ortalaması 136 mg/kg olarak SW100CM0 uygulamasında, en düşük fosfor miktarı ortalaması ise 63,25 mg/kg olarak SW75CM25 uygulamasında ölçülmüştür. Bellitürk ve Soytürk (2020) %90 fındık kabuğu+ %10 inek gübresi karışımından elde ettikleri karışımın vermikompostunda 126,28 mg/kg civarında bir P değeri elde etmişlerdir. Yani her iki çalışmanın da yüksek bitkisel atık+düşük miktarda hayvansal atık karışımlarına ait vermikompostta belirlenen P değeri açısından benzerlik taşıdığı görülmektedir. Vermikompost örneklerindeki Potasyum miktarları incelendiğinde; potasyum miktarı en yüksek olarak 488,90 mg/kg ortalama ile SW100CM0 uygulamasında, en düşük değer olarak da 133,15 mg/kg ortalama ile SW0CM100 uygulamasında bulunmuştur. Yapılan analiz sonuçları göz önüne alındığında vermikompost üretimimizdeki ayçiçek atık miktarı artıkça potasyum miktarı artmaktadır. Buradan da anlaşılacağı üzere ayçiçek atığı, vermikompost üretiminde potasyum miktarını artırmak için kullanılabilir. Lange (2005) tarafından yapılan benzer nitelikli başka bir çalışmada gıda+bahçe atığından elde edilen vermikompost örneklerindeki ortalama K miktarı %1,04 düzeyinde bulunmuştur. Arancon ve Edwards (2011) ise, inek gübresiyle besledikleri Eisenia fetida türü solucanların ürettiği vermikompostun K değerinin %1,4 civarında bulunduğunu ifade etmişlerdir. Bellitürk ve arkadaşları (2015a) tarafından kağıt+inek gübresi karışımından elde edilen atıklardan üretilen vermikompost örneklerinde elde edilen K değeri ise %0,32 düzeyinde bulunmuştur. Görüldüğü gibi atık türü değiştikçe elde edilen vermikompost örneklerindeki K değerindeki farklılık açık olarak göze çarpmaktadır. Analiz edilen vermikompost örneklerinin Ca ve Mg içerikleri incelendiğinde, en yüksek değerin K elementinde olduğu gibi SW100CM0 uygulamasında olduğu bulunmuştur. İnek gübresini solucanlara yem olarak veren Arancon ve Edwards (2011) tarafından yapılan benzer sayılabilecek nitelikteki bir çalışmadan elde edilen vermikompost örneklerinin Ca değeri 23,25 mg/kg, Mg değeri ise 5802 mg/kg olarak bulunmuştur. Ayçiçeği kabuğu+inek dışkısının yem olarak kullanıldığı bu çalışmadan elde edilen Ca ve Mg elementi için en yüksek değer sırasıyla "SW100CM0" uygulamasında 515,65 mg/kg ve 106,25 mg/kg olarak bulunmuştur.

Mikro element içerikleri bakımından vermikompost örnekleri ele alındığında; yarayışlı Cu ve Fe içeriği söz konusu olduğunda en yüksek değerin SW0CM100 uygulamasında olduğu ortaya çıkmıştır. En yüksek yarayışlı Fe içeriği "SW0CM100" uygulamasında ve 30,10 mg/kg olarak bulunmuştur. Bu değere göre, ayçiçeği çekirdeği atığı, Fe içeriği üzerine fazla bir etki yapmamıştır. Lange (2005) tarafından yapılan başka bir çalışmada atık olarak gıda atıkları+bahçe atıkları karışımı kullanılmış olup, ortalama Fe değeri 1440 mg/kg olarak

bulunmuştur. Aynı çalışmada tespit edilen yarayışlı Zn değeri ise 387,2 mg/kg olup, Bellitürk ve ark. (2015a) tarafından kağıt atıkları+inek gübresi atıklarıyla beslenen solucanlardan elde edeline vermikompostun değeri 48,8 mg/kg olmuştur. Ayçiçeği atıklarının kullanıldığı bu çalışmadan elde edilen yarayışlı Zn için en yüksek değer SW100CM0 uygulamasında 2,50 mg/kg olarak tespit edilmiştir. Dolayısıyla burada inek gübresinden ziyade ayçiçeği atıklarının yarayışlı Zn üzerinde daha fazla etkili olduğu görülmektedir. Fındık kabukları ve inek dışkısının atık olarak kullanıldığı başka bir çalışmadan elde edilen ortalama yarayışlı Fe, Mn, Zn ve Cu içerikleri sırasıyla 482,71 mg/kg, 61,95 mg/kg, 40,41 mg/kg ve 19,73 mg/kg olarak bulunmuştur (Bellitürk ve Soytürk, 2020). Epigeic tür olan Eisenia fetida türü solucanların farkı organik atıkları yeme ve ürettiği vermikomposta elementel içerik açısından etki etme açısından gösterdiği tepkiler farklı olmakla birlikte, her koşulda bu atıkları rahatlıkla yedikleri görülmektedir (Lange, 2005; Bellitürk ve ark., 2015a; Arancon ve Edwards, 2011; Bellitürk ve Soytürk, 2020). Önemli olan sadece tek tip hayvansal veya sadece bitkisel atık değil, bu atıkları uygun oranlarda karıştırarak uygun koşul ve özellikteki yemler ile solucanları besleyerek vermikompost üretmektir (Bellitürk, 2016). Bu çalışmalar sayesinde hem organik atıklar solucan yemi olarak kullanılabilmekte ve hem de çeşitli makro ve mikro element ile organik madde düzeyine sahip topraklar üzerine olumlu etki etme özelliğinde vermikompost üretebilmektir.



Şekil 8. Üretilen solucan gübrelerindeki N, P, K, Ca, Mg, Fe, Zn ve Cu içerikleri.

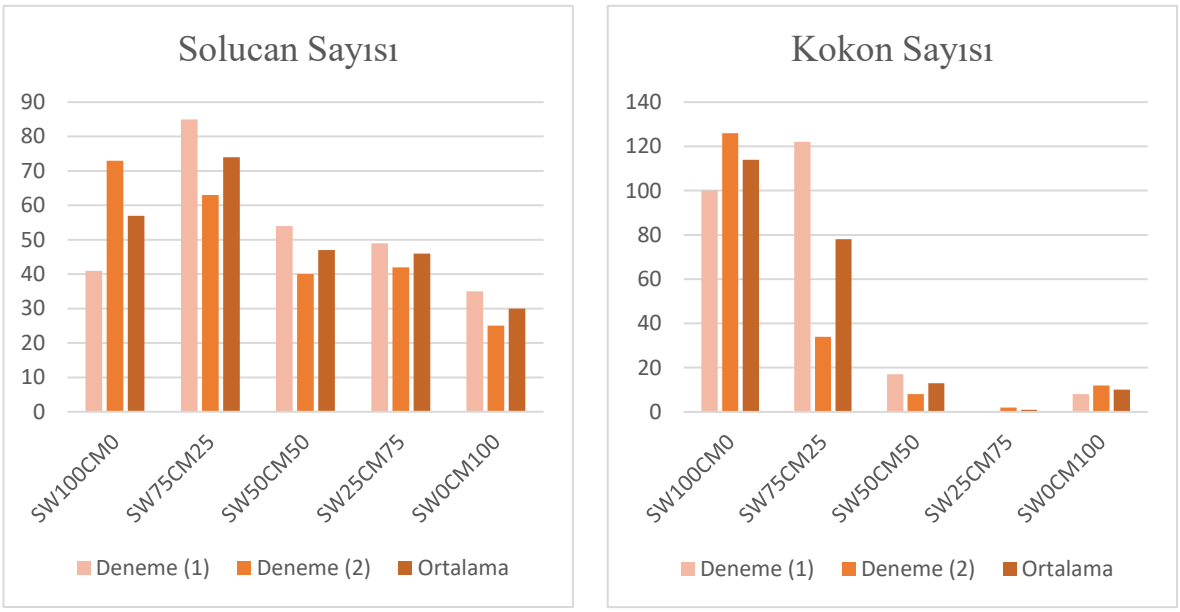
3.2. Solucan ve Kokon Sayıları

Deneme süresince kaplardaki solucanların firar ederek kaçması sorunu hiç yaşanmamış olup, solucanlar bu çalışmada kullanılan ayçiçeği atıklarını yeme konusunda pozitif davranış göstermişlerdir. Deneme sonrasında her kapta belirlenen solucan ve kokon sayıları Çizelge 4'te gösterilmiştir. Çizelge 4'ten de görüldüğü gibi başlangıçta (deneme kurulumunda) 20'şer adet Eisenia fetida cinsi solucanların deneme sonucundaki sayılarında her kapta farklılıklar olduğu görülmektedir. Genel bir değerlendirme ile en fazla solucan artışının 74 ortalama ile SW75CM25 uygulamasında (%75 ayçiçeği kabuğu+%25 inek dışkısı) olduğu görülmektedir. Solucanların ayçiçeği kabuğunu yemeleri ve sayıca artmaları, ayçiçeği kabuklarının ilerideki benzer nitelikli akademik çalışmalarda ve vermikompost (solucan gübresi) sektöründe atık olarak rahatlıkla kullanılabileceğini ortaya çıkarmıştır. Deneme sonundaki kokon (yumurta) sayısı açısından en fazla artışın SW100CM0 uygulamasında olduğu görülmektedir. Bu sonuçlar ile, ayçiçeği kabuğunun solucan sayısını artırmak için rahatlıkla kullanılabileceği ortaya çıkmıştır. Bellitürk ve Soytürk (2020) tarafından fındık kabuğu ile inek dışkısının kullanıldığı başka bir benzer çalışmada ise solucan sayılarında önemli bir değişiklik olmadığı bulunmuştur. Ancak ayçiçeği atıklarının bu çalışma sayesinde rahatlıkla solucan popülasyonlarını çoğaltmak amacıyla kullanılabileceği anlaşılmaktadır. Nemli zamanlarda ve nem sorunu yaşamayan tüm topraklarda *Eisenia fetida* türü solucanlar yaşatılabilir.

Çizelge 4. Deneme sonrasında belirlenen solucan ve kokon sayıları.

Uygulama	Tekerrür	*Eisenia fetida* Türü Solucan Sayısı	Kokon Sayısı
$SW_{100}CM_0$	1	41	101
	2	73	126
	Ortalama	57	114
$SW_{75}CM_{25}$	1	85	122
	2	63	34
	Ortalama	74	78
$SW_{50}CM_{50}$	1	54	17
	2	40	8
	Ortalama	47	13
$SW_{25}CM_{75}$	1	49	0
	2	42	2
	Ortalama	46	1
SW_0CM_{100}	1	35	8
	2	25	12
	Ortalama	30	10

Bu solucanlar, atıklardan gübre üretme yanında, toprakları havalandırma görevleri açısından da önemli canlılardır. Özellikle killi ve su geçirgenliği düşük, yapışkan nitelikteki smektit türü killerce zengin topraklarda yaşanan havalanma problemi hem kök gelişmesini etkileyerek verim miktar ve kalitesini azalttığı için, bu tip topraklara nem sorunu yok ise solucan bırakılması oldukça faydalı çalışmalar sayılmaktadır. Bu çalışma sayesinde solucan üretme amacıyla ayçiçeği atıklarının solucanlara yem olarak verilebileceği ortaya çıkmıştır.



Şekil 9. Deneme sonrasında belirlenen solucan ve kokon sayılarının grafik ile gösterimleri.

4. Sonuçlar ve Öneriler

Ülkemizde bitkisel ve hayvansal kaynaklı olarak ortaya çıkan çok çeşitte ve yüksek miktarlarda organik atıklar bulunmaktadır. Ancak maalesef çoğunlukla bu organik atıklar, diğer atıklarla karışık olarak genellikle yerel yönetimler tarafından toplandığı için tam olarak geri dönüşüm açısından gübre niteliğinde değerlendirilememektedir. Bu projenin amaçları arasında, organik atıkların kompost veya vermikompost değerinin ortaya konulması yanında bu sektörde ticari faaliyet gösteren firmaların büyük sorunlarından bir tanesi olan solucan maması bulmalarına yardımcı olacak bilgileri üretmektir. Proje sonuçlarından da görüldüğü gibi özellikle çerezlik ayçiçeği atıklarının hem solucan sayısını artırmada hem de solucan maması olarak kullanılabilecek nitelikte olduğu ortaya çıkmıştır. Vermikompost üretiminde başarılı bir şekilde kullanılan *Eisenia fetida* türü solucanların sayılarının artırılması, vermikompost sektörüne yatırım yapan işletmeciler için oldukça önemlidir. Bunun dışında bu türdeki solucanların

çoğaltılıp ülkemizin nemli bölgelerindeki arazilerine bırakılması, toprak sağlığının korunması açısından da son derece önemlidir. Çerezlik ayçiçeği üreticileri bugüne kadar atıkları bazen hayvan yemi olarak kullanmakta ve bazen de yakacak olarak kullandıkları için tam olarak değerlendirememektedirler. Bu proje sayesinde bu atıkların kompost veya vermikompost yapımında kullanılabilirliğinin ortaya konulması, organik gübre üreticileri için önemli bir bilgi niteliğindedir. Çiftlik hayvanlarından inek dışkılarının da tam olarak kompost yapılamaması gibi sorunlar olduğu bilinmektedir. Ayrıca inek dışkıları doğru yöntemde kompost yapılmadan arazilere organik gübre olarak uygulandığında, yabancı ot problemleri ortaya çıkmaktadır. Bu proje ile inek dışkılarının vermikompost yapımında başarıyla kullanılabileceği bir kez daha ortaya konulmuş olup, çerezlik ayçiçeği atığı ile karıştırılarak kullanılması durumunda önemli avantajlar elde edildiği de ortaya konulmuştur. Organik atıkların değerlendirilmeleri ile ilgili önemli bilgilerin elde edildiği bu projelerin sayı ve nitelik olarak artırılması, döviz ile gübre girişi olan ülkemiz üreticilerinin "gübre girdi maliyetlerini" düşürerek tarımsal üretim yapmaları ve ayrıca kendi atıklarını gübreye dönüştürüp girdi maliyetlerini azaltmaları açısından da önem taşımaktadır. Daha önce zeytin budama atıkları, fındık kabuğu, saman, çim atıkları, üzüm çöpü, kâğıt atıkları, badem ve ceviz kabukları gibi bitkisel kökenli atıklarla yapılan benzer çalışmalarda da bitki besleme ve toprak bilimine katkı sağlayan bilgiler ortaya konulmuştur. Bu çalışma da önceki benzer çalışmalarda olduğu gibi çerezlik ayçiçeği atıklarının vermikomposta dönüştürülebileceğinin ortaya konulması açısından değerli bir kaynak olarak kullanılabilecek niteliktedir.

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KAHRAMANMARAŞ DEPREMİNDEN SONRA ÜNİVERSİTE ÖĞRENCİLERİNİN ÖLÜM VE MUTLULUK ALGILARININ İNCELENMESİ

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Özet
Ölüm ve mutluluk birbirine hiç yakışmayacak iki kavram olarak değerlendirilebilir. Ancak her ne kadar durum bu yönde olsa da bazı durumlar ve şartlar ise bu iki kavramın birlikteliğini de beraberinde getirebilmektedir. Özellikle üniversitede öğrenim gören ve bir anlamda kendi hayatını şekillendirmeye çalışırken, diğer anlamda da bu duyguları yaşamış olan bireyler için bu durum daha karmaşık bir hal de alabilmektedir. Bu düşünceler altında araştırmada 6 Şubat'ta Türkiye'de yaşanan ve pek çok kişinin ölümü ile sonuçlanan Kahramanmaraş depremini yaşamış olan üniversite öğrencilerinin ölüm ve mutluluk algısının belirlenmesi amaçlanmıştır. Araştırmada nitel ve nicel yöntemler birlikte kullanılmıştır. Araştırmanın nicel boyutunda tarama yöntemi nitel boyutunda ise görüşme tekniği kullanılmıştır. Erzurum Atatürk Üniversitesi Fen Edebiyat Fakültesi bölümünde öğrenim gören ve Kahramanmaraş depreminde bölgede olan 300 üniversite öğrencisi ile çalışılmıştır. Araştırmada veriler "Genel Bilgi Formu", "Yarı Yapılandırılmış Görüşme Formu" "Ölüm Algısı Ölçeği" ve "Mutluluğa Aşırı Değer Verme Ölçeği" ile toplanmıştır. Araştırma sonucunda, öğrencilerin depremden önce ve sonra ölüm ve mutluluk algılarında değişimler yaşandığı belirlenmiştir. Ayrıca ölümü direk olarak yaşayan öğrencilerde mutluluk algısının yok olduğu ve birtakım sorunların yaşandığı sonucuna ulaşılmıştır. Araştırmada elde edilen bir diğer sonuç ise öğrencilerin depremde yakınlarını kaybetmemiş olsalar bile, ölümle ilgili eskiden düşündüklerinden daha farklı kavramlar elde ettikleridir. Araştırmadan elde edilen sonuçlara yönelik deprem gibi bir felaketi yaşayan ya da yaşamayan tüm öğrencilere psikososyal destek sağlanması ve bu öğrencilerin yakından takiplerinin gerçekleştirilmesi önerilebilir.
Anahtar Kelimeler: Ölüm, Mutluluk, Üniversite öğrencisi, Deprem, Psikososyal destek

Bu çalışmanın yapılmasında emeği olan ve aramızdan zamansız ve erken ayrılan Doç. Dr. Rıdvan KÜÇÜKALİ anısına ithaf edilmiştir.

INVESTIGATION OF UNIVERSITY STUDENTS' PERCEPTIONS OF DEATH AND HAPPINESS AFTER KAHRAMANMARAŞ EARTHQUAKE

Abstract
Death and happiness can be considered as two concepts that do not suit each other at all. However, although this is the case, some situations and conditions may bring about the coexistence of these two concepts. This situation can become more complicated, especially for individuals who are studying at university and who, in one sense, are trying to shape their own lives and who, in another sense, have experienced these emotions. Under these considerations, the aim of the study was to determine the perception of death and happiness of university students who experienced the Kahramanmaraş earthquake in Turkey on February 6, which resulted in the death of many people. Qualitative and quantitative methods were used together in the research. Screening method was used in the quantitative dimension of the research and interview technique was used in the qualitative dimension. The study was conducted with 300 university students studying at Erzurum Atatürk University, Faculty of Arts and Sciences, and who were in the region during the Kahramanmaraş earthquake. In the research, data were collected with the "General Information Form", "Semi-structured Interview Form", "Death Perception Scale" and "Overvaluing Happiness Scale". As a result of the research, it was determined that there were changes in the students' perceptions of death and happiness before and after the earthquake. In addition, it was concluded that the perception of happiness disappeared in students who directly experienced death and some problems were experienced. Another result obtained in the research is that even if the students did not lose their relatives in the earthquake, they acquired different concepts about death than they used to think. Based on the results obtained from the research, it may be recommended to provide psychosocial support to all students, whether they have experienced a disaster such as an earthquake or not, and to closely monitor these students.
Keywords: Death, Happiness, University student, Earthquake, Psychosocial support

Giriş

İnsanoğlunun hayatı doğum ile başlayıp ölümle sona ermektedir. Ancak durum her ne kadar bu kadar basit bir şekilde ifade edilmeye çalışılsa da aslında durumun bu kadar basit olmadığı da görülmektedir. Genellikle yenidünyaya gelme eylemi olarak ifade edilen doğum mutluluğun başlangıcı olarak da ifade edilebilmektedir. Durumun bu boyutta olması ise insanın sürekli bir mutluluk ve üzüntü duygu durumlarını yaşamalarına da yol açabilmektedir. Üstelik bu duygu durumları sanıldığından daha da farklı bir boyut alabilmektedir. Ölüm ise herkesin uzak durmaya çalıştığı adı bile anıldığında kişileri mutsuz etmeye yetecek özellikleri bünyesinde barındırabilen bir duygu durumu olarak da ifade edilebilir (Alver, 2017; Çetin, 2017; Kim, 2013; Lee vd., 2015; Testoni vd., 2019; Türkdoğan ve Duru, 2012). Bu kapsamda ölüm ve mutluluk birbirinden uzak olsa da bir o kadar da günlük yaşamda karşılaşılabilecek olgular olarak ele alınabilir.Ölüm hayatın sonu olarak düşünüldüğünden ve bu yöndeki beklentilerden dolayı genellikle pek düşünülmeyen bir olgudur. Daha doğrusu belirli bir yaş grubuna ithaf edilen bir durum olarak görülmektedir. Aslında ölümün o kadar da uzak olmadığı da aşikârdır. Toplumlarda yaşanan birtakım olay ve olgular ölümle birlikteliği daha da erken gündeme getirebilmektedir. Üstelik insanın kendisi yaşamasa da etrafında karşılaşabileceği bu tür durumlar da benzer duygusal ifadelere yol açabilecektir (Arslan, 2019; Ayten, 2009; Byeon ve Park, 2017; Genç, 2018; Lee vd., 2019; Meffert vd., 2015; Şahin, 2018). Türkiye'de bu kapsamda son zamanlarda yaşanan ve asrın felaketi olarak ifade edilen pek çok kişinin ölümüyle sonuçlanan Kahramanmaraş merkez üslü olan deprem mutluluk ve ölüm kavramlarının bir arada yaşanmasıyla sonuçlanmıştır.6 Şubat 2023 tarihinde merkez üssü Kahramanmaraş olan depremde pek çok insan hayatını kaybetmiş ve pek çok insan da yaralanmıştır. Bu kayıpların yanında pek çok kişinin maddi kayıplara da uğradığı depremde sayısız hasarlar da beraberinde gelmiştir. Özellikle üniversitelerin kapalı olduğu dönemde, pek çok gencin ailesinin yanında olması sonucunda üniversitede öğrenim gören gençler de bu durumdan fazlasıyla etkilenebilmiştir. Pek çoğu akrabalarını, arkadaşlarını kaybetmiş, pek çoğunun geleceğe yönelik hedef ve planları sekteye uğramıştır. Elbette bu durum gencin içinde bulunduğu durumu daha da kötüleştirebilmiştir (İmik ve Aydoğdu, 2023; Sarıgül, 2023). Üniversitede öğrenim gören gençlerin ifade edilen deprem felaketinden etkilenmelerinde hem yaşadıkları kayıpların hem de içerisinde bulundukları dönemin özellikle etkili olduğu ifade edilebilir. Üniversitede öğrenim gören gençler normalde geleceklerine yönelik endişeleri de oldukça fazla taşıyan bireylerdir. Aldıkları eğitimle iyi bir iş sahibi olmak onların en büyük kaygıları arasındadır. Mezun olduktan sonra hayatlarını karşılayıp karşılamayacakları durumu

onlar için endişe ve stres kaynağı olabilmektedir. Özellikle ailelerinden ayrı yaşamaya başlayan, bağımsızlığını kazanan üniversite gençliğinin bu anlamda okulu bitirdikten sonra kendi hayatını kuramayacak durumda olması ya da bu durumla karşı karşıya kalma düşüncesi bile onları büyük bir kaosun ortasında bırakabilmektedir. İfade edilen bu duygu durumuna sahip olan üniversite gençliğinin, deprem felaketini yaşaması ve bu felakette maddi ya da manevi kayıplar yaşamaları ise onların daha fazla psikolojik ya da davranışsal sorunlar yaşamalarını da beraberinde getirebilecektir (Çakır vd., 2023; Telli ve Altun, 2023). Böyle bir durumda ise bu gençlerin tespit edilerek onlara psikososyal destek sağlanması gerekecektir. Psikososyal destek, bireyin baş edemediği ve baş etme mekanizmasının sınırlarının aşıldığı durumlarda bireylere sağlanan destek olarak tanımlanabilir (Aksoy ve Kabasakal, 2023; Türk ve Kaya, 2023). Bu kapsamda deprem felaketini yaşayan üniversite öğrencilerinin belirlenmesi ve psikososyal destek mekanizmalarının devreye alınması onların incinebilirliklerini de azaltabilecektir. Yapılan araştırmalarda üniversite gençliğine yönelik yaşanan deprem felaketinde hissettiklerine yönelik sınırlı sayıda araştırmaya rastlanmıştır (İmik ve Aydoğdu, 2023; Kaplan ve Taşar, 2023; Sarıgül, 2023; Yıldız ve Öztürk, 2023). Bu kapsamda araştırmada 6 Şubat Kahramanmaraş depremini yaşayan üniversite öğrencilerinin ölüm ve mutluluk özelinde hissettiklerini belirlemek amaçlanmıştır.

Yöntem

6 Şubat Kahramanmaraş depreminden sonra üniversite öğrencilerinin mutluluk ve ölüm algılarını belirlemek amacıyla gerçekleştirilen araştırmanın modeli, çalışma grubu, veri toplama araçları, veri toplama yöntemi ve verilerin analizi kısımlarına bu bölümde yer verilmiştir.

Araştırma Modeli

Araştırmada nicel araştırma yöntemlerinden tarama modeli kullanılmıştır. Tarama modeli, geçerlik ve güvenirliği kanıtlanmış ölçme araçlarıyla geniş bir örneklem grubundan bilgi almayı sağlayan bir yöntemdir (Büyüköztürk vd., 2016). Araştırmada üniversite öğrencilerinin Kahramanmaraş depremine yönelik mutluluk ve ölüm algılarını belirlemek amacıyla tarama modeli kullanılmıştır.

Çalışma Grubu

Araştırma Erzurum Atatürk Üniversitesi Fen Edebiyat Bölümüne devam eden ve 6 Şubat Kahramanmaraş depreminde bu bölgede olan ve araştırmaya gönüllü olarak katılmayı kabul eden öğrencilerle gerçekleştirilmiştir. Araştırmaya dâhil edilen öğrencilerin %82'si kadın, %18'i erkektir. Öğrencilerin %66'ı 18-21 yaş grubunda, %61'i il merkezinde yaşamakta, %88,3'ü ikinci sınıf öğrencisi, %90,7'sinin anne- babası hayatta, %54,3'ünün annesi,

%36,7'sinin babası ilköğretim mezunudur. Öğrencilerin %53,3'ü depremde birinci derece akrabalarını kaybetmiş, %46,7'si ise kaybetmemiştir.

Veri Toplama Araçları

Araştırmada veriler "Genel Bilgi Formu", Demirci, Ekşi ve Ekşi (2018) tarafından Türkçeye uyarlanan "Mutluluğa Aşırı Değer Verme Ölçeği" ve Topuz (2013) tarafından Türkçeye uyarlanan "Ölüm Algısı Ölçeği" ile toplanmıştır.

Genel Bilgi Formu: Araştırmada yer alacak öğrencilerin sosyodemografik özelliklerini belirlemek amacıyla geliştirilmiş olan formdur. Formda öğrencilerin cinsiyetleri, yaşları, anne-baba hayatta olma durumu, anne-baba öğrenim durumu, Kahramanmaraş depreminde birinci derece yakınlarını kaybedip kaybetmediklerine yönelik sorular bulunmaktadır.

Mutluluğa Aşırı Değer Verme Ölçeği: Mauss ve arkadaşları (2011) tarafından bireylerin mutluluğa yönelik algılarını belirlemek amacıyla geliştirilen ölçek, Demirci, Ekşi ve Ekşi (2018) tarafından Türkçeye uyarlanmıştır. 7 madde ve tek boyut olarak değerlendirilen ölçek 7'li likert tipindedir. Ölçeğin uyarlama çalışması sırasında Cronbach Alfa değeri .80 olarak bulunmuştur. Araştırma kapsamında Cronbach alfa değeri ise .70 olarak değerlendirilmiştir.

Ölüm Algısı Ölçeği: Spilka ve arkadaşları (1977) tarafından geliştirilen ve bireylerin ölüm algılarını belirlemeyi amaçlayan ölçek, Topuz (2013) tarafından Türkçeye uyarlanmıştır. 24 madde dörtlü likert tipinden oluşan ölçek, beş alt boyuttan oluşmaktadır. Türkçeye uyarlama çalışmasında Cronbach Alfa değerleri, Ahirette Ödüllendirme alt boyutu için .82, Bakmakla Yükümlü Olduklarını Terk Etme alt boyutu için .72, Başarısızlık alt boyutu için .75, Cesaret alt boyutu için .69, Bilinmeyen alt boyutu için .67, Acı Çekme alt boyutu için .73 ve tüm ölçek için .81 olarak bulunmuştur. Araştırma kapsamında Cronbach alfa değerleri Ahirette ödüllendirme alt boyutu için .68, Bakmakla Yükümlü Olduklarını Terk Etmek alt boyutu için .75, Başarısızlık alt boyutu için .79, Cesaret alt boyutu için .70, Bilinmeyen alt boyutu için .64, Acı Çekme alt boyutu için .81 ve tüm ölçek için .72 olarak bulunmuştur.

Veri Toplama Yöntemi

Araştırmada Erzurum Atatürk Üniversitesi Fen Edebiyat Fakültesinde öğrenim gören öğrencilere araştırmanın amacı hakkında bilgi verilmiştir. Araştırmaya gönüllü olarak katılım sağlamak isteyen öğrencilere onam formu doldurulmuş ve veriler araştırmacı tarafından yüz yüze uygulanmıştır.

Verilerin Analizi

Araştırmada öğrencilerin verdikleri cevaplar SPSS 26.0 IBM istatistik programına aktarılmıştır. Öğrencilerin sosyodemografik özellikleri için betimsel istatistikler kullanılmıştır. Öğrencilerin

ölçeklere vermiş oldukları cevapların normal dağılım gösterip göstermediğini belirlemek için örneklem sayısının 50 üstünde olmasından dolayı Kolmogorov Sminrnov test sonuçları ile Skewness ve Kurtosis değerleri incelenmiştir. Mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait normallik analiz dağılım sonuçlarında öğrencilerin vermiş oldukları cevapların normal dağılım göstermediği belirlenmiştir. Bu nedenle analizlerde Kruskal Wallis t Testi, Mann Whitney U testi ve Spearman Korelasyon analizi kullanılmıştır.

Bulgular

Kahramanmaraş depremini yaşayan üniversite öğrencilerinin mutluluk ve ölüm algılarını belirlemek amacıyla yapılan araştırmanın bulgularına aşağıda yer verilmiştir.

Tablo 1'de üniversite öğrencilerinin cinsiyetlerine göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Mann Whitney U test sonuçları görülmektedir. Tabloda da görüldüğü gibi öğrencilerin cinsiyetlerine göre ölüm algısı ölçeği alt boyutlarından cesaret ($U=4972$; $p<.05$) ve bilinmeyen alt boyutlarında ($U=5394$; $p<.05$) anlamlı farklılık bulunmuştur. Cesaret alt boyutunda erkek öğrencilerin sıra ortalaması ($x=181,43$), kız öğrencilerin sıra ortalamasından ($x=143,71$) yüksek bulunmuştur. Bir başka ifadeyle erkek öğrenciler ölüme yönelik daha fazla cesarete sahiptirler. Bilinmeyen alt boyutunda ise kız öğrencilerin sıra ortalaması ($x=155,57$) erkek öğrencilerin sıra ortalamasına ($x=127,39$) göre daha yüksektir. Yani kız öğrenciler erkek öğrencilere oranla ölüm hakkında daha fazla bilinmezlik taşımaktadırlar.

Tablo 2'de üniversite öğrencilerinin yaşlarına göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Mann Whitney U test sonuçları görülmektedir. Tabloda da görüldüğü gibi öğrencilerin yaşlarına göre ölüm algısı ölçeği alt boyutlarından ahirette ödüllendirilme ($U=8312$; $p<.05$) ve başarısızlık ($U=8057,50$; $p<05$) alt boyutları arasında anlamlı farklılık bulunmuştur. Ahirette ödüllendirilme alt boyutunda 22 ve üstü yaş grubunda olan öğrencilerin sıra ortalaması ($x=168,01$), 18-21 yaş grubunda olan öğrencilerin sıra ortalamasına göre ($x=141,48$) yüksek bulunmuştur. Yani 22 ve üstü yaş grubunda olan öğrenciler ahirette ödüllendirileceklerini düşünmektedir. Başarısızlık alt boyutunda 18-21 yaş grubunda olan öğrencilerin sıra ortalaması ($x=160,81$), 22 ve üstü yaş grubunda olan öğrencilerin sıra ortalamasına ($x=130,50$) göre yüksek bulunmuştur. Bir başka ifadeyle 18-21 yaş grubunda olan öğrenciler ölüm hakkında daha fazla başarısızlık hissetmektedir.

Tablo 3'de üniversite öğrencilerinin doğum yerlerine göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Kruskal Wallis test sonuçları görülmektedir. Tabloda da görüldüğü gibi öğrencilerin doğum yerlerine göre mutluluğa aşırı

değer verme ölçeği arasında anlamlı farklılık bulunmuştur (x^2=46,32; p<05). Buna göre köyde dünyaya gelen öğrencilerin sıra ortalaması (x=270,39), ilçede (x=134,81) ve ilde (x=144,23) dünyaya gelen öğrencilerin sıra ortalamasına göre daha yüksektir. Bir başka ifadeyle köyde dünyaya gelen öğrenciler, ilçe ve ilde dünyaya gelen öğrencilere oranla daha mutludur. Öğrencilerin doğum yerlerine göre ölüm algısı ölçeği alt boyutlarından ahirette ödüllendirilme (x^2=25,34; p<05), bakmakla yükümlü olduklarını terk etme (x^2=17,69; p<.05) ve cesaret alt boyutlarında (x^2=10,78; p<05) anlamlı farklılık bulunmuştur. Ahirette ödüllendirilme alt boyutunda ilçede dünyaya gelen öğrencilerin sıra ortalaması (x=185,52), köyde (x=107,86) ve ilde (x=137,45) dünyaya gelen öğrencilerin sıra ortalamasından daha yüksektir. Yani ilçede dünyaya gelen üniversite öğrencileri ahirette ödüllendirileceğine daha fazla inanmaktadır. Bakmakla yükümlü olduklarını terk etme alt boyutunda ilçede dünyaya gelen öğrencilerin sıra ortalaması (x=181,15), ilde dünyaya gelen öğrencilerin sıra ortalamasından (x=137,19) yüksek olarak bulunmuştur. Yani ilçede dünyaya gelen öğrenciler ölümle bakmakla yükümlü olduklarını terk edeceklerini düşünmektedirler. Cesaret alt boyutunda köyde dünyaya gelen öğrencilerin sıra ortalaması (x=197,91), ilçede (x=160,11) ve ilde (x=139,81) dünyaya gelen öğrencilerin sıra ortalamasına göre yüksek bulunmuştur. Yani köyde dünyaya gelen öğrenciler ölüm konusunda daha cesaretli oldukları söylenebilir. Tablo 4'de üniversite öğrencilerinin sınıf düzeylerine göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Kruskal Wallis test sonuçları görülmektedir. Tabloda da görüldüğü gibi üniversite öğrencilerinin sınıf düzeyleri ile mutluluğa aşırı değer verme ölçeği arasında anlamlı farklılık bulunmuştur (x^2=25,57; p<.05). Bu duruma göre birinci sınıfta bulunan öğrencilerin sıra ortalaması (x=48,50), ikinci sınıf (x=147,25), üçüncü sınıf (x=194,67) ve dördüncü sınıf (x=243,00) öğrencilerine göre düşük bulunmuştur. Yani birinci sınıf öğrencileri mutluluğa daha az değer vermektedir. Öğrencilerin sınıf düzeylerine göre ölüm algısı ölçeğinin tamamında (x^2=24,77; p<.05), Ahirette ödüllendirilme alt boyutunda (x^2=8,86; p<05); başarısızlık alt boyutunda (x^2=25,68; p<.05), cesaret alt boyutunda (x^2=13,77; p<.05), bilinmeyen alt boyutunda (x^2=26,36; p<.05) ve acı çekme alt boyutunda (x^2=13,77; p<.05) anlamlı farklılık bulunmuştur. Ölüm algısı ölçeğinin tamamında birinci sınıf öğrencilerinin sıra ortalaması (x=268), ikinci sınıf (x=148,36), üçüncü sınıf (x=173,33) ve dördüncü sınıf öğrencilerinin (x=45,50) sıra ortalamasından yüksek bulunmuş, ikinci sınıf öğrencilerinin sıra ortalaması (x=148,36), dördüncü sınıf öğrencilerinin sıra ortalamasından (x=45,50) yüksek bulunmuştur. Yani birinci ve ikinci sınıf öğrencileri daha fazla ölüm algısına sahiptir. Ahirette ödüllendirme alt boyutunda üçüncü sınıf öğrencilerinin sıra ortalaması (x=175,83), birinci sınıf öğrencilerinin

(x=207,50) ve dördüncü sınıf (x=207,50) öğrencilerinin sıra ortalamasından düşük bulunmuştur. Bir başka ifadeyle ikinci sınıf öğrencileri ahirette ödüllendirileceklerine daha az inanmaktadır. Başarısızlık alt boyutunda birinci sınıf öğrencilerinin sıra ortalaması (x=244,00), ikinci sınıf öğrencilerinin (x=153,87), üçüncü sınıf (x=117,17) ve dördüncü sınıf öğrencilerinin (x=29,50) sıra ortalamasından yüksek, dördüncü sınıf öğrencilerinin sıra ortalaması (x=29,50), ikinci sınıf öğrencilerinin (x=153,87) ve üçüncü sınıf öğrencilerinin (x=117,17) sıra ortalamasından düşük bulunmuştur. Yani birinci sınıf öğrencileri ölümde başarısızlık duygusunu daha fazla yaşamaktayken, dördüncü sınıf öğrencileri daha az oranda yaşamaktadır. Cesaret alt boyutunda birinci sınıf öğrencilerinin sıra ortalaması (x=258,00), ikinci sınıf (x=148,58), üçüncü sınıf (x=156) ve dördüncü sınıf (x=99) öğrencilerinin sıra ortalamalarından daha yüksek bulunmuştur. Yani ölüme karşı birinci sınıf öğrencileri daha fazla cesur davranmaktadır. Bilinmeyen alt boyutunda ise dördüncü sınıf öğrencilerinin sıra ortalaması (x=7,00), birinci sınıf (x=199,50), ikinci sınıf (x=155,82), üçüncü sınıf öğrencilerinin (x=114,83) sıra ortalamasından düşük; üçüncü sınıf öğrencilerinin sıra ortalaması (x=114,83), birinci sınıf öğrencilerinin (x=199,50) ve ikinci sınıf (x=155,82) öğrencilerinin sıra ortalamasından düşük bulunmuştur. Yani üçüncü ve dördüncü sınıf öğrencileri ölüm karşısında daha fazla bilinmezlik hissetmektedir. Acı çekme alt boyutunda ise birinci sınıf öğrencilerinin sıra ortalaması (x=215,00), ikinci sınıf öğrencilerinin sıra ortalamasından (x=144,11) ve dördüncü sınıf öğrencilerinin (x=169,50) sıra ortalamasından yüksek, üçüncü sınıf öğrencilerinin sıra ortalaması (x=203,33), ikinci sınıf öğrencilerinin (x=144,11) sıra ortalamasından yüksek olarak bulunmuştur. Bir başka ifadeyle birinci ve üçüncü sınıf öğrencileri ölümü daha fazla oranda acı çekme olarak düşünmektedirler. Tablo 5'de üniversite öğrencilerinin anne-baba hayatta olma durumuna göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Mann Whitney U test sonuçları görülmektedir. Tabloda da görüldüğü gibi öğrencilerin anne-baba hayatta olma durumuna göre mutluluğa aşırı değer verme ölçeği arasında anlamlı farklılık bulunmuştur (U=2659,50; p<.05). Buna göre anne-babası hayatta olan öğrencilerin sıra ortalaması (x=154,72), anne-babası hayatta olmayan öğrencilerin (x=109,48) sıra ortalamasına göre yüksek bulunmuştur. Yani anne babası hayatta olan öğrenciler mutluluğa daha fazla değer vermektedir. Öğrencilerin anne-baba hayatta olma durumuna göre ölüm algısı ölçeğinin tamamında (U=1975; p<.05), başarısızlık alt boyutunda (x=2418; p<.05), bilinmeyen alt boyutunda (x=2579; p<.05) ve acı çekme alt boyutlarında (x=1805,50; p<.05) anlamlı farklılık bulunmuştur. Ölüm algısı ölçeğinin tamamında anne-babası hayatta olmayan öğrencilerin sıra ortalaması (x=215,96),

anne-babası hayatta olan (x=143,76) öğrencilere oranla yüksek bulunmuştur. Yani anne-babası hayatta olmayan öğrenciler daha fazla ölüm algısı hissetmektedir. Başarısızlık alt boyutunda anne-babası hayatta olmayan öğrencilerin sıra ortalaması (x=200,14), anne-babası hayatta olan öğrencilerin sıra ortalamasına (x=145,39) göre, bilinmeyen alt boyutunda anne-babası hayatta olmayan öğrencilerin sıra ortalaması (x=194,39), anne-babası hayatta olan öğrencilerin sıra ortalamasına (x=145,98) ve acı çekme alt boyutunda anne-babası hayatta olmayan öğrencilerin sıra ortalaması (x=222,02), anne-babası hayatta olan öğrencilerin sıra ortalamasına (x=143,14) yüksek bulunmuştur. Bir başka ifadeyle anne-babası hayatta olmayan öğrenciler, anne-babası hayatta olan öğrencilere oranla ölümden sonra başarısızlık, bilinmeyen ve acı çekme duyguları yaşamaktadır. Tablo 6'da üniversite öğrencilerinin anne öğrenim durumuna göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Kruskal Wallis test sonuçları görülmektedir. Tabloda da görüldüğü gibi öğrencilerin anne öğrenim durumlarına göre mutluluğa aşırı değer verme ölçeği arasında anlamlı farklılık bulunmuştur (x^2=15,76; p<.05). Annesi ilköğretim mezunu olan öğrencilerin sıra ortalaması (x=167,89), annesi ortaokul (x=120,35) ve annesi lise mezunu olan (x=136,02) öğrencilerin sıra ortalamasından yüksektir. Yani annesi ilköğretim mezunu olan öğrenciler daha fazla mutluluk hissetmektedir. Öğrencilerin anne öğrenim durumlarına göre ölüm algısı ölçeğinin tamamı (x^2=21,97; p<.05), ahirette ödüllendirilme alt boyutunda (x^2=35,31; p<.05), bakmakla yükümlü olduklarını terk etme alt boyutunda (x^2=18,62; p<.05), başarısızlık alt boyutunda (x^2=27,05), cesaret alt boyutunda (x^2=22,98; p<.05) ve acı çekme alt boyutunda (x^2=13,99; p<.05) anlamlı farklılık bulunmuştur. Ölüm algısı ölçeğinin tamamında annesi üniversite mezunu olan öğrencilerin sıra ortalaması (x=257,15), annesi ilkokul (x=144,12), annesi ortaokul (x=138,68) ve annesi lise (x=156,16) mezunu olan öğrencilerin sıra ortalamasından yüksek bulunmuştur. Yani annesi üniversite mezunu olan öğrenciler daha fazla ölüm algısı çekmektedir. Ahirette ödüllendirilme alt boyutunda annesi lise mezunu olan öğrencilerin sıra ortalaması (x=204,66), annesi ilköğretim (x=131,94), annesi ortaöğretim (x=137,81) mezunu olan öğrencilere oranla yüksek bulunmuştur. Yani annesi lise mezunu olan öğrenciler ahirette ödüllendirileceklerini düşünmektedir. Bakmakla yükümlü olduklarını terk etme alt boyutunda, annesi ortaokul mezunu olan öğrencilerin sıra ortalaması (x=108,48), annesi ilkokul mezunu olan öğrencilerin (x=164,56) ve annesi lise mezunu (x=153,95) olan öğrencilerin sıra ortalamasına göre düşük bulunmuştur. Yani annesi ortaokul mezunu olan öğrenciler ölümden sonra bakmakla yükümlü olduklarını daha az oranda terk ettiklerini düşünmektedir. Başarısızlık alt boyutunda annesi ilkokul mezunu olan öğrencilerin sıra ortalaması (x=131,64), annesi ortaokul (x=167,98),

annesi lise (x=163,15), annesi üniversite mezunu olan öğrencilerin (x=244,00) sıra ortalamasına göre düşük; annesi üniversite mezunu olan öğrencilerin sıra ortalaması (x=244,00), annesi ortaokul (x=167,98) ve annesi lise (x=163,15) mezunu olan öğrencilerin sıra ortalamasına göre yüksek bulunmuştur. Bir başka ifadeyle annesi ilkokul mezunu olan öğrenciler ölüm karşısında daha az başarısızlık hissederken, annesi üniversite mezunu olan öğrenciler daha fazla başarısızlık hissetmektedir. Cesaret alt boyutunda annesi üniversite mezunu olan öğrencilerin sıra ortalaması (x=258,00), annesi ilkokul (x=148,81), annesi ortaokul (x=149,67) ve annesi lise (x=133,75) mezunu olan öğrencilerin sıra ortalamasına göre yüksek bulunmuştur. Yani annesi üniversite mezunu olan öğrenciler ölüm karşısında daha fazla cesaret hissetmektedir. Acı çekme alt boyutunda annesi üniversite mezunu olan öğrencilerin sıra ortalaması (x=204,38), annesi ilkokul (x=149,46), annesi lise (x=124,48) mezunu olan öğrencilerin sıra ortalamasına göre yüksek ve annesi ortaokul mezunu olan öğrencilerin sıra ortalaması (x=169,40), annesi lise mezunu olan öğrencilerin sıra ortalamasına (x=124,48) göre yüksek bulunmuştur. Bir başka ifadeyle annesi üniversite mezunu olan ve annesi ortaokul mezunu olan öğrenciler daha fazla oranda ölüm karşısında acı hissetmektedir. Tablo 7'de üniversite öğrencilerinin baba öğrenim durumuna göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Kruskal Wallis test sonuçları görülmektedir. Tabloda da görüldüğü gibi öğrencilerin baba öğrenim durumuna göre mutluluğa aşırı değer verme ölçeği arasında anlamlı farklılık bulunmuştur (x^2=30,79; p<.05). Babası üniversite mezunu olan öğrencilerin mutluluğa aşırı değer verme ölçeği sıra ortalamaları (x=84,87), babası ilkokul (x=170,98), babası ortaokul (x=132,01), babası lise (x=169,17) mezunu olan öğrencilerin sıra ortalamasına göre düşük bulunurken, babası ortaokul mezunu olan öğrencilerin sıra ortalaması (x=132,01), babası ilkokul (x=170,98) ve babası lise (x=169,17) mezunu olan öğrencilerin sıra ortalamasına göre düşük bulunmuştur. Bir başka ifadeyle babası üniversite ve ortaokul mezunu olan öğrenciler mutluluğa daha az değer vermektedir. Üniversite öğrencilerinin baba öğrenim durumlarına göre ölüm algısı ölçeğinin tamamında (x^2=15,03; p<.05); bakmakla yükümlü olduklarını terk etme alt boyutunda (x^2=21,31; p<.05), cesaret alt boyutunda (x^2=12,43; p<.05) ve bilinmeyen alt boyutunda (x^2=8,96; p<.05) anlamlı farklılık bulunmuştur. Ölüm algısı ölçeğinin tamamında babası ilkokul mezunu olan öğrencilerin sıra ortalaması (x=164,83), babası ortaokul (x=138,70) ve lise (x=127,70) mezunu olan öğrencilerin sıra ortalamasına göre yüksek, babası üniversite mezunu olan öğrencilerin sıra ortalaması (x=187,28), babası ortaokul mezunu (x=138,70) ve babası lise (x=127,70) mezunu olan öğrencilerin sıra ortalamasına göre yüksek bulunmuştur. Yani babası

ilkokul mezunu ve üniversite mezunu olan öğrenciler daha fazla oranda ölüm algısı hissetmektedir. Bakmakla yükümlü olduklarını terk etme alt boyutunda babası lise mezunu olan öğrencilerin sıra ortalaması (x=113,19), babası ilkokul mezunu (x=172,86), babası ortaokul (x=155,49) ve babası üniversite (x=143,42) mezunu olan öğrencilerin sıra ortalamasına göre düşük bulunmuştur. Yani babası lise mezunu olan öğrenciler bakmakla yükümlü olduklarını terk etme konusunda daha az endişe hissetmektedir. Cesaret alt boyutunda babası üniversite mezunu olan öğrencilerin sıra ortalaması (x=197,90), babası lise (x=139,94), babası ortaokul (x=137,90) ve babası ilkokul (x=154,57) mezunu olan öğrencilerin sıra ortalamasına göre yüksek bulunmuştur. Bir başka ifadeyle babası üniversite mezunu olan öğrenciler daha fazla oranda ölüm karşısında cesaret hissetmektedir. Bilinmeyen alt boyutunda babası ortaokul mezunu olan öğrencilerin sıra ortalaması (x=130,68), babası ilkokul (x=164,82) ve babası üniversite mezunu (x=166,63) olan öğrencilerin sıra ortalamasına göre düşük bulunmuştur. Yani babası ortaokul mezunu olan öğrenciler daha az oranda bilinmezlik hissetmektedir. Tablo 8'de üniversite öğrencilerinin Kahramanmaraş depreminde yakınını kaybetme durumuna göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait ortalamalar ve Mann Whitney U test sonuçları görülmektedir. Tabloda da görüldüğü gibi üniversite öğrencilerinin Kahramanmaraş depreminde yakınını kaybetme durumuna göre mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutları arasında anlamlı farklılık bulunmamıştır (p>.05). Tablo 9'da mutluluğa aşırı değer verme ölçeği ile ölüm algısı ölçeği ve alt boyutlarına ait Spearman korelasyon analiz test sonuçları görülmektedir. Tabloda da görüldüğü gibi mutluluğa aşırı değer verme ölçeği ile ahirette ödüllendirme alt boyutu arasında negatif yönde zayıf (r=-.23; p<.05); başarısızlık alt boyutunda negatif yönde ve zayıf (r=-19; p<.05) anlamlı ilişki bulunmuştur. Yani mutluluğa aşırı değer verdikçe ahirette ödüllendirme ve başarısızlık duyguları azalmaktadır.

Tartışma

6 Şubat Kahramanmaraş depreminden sonra üniversite öğrencilerinin mutluluk ve ölüm algılarını belirlemek amacıyla gerçekleştirilen araştırma sonucunda öğrencilerin cinsiyetlerine göre erkek öğrencilerin ölüme karşı daha fazla cesaret sergilerken, kız öğrencilerin bilinmezliğe sahip oldukları görülmektedir. Elde edilen bu sonucu kız ve erkek öğrencilerin yetiştirilme ve gelişimsel niteliklerine bağlanarak açıklamak mümkündür. Erkek öğrenciler toplumun kendine yüklediği misyon ve vizyona bağlı olarak genelde daha fazla risk alma potansiyeline sahiptir. Erkeklerin bu özelliğinden dolayı ölüme karşı da daha fazla cesaretli olmaları beklendik bir özellik olarak ele alınabilir. Nitekim erkeklerin güçlü olmak istemeleri ve ağlamalarının bile

uygun olarak görülmediği durumlarda elde edilen sonuca yönelik olarak da cesaretleri daha fazla olabilmektedir. Buna karşılık kızların daha fazla oranda empati duyguları ile yetişmesi de benzer şekilde bilinmezlik duygularının yoğunluğunu gerektirebilecektir. Çünkü ölüm algısı aslında bilinmezliklerle dolu bir durum olarak ifade edilebilir. (Ayten, 2009; Sezer ve Saya, 2009). Yapılan araştırmalarda da araştırma sonucuna benzer şekilde kız ve erkek öğrenciler arasında erkek öğrencilerin daha fazla cesarete sahip oldukları ve kızların daha bilinmezlik duygularıyla hareket etmelerine yönelik elde edilen bulgular araştırma sonucunda elde edilen bulguları desteklemektedir (Kutlu, Çavuşoğlu ve Uygun, 2018; Pinzon- Segura vd., 2022).Araştırma sonucunda 22 yaş ve üstünde olan öğrencilerin ahirette daha mutlu olduklarını düşündükleri ve 18-21 yaş arasındaki öğrencilerin ölüm karşısında daha fazla başarısız hissettikleri sonucuna ulaşılmıştır. 22 yaş ve üstünde bulunan öğrencilerin soyut anlamda olaylara daha farklı bir perspektifte bakabilme durumları ile 18-21 yaş arasındaki öğrencilerin henüz istediklerini elde edememe durumlarını yaşadıklarından dolayı sonucun bu yönde çıktığı düşünülmektedir. Çünkü 18-21 yaşında kişinin genelde istekleri ve beklentileri, geleceğini kurma, iyi bir işe sahip olma ve iyi bir şekilde yaşama şansı olarak özetlenebilir. Böyle bir durumda ise 18-21 yaş grubundaki öğrenciler henüz üniversite hayatının da başında olduklarından dolayı başarısızlık hissedebilirler. Öte yandan 22 yaşında genelde ifade edilenlerin elde edildiğini düşünmekle birlikte, öğrencilerin yaşayabilecekleri ve elde edemedikleri durumlar ise onların ahirette mutlu olacaklarını düşünmelerine neden olabilmektedir (Bolat ve Artan, 2022; Karakuş, Öztürk ve Tamam, 2012). Araştırma sonucunda köyde dünyaya gelen öğrencilerin, ilçe ve ilde dünyaya gelen öğrencilere göre daha mutlu oldukları bulunmuştur. Köyde yaşam genel anlamda insanların daha geniş aile topluluklarında yaşadıkları ve bir arada oldukları bir durum olarak ifade edilebilir. Böyle bir durumda öğrenciler stresten uzakta ve doğa ile iç içe bir yaşamla büyümektedir. Öğrencilerin köyde yaşamaları bir başka ifadeyle ilçe ve ilin sınırlarını ortadan kaldırarak çok erken yaşlardan itibaren psikolojik sağlamlığın da güçlü olmasını sağlayabilir. Böyle bir durum ise mutluluğa daha fazla değer verilmesini beraberinde getirebilir (Aksoy, Aytar ve Kaytez, 2018; Keleş, Keskin ve Ertek, 2018). İlçede dünyaya gelen öğrencilerin daha fazla oranda ahirette ödüllendirileceklerine inandıkları aynı zamanda bakmakla yükümlü olduklarını terk edeceklerini düşündükleri ve köyde dünyaya gelen öğrencilerin ölüm hakkında daha fazla cesarete sahip oldukları sonucuna ulaşılmıştır. Bu durumu ilçe ve köyün sosyoekonomik yapısına bağlayarak açıklamak mümkündür. İlçe ve ilde genel anlamda ölüme verilen algı oldukça farklı olabilmektedir. Kırsal kesimde ölümle hayatın son bulmadığı ve bu dünyada

yaptığı iyiliklerin karşılığını bir şekilde alacakları düşünülmektedir. Bu durum ise kişilerin ölüme yönelik daha cesaretli davranmalarını beraberinde getirebilmektedir (Alptekin, 2018; Coşkun, 2010; Çınar ve Akgümüş, 2023; Güven, 2019). Ancak buna karşılık olarak da bakmakla yükümlü olduklarını terk etme ve bundan dolayı da endişenin yoğun olarak yaşanması da söz konusu olabilmektedir (Dağ ve Alkar, 2022; Marti- Garcia vd., 2017). İfade edilen bu durumların ise araştırma bulgularını desteklediği düşünülmektedir. Araştırmada birinci sınıf öğrencilerinin mutluluğa daha az değer verdikleri bulunmuştur. Bu durumu üniversitenin başlangıcında öğrencilerin yaşayabilecekleri duygu durumuna bağlı olarak açıklamak mümkündür. Üniversitenin ilk dönemi genelde çevreye, derslere uyum sağlama çabalarıyla ilerlemektedir. Ancak öğrencilerin ilk senede genelde etrafa uyum sağlayamamaları, derslerin yoğunluğu ve sorumluluklarını daha fazla hissetmeleri onların mutsuz olmalarını da beraberinde getirebilmektedir (Özer ve Deniz, 2014; Sevinç ve Gizir, 2014). Ölüm algısı ve ölüme ait düşüncelerde sınıf düzeyine göre de farklılıklar bulunmuştur. Bu kapsamda sınıf düzeyi düştükçe, ölüme yönelik daha fazla korku, kaygı yaşama, ancak buna koşut olarak da daha fazla cesur davranışlar gösterdikleri bulunmuştur. Bu durumu yine birinci sınıf öğrencilerinin gelişimsel özelliklerine bağlayarak açıklamak mümkündür. Genelde üniversite birinci sınıf öğrencileri ergenlik döneminden yeni çıkmış ve çıkmakta olan bireylerdir. Ergenlerin ise genelde daha fazla risk alma davranışlarına sahip oldukları bilinmektedir. Bununla birlikte ergenler aynı zamanda ölümsüz olduklarını düşünmekte ve ölüme yönelik büyük oranda kaygı ve korku hissedebilmektedir. Böyle bir durum ise bu dönemdeki bireylerin daha cesur olmalarını beraberinde getirdiği gibi, aynı zamanda korku ve kaygı durumunu da beraberinde getirebilecektir (Çubuk, 2020; Sekiz Öz ve Kargın, 2021; Tatlılıoğlu, 2012). Araştırmada anne-babası hayatta olan öğrencilerin daha fazla mutlu oldukları, buna karşılık anne-babası hayatta olmayan öğrencilerin ölüm algılarının daha yüksek olduğu sonucuna ulaşılmıştır. Anne-baba her yaşta bireyin en önemli sosyal sermayesidir. Sadece ekonomik anlamda değil, anne-baba çocuğuna da psikolojik destek veren önemli bir güçtür. Bu kapsamda anne-babanın hayatta olması, kişilerin mutlu olmasını da sağlamaktadır (Ekşi vd., 2020; Kumcağız, Orak ve Şahin, 2018; Yıldırım ve Sezer, 2018). Ancak anne ya da babadan birinin kaybı bireyin sadece mutsuz olmasını değil, bazı durumlarda anne-babaya kavuşma isteğini ortaya çıkarabilmekte, bazen de ölüme yönelik korku ve kaygıyı güçlendirebilmektedir (Annor vd., 2023). Böyle bir durum sonucunda ise öğrencilerin anne-babalarının yaşaması onlar için bir mutluluk nesnesi olurken, olmaması ise ölüme yönelik araştırma sonuçlarının ortaya çıkmasını sağlayabilmektedir.

Araştırma sonucunda annesi ilköğretim mezunu olan üniversite öğrencilerinin daha fazla mutluluk hissettikleri bulunmuştur. Annenin ilköğretim mezunu olması, çocuğuyla daha yakın ilişki kurmasını beraberinde getirebilir. Böyle bir durum anne-çocuk arasında kurulan kaliteli ilişkinin çok erken zamanlardan beri kurulacağını ve bunun sonucunda da çocukların yetişkin olduklarında da bu güven hissiyle mutlu olmalarını sağlayabilir (Arslanargun, Bozkurt ve Sarıoğlu, 2016; Şanlı ve Öztürk, 2012). Buna karşılık, annenin öğrenim düzeyinin yükselmesinin, öğrencilerin ahirette mutlu olacaklarını düşünmelerini, bakmakla yükümlü olduklarını terk etme, daha fazla başarısızlık yaşama ve acı çekme davranışlarını birlikte getirdiği yönünde sonuçlara ulaşılmıştır. Annenin öğrenim durumunun yükselmesi, çocuğuyla kuracağı iletişim ve etkileşimin daha farklı bir hal almasını da beraberinde getirebilir. Bir başka ifadeyle çocuğun sürekli ailesinin yanında olmasını isteme nedeni olabilir. Böyle bir duygu durumu ile bir arada büyümek ise ölüm karşısında daha fazla başarısızlık duygusunu beraberinde getirebileceği gibi, bu dünyada istediklerini alamadıkları için ahirette alacaklarını düşünmelerine de neden olabilir (Uslu ve Çağdaş, 2014; Zajac ve Boyatzis, 2021). Araştırma sonucunda babası üniversite ve ortaokul mezunu olan öğrencilerin mutluluğa daha az değer verdikleri, daha fazla ölüm algısı hissettikleri, babanın öğrenim düzeyinin artması ile ölüme yönelik farklı duyguların olduğu, bilinmezlik ve cesaret hissettikleri sonucuna ulaşılmıştır. Babanın öğrenim düzeyinin yüksek olması, çocuğuyla olan iletişim ve etkileşimini sınırlandırabilmektedir. Bu kapsamda çocuğun babasıyla olan ilişkisinin istendik yönde olmaması sonucunda, yetişkinliğinde de anne öğrenim düzeyine benzer şekilde duygusal anlamda rahat edememe ve bu durumla bağlantılı olarak da mutsuzluğu beraberinde getirebilir (Gözübüyük ve Özbey, 2020; Mert ve Kahraman, 2018). Yine babanın öğrenim düzeyinin yükselmesi sonucunda babayla yaşanamayan ilişki ve etkileşimler, anne öğrenim düzeyinde olduğu gibi ölüm algısına aktarılabilir. Böyle bir durumun da araştırmada elde edilen bulguları desteklediği düşünülmektedir. Araştırma sonucunda, öğrencilerin Kahramanmaraş depreminde yakınlarını kaybetmeleri ile mutluluk durumu ve ölüm algıları arasında anlamlı farklılık bulunmamıştır. Ancak bununla birlikte yakınlarını kaybedenlerin mutluluk puanlarının düşük, ölüm algılarının ise yüksek olduğu bulunmuştur. Kahramanmaraş depremi gibi ani olarak gelişen, kestirilemeyen ve pek çok yıkımın yaşandığı durumlarda, bireylerin öncelikle şok yaşadıkları ve sonrasında gelişen duruma uyum sağlamaya çalıştıkları bir süreçten geçtikleri bilinmektedir. Böyle bir durum ise yakınını kaybeden ya da kaybetmeyen her bireyi derinden etkilemiştir. Özellikle medyada yer alan görüntüler ve insanların çaresizliği depremi deneyimlemeyen bireylerin bile depremi deneyimlemiş olarak algılamalarına yol açabilmiştir

(Gören, 2023; Koçyiğit, 2023; Şeker, 2023; Tüccar ve Yavuz, 2023; Yelboğa, 2023). Böyle bir durumun ise araştırma sonucunda olduğu gibi anlamlı farklılığı ortaya çıkarmadığı düşünülmektedir. Araştırma sonucunda ulaşılan son bulgu, mutluluğa aşırı değer verme ölçeği ile ahirette ödüllendirme ve başarısızlık alt boyutlarında negatif yönde ilişkinin olmasıdır. Mutluluk ve ölüm birbirine zıt iki kavram olarak değerlendirilebilir. Birinde daha pozitif duyguların olması, diğerinde daha negatif duyguların olmasını gerektirir (Akalın, 2020; Karakuş, Öztürk ve Tamam, 2012; Kurtulan ve Karaırmak, 2016). Bu kapsamda ele alındığında mutluluğun artması ile ölüm algısı arasında bir zıtlığın olması beklenen bir durum haline gelmektedir.

Sonuç ve Öneriler

Araştırmada elde edilen sonuçlara yönelik olarak aşağıdaki önerilerde bulunmak mümkündür.

- Üniversite öğrencilerinin yaşadıkları ortama uyumu ve entegrasyonunu sağlayacak çalışmaların yapılması,
- Öğrencilerin özellikle ölümle ilişkili algılarında farklı değişkenlerin ele alınarak inceleneceği çalışmaların planlanması,
- Deprem ya da doğal bir afet yaşama durumunda psikososyal desteğin hemen sağlanması
- Öğrencilerin görüşlerinin de ele alındığı karma yöntem çalışmalarının gerçekleştirilmesi

önerilebilir.

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PANDEMİ DÖNEMİNDE İLKÖĞRETİM ÇOCUKLARINA YÖNELİK HAZIRLANAN SOSYAL BECERİ EĞİTİM PROGRAMININ ÇOCUKLARIN SOSYAL GELİŞİM VE ARKADAŞLIK BECERİLERİNE ETKİSİNİN İNCELENMESİ

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Özet
İlkokul döneminde çocuklar, gelişim görevlerinde yeni sorumluluklarla karşı karşıyadır. Özellikle içinde bulunduğu bazı şartlar da çocuğun bocalamasına ve gelişim görevlerini yerine getirirken zorlanmasına neden olabilmektedir. Bunlardan biri ise Covid-19 pandemisi olarak ifade edilebilir. Covid-19 pandemisinde okulun eve taşınması çocuğun akademik becerileri kazanmasında, arkadaşlık becerilerinin sınırlanmasına yol açabilmiştir. Ancak böyle bir durum içinde bulunulan dönemin özellikleri ile bağlantılı olarak çocuklarda problemli davranışların da ortaya çıkmasına neden olabilmiştir. Bu düşüncelerden hareketle araştırmada Covid-19 pandemisinde ilkokul çocuklarının akran ilişkilerini destekleyerek, sosyal becerilerinin devamını sağlamak amaçlanmıştır. Araştırmada nicel araştırma yöntemlerinden yarı deneysel desen kullanılmıştır. Araştırmada örneklem seçimine gidilmemiştir. Türkiye'de ikamet etmekte olan ve 7-12 yaş arasındaki çocuklarla çalışılmıştır. Araştırmada araştırmacılar tarafından geliştirilen sosyal beceri eğitim programı online olarak uygulanmıştır. Çocukların sosyal becerilerini ve akran ilişkilerini belirlemek için Kaner (2000) tarafından geliştirilen "Akran İlişkileri Ölçeği" ve Sezgin ve Akman (2014) tarafından geliştirilen "6-12 yaş Türk çocukları için Sosyal Beceri ve Uyum Ölçeği" kullanılmıştır. Araştırma sonucunda çocukların ön test-son test sonuçları arasında son test sonuçları lehine anlamlı düzeyde farklılık olduğu ve çocukların sosyal beceri uyumlarının arttığı sonucuna ulaşılmıştır. Araştırmadan elde edilen verilere dayanarak, çocukların akran ilişkilerinin geliştirilmesi için daha uzun ve yüz yüze eğitimlerin yapılması gerektiği önerilebilir.
Anahtar Kelimeler: İlkokul dönemi, akran, sosyal gelişim, arkadaşlık ilişkileri, Covid-19 pandemisi

INVESTIGATION OF THE EFFECT OF THE SOCIAL SKILLS TRAINING PROGRAM PREPARED FOR PRIMARY SCHOOL CHILDREN DURING THE PANDEMIC PERIOD ON CHILDREN'S SOCIAL DEVELOPMENT AND FRIENDSHIP SKILLS

Abstract
During the primary school period, children face new responsibilities in their developmental tasks. Particularly, some conditions may cause the child to hesitate and have difficulty in fulfilling his/her developmental tasks. One of these can be expressed as the Covid-19 pandemic. Moving school to home during the Covid-19 pandemic may limit the child's ability to gain academic skills and limit their friendship skills. However, such a situation may also cause problematic behaviour in children, depending on the characteristics of the current period. Based on these thoughts, the research aimed to ensure the continuation of the social skills of primary school children by supporting their peer relationships during the Covid-19 pandemic. A quasi-experimental design, one of the quantitative research methods, was used in the research. No sample selection was made in the research. It was studied with children between the ages of 7 and 12 who reside in Turkey. Children were reached through the information given to schools. In this context, 50 children whose families gave consent constituted the study group of the research. In the study, the social skills training program developed by the researchers was applied online. To determine children's social skills and peer relationships, the "Peer Relations Scale" developed by Kaner (2000) and the "Social Skills and Adaptation Scale for 6–12-year-old Turkish children" developed by Sezgin and Akman (2014) were used. As a result of the research, it was concluded that there was a significant difference between the children's pre-test and post-test results in favor of the post-test results and that the children's social skill adaptation increased. Based on the data obtained from the research, it can be suggested that longer and face-to-face education should be provided to improve children's peer relationships.
Keywords: Primary school period, peer, social development, friendship relations, Covid-19 pandemic

Giriş

İlkokul dönemi, hayatın önemli ancak gizli kalmış bir dönemi olarak ifade edilebilir. Bu dönemde çocuğun gerçekleştirmek zorunda olduğu yeni gelişim görevleri ile karşı karşıya kalması, formal olarak okula başlaması, okul sorumluluklarını alması ve aynı zamanda etrafıyla uyumlu etkileşim içinde bulunması gerekmektedir. Çocuğun ilkokula başlaması ile artık çocuktan okuma-yazma ve matematik becerilerini kazanması istenmektedir. Çocuğun akranlarından geri kalması istenmemekte, bunun için daha çok çalışması ve bir an önce akademik olarak yetkinliğini elde etmesi istenmektedir. Bu dönemde çocuğun oyuncakları ve oyunları yasaklanmakta ve çocuk adeta yetişkin biri gibi sorumluluklarıyla karşı karşıya kalmaktadır. İlkokul döneminde çocuklar için ailesi hala oldukça önemli olsa da, okulu ve akranları ön plana geçmeye başlamaktadır (Malik ve Marhawa, 2018; Özen, 2018; Tatlılıoğlu ve Korkmaz, 2015; Tümkaya ve Türkmenoğlu, 2021). Adeta öğretmenin gözdesi olmak için çaba vermektedir. Akranlarıyla olan arkadaşlıkları ise onun yeni bir dünyaya açılmasında önemlidir. Çocuk için okulda başarılı olamaması, öğretmeni, akranları ve ailesinden olumsuz geri dönütler alması onun spor ya da sanat gibi alanlarda başarılı olma isteğini de beraberinde getirebilmektedir (Crisogen, 2016; Sopa, 2014; Theiman, 2016; Türker ve Erhan, 2021). Ancak bazı durumlarda böyle bir imkân da bulunmayabilmektedir. Günümüzde bu kapsamda yaşadığımız ve ilkokul dönemindeki çocuklar başta olmak üzere tüm bireyleri zorlayan bir etken Covid-19 pandemisi olmuştur.Covid-19, Çin'in Vuhan kentinde 2019 yılının sonlarında ortaya çıkan ve sadece bulunduğu bölgede değil, dünyanın büyük bir çoğunluğunda ölümlere yol açan ve bu nedenle de kısa bir süre sonra pandemi ilan edilmesine neden olan bir durumdur. Covid-19 pandemisinde yaşanan hızlı bulaşın engellenebilmesi için tüm Dünyada gereken önlemler alınmıştır. Alınan önlemler ise kısa bir süre sonra Türkiye'de de yaşanmaya başlanmıştır. Bu önlemler okulların kapatılması, sokağa çıkmanın yasaklanması, derslerin çevrim içi sürece evrilmesi olarak ifade edilebilir. Elbette böyle bir durum tüm bireyleri etkilediği gibi ilkokul dönemindeki çocukların da etkilenmesine neden olmuştur. Okulların kapanması ve derslerin çevrim içi yapılması sonucunda çocuklar eve kapanmışlardır. Ancak aynı zamanda bu durum birtakım eşitsizliklerin olmasına neden olmuştur (Duban ve Şen, 2020; Fauzi ve Khusuma, 2020; Nuraini vd., 2020; Okatan ve Tagay, 2021; Putri vd., 2020; Yavuz ve Toprakçı, 2021; Yıldız vd., 2020). Çevrim içi eğitim imkanına sahip olmayan ya da yeterli teknik bilgiye sahip olmayan çocuklar bu kapsamda oldukça zor bir süreci yaşamışlardır (İnci Kuzu, 2020; Rasmitadlia vd., 2020; Scarpelini vd., 2021). Dahası çocukların evden çıkmalarına getirilen kısıt çocukların hayatlarında çok önemli olan öğretmeni ve akranlarıyla olan

ilişkilerini de sınırlandırabilmiştir (Demiryürek, 2022). Böyle bir durum sonucunda ise zaten oldukça zor şartları olan Covid-19 pandemisine bir de psikolojik problemler eklenebilmiştir (Anggraeni, Alpian ve Kodariah, 2021; Çalışkan, 2020; Siachpazidou vd., 2021).Çocukların içinde bulundukları durumdan kurtularak rahatlatılmaya çalışılması ise bu anlamda oldukça önemli bir toplum sorunu haline gelmiştir (Hamilton ve Gross, 2021). Bu nedenle farklı yaş gruplarında bulunan çocuklara yönelik birtakım programlar yine çevrim içi olarak hazırlanmaya ve uygulanmaya başlanmıştır. Ancak yapılan bu programların belirli bir kesime yönelik olduğu ve genelleşmesinde sorunların da olduğu görülmüştür (Aral vd., 2021; Gözeler ve Özbey, 2023; Lestari ve Sukmawati, 2022; Nurjanah vd., 2022). Yapılan literatür taramasında ilkokul dönemindeki çocuklara yönelik pandemi döneminde hazırlanan ve uygulanan sosyal becerilerini ve akran ilişkilerini desteklemeye yönelik sınırlı sayıda araştırmaya rastlanmıştır (Nur'Aini vd., 2022; Oliveria Major vd. 2023). Bu nedenle araştırmada ilkokul döneminde bulunan çocuklara yönelik olarak hazırlanan sosyal beceri eğitim programının çocukların sosyal beceri ve akran ilişkileri üzerindeki etkisinin belirlenmesi amaçlanmıştır.

Yöntem

Bu bölümde, araştırma modeli, çalışma grubu, veri toplama araçları, veri toplama yöntemi ve verilerin toplanması bölümlerine yer verilmiştir.

Araştırma Modeli

Araştırmada nicel araştırma yöntemlerinden biri olan zayıf deneysel tek grup ön test- son test deneysel desen kullanılmıştır. Zayıf deneysel desenlerden tek grup ön test- son test deseninde deneysel işlem bir tek grup üzerinden gerçekleştirilmektedir (Büyüköztürk vd., 2016). Araştırmada kontrol grubu seçilmemiştir. Covid-19 pandemisinde çocukların yaşamış oldukları problemler göz önüne alınarak hazırlanan programın tüm gruplar üzerinde uygulanması ve tüm çocukların bu süreçten yararlanabilmesi için kontrol grubu seçilmemiştir. Ayrıca Türkiye'de yer alan tüm çocukların bu programa katılım sağlayabilmesi açısından eşleştirme gerçekleştirilmemiştir.

Çalışma Grubu

Araştırmanın çalışma grubu Türkiye'de ikamet etmekte olan 8-11 yaş arasındaki çocuklardan oluşmaktadır. Bu kapsamda Covid-19 pandemisinde üniversitelerin de uzaktan eğitime geçmeleri sonucunda, Türkiye'de farklı illerde memleketlerine giden üniversite öğrencilerinin ulaşabildikleri ilköğretim öğrencileri araştırmaya dâhil edilmiştir. Araştırmada 50 çocukla çalışılmıştır. Çocukların sosyodemografik özelliklerinin dağılımı Tablo 1'de verilmiştir.

Tablo 1'de araştırmaya dâhil edilen çocukların sosyodemografik özelliklerinin dağılımı görülmektedir. Tabloda da görüldüğü gibi çocukların %54'ünün erkek, %46'sının kız olduğu, %32'sinin 10 yaş grubunda ve %46'sının 6. Sınıfa devam ettiği; çocukların annelerinin %44'ünün ilkokul, babalarının %48'inin üniversite mezunu olduğu ve çocukların %52'sinin ilçe, %48'inin ise ilde yaşadığı belirlenmiştir.

Veri Toplama Araçları

Araştırmada veriler, "Genel Bilgi Formu", Sezgin ve Akman (2014) tarafından geliştirilen "6-12 Yaş Türk Çocukları için Sosyal Uyum ve Beceri Ölçeği" ve Kaner (2000) tarafından geliştirilen "Akran İlişkileri Ölçeği" ile toplanmıştır. Ayrıca araştırmacılar tarafından geliştirilen ve on hafta devam eden "Sosyal Beceri Eğitim Programı" uygulanmıştır.

Genel Bilgi Formu: Araştırmaya dâhil edilen çocukların sosyodemografik özelliklerini belirlemek için araştırmacılar tarafından geliştirilen formdur. Formda, çocukların cinsiyeti, yaşı, devam ettikleri sınıf, anne ve baba öğrenim düzeyleri ve çocukların nerede yaşadıklarına yönelik sorular bulunmaktadır.

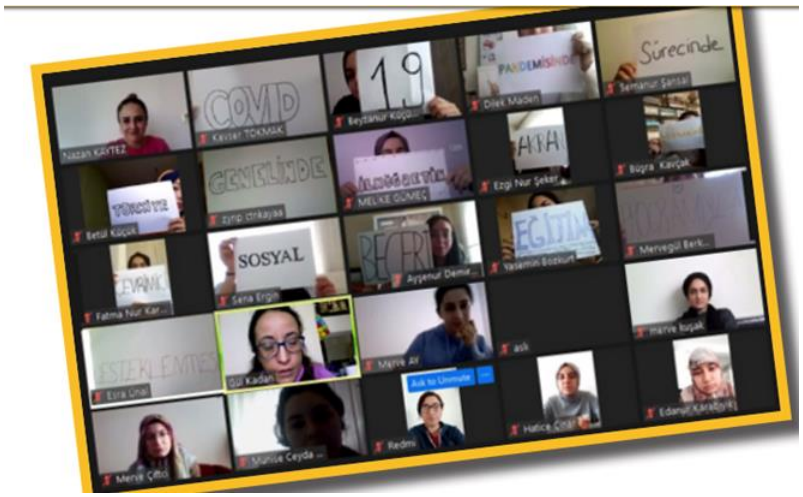
6-12 Yaş Türk Çocukları İçin Sosyal Uyum ve Beceri Ölçeği: Sezgin ve Akman (2014) tarafından annelerin çocuklarının sosyal uyumlarını değerlendirebilmeleri amacıyla geliştirilen ölçektir. Ölçek 59 madde ve 7 alt boyuttan oluşmaktadır. 3'lü likert tipinde değerlendirilen ölçekte ters kodlanan madde bulunmamaktadır. Ölçeğin geliştirilme aşamasında Cronbach Alfa değerleri, tüm ölçek için .94, Dürtüsellik alt boyutu için .83, Engellenme eşiği alt boyutu için .62, Dikkat/Hareketlilik alt boyutu için .74, Sosyal İlişki alt boyutu için .84, Duygu Durumu alt boyutu için .68, Onay İhtiyacı alt boyutu için .78 ve İçe Dönüklük alt boyutu için .67 olarak hesaplanmıştır. Araştırma kapsamında Cronbach Alfa değerleri ise tüm ölçek için .90, Dürtüsellik alt boyutu için .80, Engellenme eşiği alt boyutu için .69, Dikkat/Hareketlilik alt boyutu için .79, Sosyal İlişki alt boyutu için .80, Duygu Durumu alt boyutu için .75, Onay İhtiyacı alt boyutu için .78 ve İçe Dönüklük alt boyutu için .81 olarak belirlenmiştir. Ölçek değerlendirilirken, alt boyutlardan alınan puanların düşük olması gerekmektedir. Bir başka ifadeyle alt boyutlardan alınan düşük puanlar çocukların o becerilerde yetkin olduğunu göstermektedir.

Akran İlişkileri Ölçeği: Çocukların akranlarıyla olan ilişkilerini belirlemek amacıyla Kaner (2000) tarafından geliştirilmiştir. 5'li likert tipi olarak değerlendirilen ölçek, 18 maddeden ve dört alt boyuttan oluşmaktadır. Ölçeğin geliştirilme aşamasında Cronbach Alfa değerleri tüm ölçek için .90, Bağlılık alt boyutu için .85, Güven ve Özdeşim alt boyutu için .87, kendini açma alt boyutu için .85 ve Sadakat alt boyutu için .88 olarak belirlenmiştir. Araştırma kapsamında

Cronbach Alfa değerleri tüm ölçek için .85, Bağlılık alt boyutu için .80, Güven ve Özdeşim alt boyutu için .80, Kendini Açma alt boyutu için .82, Sadakat alt boyutu için .79 olarak belirlenmiştir. Boyutlardan alınacak yüksek puanlar çocukların arkadaşlık ilişkilerinde başarılı oldukları şeklinde değerlendirilmektedir.

Sosyal Beceri Eğitim Programı: Araştırmacılar tarafından geliştirilen program 10 hafta devam etmiştir. Programda çocukların bireysel özelliklerinden yararlanılmıştır. Bu kapsamda program oluşturulurken felsefi yapısını pragmatizm ve yeniden kurmacılıktan, psikolojik temellerini ise Ralp Tayler'ın görüşlerinden almıştır. İfade edilen kuram ve yaklaşımlarda eğitim ortamına etkin katılımın sağlanmasının önemi üzerinde durulmakta ve küçük adımlarla çalışmanın öneminden bahsedilmektedir. Ayrıca bireyselliğin ön plana alınması gerektiğine vurgu da yapılmaktadır (Demirel, 2017). Bu düşünceler altında programda çocukların aktif yer alacakları etkinlikler gerçekleştirilmiştir. Ayrıca çocukların sevdikleri aktivitelerden yararlanılmıştır. Programda yer verilen oturumlar hafta sonu bir saat çevrim içi olarak gerçekleştirilmiştir. Programda üniversite öğrencileri aktif rol almışlardır. Programlara ait bilgilere aşağıda yer verilmiştir.

- **1. Oturum: Tanışma ve Program Tanıtımı:** Oturumda amaçlanan çocuklarla ve ebeveynlerle tanışılmasıdır. Tanışma etkinliği gerçekleştikten sonra çocuklarla program hakkında konuşulmuştur. Programın neden gerçekleştirildiği, programla nelerin amaçlandığı ve bu süreçten çocuklardan beklentilerin neler olduğu üzerinde durulmuştur. Tanışma oturumunda ayrıca Covid-19 pandemisinin ne olduğu, virüsten nasıl korunulması gerektiğine yönelik bilgilendirmeler yapılmış ve animasyon filmler izlenmiştir. Çocuklarla birlikte programda parmak oyunları, kelime kartları oyunları oynanmıştır.



- **2. Oturum: Virüste Neymiş:** Oturumun amacı, çocukların pandemi nedeniyle yaşamış oldukları kaygıları fark etmelerini sağlayarak, bu kaygıdan sağlıklı baş etme yöntemleri ile kurtulmalarının sağlanmasıdır. Bu kapsamda da nefes ve rahatlama egzersizlerine yönelik etkinlikler gerçekleştirilmiştir. Ayrıca çocuklarla dans edilmiş ve çocukların biriken enerjilerini boşaltmaları konusunda destek de sağlanmıştır.



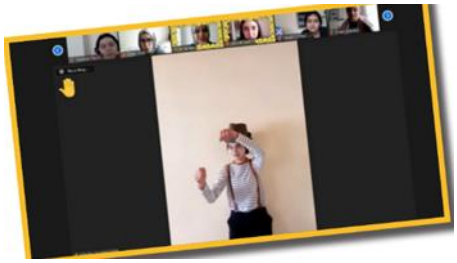
- **3. Oturum: Arkadaşlık Sadece Yakın Mesafe Değildir, Arkadaşlık Uzun Mesafelerde de Bir Olabilmektir:** Oturumun amacı çocukların Türkiye'nin farklı bölgelerinde de olsalar bir arada olabileceklerini ve kendilerini üzen, mutlu eden anıları paylaşabileceklerini fark etmelerinin sağlanmasıdır. Bu kapsamda oturumda Türkiye'nin farklı bölgelerini tanıtmaya yönelik geziler sanal ortamda düzenlenmiş, birlikte halk oyunları oynanmış, o bölgede yaşayan çocukların kendilerinin de aktif olarak ev sahipliği yaptıkları programlar yedi bölgenin güzellikleri ve özellikleri boyutunda sürdürülmüştür.



- **4. Oturum: Zenginliklerimizle Varız ve Var Olacağız:** Oturumun amacı çocuklar arasındaki iletişim ve etkileşimin arttırılmasıdır. Birlikte nesi var oyunu oynanan oturumda origami etkinliklerine yer verilmiştir. Aynı zamanda çocukların yaşlarına ve gelişimlerine uygun olan bir kitap ekrana yansıtılmış ve çocuklarla birlikte etkileşimli kitap okuma etkinliği gerçekleştirilmiştir. Çocukların birbirlerine duygu ve düşüncelerini anlatmaları da sağlanmıştır.



- **5. Oturum: Duymazsak da Anlaşabiliriz:** Oturumun amacı çocukların farklılıklara yönelik bakış açısı geliştirmelerinin sağlanmasıdır. Burada ilk olarak çocuklarla günlük sohbetler gerçekleştirilmiştir. Çocukları üzen ya da mutlu eden günlük olaylar konusunda sohbetler gerçekleştirilmiştir. Daha sonra araştırmacılar tarafından sessiz sinema şeklinde bir animasyon getirilmiş ve bu filmde ne anlatıldığını anlayıp anlamadıkları sorulmuştur. Çocukların tamamının görüşleri alınmıştır. Ayrıca pandomim gösterisi sunulmuştur. Pandomim gösterisi hakkında sohbet edilmiştir.

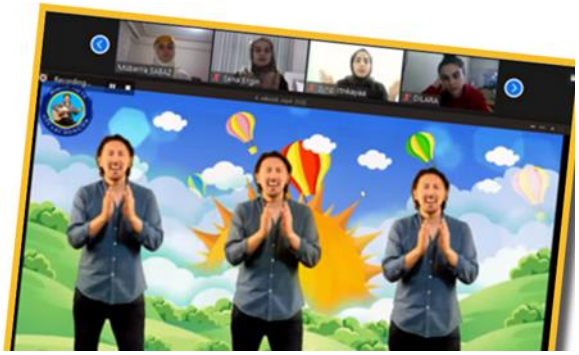


- **6. Oturum: Duygularımız Bizim Neyimizdir?** Oturumun amacı, çocukların duygularını tanımalarını ve bunu uygun şekilde ifade edebilmelerinin sağlanmasıdır. Bu nedenle duygularımız oyunu oynanmıştır. Duygularımızı uygun şekilde ifade ettiğimizde ya da edemediğimizdeki durumlarla ilgili oyunlar oynanmıştır. Sonrasında ise çocuklarla beraber duygu ayraçları yapılmıştır.



- **7. Oturum: Sihirli Güç, İşbirliği:** Oturumun amacı çocukların işbirliğinin neden önemli olduğunu fark etmelerini sağlamaktır. Oturumda, “Bir elin nesi var, iki elin sesi var” adındaki hikaye canlandırmalarla işlenmiştir. Çocuklarla etkileşimli kitap okuma etkinliği

gerçekleştirilmiş ve çocuklara işbirliğinin neden önemli olduğuna yönelik sorular yöneltilmiştir. Oturum çocuklar tarafından çok sevilen hareketli şarkılarla devam etmiş ve çocukların oynaması ve dans etmesi sağlanmıştır.



- **8. Oturum: Empati Becerisi Nedir?** Oturumda amaçlanan empati becerisinin ne olduğunu çocukların algılaması ve empatik iletişim örnekleri sergilemelerinin sağlanmasıdır. Bu amaçla çocuklara farklı durumlar yansıtılmış ve çocuklar bu farklı durumlarda ne yapmalarının ya da ne yapmamalarının uygun olacağı üzerinde durmuşlardır. Empatinin neden önemli olduğuna yönelik çocuklara sorular yöneltilmiş ve çocukların kendini başkasının yerine nasıl koyabileceği üzerinde durulmuştur.



- **9. Oturum: Siber Zorbalık ve Akran Zorbalığı:** Oturumda amaçlanan siber zorbalığın ve akran zorbalığın ne olduğu üzerinde durulmasıdır. Bu kapsamda çocuklara siber zorbalığın ne olduğu ve nasıl karşılaşılabileceğine yönelik bilgiler verilmiş, böyle durumlarda ne yapılması gerektiği örnekler üzerinde anlatılmıştır. Siber zorba bir kuklanın başına gelenlere yönelik kuklanın ağzından düşünceleri alınmıştır.



- **10. Oturum: Neler Yaptık, Neler Yaşadık?** Oturumun amacı on haftalık süreç içerisinde çocuklarla yapılan etkinliklerin gözden geçirilmesidir. Bu kapsamda yapılanlara yönelik hazırlanan slayt gösterisi çocuklarla birlikte izlenmiştir. Oturumun sonunda çocuklarla birlikte gevşeme teknikleri ve nefes egzersizleri çalışılmıştır.

Veri Toplama Yöntemi

Araştırma Covid-19 pandemi salgınından sonra üniversitelerin ve okulların kapatılması döneminde gerçekleştirilmiştir. Bu nedenlerle üniversiteden memleketlerine dönen öğrencilere, bulundukları illerde/ilçelerde yaşayan ve 8-11 yaş aralığında çocuğu olan ebeveynlere araştırma hakkında bilgi vermeleri istenmiştir. Öğrenciler aracılığıyla ailelere ulaşılmış ve araştırma hakkında araştırmacılar tarafından tekrar bilgilendirme yapılmıştır. Araştırmaya katılmayı kabul eden ebeveynlere aydınlatılmış onam formları yine öğrenciler aracılığıyla ulaştırılmıştır. Çocuklarla ve ailelerle çevrim içi bir araya gelinmiştir. Bu süreçte çocuklarla tanışılmış ve onların güveni kazanılmıştır. Ailelere "Google Form" aracılığıyla ölçme araçları gönderilmiş ve ön test uygulamaları tamamlanmıştır. Ön test uygulamalarının tamamlanmasından sonra on hafta sürecek eğitimlere başlanmıştır. Eğitimlerin tamamlanmasından sonra ailelere tekrar "Google Form" aracılığıyla ulaşılmış ve son test çalışmaları gerçekleştirilmiştir.

Verilerin Analizi

Araştırmada elde edilen veriler SPSS 26.0 IBM istatistik paket programına alınmıştır. Çocukların ve ailelerin sosyodemografik özelliklerine yönelik betimsel analizler uygulanmıştır. Ailelerin ölçme araçlarına vermiş oldukları cevaplara yönelik normallik analizleri gerçekleştirilmiştir. Örneklem sayısının 50 olması nedeniyle Shapiro Wilk test sonuçları ile Kurtosis ve Skewness değerleri incelenmiştir. Normallik testi sonuçları Tablo 2'de verilmiştir. Tablo 2'de araştırmaya dâhil olan ebeveynlerin çocuklarına ait Arkadaşlık ilişkileri Ölçeği ve 6-12 Yaş Türk Çocukları için Sosyal Beceri Uyum Ölçeğine verdikleri cevaplara yönelik normallik analiz sonuçları görülmektedir. Tabloda da görüldüğü gibi ebeveynlerin vermiş oldukları cevapların normal olmayan dağılım gösterdikleri belirlenmiştir. Bu nedenle çocukların ön test- son test sonuçlarını değerlendirmek için nonparametrik analizlerden Wilcoxan İşaretli Sıralar test sonuçları incelenmiştir.

Bulgular

Covid-19 pandemi döneminde ilköğretim çocuklarına yönelik uygulanan Sosyal beceri eğitiminin çocukların akran ilişkileri ve sosyal beceri uyumları üzerinde etkisinin olup olmadığını belirlemek amacıyla gerçekleştirilen araştırmanın bulgularına aşağıda yer verilmiştir.Tablo 3'de ilköğretim çocuklarının akran ilişkileri ölçeği alt boyutlarına ait ön test-

son test sonuçlarına ait ortalamalar ve Wilcoxan İşaretli Sıralar Test Sonuçları görülmektedir. Tabloda da görüldüğü gibi çocukların son test sonuçlarının bağlılık, güven ve özdeşim ve kendini açma alt boyutlarında anlamlı derecede yüksek olduğu ve ön test sonuçlarına oranla etki büyüklüğü Cohen (d) (1998) kriterlerine göre yüksek oranda arttığı görülmektedir. Bir başka ifadeyle çocuklara uygulanan sosyal beceri eğitim programının çocukların akran ilişkilerinde sadakat alt boyutu haricinde anlamlı etkide bulunduğu ifade edilebilir.

Tablo 4'de ilköğretim çocuklarının sosyal beceri uyum ölçeği alt boyutlarına ait ön test- son test sonuçlarına ait ortalamalar ve Wilcoxan İşaretli Sıralar test sonuçları görülmektedir. Tabloda da görüldüğü gibi çocukların sosyal beceri uyum ölçeği alt boyutlarında son test puanları ön test puanlarına oranla Cohen d(1998) etki büyüklüğüne göre anlamlı oranda azalmıştır. Bir başka ifadeyle uygulanan sosyal beceri eğitim programı çocukların sosyal becerilerine etki etmiş ve çocuklarda istenen sosyal beceri özelliklerinin ortaya çıkmasına neden olmuştur.

Tartışma

Covid-19 pandemi döneminde ilköğretim dönemindeki çocuklara yönelik uygulanan sosyal beceri eğitim programının çocukların akran ilişkileri üzerinde sadakat alt boyutu haricinde anlamlı etki yaptığı belirlenmiştir. Bu durumu çocukların on hafta boyunca almış oldukları eğitime bağlayarak açıklamanın mümkün olduğu düşünülmektedir. Çocuklara uygulanan eğitimde farklılıklara saygı, empati ve arkadaşlık ilişkileri, üzerinde durulan konular arasındadır. Eğitimde çocukların aktif olarak yer alması ve problem durumlarına kendilerinin çözüm yolu bulması istenmiştir. Bu nedenle çocuklar farklılıklara saygı ve akran ilişkilerinin önemini yaparak yaşayarak öğrenmişlerdir. Bu durumun ise araştırma sonuçlarına yansıdığı görülmektedir. Nitekim çocukların akran ilişkilerini kazanmalarında önemli olan noktalardan biri, etrafındaki yetişkinlerin varlığıdır denilebilir. Çocuklar gelişimsel özellikleri nedeniyle özellikle bu dönemde kendisinden farklı olan akranlarına karşı acımasız davranışlar içerisine girebilmektedir. Böyle bir durumda çocukların doğru yönlendirilmesi ise bu durumların önlenmesine katkı sağlayabilmektedir (Calp, Karaman ve Çavuşoğlu, 2018; Carroll, 2011; Erol ve Erol, 2020; Hargreaves, Buchanan ve Quick, 2022). Özellikle içinde bulundukları ve sokağa çıkamadıkları bu dönemde çocuklara uygulanan eğitimle çocukların arkadaşlık ilişkilerinin de bu yönde gelişmesi beklenen bir sonuç olarak değerlendirilebilir. Ancak çocukların sadakat alt boyutunda anlamlı farklılık elde edememesini sadakatin daha üst düzey bilişsel ve sosyal becerilere dayanmasından olduğu düşünülmektedir. Sadakat karşıdaki kişiyle fiziksel teması gerektirebilen bir yetidir (Doğruyol ve Yetim, 2019; Erden ve Yılmaz, 2016) Çocuklar her ne

kadar çevrim içi ortamda bir araya gelmiş olsalar da bu sürenin yeterince uzun olmaması ve bağlantı sorunlarının yaşanması çocukların akranlarına dokunamamasına neden olmuştur. Böyle bir durum ise sadakat alt boyutunda farklılaşmayı engelleyebilmiştir. Araştırma sonucuna benzer şekilde çocuklarla yapılan sosyal beceri eğitimlerinin çocukların akran ilişkilerini desteklediğine (Battistich, 2003; Kabasakal ve Çelik, 2010; Roh vd., 2018; Samancı ve Uçan, 2017; Uz Baş, 2010) yönelik bulgular ise araştırma sonucunu desteklemektedir.

Araştırmada uygulanan eğitim sonucunda çocukların sosyal becerilerinde istenen davranış özelliklerini kazandıkları bulunmuştur. Özellikle pandemi döneminde çocukların evde kalmak zorunda olmaları onlarda dürtüsellik, dikkatle ilgili problemlerin yaşanmasına neden olabilmiştir. Çocuklar bu dönemde gelişim alanlarındaki olgunlaşmamışlıkla paralel olarak engellenmelere karşı aşırı hassasiyet göstermişler ve bunun sonucunda duygusal ve davranışsal birtakım problemler de yaşanabilmiştir. Dahası bu çocukların pandemiden bağımsız olarak onay arama ihtiyaçları ise gelişimsel dönem özellikleri arasında yer almaktadır (Arısoy ve Özer, 2023; Buchanan, Hargreaves ve Quick, 2023; Contini vd., 2021; Dallalio vd., 2022; Duban ve Şen, 2020; Matiz vd., 2022; Stevanus ve Gita, 2022; Talu ve Kurt, 2022). Çocuklara uygulanan eğitim programında nefes egzersizlerine ve gevşeme tekniklerine yer verilmesinin, içinde bulunulan durumun çocuklara farklı örneklerle anlatılmasının, çocukların duygularını paylaşan başka akranlarını görmelerinin onlarda ifade edilen durumlara yönelik farklı bir bakış açısı getirdiği ve sonuçta da son test puanlarının istenen düzeyde çıkmasına neden olduğu düşünülmektedir. Çocuklarla gerçekleştirilen sosyal beceri eğitim programlarında çocukların dikkat ve dürtüsellik başta olmak üzere istenmeyen problem davranışlarının azalmasına yardımcı olduğuna yönelik sonuçlar (Beier, 2021; Kabasakal ve Çelik, 2010; Ni ve Jia, 2023; Uz Baş, 2010; Wardana vd., 2022) ise araştırmada ulaşılan sonuçları doğrulamaktadır.

Sonuç ve Öneriler

Covid-19 pandemi döneminde ilköğretim dönemindeki çocuklara uygulanan sosyal beceri eğitim programının çocuklarda akran ilişkilerini desteklediği ve sosyal becerilerinde de istenen yönde gelişim sağladığı sonucuna ulaşılmıştır. Araştırmadan elde edilen sonuçlara dayanarak aşağıdaki önerilerde bulunmak mümkündür.

- Araştırma ilköğretim dönemindeki çocuklarla uygulanmıştır. Farklı yaş ve gelişim özelliklerine sahip olan çocuklara da benzer programlar uygulanabilir.
- Pandemi nedeniyle program 10 hafta devam etmiştir. Bu nedenle çalışmaların daha uzun soluklu gerçekleştirilmesi sağlanabilir.

- İlkokul dönemindeki çocuklara yönelik arkadaşlık ilişkileri ve sosyal becerilerini destekleyecek eğitim programları yüz yüze uygulanabilir.
- Toplumda kriz durumlarına yönelik bu tarz eğitim programlarının taslaklarının hazırlanması ve uygulamaya hazır hale getirilmesi önerilebilir.

Katkı ve Teşekkür

Araştırmacıların her ikisinin de katkısı %50'dir. Araştırmada yer alan üniversite öğrencileri, çocuklar ve ebeveynlerine teşekkür ederiz.

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MITIGATING GASTATIONAL DIABETES RISK: THE POSITIVEIMPACT OF PHYSICAL ACTIVITY DURING PREGNANCY

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Abstract
Previous studies have shown that physical activity may play a significant role in the management and control of gestational diabetes mellitus. However, few studies have been conducted to evaluate the effectiveness of a structured program of moderate physical activity in women with gestational diabetes. This pilot study aimed to determine the effectiveness of such a program in reducing glucose levels. The study emphasized a positive correlation between physical activity during pregnancy and a reduced risk of gestational diabetes. Pregnant women who engaged in regular exercise routines showed a lower likelihood of developing gestational diabetes compared to those with lower levels of physical activity. This finding indicates that physical activity during pregnancy plays a significant role in the management and prevention of gestational diabetes, a condition that can have serious consequences for both the mother and the fetus. Stabilizing blood sugar levels and the positive impact on metabolic control are potential mechanisms that explain this connection. For pregnant women, this discovery can be interpreted as an additional reason to incorporate physical activity into their daily routine, thereby creating a healthier environment for themselves and the well-being of their future offspring.
Keywords: physical activity: Pregnancy, Gestational diabetes, Risk, Blood sugar leve

Introduksion

Në këtë artikull, ne shqyrtojmë lidhjen midis aktivitetit fizik gjatë shtatzënisë dhe rrezikut të diabetit gestacional. Diabeti Gestacional është një problem shëndetësor serioz për shëndetin e nënës dhe të foshnjës dhe studimet tregojnë se aktiviteti fizik mund të ketë një ndikim pozitiv në parandalimin e tij. Studimet tregojne se egziston nje lidhje mes aktivitetit fizik stilit te jetes se gruas shtatzane dhe diabetit Gestacional.Ne fillim me një shqyrtim të literaturës për të identifikuar synimet kryesore dhe pastaj analizuam te dhenat e mbledhura ne qendrat e shendetit te gras .Kerkimi bazohet ne te dhena konkrtet te mbledhura ne fillim te javes se 28 te grave shtatzana kur dhe eshte risku per tu shfaqur ky lloj diabeti dhe matja e glicemise cdo jave me futjen e programit fizik dhe dietes ushqimore te pershtatshme. 2.2.1 Përkufizimi i diabetit gestacional Diabeti gestacional i referohet vetëm diabetit tek gratë që kurrë nuk kishin diabet më parë dhe zhvillojnë glukozë të lartë të gjakut gjatë shtatzënisë (Ogden 2011) 2.2.2 Klasifikimi i diabetit në gestacional. Klasifikimi më i njohur dhe më i përdorur gjerësisht i diabetit në shtatzëni është klasifikimi i WHITE. Ky sistem bazohet në moshën e pacientit dhe kohëzgjatjen e sëmundjes. Nga pikëpamja e trajtimit është më e dobishme për të grupuar pacientët në tre grupe funksionale: 1. Diabeti Gestacional (pacientët që zhvillojnë diabet për herë të parë gjatë shtatzënisë) 2. Diabeti i paraprak pa pasoja diabetike (si varësia e insulinës ashtu edhe diabeti i pavarur nga insulina). 3. Diabeti paraprak me sëmundje serioze diabetike (nefropatia, retinopatia e avancuar neuropatia autonome ose sëmundja e arterieve koronare) (Mishell 1994). Figure 3. Klasifikimi i diabetit Gestacional (clinicalgate.com) 2.2.3 Diagnostifikimi i diabetit gestacional. Kriteret diagnostike të diabetit të shtatzënisë janë të shumta, por nuk ka konsuensus të plotë për këto kritere. Kriteret diagnostike: 9 -Diagnoza e diabetit vendoset nëse glicemia esëll në dy matje gjendet mbi 126 g/l (7.0mmol/l). Depistimi i parë mund të realizohet lehtë duke dhënë në çfarëdo moment të ditës 50 g glukozë nga goja pa marrë parasysh ushqimin e mëparshëm. Nëse glicemia 1 orë pas dhënies së glukozës është mbi 1.40 g/l duhet të realizohet prova e hiperglicemisë së provokuar orale (HGPO). Për HGPO përdoren dy metoda: kriteret e përcaktuara nga OBSH-ja dhe kriteret e propozuara nga O'Sullivan dhe Mahan. Përkufizimi i OBSH-së: Përkufizimi i intolerancës ndaj karbohidrateve te gruaja shtatzënë është i njejtë me atë të tolerancës jashtë shtatzënisë . Prova e HGPO bëhet me dhënien e 75 g glukozë. Ka intolerancë ndaj karbohidrateve nëse glicemia esëll është midis 1.20 g/l dhe 1.40 g/l, dhe glicemia 2 orë pas ngarkesës me glukozë midis 1.40 dhe 2.0 g/l. Kriteret e O'Sullivan dhe Mahan për diagnozën e diabetit të shtatzënisë: Prova e HGPO bëhet me 100 g glukozë nga goja, të dhënë në mëngjes pas 8 ose 14 orë esëll, pa kufizim paraprak të

glucideve. Gjaku venoz për glicemi të merret esëll, pastaj çdo 1, 2 dhe 3 orë pas marrjes së glukozës. (Ylli 2010). Dy glicemi të paktën duhet të jenë mbi vlerat e mëposhtme: Koha në orë: 0 1 2 3 Glicemia në g/l 1.05(5.8) 1.90 (10.6) Tek kush duhet kërkuar diabeti i shtatzënisë? 1.65(9.2) 1.40 (7.80). Nuk ka konsensus as për këtë çështje. Të gjitha gratë shtatzëna duhet të përfitonin nga depistimi midis javës 24 dhe 28 të shtatzënisë. Për këtë arsye praktike dhe ekonomike, depistimi në fillim të shtatzënisë u rezervohet vetëm grave me rrezik. Te këto gra, depistimi i dytë (nëse i pari ka qenë negativ) duhet të bëhet në mes të javës së 24-tët dhe 28-të të shtatzënisë. Në planin mjeko-ligjor glukozuria (edhe pse nuk ka të njejtën vlerë si jashtë shtatzënisë) është e detyrueshme të bëhet në çdo konsultim obstetrical kur ajo është pozitive, është e rëndësishme të bëhet glicemia esëll dhe 2 orë pas ngrënies. Faktorët e rrezikut për të zhvilluar diabet në shtatzëni: Obeziteti Diabeti Gestacional është një nga problemet më të zakonshme shëndetësore në shtatzëninë e vajzave. Ndërsa predispozicioni gjenetik luan një rol kyç në shfaqjen e tij, faktorë të tjerë si stili i jetesës dhe aktiviteti fizik gjithashtu kanë një ndikim të rëndësishëm. Në këtë artikull, ne kërkojmë të analizojmë lidhjen midis aktivitetit fizik gjatë shtatzënisë dhe rrezikut të diabetit gestacional.Studimi theksoi një ndërlidhje pozitive midis aktivitetit fizik në shtatzëni dhe zvogëlimit të rrezikut të diabetit gestacional. Gratë shtatëzënë që përfshiheshin në rutina të rregullta të ushtrimeve shfaqën një shans më të ulët për të zhvilluar diabet gestacional krahasuar me ato që kishin një nivel më të ulët të aktivitetit fizik.Kjo zbulim tregon se aktiviteti fizik në shtatzëni ka një rol të rëndësishëm në menaxhimin dhe parandalimin e diabetit gestacional, një gjendje që mund të ketë pasojat e rënda për nënën dhe fetusin. Stabilizimi i niveleve të sheqerit në gjak dhe ndikimi pozitiv në kontrollin metabolic janë mekanizma të mundshëm që shpjegojnë këtë lidhje.Për gratë shtatëzënë, ky zbulim mund të interpretohet si një arsye shtesë për të përfshirë aktivitetin fizik në rutinën e tyre të përditshme, duke krijuar kështu një mjedis shëndetësor më të favorshëm për veten dhe të ardhmen e tyre të re.Studimi ka për objekt të kryejë një analizë të thelluar mbi ndikimin e aktivitetit fizik në shëndetin e grave shtatëzënë, me një përqendrim të veçantë në zvogëlimin e rrezikut të diabetit gestacional. Për të arritur këtë objektiv, studimi përfshin një numër të madh të pjesëmarrësve shtatëzënë dhe regjistrime të rregullta të nivelit të aktivitetit fizik që ata kryejnë gjatë periudhës së shtatzënisë.

Symimet e studimit përfshijnë:

Analizën e të dhënave të Aktivitetit Fizik: Përmes pyetësorëve dhe regjistrimeve të aktivitetit fizik, do të analizohen nivelet dhe llojet e aktivitetit të kryer nga pjesëmarrësit në studim gjatë çdo trimestri të shtatzënisë.Vlerësimin e Shëndetit të Pjesëmarrësve: Symimet përfshijnë monitorimin e shëndetit të grave shtatëzënë, duke përfshirë kontrollin e peshës, tensionin arterial, dhe nivelin e sheqerit në gjak për të identifikuar ndonjë ndryshim apo rregullim në shëndetin e tyre.Identifikimin e Rasteve të Diabetit Gestacional: Duke analizuar të dhënat e rezultateve të testeve të glukozës, studimi synon identifikimin e rasteve të diabetit gestacional ndër pjesëmarrësit dhe krahasimin e tyre me nivelet e aktivitetit fizik.Krahasimin me Grupa Kontrolle: Pjesëmarrësit do të ndahen në grupe bazuar në nivelin e aktivitetit fizik, duke përfshirë një grup kontrol pa ndonjë ndërhyrje të veçantë, për të vlerësuar ndryshimet në rrezikun e diabetit gestacional sipas niveleve të aktivitetit.Ky plan i hulumtimit synon të ofrojë një kuptim më të thellë të lidhjes midis aktivitetit fizik në shtatzëni dhe shëndetit të grave, duke përqëndruar veçanërisht në rrezikun e diabetit gestacional.Metodologjia e këtij studimi është struktuar nëpërmjet një seri hapat e përcaktuara për të siguruar një analizë të saktë dhe të detajuar të ndikimit të aktivitetit fizik në shëndetin e grave shtatëzënë, duke thelluar përqendrimin në rrezikun e diabetit gestacional. Këtu janë hapat kryesorë të metodologjisë:Seleksioni i Pjesëmarrësve: Pjesëmarrësit janë zgjedhur në mënyrë që të përfaqësojnë një grup reprezentativ të grave shtatëzënë. Kriteret e përfshirë përfshijnë moshën, indeksin e masës trupore, dhe historinë e shëndetit shtatzanë.Krijimi i Pyetësorëve dhe Regjistrimeve të Aktivitetit Fizik: Është zhvilluar një pyetësor i strukturuar dhe një sistem regjistrimi për të matur nivelin dhe llojet e aktivitetit fizik të kryer nga pjesëmarrësit gjatë çdo trimestri të shtatzënisë.Monitorimi i Shëndetit të Pjesëmarrësve: Shëndeti i grave shtatëzënë është monitoruar duke përfshirë kontrollin e peshës, tensionin arterial, dhe nivelin e sheqerit në gjak në periudhën e përcaktuar gjatë shtatzënisë.Identifikimi i Rasteve të Diabetit Gestacional: Rezultatet e testeve të glukozës janë regjistruar dhe analizuar për të identifikuar rastet e diabetit gestacional midis pjesëmarrësve.Analiza e të Dhënave: Të dhënat janë analizuar duke përdorur mjetet statistikore të përshtatshme për të vlerësuar lidhjet dhe ndryshimet në nivelet e aktivitetit fizik dhe rrezikun e diabetit gestacional.Krahasimi me Grupa Kontrolle: Pjesëmarrësit janë ndarë në grupe bazuar në nivelin e aktivitetit fizik, duke përfshirë një grup kontrol, për të bërë krahasime dhe vlerësime më të saktë të ndikimit të aktivitetit fizik në rrezikun e diabetit gestacional.Kjo metodologji është projektuar për të siguruar një përcaktim të saktë të lidhjeve midis aktivitetit fizik në shtatzëni dhe shëndetit të grave, duke ofruar një bazë të qëndrueshme

për vlerësimin e rrezikut të diabetit gestacional.Objekti i këtij artikulli është të vlerësojë lidhjen midis aktivitetit fizik gjatë shtatzënisë dhe rrezikut të diabetit gestacional.Metodologjia e këtij studimi përfshin një shqyrtim sistematik të literaturës për të identifikuar studimet e rëndësishme dhe rezultatet e tyre në lidhje me aktivitetin fizik gjatë shtatzënisë dhe diabetin gestacional. Një analizë meta-sintetike është zhvilluar për të përpiluar dhe vlerësuar të dhënat nga këto studime të përfshira, duke përdorur metoda statistikore për të vlerësuar forcat dhe lidhjet e mundshme midis variablave të interesit. Në përfundim, synimet e këtij studimi janë të ofrojnë një kuptim më të thellë dhe të qëndrueshëm të ndikimit të aktivitetit fizik në rrezikun e diabetit gestacional dhe të kontribuojnë në literaturën ekzistuese për këtë temë

Metodologjia

Metodologjia jonë përfshin një shqyrtim sistematik të literaturës për të identifikuar studimet e rëndësishme të kryera në këtë fushë. Nuk u gjet nje nr I konsidetueshem programesh stervitore te ketj target grupi por ne bashkepunim me instuktore fitnesi dhe mjek endokrinolog hartam programin tone per 13 jave

Metodologjia

Metodologjia jonë përfshin një shqyrtim sistematik të literaturës për të identifikuar studimet e rëndësishme të kryera në këtë fushë. Nuk u gjet nje nr I konsidetueshem programesh stervitore te ketj target grupi por ne bashkepunim me instuktore fitnesi dhe mjek endokrinolog hartam programin tone per 13 jave Përdorimi i kritereve të përcaktuara për përzgjedhjen e studimeve të përfshira siguron një analizë të plotë dhe të besueshme të informacionit kryesisht teorik. Pastaj, për studim tonepërfshirë, vlerësojmë metodologjinë dhe të dhënat e përdorura për të përcaktuar forcën dhe kufizimet e rezultateve.

Pjesëmarrësit ishin 50 nga te cilat 25 prej tyre aplikuam programin tone dhe djeten e shendetshme tone gra me diabet të shtatzënisë, të cilat u nënshtrohën një programi 13-javor të aktivitetit fizik të moderuar nders ne 25 te tjerat beme vetem matje te glicemise pa aplikuar metodologjine. Pjesa tjetër e grupit kontrollit mori informacion standarde në lidhje me diabetin e shtatzënisë dhe rrezikun e tij. Një analizë u bë për të krahasuar ndryshimet në nivelin e glukozës dhe aktivitetit fizik midis dy grupeve.Matjet e para te glivemise ishin ne vlera 130 esell deri 200 per grupin e pare dhe ne te njejtet vlera per te dytin . pas aplikimit te programit tone si me poshte Java 1 program U vune re ndryshime te vogla ne vlerat e larta 200 ra ne vlera 180 Dhe ndryshimet me te medha u vune re ne javen e 5 dhe 6 qe parametrat shkuan gati ne norme Natyrisht dhe diets se personalizuar pershtatur me kalorazhin e arxhuar.Përdorimi i kritereve të përcaktuara për përzgjedhjen e studimeve të përfshira siguron një analizë të plotë

dhe të besueshme të informacionit kryesisht teorik. Pastaj, për studim tonepërfshirë, vlerësojmë metodologjinë dhe të dhënat e përdorura për të përcaktuar forcën dhe kufizimet e rezultateve. Pjesëmarrësit ishin 50 nga te cilat 25 prej tyre aplikuam programin tone dhe djeten e shendetshme tone gra me diabet të shtatzënisë, të cilat u nënshtrohën një programi 13-javor të aktivitetit fizik të moderuar nders ne 25 te tjerat beme vetem matje te glicemise pa aplikuar metodologjine. Pjesa tjetër e grupit kontrollit mori informacion standarde në lidhje me diabetin e shtatzënisë dhe rrezikun e tij. Një analizë u bë për të krahasuar ndryshimet në nivelin e glukozës dhe aktivitetit fizik midis dy grupeve.Matjet e para te glivemise ishin ne vlera 130 esell deri 200 per grupin e pare dhe ne te njejtet vlera per te dytin . pas aplikimit te programit tone si me poshte Java 1 program U vune re ndryshime te vogla ne vlerat e larta 200 ra ne vlera 180 Dhe ndryshimet me te medha u vune re ne javen e 5 dhe 6 qe parametrat shkuan gati ne norme Natyrisht dhe diets se personalizuar pershtatur me kalorazhin e arxhuar.Grupi 2 nuk pati asnje ndryshim te dukshem ne vlera te glicemise dhe as ne javet ne vazhdim .

- luan një rol të rëndësishëm në trajtimin dhe menaxhimin e diabetit tip 2. Ai
- përmirëson ndjeshmërinë ndaj insulinës, duke përmirësuar kontrollin e glicemisë dhe ndihmon në
- humbjen në peshë. Ne personat me diabet që i nënshtrohen ushtrimeve fizike rregullisht, ka patur
- një ulje të mortalitetit gjatë 12-14 vjetëve. Kryerja e aktivitetit të rregullt parandalon fillimin e
- diabetit tip 2 në personat me risk të lartë.
- · Qëllimi i aktivitetit fizik është që personat me diabet të kryejnë çdo javë rreth 150 minuta ushtrime
- aerobike me intensitet mesatar (50-70% e rrahjeve maksimale të zemrës). Kjo përfshin aktivitete si
- ecje e shpejtë, ecje me biçikletë, punë shtëpie, pastrim kopshti, etj.
- për forcimin e muskulaturës duhen inkurajuar të paktën dy herë në javë, sidomos për
- grupet e muskujve të mëdhenj të këmbëve, trungut, krahëve, shpatullave. Programi i aktivitetit
- fizik, përshtatet sipas moshës së personit, gjendjes së tij ekonomike e sociale, nivelit të tij kulturor,
- gjendjes fizike.

- Në rast se pacienti është shumë simptomatik ose ka nivele të rritura të glukozës në gjak, dieta dhe
- modifikimi i stilit të jetesës kanë pak të ngjarë të bëjnë që të arrihen vlerat e synuara të kontrollit
- glicemik. Në këtë rast, duhet filluar pa vonesë terapia farmakologjike. Trajtimi medikamentoz duhet
- të shtohet vetëm në rast se dieta, aktiviteti fizik dhe edukimi i pacientit nuk kanë arritur dot objektivat
- □ Fillimi/diagnostikimi i parë në tremujorin e parë - gjysmën e parë të tremujorit të dytë;
- □ Për të vendosur, kryhet prova standarde OGTT - pas nje nate pa ngrene (8-14 h) jepen 75 g glukozë
- në 250 ml uje; matet glukoza plazmatike esëll dhe pas 2 orësh.
- □ Riklasifikohet 6 javë pas lindjes ose më vonë me një prove tjetër OGTT me 75g glukozë.
- Të marra më vete, vlerat e glukozës në gjak nuk kanë vlerë për klasifikimin e diabetit. Edhe
- ketoacidoza, e cila zakonisht shihet si shenjë e diabetit tip 1, ndonjëherë ndodh edhe në diabetin tip 2.
- Disa ekspertë madje mund të hasin vështirësi në klasifikimin fillestar të një pacienti.
- Klasifikimi eshte i vështirë në adultët me moshë të re, pasi si diabeti tip 1 edhe diabeti tip 2 apo
- diabeti latent autoimun në adultë (LADA) janë pothuaj njëlloj të shpeshtë. LADA fillimisht ka disa
- karakteristika të diabetit tip 2, por progredon në një diabet që duhet trajtuar me insulinë brenda pak
- muajsh apo vitesh. Edhe pse diabeti tip 2, karakterizohet nga fillimi pas moshës 50 vjeç, gjithnjë e më
- tepër është po rritet prevalenca e fillimit të tij në moshën 20-30 vjeçare, madje po vihen re gjithnjë e
- më shpesh rastet të zbulimit të tij në femije dhe preadoleshente.
- individualë të përcaktuar që më parë.

- Të gjitha femrat me potencialitetin për të mbetur shtatzanë kanë nevojë për kujdes të mirë që përpara
- koncepsionit për të përjashtuar riskun për keqformim fetal dhe humbje të fëmijës në fillim te
- shtatzanisë. Kjo përfshin:
- □ Këshillim pre-koncepsional, që përfshin depistim të komplikacioneve dhe aty ku është nevoja
- këshillim për kontracepsion deri sa të arrihen objektivat glicemikë të paracaktuar;
- □ Kontroll sa më optimal të glicemisë;
- □ Fillimin e mjekimit me suplement folatesh (5 mg/ditë);
- □ Ndalimin e mjekimit me statina dhe rishikimin e mjekimit me antihipertensivë;
- □ Zëvendësimi i antidiabetikëve oralë me terapi insulinike sa më shpejt që të jetë e mundur;
- Gratë që nuk janë diagnostikuar më parë me diabet tip 2, kur mbeten shtatzënë kanë risk më të rritur
- për të patur fëmijë me malformacione. Depistimi për diabet gestacional do të zbulojë këto gra, si dhe
- do të reduktojë ndjeshëm rrezikun e dëmtimeve perinatale. Gjatë shtatzanisë kërkohet një ekuilibër
- shmë i mirë glicemik dhe monitorim obstetrikal, me një ndërhyrje më të hershme (që në javën e 38)
- kur është e nevojshme. Për kontroll optimal të diabetit:
- □ Të gjitha gratë diabetike duhet ta kontrollojnë glicemine katër herë në ditë, përshirë dhe matjen pas
- vakteve të marra. Objektivi është që glicemia esëll dhe preprandiale të jetë <100mg/dl (5.5 mmol/l)
- dhe postprandiale më pak se 126mg/dl (7.0 mmol/l);
- □ Nevojat për insulinë duhen përshtatur sipas pacientit, ku pjesa më e madhe e pacienteve duhet të
- jetë në terapi me 4-5 injeksione
- në ditë.
- Nevojat për insulinë janë më të
- ulura në tremestrin e parë dhe

- mund të bien në tremestin e tretë,
- prandaj kërkohet monitorim e
- modifikim i terapisë insulinike
- sipas rezultateve të vetëkontrollit.
- □ Analogët e insulinës me
- veprim të shkurtërjane të
- sigurtë në shtatzani, ndërkohë
- që nuk ka të dhëna për analogët
- me veprim të gjatë të saj, që
- duhen evituar në shtatzani;
- □ Agjentët oralë hypoglicemikë
- nuk rekomandohen për t'u
- përdorur në shtatzani;
- □ Sytë duhen kontrolluar për
- pranine e retinopatisë dhe
- perparimin e saj në çdo
- trimester;
- □ Kontrolli ekografik i
- diabetikeve gjatë shtatzanisë
- duhet të jetë i shpeshtë (çdo 4-
- 6 javë);
- Diabet Mellitus Gestacional
- (DMG) quhet çdo intolerance
- ndaj glukozës që zbulohet për
- herë të parë në shtatzani. Në
- shumicën e rasteve GDM zhduket
- pas lindjes. Rreth 7% e shtatzanive komplikohen me GDM. Strategjitë për depistimin/diagnostikimin
- për GDM paraqiten në tabelën 16.5.
- Që në vizitën e parë prenatale, femrat me risk të lartë për GDM,
- depistohen për diabet.
- □ **Kriteret për risk të lartë**:
- Obezitet

- i shkallës së rëndë (BMI >35 kg/m2)
- Ekzistenca
- e mëparshme e GDM ose lindje të mëparshme
- të fëmijëve me peshë të madhe.
- Prezenca
- e glukozurisë.
- Raste
- të diagnostikuara më parë me Sindromin e Ovarit
- Policistik (PCOS).
- Histori
- familjare pozitivë për diabet tip 2.
- **Situata me risk të ulët**:
- Mosha
- nën 25 vjeç.
- Peshë
- normale para shtatzanisë.
- Pa
- histori pozitive për Diabet Mellitus në të afërm të gradës
- së parë.
- Pa
- histori çrregullimesh të tolerancës së glukozës.
- Pa
- histori për komplikacione në shtatzanitë e mëparshme.
- **Diagnoza e GDM kërkon të paktën dy nga vlerat e**
- **mëposhtme të glukozës në plazëm:**
- Glicemia
- esëll ≥ 95mg/dl (≥5.3 mmol/l)
- 1
- orë ≥ 180 mg/dl (≥ 10.0 mmol/l)
- 2
- orë ≥ 155 mg/dl (≥ 8.6 mmol/l)
- 3
- orë ≥ 140 mg/dl (≥ 7.8 mmol/l)



30-DAY PRENATAL WORKOUT PLAN

01 **Prenatal Strength Workout** *30 Minutes*	02 **Low Impact HIIT** *AND* **Prenatal Core** *25 Minutes*	03 **Lower Body Strength** *30 Minutes*	04 **Rest Day** *OR* **Recovery Yoga** *10 Minutes*	05 **Upper Body Strength** *30 Minutes*	06 **Cardio Barre** *20 Minutes*	07 *Rest Day*
08 **7 Best Strength Exercises** *30 Minutes*	09 **Power Yoga** *AND* **Prenatal Core** *25 Minutes*	10 **Barre Legs** *20 Minutes*	11 **Rest Day** *OR* **Prenatal Yoga** *15 Minutes*	12 **Mommy Cardio** *AND* **10-Min Arms** *20-30 Minutes*	13 **Cardio Barre** *30 Minutes*	14 *Rest Day*
15 **Prenatal Strength Workout** *30 Minutes*	16 **Low Impact HIIT** *AND* **Prenatal Core** *25 Minutes*	17 **Lower Body Strength** *30 Minutes*	18 **Rest Day** *OR* **Recovery Yoga** *10 Minutes*	19 **Upper Body Strength** *30 Minutes*	20 **Cardio Barre** *20 Minutes*	21 *Rest Day*
22 **7 Best Strength Exercises** *30 Minutes*	23 **Cardio Barre** *AND* **Prenatal Core** *25 Minutes*	24 **Prenatal Strength + Cardio** *30 Minutes*	25 **Rest Day** *OR* **Prenatal Yoga** *15 Minutes*	26 **Low Impact HIIT** *AND* **10-Min Arms** *20-30 Minutes*	27 **Cardio Barre** *30 Minutes*	28 *Rest Day*

NOURISH **MOVE** LOVE

Diary of a FitMommy
Creating fit mommies one at a time

3RD TRIMESTER HOMESTRETCH WORKOUT

Complete each move 3 times for 12 reps.







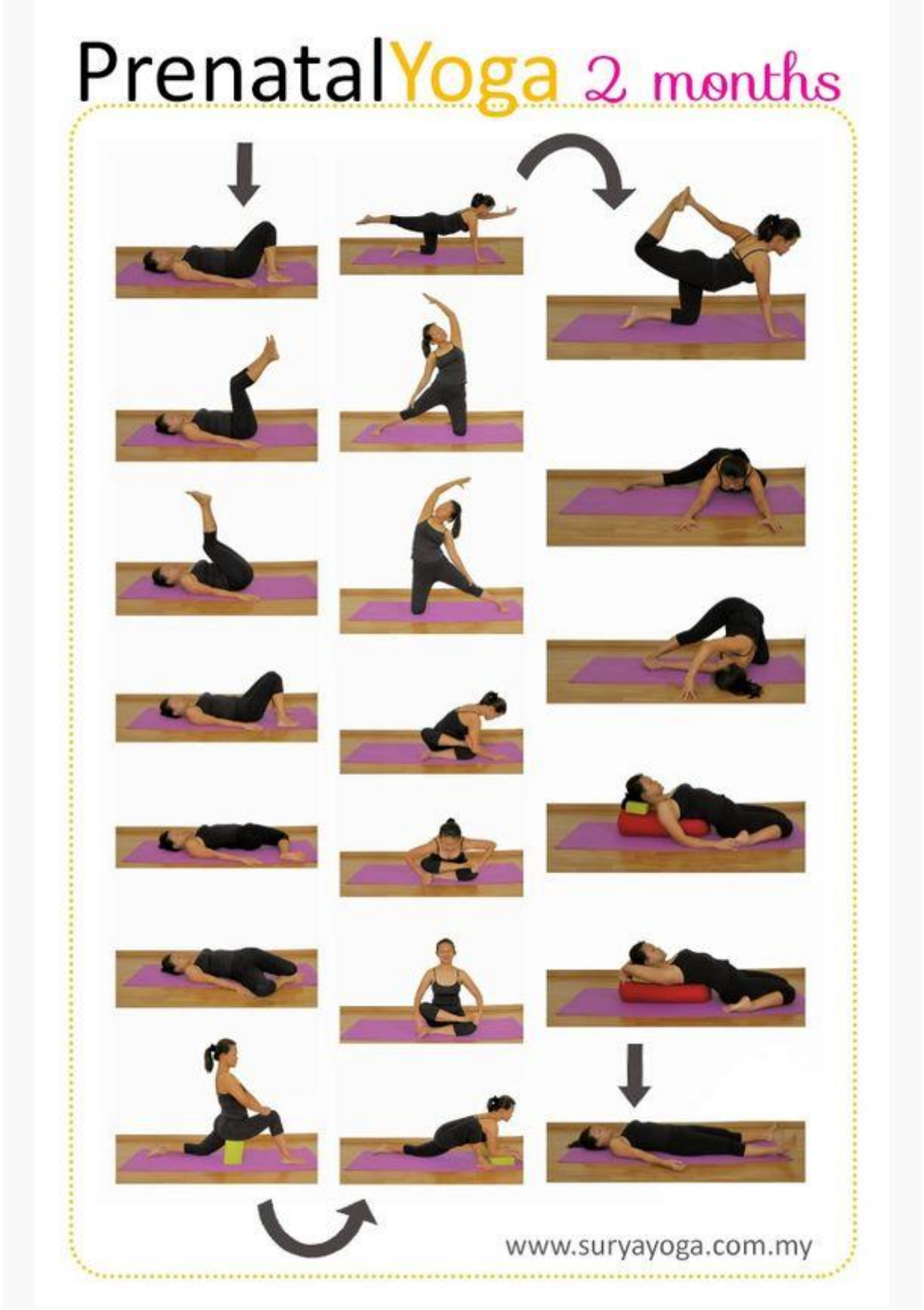


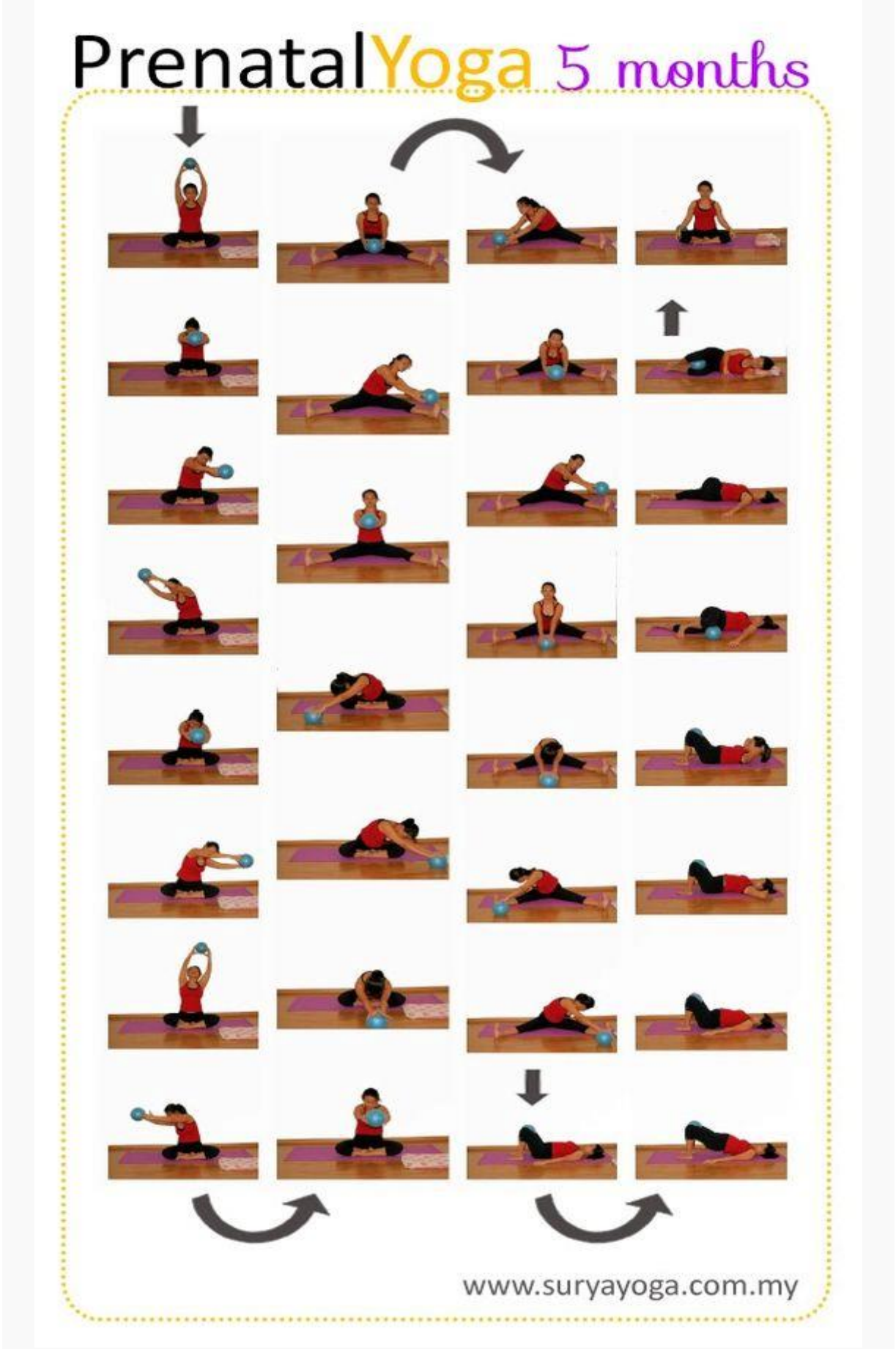


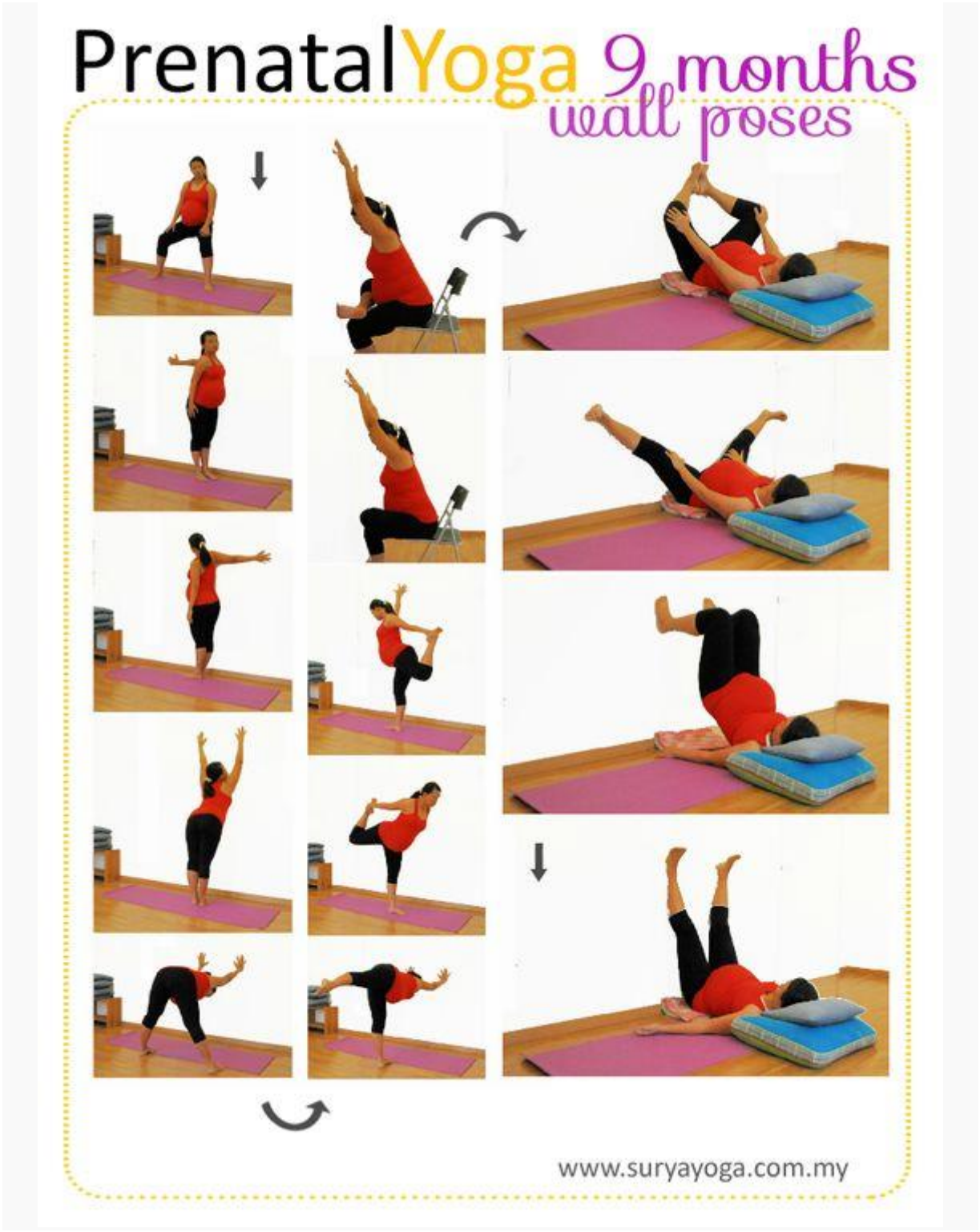

12 SUPER FOODS You Should Eat During PREGNANCY
OATMEAL
Complex carbohydrates
Folic acid
Iron
Fiber
Satisfied hunger longer
Helps mom stay regular
AVOCADO
Omega 3's
Vitamin B
Promote babies brain development
BANANAS
Potassium
Gives mom energy
Helps fight fatigue
BERRIES
Vitamin C
Fiber
Promotes good urinary tract health
DRIED APRICOTS
Fiber
Potassium
Vitamin A
Great for immune system
EGGS
Amino acids
Choline
Protein
Encourage babies brain growth
BEANS/LENTILS
Protein
Fiber
Iron
Zinc
Help ward off nausea
YOGURT
Probiotics
Calcium
Supports mom and babies bones
DARK LEAFY GREENS
Vitamin E
Magnesium
Beta Carotene
Promote eye, bone, skin, and cell growth
NUTS
Omega 3's
Vegetarian protein
Easy on the go snack
SEAFOOD
Full of DHA and EPA
Omega-3 fatty acids
Good for fetal brain and nervous system development
RED MEAT
Zinc
Protein
Iron
Supports collagen, tissues, blood, and bones
GET HEALTHY U

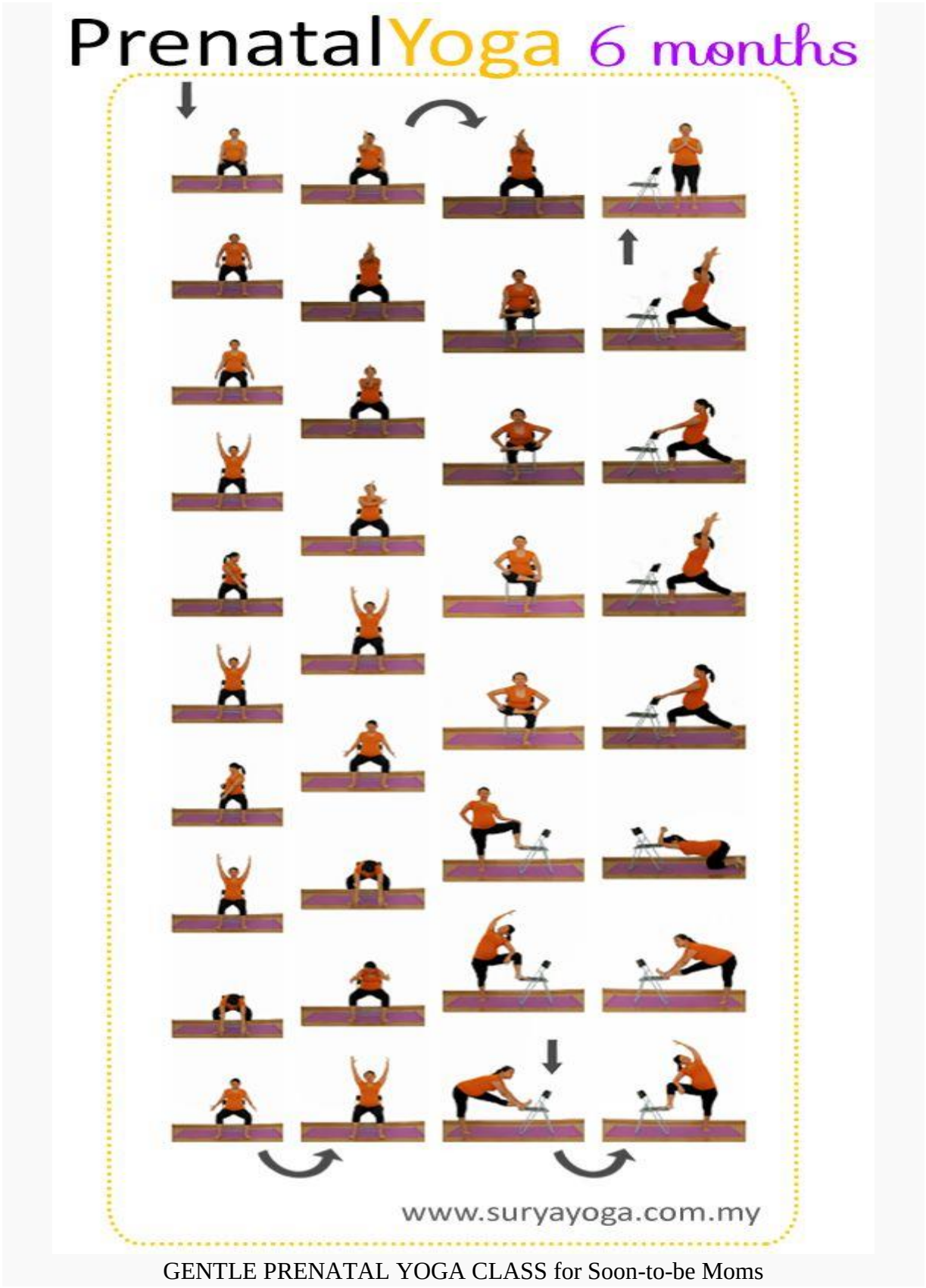




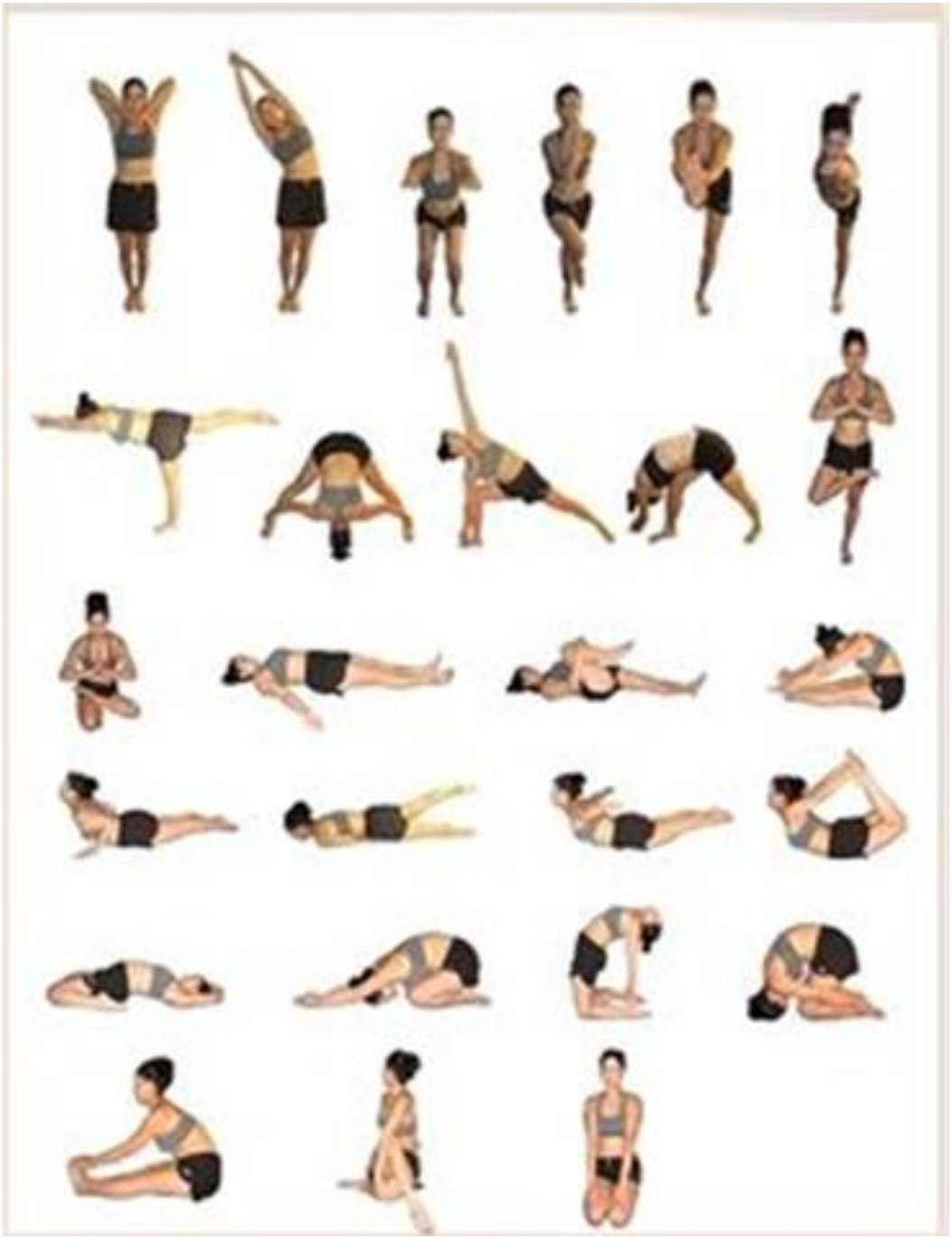

PrenatalYoga 2 months
www.suryayoga.com.my

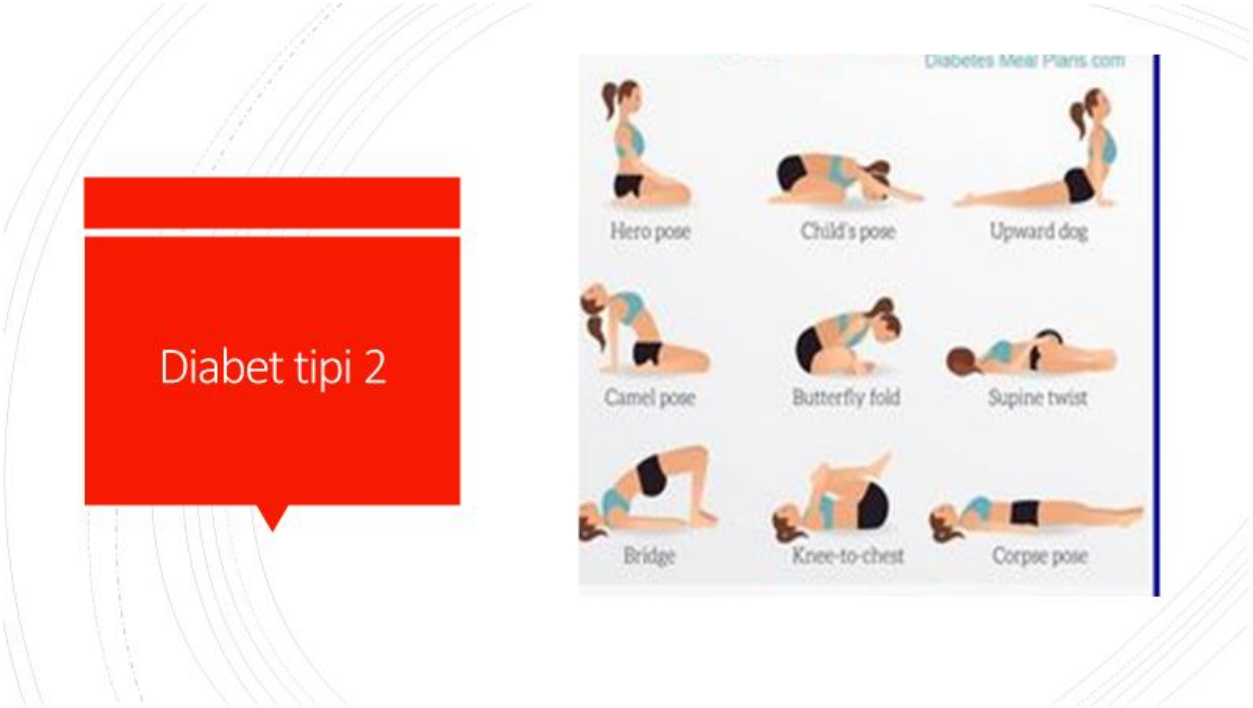

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www.suryayoga.com.my


Prenatal Yoga 9 months
wall poses
www.suryayoga.com.my



GENTLE PRENATAL YOGA CLASS for Soon-to-be Moms





Rezultatet: Në fund të 13 javëve, 70% e grave që morën pjesë në programin e aktivitetit fizik të moderuar raportuan një reduktim të nivelit të glukozës. Ndërkaq, grupi kontroll 2 nuk tregoi ndonjë ndryshim të konsiderueshëm në nivelin e glukozës. Qellimi eshte mbajtja e niveleve te glicemive esell dhe para vakteve ne nivelet <110 mg/dl (<6.0 mmol/l); me pas monitorohen glicemite postprandiale. Mbeshtetja duhet te ofrohet nga personeli mjeksor deri sa te arrihen nivelet target te glicemive.Rezultatet e këtij studimi pilot sugjerojnë se një program i strukturuar i aktivitetit fizik të moderuar mund të jetë efektiv në reduktimin e nivelit të glukozës në grave me diabet të shtatzënisë. Megjithatë, nevojiten hulumtime të mëtejshme për të vlerësuar këtë ndikim në një grup më të madh dhe për një periudhë kohore më të gjatë. Diskutojmë rezultatet në kontekstin e metodologjisë së përdorur dhe shqyrtojmë implikimet e tyre për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë. Por dhe Rezultatet e analizës së literaturës tregojnë një asociacion të rëndësishëm dhe të qëndrueshëm midis aktivitetit fizik gjatë shtatzënisë dhe rrezikut të diabetit gestacional. Nëpërmjet një shqyrtimi të thellë të studimeve të përfshira, është evidentuar se nivelet e aktivitetit fizik kanë një ndikim të qartë në parandalimin dhe menaxhimin e diabetit gestacional.Studimet e përfshira në analizë ofrojnë një gamë të gjerë të të dhënave, duke përfshirë analiza meta-sintetike dhe studime epidemiologjike të mëdha. Për shembull, një numër i studimeve kanë raportuar një lidhje të fortë midis nivelit të aktivitetit fizik dhe rrezikut të diabetit gestacional, ku gratë që kanë praktikuar aktivitet fizik të rregullt kanë pasur një rrezik më të ulët të zhvillimit të kësaj gjendjeje krahasuar me ato që kanë qëndruar më pak aktive gjatë shtatzënisë.Diskutimi i rezultateve është i rëndësishëm për

të kuptuar kontekstin dhe implikimet e tyre për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë. Në këtë analizë, është theksuar rëndësia e inkurajimit të aktivitetit fizik si një mjet efektiv për parandalimin dhe menaxhimin e diabetit gestacional në populacionin e grave shtatzëna. Gjithashtu, është bërë vëmendje në nevojën për më shumë hulumtime për të kuptuar me saktësi mekanizmat përmes të cilëve aktiviteti fizik ushtron ndikim në shëndetin gjatë shtatzënisë dhe në zhvillimin e diabetit gestacional.

Kjo analizë kontribuon në rritjen e kuptimit tonë të lidhjes midis aktivitetit fizik dhe rrezikut të diabetit gestacional dhe ofron udhëzime të rëndësishme për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë. Përmes vlerësimit të metodologjisë dhe interpretimit të rezultateve, është evidentuar se aktiviteti fizik gjatë shtatzënisë mund të jetë një mjekim efektiv për të zvogëluar rrezikun e diabetit gestacional dhe për të mbështetur shëndetin e nënës dhe foshnjës. Implikimet praktike të kësaj analize janë të rëndësishme për shëndetin e publikut dhe praktikën klinikore. Rezultatet e gjetura në këtë studim sugjerojnë se përfshirja e aktivitetit fizik gjatë shtatzënisë mund të jetë një strategji efektive për të parandaluar ose zvogëluar rrezikun e diabetit gestRezultatet e analizës së literaturës tregojnë një asociacion të rëndësishëm dhe të qëndrueshëm midis aktivitetit fizik gjatë shtatzënisë dhe rrezikut të diabetit gestacional. Nëpërmjet një shqyrtimi të thellë të studimeve të përfshira, është evidentuar se nivelet e aktivitetit fizik kanë një ndikim të qartë në parandalimin dhe menaxhimin e diabetit gestacional.Studimet e përfshira në analizë ofrojnë një gamë të gjerë të të dhënave, duke përfshirë analiza meta-sintetike dhe studime epidemiologjike të mëdha. Për shembull, një numër i studimeve kanë raportuar një lidhje të fortë midis nivelit të aktivitetit fizik dhe rrezikut të diabetit gestacional, ku gratë që kanë praktikuar aktivitet fizik të rregullt kanë pasur një rrezik më të ulët të zhvillimit të kësaj gjendjeje krahasuar me ato që kanë qëndruar më pak aktive gjatë shtatzënisë.Diskutimi i rezultateve është i rëndësishëm për të kuptuar kontekstin dhe implikimet e tyre për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë. Në këtë analizë, është theksuar rëndësia e inkurajimit të aktivitetit fizik si një mjet efektiv për parandalimin dhe menaxhimin e diabetit gestacional në populacionin e grave shtatzëna. Gjithashtu, është bërë vëmendje në nevojën për më shumë hulumtime për të kuptuar me saktësi mekanizmat përmes të cilëve aktiviteti fizik ushtron ndikim në shëndetin gjatë shtatzënisë dhe në zhvillimin e diabetit gestacional.Kjo analizë kontribuon në rritjen e kuptimit tonë të lidhjes midis aktivitetit fizik dhe rrezikut të diabetit gestacional dhe ofron udhëzime të rëndësishme për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë. Përmes vlerësimit të metodologjisë dhe interpretimit të rezultateve, është evidentuar se aktiviteti fizik gjatë shtatzënisë mund të jetë

një mjekim efektiv për të zvogëluar rrezikun e diabetit gestacional dhe për të mbështetur shëndetin e nënës dhe foshnjës.

Konkluzioni dhe Implikimet Praktike

Në përfundim, ne konkludojmë se aktiviteti fizik gjatë shtatzënisë ka një ndikim pozitiv në zvogëlimin e rrezikut të diabetit gestacional. Kjo përfshin rekomandime për praktikën klinikore dhe politikat shëndetësore për të inkurajuar aktivitetin fizik si një mjet për parandalimin e komplikacioneve shtatzënore. Këto rezultate janë të rëndësishme për shëndetin e nënës dhe foshnjës dhe për shëndetin publik në përgjithësi.

Kjo revistë ofron një përfundim të detajuar të literaturës së tanishme dhe synon të ndriçojë rrugët për punën e ardhshme në fushën e aktivitetit fizik dhe diabetit gestacional.

Konkluzioni: Ky studim sugjeron se inkorporimi i një programi të strukturuar të aktivitetit fizik mund të jetë një mjet i rëndësishëm në menaxhimin e diabetit të shtatzënisë. Nëse rezultatet e këtij studimi verifikohen në hulumtime më të mëdha, kjo mund të ofrojë një strategji të efektshme dhe të ulë kostot për menaxhimin e kësaj sëmundjeje në gratë shtatzëna.

Rezultatet dhe Diskutimi Rezultatet e analizës së studimit tregojnë një asociacion të qëndrueshëm midis aktivitetit fizik dhe rrezikut të diabetit gestacional. Rezultatet: Në fund të 13 javëve, 70% e grave që morën pjesë në programin e aktivitetit fizik të moderuar raportuan një reduktim të nivelit të glukozës. Ndërkaq, grupi kontroll 2 nuk tregoi ndonjë ndryshim të konsiderueshëm në nivelin e glukozës. Qellimi eshte mbajtja e niveleve te glicemive esell dhe para vakteve ne nivelet <110 mg/dl (<6.0 mmol/l); me pas monitorohen glicemite postprandiale. Mbeshtetja duhet te ofrohet nga personeli mjeksor deri sa te arrihen nivelet target te glicemive.

Rezultatet e këtij studimi pilot sugjerojnë se një program i strukturuar i aktivitetit fizik të moderuar mund të jetë efektiv në reduktimin e nivelit të glukozës në grave me diabet të shtatzënisë. Megjithatë, nevojiten hulumtime të mëtejshme për të vlerësuar këtë ndikim në një grup më të madh dhe për një periudhë kohore më të gjatë. Diskutojmë rezultatet në kontekstin e metodologjisë së përdorur dhe shqyrtojmë implikimet e tyre për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë.

Por dhe Rezultatet e analizës së literaturës tregojnë një asociacion të rëndësishëm dhe të qëndrueshëm midis aktivitetit fizik gjatë shtatzënisë dhe rrezikut të diabetit gestacional. Nëpërmjet një shqyrtimi të thellë të studimeve të përfshira, është evidentuar se nivelet e aktivitetit fizik kanë një ndikim të qartë në parandalimin dhe menaxhimin e diabetit gestacional.

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Diskutimi i rezultateve është i rëndësishëm për të kuptuar kontekstin dhe implikimet e tyre për praktikën klinikore dhe për të ardhmen e kërkimeve në këtë fushë. Në këtë analizë, është theksuar rëndësia e inkurajimit të aktivitetit fizik si një mjet efektiv për parandalimin dhe menaxhimin e diabetit gestacional në populacionin e grave shtatzëna. Gjithashtu, është bërë vëmendje në nevojën për më shumë hulumtime për të kuptuar me saktësi mekanizmat përmes të cilëve aktiviteti fizik ushtron ndikim në shëndetin gjatë shtatzënisë dhe në zhvillimin e diabetit gestacional.

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Konkluzioni dhe Implikimet Praktike

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A Clinical Update on Gestational Diabetes Mellitus
Arianne Sweeting 1 2, Jencia Wong 1 2, Helen R Murphy 3 4 5, Glynis P Ross 1 2
Affiliations expand

9. Barriers to and enablers of postpartum health behaviours among women from diverse cultural backgrounds with prior gestational diabetes: A systematic review and qualitative synthesis applying the theoretical domains framework

10.Adriana C H Neven 1, Amelia J Lake 2 3, Amelia Williams 2 3, Sharleen L O'Reilly 4 5, Christel Hendrieckx 2 3, Melinda Morrison 6, James A Dunbar 7, Jane Speight 2 3, Helena Teede 1, Jacqueline A Boyle 8; ME-MaGDA Study Group

Grupi 2 nuk pati asnje ndryshim te dukshem ne vlera te glicemise dhe as ne javet ne vazhdim

THE ROLE OF PHARMACIST IN PANDEMIC MENAGEMENT, RESPONSIBILITIES AND CONTRIBTIONSIN EDUCATION COUNTRITIONSIN EDUCATION COUNSELINGAND MEDICATION

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Abstract
This scientific article examines and explores the role of pharmacists during health crises, with a particular emphasis on managing the Covid-19 pandemic. During this challenging period, pharmacists play a crucial role in providing healthcare services, including patient education, counseling, and ensuring the provision of necessary medications. Pharmacists, as frontline healthcare professionals, have a critical duty in educating the public about preventive measures, possible symptoms, and the use of medications. They play a leading role in explaining the importance of adhering to health authority guidelines and preventing the spread of infection.In addition to education, pharmacists provide specialized advice on the use of medications in treating and alleviating pandemic-related symptoms. They are actively involved in monitoring and managing medication stocks, ensuring that patients have continuous access to their treatment. This article also examines the challenges and opportunities pharmacists face during health crises and proposes possible measures to improve their preparedness for such situations in the future. To achieve effective pandemic management, close collaboration between healthcare professionals and pharmacists is essential, improving coordination and information exchange.This article aims to raise awareness of the pharmacist's contribution to pandemic management and serve as a source of information for those interested in improving the role and effectiveness of pharmacy during health emergencies. By identifying the successes and challenges of pharmacists in pandemic management, the study aims to provide a basis for discussions and recommendations for improving pharmacist preparedness and role in health emergency situations. With this goal in mind, it is intended to contribute to improving efficiency and cooperation between healthcare professionals and pharmacists in protecting public health.
Keywords: pharmacist, pandemic management, health education, medication provision, healthcare role.

Introduction: The recent Covid-19 pandemic has highlighted the crucial role of pharmacists in managing health emergencies (2). In this context, this scientific study specifically analyzes the responsibilities and contributions of pharmacists in the fight against the pandemic, delving into aspects of patient education, specialized counseling, and ensuring the availability of necessary medications (1). Pharmacists, as part of the healthcare workforce, are at the forefront of assistance for patients and the community during health crises (3). Their role in patient education is closely linked to the transmission of important information regarding preventive measures, symptoms, and medication usage (6).In this regard, pharmacists serve as significant sources of education, conveying current and reliable information to the community (7). Their specialized counseling helps patients manage illness and minimize health risks for themselves and others. Additionally, the role of pharmacists includes ensuring the availability of necessary medications. They are responsible for monitoring stock and ensuring that patients have continuous access to their treatment (5). In this way, pharmacists play an essential role in supporting the healthcare system and ensuring appropriate care for patients during emergency situations.This article aims to convey the pharmacist's intervention in pandemic management from a scientific perspective, identifying challenges and achievements, as well as suggesting possibilities for improving their preparedness and response in the future (3). By thoroughly analyzing the pharmacist's contribution during challenging health crises, we aim to assist in enhancing their role and awareness of their significance in global health (9).

The objective of this study, in an inductive manner, is the readiness and educational role of the pharmacist in pandemic management. Specifically, the focus of this study is on the Educational Role of the Pharmacist: Counseling and Assistance for Patients: 100 questionnaires were distributed to 100 pharmacies, with 7 questions each. They were distributed through "Geca," and data were collected over a 2-month period.(8,9)The aim is to examine how pharmacists provide specialized advice and assistance to patients in managing symptoms, using medications, and generally treating them during health emergencies. Descriptive studies are part of a simple situation announcement and do not aim to uncover causes of events or establish causal relationships. This study provides a detailed description of reality at a specific moment in time, such as the entire pandemic period, aiding in understanding the context and characteristics of a specific phenomenon to achieve our goal.(7.)This was conducted indirectly through questionnaires. In this descriptive study, the aim is to present and describe solely their role in this unprecedented situation and the process of managing and supplying necessary medications.(5) In this specific case, a methodology and plan used to understand the situation

and ensure the preparation and distribution of medications in a specific period and context are described, using a questionnaire as a tool to gather necessary information.

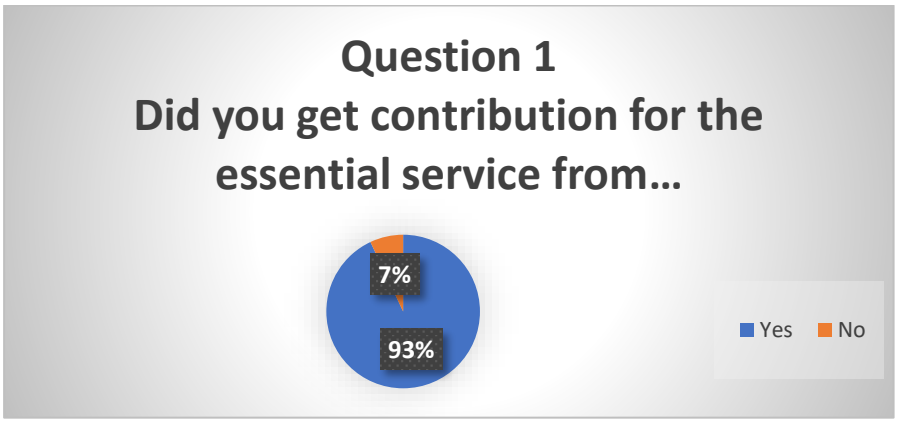
The study aims to analyze and focus on the role and contribution of pharmacists in the treatment and managerial aspect during the pandemic, including their specific responsibilities in patient education and counseling.Specifically, it aims to analyze the pharmacist's responsibility in ensuring the availability of necessary medications and managing stock during Covid-19. This includes monitoring the availability of essential medications and ensuring that patients have continuous access to those medications needed during the pandemic.

Additionally, it aims to identify specific challenges that pharmacists may face during pandemics and draw lessons that can be used to improve their preparedness and response in the future. This includes assessing the problems and challenges pharmacists have faced during the Covid-19 pandemic and proposing measures to address them in the future.Furthermore, it seeks to understand how pharmacists' activities in pandemic management impact public health and improve the healthcare system overall. This includes the pharmacist's role in educating the public about the pandemic, explaining preventive measures, symptoms, and health risks. In this way, it aims to understand how pharmacists are involved in enhancing public awareness and contribute to improving the overall response to the pandemic and healthcare system.

Methodology: We reviewed and scheduled foreign and Albanian literature related to the pandemic, its consequences, and management. We identified the issues and developed questionnaires related to our hypothesis. We distributed the questionnaires to 10 pharmacies with the help of distributor GeC and allowed sufficient time to collect the data. We analyzed and reached respective conclusions regarding the focus of our study.

Experiment: This study is a descriptive exploratory study, and we chose experimental forms of questionnaires to achieve our aim. The questionnaires were designed with a focus on our goal to highlight the role of the pharmacist in whether they were adequately educated or not during this unprecedented situation. The questionnaire was distributed to several pharmacies through distributor GeCa s one, and the distributor of medications or tools for the treatment or protection of patients with COVID-19 had their access. The subjects recruited were random without age or gender restrictions, all above 18 years old who completed the questionnaire anonymously and without our presence. Ideally, this questionnaire will be used as a tool to collect important information that will help in developing appropriate strategies and ensuring the necessary supply for the treatment of patients with COVID-19.

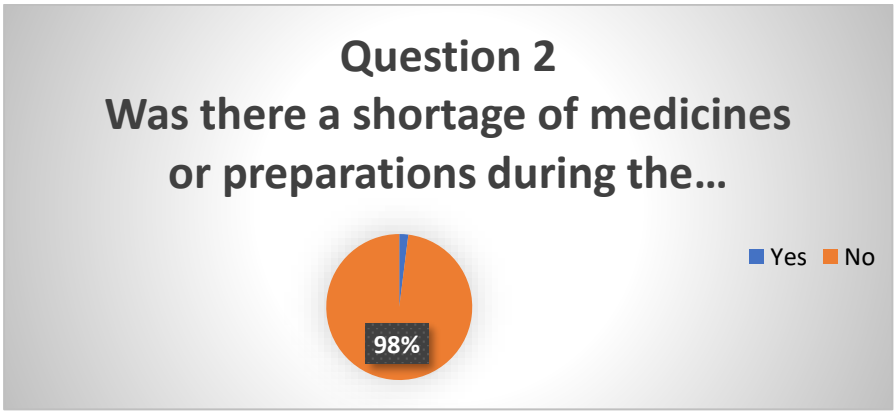
Analysis and Discussion: The study described above, which deals with the use of a questionnaire to organize the preparation and distribution of medications related to the treatment of patients with COVID-19, appears to be more of a descriptive study. In a descriptive study, the aim is to present and describe the characteristics, features, and processes in a clear and suitable manner. In the specific case, a methodology and plan used to understand the situation and to ensure the preparation and distribution of medications in a specific period and context are described, using a questionnaire as a tool to collect important information.Descriptive studies are part of a simple announcement of the situation and do not aim to uncover the causes of events or establish causal relationships. They provide a detailed description of reality at a specific point in time and help in understanding the context and characteristics of a specific phenomenon.The study aims to examine the role of the pharmacist during health crisis periods, including pandemic management as a case study. In this analysis, questionnaires distributed to 100 pharmacies through distributor GeC were used to gather pharmacists' perspectives on their contribution during the pandemic.Regarding the pharmacist's educational role, the results show that the majority of pharmacists are involved in providing necessary information to patients regarding preventive measures and medication use. This involvement is valued as a key contribution to public awareness and minimizing infection risks. In terms of counseling and assistance for patients, pharmacists indicated they are available to offer their specialized advice on symptom treatment and medication use. This represents an important aspect of their engagement in improving healthcare during emergency situations.However, the analysis also indicates some challenges and opportunities for improvement in pharmacist preparation and role during the pandemic. The main challenge lies in medication availability and stock management, where some pharmacists reported issues in this aspect. This finding highlights the need for coordination and improvement of logistic processes to ensure continuous access to medications for patients.To enhance the pharmacist's role during the pandemic, it is important to address specific challenges identified through the analysis and propose concrete measures for improvement. The findings of this study can serve as a basis for recommendations and further research in the field of pharmacist preparation and role in managing health emergencies.



Graph 1

After the research, it was reported that a majority of 70% of participants assessed that they received significant and necessary contributions from pharmacists during the pandemic. They emphasized that pharmacists provided valuable advice and ensured the necessary medications, distributing important information on preventive measures and the treatment of COVID-19-related symptoms. Participants also appreciated the availability and readiness of pharmacists to offer personalized assistance and advice according to their individual needs during this difficult health period. These assessments serve as support for the critical role of pharmacists in improving healthcare and assisting in pandemic management.

2.Were there any shortages of medications or any preparations during the pandemic?

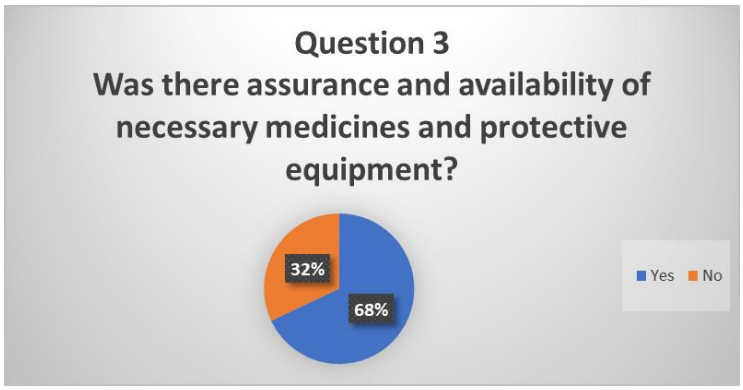


Graph 2

Researchers reported that 92% of participants did not experience shortages of medications or any necessary preparations during the pandemic period. This indicates that the majority of individuals had continuous and permanent access to their medications and medical products

during this difficult health period. This availability of medications may have helped in managing symptoms and maintaining appropriate healthcare during the pandemic.

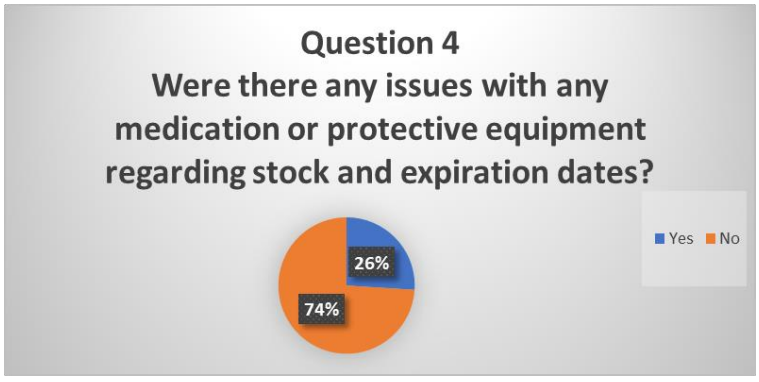
3.Were there adequate availability of medications and protective equipment for you?



Graph 3

From the data processing regarding the above question, it was reported that 32% of participants stated that they did not have access to or availability of necessary medications and protective equipment during the pandemic. On the other hand, 68% of participants stated that they were provided with and had access to the necessary medications and protective equipment. This data indicates a difference in responses, thus reflecting a division between those who had access and those who did not have full access to medications and protective equipment during the pandemic period. This may reflect different challenges that individuals faced in securing their healthcare needs during this difficult period.

4.Did you experience any issues with any medication or protective equipment regarding stock or expiration dates?

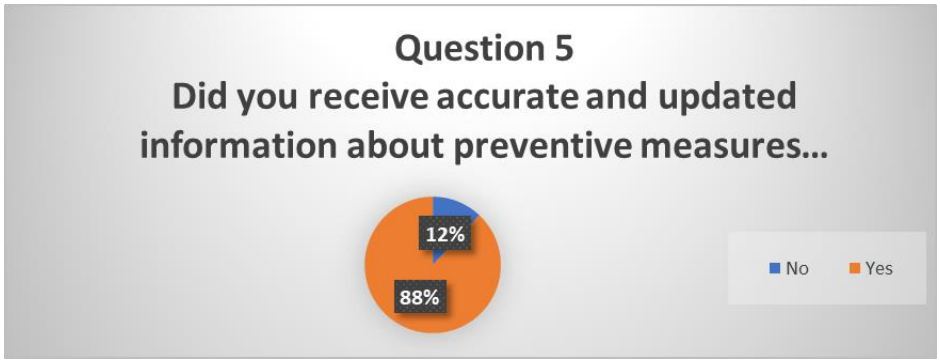


Graph 4

From the survey research, it was reported that 74% of participants did not experience any issues with any medication or protective equipment regarding stock or expiration dates. In this case,

the majority of individuals reported having sufficient access to the medications and protective equipment they needed, without encountering problems with their availability or expiration dates.On the other hand, 26% of participants stated that they experienced problems with some medication or protective equipment regarding stock or expiration dates. This may indicate challenges and obstacles that individuals faced in improving their availability in due time or in storing medications with mainly had to do with the quality of the masks.This result emphasizes the importance of good stock management and efficient coordination to ensure that patients have continuous access to their treatment during health emergencies.

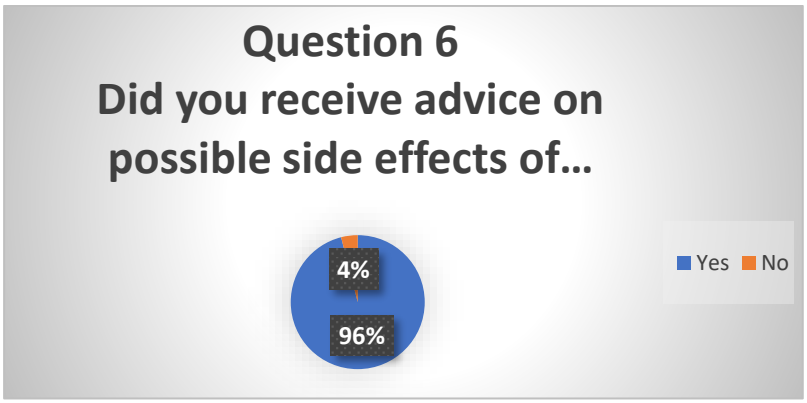
5.Did you receive accurate and up-to-date information on preventive measures, such as social distancing, hand hygiene, and mask-wearing? Guidance on possible symptoms of COVID-19 and instructions for home care.



Graph 5

From the researchers' report, 88% of participants stated that they received accurate and up-to-date information on preventive measures, including social distancing, hand hygiene, and mask-wearing. This indicates that the majority of individuals had access to and benefited from regular and updated information regarding preventive measures to protect themselves and others from COVID-19.On the other hand, 12% of participants reported that they did not receive accurate and up-to-date information on preventive measures. This may reflect the need for improvements in providing and communicating health information in some cases.This result highlights the importance of providing accurate and up-to-date information by healthcare professionals, including pharmacists, to assist in raising awareness and implementing preventive measures by the public during the pandemic.

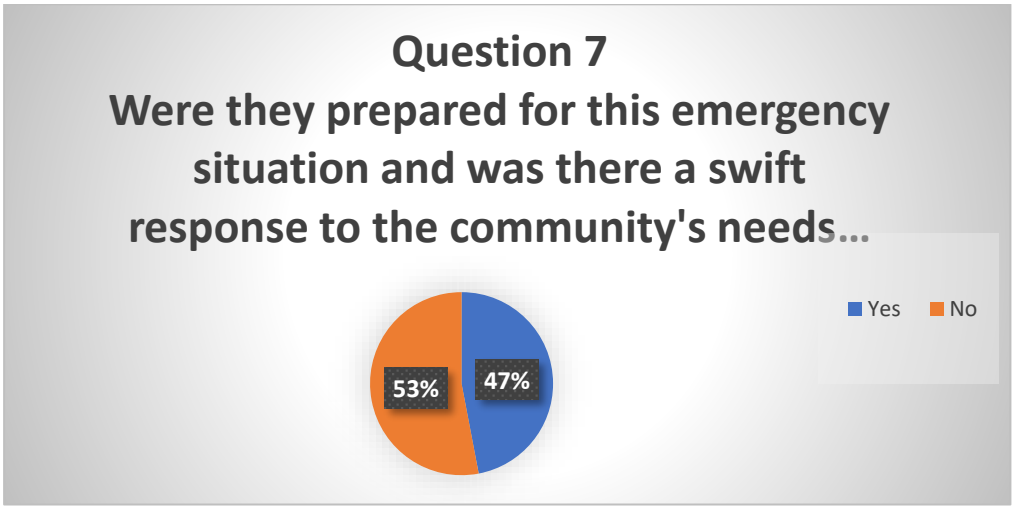
6.Did you receive counseling on possible medication effects and assistance in minimizing the risks of side effects?



Graph 6

Researchers reported that 96% of the participants stated that they received advice on the possible effects of medications and assistance in minimizing the risks of side effects. This indicates that the majority of individuals had access to specialized information and advice from pharmacists regarding the potential effects of medications and ways to reduce the risks of side effects during treatment.On the other hand, 4% of the participants stated that they did not receive advice on the possible effects of medications and minimizing the risks of side effects. This may indicate the need for improvement in providing information and advice from healthcare professionals, especially for those who may have concerns or contraindications regarding the use of medications.This result emphasizes the importance of the pharmacist's role in providing personalized advice to patients regarding the use of medications and minimizing the potential risks of side effects.

7. Were they prepared for this emergency situation and did they react promptly to the community's needs for medication and healthcare?



Graph 7

Researchers reported that 53% of participants stated that they were prepared for this emergency situation and reacted promptly to the community's needs for medications and healthcare. This indicates that a significant portion of individuals had a level of preparedness and readiness to respond to the health emergency situation, including ensuring the provision of medications and healthcare for the community.On the other hand, 47% of participants said they were not prepared for this emergency situation and did not react promptly to the community's needs for medications and healthcare. This may indicate challenges and difficulties that some individuals faced in responding to the pandemic and preparing for such emergency situations.This result emphasizes the importance of individual and community preparedness for health emergency situations, as well as the need to strengthen the capacity for response at the community and individual levels.

Conclusion

This study extensively examines the role and contribution of pharmacists during the COVID-19 pandemic. In this analysis, the results of a survey conducted in 100 pharmacies in Tirana are included, involving questionnaires to gauge pharmacists' perspectives on their contribution during this challenging health crisis.Overall, the results of our study indicate that the majority of pharmacists have played a significant role in public education regarding preventive measures, symptom management, and ensuring access to necessary medications. They have provided specialized advice and assistance to patients, ensuring they receive proper treatment and healthcare.Additionally, the results show that the majority of patients have had continuous access to their medications during the pandemic, while a small portion reported some challenges in the availability of medications and protective equipment. This underscores the importance of proper stock management and efficient coordination to ensure patients have continuous access to their treatment.Regarding the information and advice provided by pharmacists, the results demonstrate a high level of accuracy and timeliness of the information offered, including advice on the possible effects of medications and minimizing the risks of side effects.In conclusion, this study confirms the importance of the pharmacist's role in pandemic management and suggests several measures for improving their preparedness and response in the future. These include the need for better coordination in ensuring medication availability and addressing potential challenges pharmacists may face during health emergencies.

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TEACHERS AND PARENTS IN THE WORLD OF STEM CONCEPTS - ACTION RESEARCH IN THE FUNCTION OF POPULARIZING STEM ACTIVITIES

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Abstract
Domestic and foreign authors make great contributions to action research and provide a spectrum of ideas and possibilities for their application in pedagogical work. In this paper, we want to present the relevance of the popularization of STEM activities in the first cycle of compulsory education through the application of action research. Guided by contemporary recent literature, we will present: the role of teachers in improving teaching and extracurricular activities by applying action research with a focus on the popularization and implementation of the STEM concept in working with students. We will also present proposals for practical activities that teachers and parents can use in order to investigate natural phenomena and processes, as well as an example of good practice that shows us the positive effects and impacts that STEM activities have on children's engagement, curiosity and creativity. At the very end, we will present ideas for future action research that will unite teachers, students, and parents in the interest of popularizing STEM activities in the first cycle of primary education.
Keywords: action research, STEM, reflective practice, partnership.

INTRODUCTION

One of the recommendations of modern educational work that would overcome the weaknesses of subject-class teaching is the integration of content that enables students to acquire better quality and long-lasting knowledge (Miletić, Golubović-Ilić & Cekić-Jovanović, 2020). In many educational systems, there are different strategies for the integration of teaching subjects, and one of the ,,most famous concepts applied in the American educational system is STEM" (Blagdanić & Banđur, 2018: 281). As the STEM (Science, Technology, Engineering and Math) integrative educational concept is based on the study and connection of different teaching areas into one whole, which contributes to the development of cross-curricular competencies, in the paper we focus on the usefulness and relevance of action research in the function of popularizing the STEM learning concept . What makes this concept different from traditional teaching is that it includes ,,all educational activities during all developmental periods, in a formal but also informal sense" (Milošević, 2018: 180). Also, the STEM concept implies ,,acquiring knowledge about the functioning of natural, scientific and technical laws and rules and acquiring skills that involve solving problems, analytical way of thinking, developing and making logical conclusions and acquiring practical knowledge" (Ilić, Škorić & Subotin., 2020: 84) which represents an essential component of 21st century education. In order to apply the mentioned concept in the first cycle of basic education and upbringing, it is necessary for teachers to be motivated and competent, because most subject outcomes are achieved through the direct research activity of students with the continuous support of teachers (*Pravilnik o programu nastave i učenja za prvi razred osnovnog obrazovanja i vaspitanja,* 2018). Aggravating circumstances for the application of the STEM educational concept are ,,insufficiently flexible class schedule, formal teacher education - the concept of separate teaching methods for different subjects and the reluctance of a certain number of teachers to change their own methodological paradigms" (Blagdanić & Banđur, 2018: 282). However, regardless of the aforementioned aggravating factors, research shows that teachers recognize the importance of the STEM concept and are ready for its implementation (Filipović, 2023). What teachers need, in order to apply the STEM concept in teaching in a better way, is professional development in the form of seminars, round tables or gatherings where examples of good practice will be exchanged. Since one of the goals of the *Education Development Strategy in Serbia until 2030* is to improve the system of professional training that will contribute to the application of what has been learned in everyday work, improve the quality of teaching, and therefore the quality of student learning, one of the topics should also be the

possibilities and ways of applying STEM concept in the first cycle of basic education and upbringing. By representing the STEM concept, school practice can be improved, and the knowledge gained through this integrative model provides an opportunity for students to learn in an original and creative way. For this reason, in this work we point to the application of action research in the function of popularizing the STEM concept. „It is considered that action pedagogical research is the most effective, the most direct and the most natural way of simultaneously changing and improving (improving) educational practice“ (Knežević Florić & Ninković, 2012: 101). Accordingly, „the educator - action researcher, organizes activities, identifies the existing situation and problems that he strives to innovate, by introducing certain changes in the educational process and re-analyzes and evaluates the achieved results and the effects of the implemented changes“ (Dedaj, 2019: 88). Many researches based on implemented action research show positive outcomes (e.g. Osmanović & Mihajlović, 2014; Maksimović, Milanović & Osmanović Zajić, 2022; Milanović, 2023), which indicates the need for their more frequent representation in school practice in the context of its innovation, improvement and modernization. Research in the field of upbringing and education indicates the importance of involving parents (e.g. Polovina, 2011; Tokić, 2015; Milanović, 2021). „It is expected that the parent, as a partner in educational work, actively participates in various school activities“ (Kuveljić & Jović, 2013: 122), whereby parents can apply the STEM concept at home and actively participate in STEM activities at school. With this theoretical paper, we point to the practical application of action research in the aspect of popularizing the STEM concept and improving school practice through the active participation and engagement of parents and students.

TEACHERS AND PARENTS IN THE WORLD OF STEM CONCEPTS

Authors in our country and abroad (e.g. Elliot, 1991; Maksimović, 2010; Maksimović & Cenić, 2013; Laudonia, Mamlok-Naaman, Abels, & Eilks, 2018) present different and very interesting topics about action research. By focusing on that „conducting quality researches does not only inform teaching and learning but empowers teachers to become more reflective of their roles and responsibilities in the clasroom, and for schools to improve the delivery of quality education for the students” (Barcelona, 2020: 517). In this part, we will present some examples that can serve as an idea for modernizing school practice with action research through the popularization of the STEM concept of learning through the participation of parents.As most subject outcomes are realized through the research activity of children and the support of teachers, it is desirable,

whenever possible, to include interaction with parents, who, in accordance with their knowledge and capabilities, can contribute to the realization of teaching and extracurricular activities. According to the Law on Basic Education and Upbringing (2023), the school is obliged to implement extracurricular activities, and one of them is in the field of science in order to strengthen the educational activity of the school, encourage individual interests and inclinations of children, but also meaningful and purposeful use of free time. The law provides for a program of cooperation with the family, which represents the organization of an open school day every month, when parents can attend educational work and thus get involved in the realization of the STEM concept. Acquaintance and participation of parents in such activities will give them the opportunity to realize these activities with their children at home. As part of such activities, the students' parents would come and create STEM materials together, learn and collaborate. This gathering is also an opportunity for parents to present STEM activities, games and toys that they have realized and constructed with their children at home. Students, on the open day, can demonstrate certain experiments, point out their importance and present what they have learned, what knowledge and skills they have developed, and teachers can present new examples, games and toys for exploring some other natural phenomena and processes using of STEM concepts. Teachers can survey or interview parents and students about participation in activities and workshops, in order to get feedback on their impressions and opinions about the preparation of materials and the application of STEM learning concepts, because feedback and suggestions.Analysis of the Rulebook on the teaching and learning program for the first, second, third and fourth grade of primary education (*Pravilnik o programu nastave i učenja za prvi razred osnovnog obrazovanja i vaspitanja, 2018; Pravilnik o programu nastave i učenja za drugi razred osnovnog obrazovanja i vaspitanja, 2018; Pravilnik o programu nastave i učenja za treći razred osnovnog obrazovanja i vaspitanja, 2019; Pravilnik o programu nastave i učenja za četvrti razred osnovnog obrazovanja i vaspitanja, 2019*) it can be seen that there is a lot of power for the application of the STEM concept, because with the amendment of the Rulebook, the contents do not have the character of prescribed, but recommended contents, so it depends on the competence, motivation and creativity of the teacher whether and in what way they will apply the STEM concept in their work. In the paper, we specifically consider examples related to content about movement, magnetic and electrical properties of materials, after which concrete solutions will be offered for connecting related content as a whole, because the teacher's role is to enlighten students and create a complete picture, not to teach interprets the contents as biological, geographical, historical and other contents (*Pravilnik o programu*

nastave i učenja za prvi razred osnovnog obrazovanja i vaspitanja, 2018).The content on movement in the Teaching and Learning Programs for the first cycle of basic education and upbringing is viewed as a physical phenomenon about which students have significant knowledge, but the task of the teacher is to make experiential knowledge a function of a better understanding of the world that surrounds them (*Pravilnik o programu nastave i učenja za prvi razred, 2018*). As the contents of movement are studied in all four grades within the first cycle of basic education and upbringing, they are distributed and developed according to a spiral-ascending model, in accordance with the age characteristics of the children, which means that the same topic is expanded and deepened from grade to grade.

Content about movement can be classified into three units:

- basic determinants of movement as a phenomenon;
- factors affecting body movement;
- different forms of body movement (Blagdanić & Banđur, 2018: 181).

All three units are suitable for the application of STEM learning concepts, but we will refer to some of them in the paper. In the realization of the STEM activity, in order for the students to explore different forms of movement of the body according to the path (straight and curvilinear), they used a base on which they poured salt and shaped the paths (picture 1) and thus observed rectilinear and curvilinear movement. They expanded the research by using objects of different shapes that they tried to move on the surface of the same name and examined which factors influence the movement of the body. In order to determine the direction and direction in which the movement takes place, as well as different ways to start and stop the body, they used a polygon with different obstacles (picture 2).



Picture 1. Straight and curvilinear movement



Picture 2. Determining the direction and direction in which the movement takes place

In contrast to the content about movement, students examine the magnetic properties of materials (natural magnets, the possibility of magnetizing the body and the properties they then manifest) in the fourth grade of the first cycle of basic education and upbringing. As the understanding of these phenomena is demanding for students of this age, because they are not immediately accessible to the senses (*Pravilnik o programu nastave i učenja za četvri razred, 2019)* recommends that one should dwell on the manifestations of magnetism in everyday life through trials or experiments. At an early age, children gain experience in using magnetic toys and applying magnets in everyday life, but it is important that through research STEM activities, we point out to students the material error *that magnets attract all metals* (Blagdanić & Banđur, 2018). In order not to make such a generalization, students have different metals at their disposal in order to independently conclude that a magnet attracts objects made of only some metals (picture 3). One of the STEM activities that the students had was to create toys from the offered metals and magnets and in this way they also investigated what they could use to create a magnetic toy (picture 4). Also, in this way, they gained knowledge about other ways of applying magnets in everyday life.



Picture 3. Objects made of which materials are attracted to a magnet?



Picture 4. Constructing magnetic toys

In order to investigate the effect of magnets through different substrates, the students had certain problem tasks (some of them are: how can you, using the given objects, move Santa Claus without touching him, how can you write a name or draw something on the substrate, and to

add salt...) and using substrates prepared from different materials, examined one of the properties of the magnet (picture 5).



Picture 5. Through which materials does the magnet work?In order to investigate the poles of magnets and to observe that different poles attract, and those with the same name repel, we used magnetic sticks, a substrate that was compressed for researching content about movement, and magnetic cars - the students made using cars and magnets (picture 6).



Picture 6. Magnet attraction and repulsion

In the first cycle of basic education and upbringing, students study and research the electrical properties of materials in the fourth grade. The recommendation of the Rulebook on the teaching and learning program for the fourth grade (2019) is to test the electrical conductivity of materials using a simple circuit with a battery and a light bulb, and in this way students gain knowledge about the flow of electric current, parts of the circuit (source, conductor, consumer electric currents) but also about the reasons why cables are made of metal and coated with plastic and/or rubber (conductors/insulators of electric current). In this way, students research and acquire knowledge about the electrical conductivity of materials that they can apply in everyday life, because it „represents the basis for understanding the safety risks of using electricity, using the examples of handling electrical appliances in the household" (*Pravilnik o programu nastave i učenja za četvrti razred, 2019: 45*). The pictures show examples that children, in cooperation with students, teachers, and parents, realized through STEM activities in order to examine the electrical properties of materials.



Picture 7. Electrical conductivity of materials

The teacher, depending on the outcome he wants to achieve, should encourage students to engage in various activities that involve individual senses or multiple senses at the same time. It needs to empower students to research and analyze natural phenomena and processes, which the STEM concept encourages.

The presented examples open opportunities for modern teachers to improve teaching in school practice by applying action research, cooperate with parents, improve the relationship and encourage active learning in children.

CONCLUSION

The presented topic opens up many ideas for further research that would focus on the practical application of action research in the field of popularizing the STEM concept through the participation of teachers, parents and students. Organizing workshops based on the STEM concept through the involvement of psychologists, pedagogues, school teachers, STEM subject teachers, parents and students opens another practical idea. Certainly, the volunteer participation of students, future educators and teachers can be of great benefit both to them in terms of empowerment and preparation for the professional role of a pedagogical worker, as well as to other participants. Action research, extracurricular activities, popularization of the STEM concept of learning and the involvement of parents is another idea that would improve school practice, bring interesting things, innovations and strengthen family-school relations. A very interesting paper points to the popularization of science and STEM concepts in the school library (Radovanović & Duković, 2020), which opens up the possibility of improving work in this aspect as well through action research. The development of teachers' professional competences, through the application of action research, the popularization of STEM learning and partnership with parents open up ideas for practitioners to implement activities in practice. Certainly, the improvement of the existing practice with the presented examples opens a window to modern practitioners for ideas that they can apply in their daily work and make the school a place of joy, happiness, fun - a place that children adore.

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FARKLI ORANLARDA ALKOL DİZEL YAKIT KARIŞIMLARI KULLANILAN BİR DİZEL MOTORUN EGZOZ EMİSYONLARININ OPTİMİZASYONU

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ÖZET
Günümüzde fosil yakıtların talebi ve tüketimi, ülkelerin kalkınma hızlarıyla aynı oranda artmaktadır. Dizel motorlar yüksek verimlilikleri ve dayanıklılıkları sayesinde endüstri, tarım, havacılık ve demiryolu gibi birçok alanda yaygın olarak kullanılırlar. Dizel motorlar, azot oksit (NOx), hidrokarbon (HC), karbon monoksit (CO), karbon dioksit (CO_2) ve duman yoğunluğu gibi egzoz emisyonlarının oluşmasının ana nedenlerinden biridir. Bu çalışmanın amacı, dizel motorlarda motorin ve metanol karışımlarının üçlü karışım (%5, %10, %15) olarak kullanılmasının egzoz emisyonları üzerindeki etkisini araştırıp optimum değerleri Yanıt Yüzey metodolojisi ile elde etmektir. Deneyler 4 zamanlı 6 silindirli turboşarjlı dizel motorda gerçekleştirilmiştir. Yanıt Yüzey Metodolojisi (YYM) modeli, deneysel veriler kullanılarak geliştirilmiştir. Giriş parametreleri olarak metanol oranı ve motor hızı seçilirken, yanıt parametreleri olarak azot oksitleri (NOx), karbon monoksit ve hidrokarbon emisyonları seçilmiştir. Giriş parametrelerinin optimum değerleri, sırasıyla %15 metanol oranı ve 1667 rpm motor hızı olarak bulunmuştur. Bu optimum değerlere karşılık gelen NOx, CO ve HC yanıtları sırasıyla 890.7 ppm, 77,21 ppm ve 20.4 ppm dir. Geliştirilen matematiksel modelin, motor emisyonlarını etkili bir şekilde tahmin etmek için etkin bir biçim-de kullanılabileceği bulunmuştur.
Anahtar Kelimeler: Metanol, dizel motor, emisyonlar, optimizasyon, YYM

OPTIMIZATION OF EXHAUST EMISSIONS OF A DIESEL ENGINE USING DIFFERENT PROPORTIONS OF ALCOHOL DIESEL FUEL BLENDS

ABSTRACT
In today's world, the demand for and consumption of fossil fuels are increasing in line with the pace of countries' development. Diesel engines are widely used in many fields such as industry, agriculture, aviation, and railways due to their high efficiency and durability. Diesel engines are one of the main causes of exhaust emissions such as nitrogen oxides (NOx), hydrocarbons (HC), carbon monoxide (CO), carbon dioxide (CO_2), and smoke density. The aim of this study is to investigate the effect of using blends of diesel and methanol in diesel engines as ternary mixtures (5%, 10%, 15%) on exhaust emissions and to obtain optimum values using Response Surface Methodology. Experiments were conducted on a 4-stroke 6-cylinder turbocharged diesel engine. The Response Surface Methodology (RSM) model was developed using experimental data. Methanol ratio and engine speed were selected as input parameters, while nitrogen oxides (NOx), carbon monoxide, and hydrocarbon emissions were selected as response parameters. The optimum values of the input parameters were found to be 15% methanol ratio and 1667 rpm engine speed, respectively. The corresponding NOx, CO, and HC responses to these optimum values are 890.7 ppm, 77.21 ppm, and 20.4 ppm, respectively. It was found that the developed mathematical model can be effectively used to predict engine emissions.
Keywords: Methanol, diesel engine, emissions, optimization, RSM

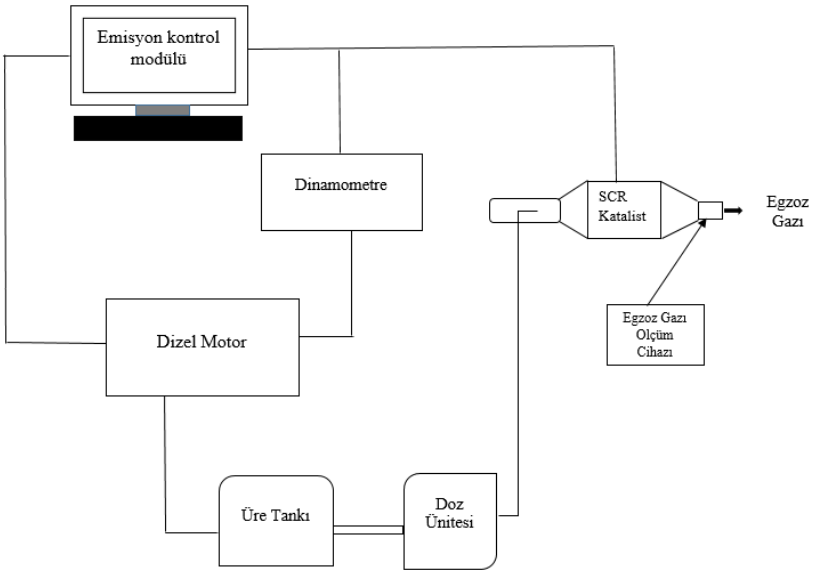
GİRİŞ

Günümüzde taşımacılık, sanayi ve kentsel sektörlerdeki hızlı büyüme ile enerji ihtiyaçları küresel olarak aynı hızda artmaktadır (Dubey ve ark,2023). Fosil yakıtlar, dünyanın enerji taleplerini karşılamak için önemli kaynaklardır (Asokan ve ark, 2019). Sıkıştırmalı ateşlemeli (CI) motorlar, taşımacılık, tarım ve enerji üretimi uygulamalarında sürekli olarak kullanılmaktadır (Atmanlı ve Yılmaz 2021). Son dönemde artan küresel enerji talebi, azalan petrol rezervleri ve dünya politikasındaki istikrarsızlık, fosil yakıt piyasasını önemli ölçüde etkilemiştir. Fosil yakıtların içten yanmalı motorlarda yakılması, egzoz emisyonlarına bağlı olarak küresel ısınma, iklim değişiklikleri ve sera gazlarının etkileri gibi büyük olumsuzluklara neden olur (Baranitharan, 2019). Hidrokarbon (HC), azot oksit (NOx) ve karbon monoksit (CO) emisyonlarının salınımının çevreye olumsuz etkiler vardır (Shadrack ve ark. 2023). Bu faktörler, araştırmacıları ve motor üreticilerini çevre dostu, kolayca temin edilebilen ve stabil motor işletmesi sağlayan alternatif yakıtları aramaya yönlendirmiştir (Hasan ve ark., 2021).Biyokütle kaynaklarından biyokimyasal süreçlerle elde edilen alkoller, yenilenebilir ve temiz yanma özelliğine sahip karbon temelli yakıtlara doğru bir yol sunma potansiyeline sahiptir (At-manlı ve ark, 2015). Alkol yakıtları, bol miktarda üretim avantajına, yüksek oksijen içeriğine, atmosfer sıcaklığında ve basıncında sıvı halde bulunma özelliğine ve ekonomik avantajlara sahip olarak, en umut vaat eden alternatif yakıtlardan biri olarak kabul edilmiştir (Chen ve ark, 2022). Özellikle etanol ve metanol, uzun yıllardır alternatif yakıtlar olarak değerlendirilmektedir (Yao ve ark, 2010).Optimizasyon yöntemleri deneme sayısını azaltır, matematiksel optimizasyon modelleri geliştirir ve cevapları tahmin eder (Dubey ve ark. 2022). Yanıt yüzey metodolojisi pek çok alanda karmaşık süreçleri geliştirmek, iyileştirmek ve optimize etmek için kullanılır (Betiku ve ark, 2014). Yanıt yüzey metodu çok sayıda araştırmacı tarafından test sayısını azaltmak için seçilmiştir (Uslu, 2020). Bu çalışmayı yürütmek için, egzoz gazı emisyonları, Yanıt Yüzey Metodolojisi (RSM) kullanılarak modellenmiştir. Bu modelleme yöntemi, yeterli deneysel veri sağlandığında tercih edilen çıkış değişkenlerini değerlendirir. YYM, sayısal bir optimizasyon tekniği ve işlemleri ve ürün tasarımlarını optimize etmek için istatistiksel bir tasarımın bir seçkisidir (Patel ve ark. 2018)Giriş parametrelerini tasarlamak ve egzoz emisyonları ile ilgili analizleri yapmak için yüzey yanıt metodolojisi kullanılmıştır. Deney Tasarımı (DoE) kavramı, minimum deneme sayısıyla maksimum varyasyon aralığını değerlendirmek için sunulur.Literatür incelendiğinde, birçok araştırmacının dizel motorun egzoz emisyonları üzerinde alkol kullanımının etkilerini araştırdığı görülmektedir. Ancak, sadece birkaç araştırmacının, alkol ve yakıt karışımlarının

egzoz emisyonları üzerindeki etkilerini analitik olarak değerlendirmek için yüzey yanıt metodolojisini kullandığı gözlemlenmiştir. Bu çalışmanın amacı, metanol dizel yakıt karışımlarının Yüzey yanıt metodolojisine dayalı merkezi kompozit modeli kullanarak egzoz emisyonlarını (NO_x, CO, HC) optimize etmek ve egzoz emisyonlarını minimize etmektir.

MATERYAL VE METOD

Bu çalışmada kullanılan motor, Türkiye'de üretilen Netfren hidrolik dinamometre üzerinde çalıştırılan, 6 silindirli, turboşarjlı ve şarj hava soğutmalı bir dizel motordur. Motor torku, hidrolik dinamometrenin yardımıyla ölçülmüştür. Tablo 1 dinamometrenin teknik özelliklerini göstermektedir.



Şekil 1. Deney düzeneğinin resmi

Tablo 1. Dinamometre teknik özellikleri

Tork aralığı	250-2200 Nm
Hız aralığı	0-4500 rpm
Ağırlığı	45 kgf
Bağlantı uzunluğu	400-750 mm
Tork kolu uzunluğu	350mm

Yanıt Yüzey Methodu

Bu çalışmada Minitab (Deneme Sürümü) yazılımı kullanılarak deneysel değerlerin istatistiksel analizi için yanıt yüzeyi metodolojisi kullanılmıştır. Optimizasyon işlemi için yanıt yüzey metoduna dayalı merkezi kompozit modeli kullanılmıştır. Toplam da 13 deney gerçekleştirilmiştir. Merkezi kompozit modelinde metanol oranı (A) ve motor hızı (B) dâhil

olmak üzere 2 adet giriş parametresinin etkileri incelenmiştir. Tablo 2'de kullanılan giriş parametreleri ve onların değerleri verilmiştir. Oluşturulan modelde tepki faktörü olan egzoz emisyonlarının (NOx, CO, HC) seçilen giriş parametreleriyle olan ilişkileri değerlendirilmiştir. Yanıt yüzey metodolojisi yanıt yüzeyini tahmin etmek için eşitlik 1 'de verilen 2. dereceden polinom modelini kullanır.

$$Y = \beta_0 + \sum_{i=1}^{n} \beta_i x_i + \sum_{i=1}^{n} \beta_{ii} x_i^2 + \sum_{i>j}^{n} \sum_{j}^{n} \beta_{ij} x_i x_j + e \quad (1)$$

Burada; Y değeri tahmin edilen Egzoz emisyon değerini, n değeri faktör sayısını, β_0 sabit, β_i, β_{ii}, β_{ij} doğrusal, dörtlü ve etkileşim katsayılarını belirtmektedir.

Tablo 2. Giriş parametreleri ve değerleri

Sembol	**Değişken**	**Birim**	**Seviye**		
			-1	0	+1
A	Metanol Oranı	%	5	10	15
B	Motor Hızı	Rpm	1400	1800	2200

SONUÇLAR VE TARTIŞMA

İki bağımsız değişken (işlem faktörü) ile minimum egzoz emisyon değerlerini bulmak için Merkezi kompozit deneysel tasarımı kullanılmıştır ve sonuçlar Tablo 3'te gösterilmiştir. Egzoz emisyon deneylerini tasarlamak ve tepkime koşullarını optimize etmek için Minitab yazılımı kullanılmıştır. Gerçek motor egzoz emisyon değişkenlerini belirlemek için 2-4 numaralı denklemler kullanılmıştır.

Tablo 3. Egzoz Emisyonları için Gerçek ve Tahmini Değerler

			Deneysel			Tahmini		
Deney No	A: Metanol oranı	B: Motor Hızı	NO_x (Ppm)	CO (ppm)	HC (ppm)	NO_x (Ppm)	CO (ppm)	HC (ppm)
1	10	1800	850	126	22.34	850.28	126.62	22.38
2	10	1800	850	126	22.34	850.28	126.62	22.38
3	15	1400	1032	107	14.10	1031.18	108.28	14.27
4	10	1800	850	126	22.34	850.28	126.62	22.38
5	15	2200	712	500	27.34	715.18	501.28	27.49
6	10	2200	741	511	27.12	736.31	509.49	27.04
7	10	1800	850	126	22.34	850.28	126.62	22.38
8	5	1800	862	135	22.14	862.98	134.45	22.28
9	5	1400	1054	112	13.92	1051.51	112.28	13.86
10	10	1800	850	126	22.34	850.28	126.62	22.37
11	5	2200	752	521	26.98	753.51	521.28	26.60
12	15	1800	836	125	23.10	833.64	122.45	22.78
13	10	1400	1040	110	14.02	1043.31	108.45	13.91

$$Y_1 = 2322.6 + 2.69A - 1.2508B - 0.0786A^2 + 0.000247B^2 - 0.002250AB \quad (2)$$

$$Y_2 = 2899.8 + 0.94A - 3.5811B + 0.0731A^2 + 0.001140B^2 - 0.002000AB \quad (3)$$

$$Y_3 = -45.09 - 0.112A + 0.05890B + 0.00608A^2 - 0.000012B^2 + 0.000023AB \quad (4)$$

Varyans Analizi (ANOVA)

İki bağımsız faktörün (metanol oranı ve motor hızı) egzoz emisyon değerleri (NO_x, CO, HC), üzerindeki etkileri ANOVA analizi kullanılarak belirlenmiştir. Sonuçlar Tablo 4'te gösterilmiştir. ANOVA analizine göre, model terimleri için p-değerleri 0.05'ten küçük olduğunda anlamlıdır. Belirleme katsayısı R^2, uyumlu modellerin kalitesini belirlemede kullanılmıştır. Memnuniyet verici bir model uyumu elde etmek için R^2'nin 1.0'a yakın olması gerekmektedir (Singh ve ark. 2019). Ayrıca, modelin uygunluğu, regresyon katsayısı (R^2),

düzeltilmiş regresyon katsayısı (Ayarlanmış R^2) ve tahmin edilen çoklu belirleme katsayısı (Tahmini R^2) kullanılarak test edilmiştir. NOx, CO ve HC emisyonları için R^2 değerleri Tablo 5'e göre sırasıyla 0.9996, 0.9999 ve 0.9992 olarak bulunmuştur. Modelin regresyon katsayısı R^2 değerlerinin oldukça yüksek olduğu gözlemlenmiştir. Bu, modelde kullanılan ikinci dereceden regresyonun deneysel tasarımdaki herhangi bir değişkendeki yanıt faktörlerini hesaplamak için uygun olabileceğini göstermiştir. R^2 ve ayarlanmış R^2 değerlerinin birbirine yakın olması, önerilen modellerin deneysel verilerle uyumlu olduğunu göstermiştir (Aygun ve ark. 2019).

Tablo 4. Egzoz emisyonları için varyans analizi

	NOx		*CO*		*HC*	
Kaynak	*F-değeri*	*P-değeri*	*F-değeri*	*P-değeri*	*F-değeri*	*P-değeri*
Model	*3497,30*	*0.000*	*288858.52*	*0.000*	*1818.37*	*0.000*
A-Metanol Oranı	*8449,96*	*0.000*	*89.12*	*0.000*	*12.62*	*0.009*
B-Motor Hızı	*152,89*	*0.000*	*99520.13*	*0.000*	*8708.64*	*0.000*
AB	*16747,03*	*0.017*	*26.41*	*0.001*	*0.27*	*0.618*
A^2	*288,50*	*0,298*	*3.81*	*0.092*	*2.15*	*0.186*
B^2	*1,26*	*0.000*	*37883.00*	*0.000*	*334.87*	*0.000*

Önemli – ($0.000 < p \leq 0.05$).

Tablo 5. Model Uyumu

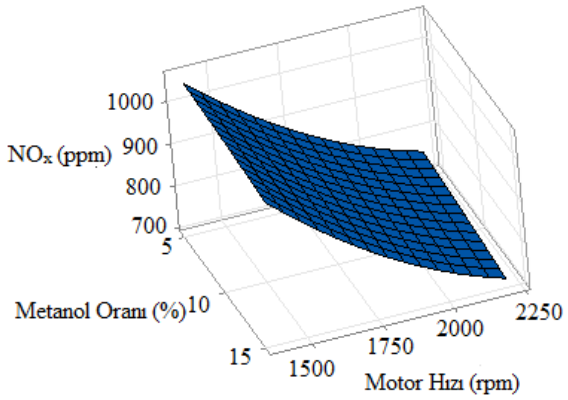
Egzoz	**NOx**	**CO**	**HC**
R^2	% 99.96	% 99.99	% 99.92
Ayarlanmış R^2	% 99.93	% 99.98	% 99.87
Tahmini R^2	% 99.60	% 99.95	% 99.28

Emisyonlarının Analizi

NOx Emisyonu

Şekil 2, NOx emisyonları üzerinde metanol karışım oranı ve motor hızının etkileşimini gösteren 3 boyutlu tepki yüzeyi grafiğini göstermektedir. Metanol içeren dizel yakıt karışımlarında, saf dizel yakıta kıyasla azot oksit (NOx) emisyonlarında bir azalma görülmektedir. Bu azalma, karışımdaki alkol yüzdesi ile artmaktadır. Bu durumun, alkolün (daha düşük kalorifik değere sahip olması nedeniyle) sıcaklığı düşürme etkisinden kaynaklanabileceği düşünülmektedir. Bu etki, alkolün oksijen içeriği ve daha düşük setan sayısının (ve dolayısıyla daha uzun yanma gecikmesinin) karşıt etkisini neredeyse dengelemektedir. Bu da olası olarak, karışımın ön

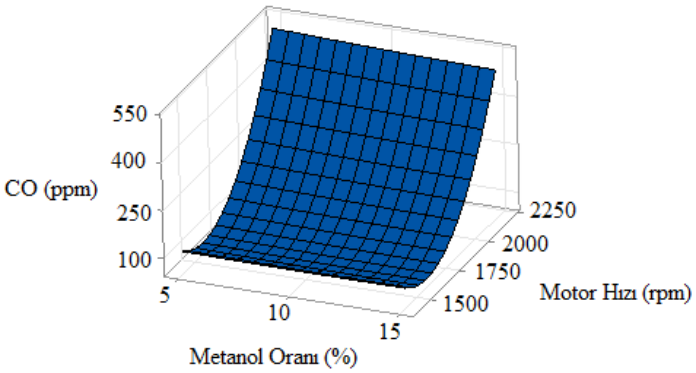
karışımlı yanması sırasında daha yüksek sıcaklıklara ve dolayısıyla NO üretimine yol açabilir (Rakopoulos ve ark., 2008).



Şekil 2. Metanol karışım oranı ve motor hızı karşısında NOx emisyonları için 3 boyutlu yüzey grafiği

CO Emisyonu

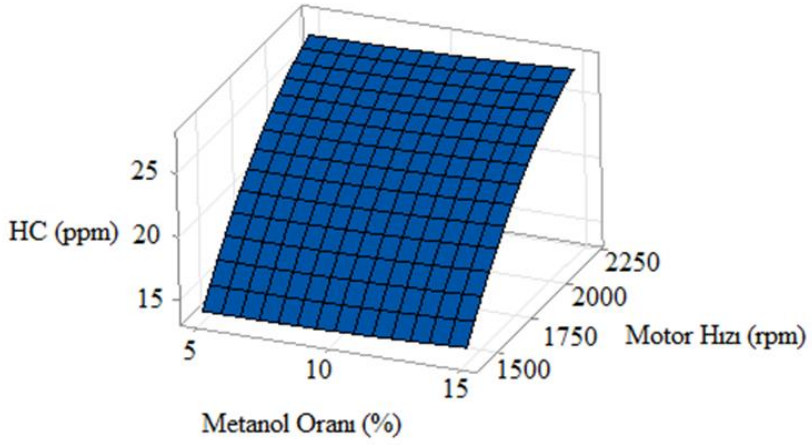
Motor işletme değişkenlerinin CO emisyonu üzerindeki etkileri Şekil 3'te gösterilmektedir. Alkol karışımı yakıtların CO emisyon değerleri, saf dizel yakıtına kıyasla azalmıştır. CO emisyonun azalma sebebi, alkol yakıtlarının dizel yakıtına kıyasla daha yüksek oksijen içeriğine sahip olmalarıdır. Ayrıca, alkol-dizel yakıt karışımları, dizel yakıtına kıyasla daha düşük stokiyometrik A/F oranına sahiptir; karışımların stokiyometrik A/F oranları, dizel yakıtınınkinden daha düşüktür. Sonuç olarak, test edilen karışımlar daha düşük CO emisyonu vermektedir (Rakopoulos ve ark., 2008).



Şekil 3. Metanol karışım oranı ve motor hızı karşısında CO emisyonları için 3 boyutlu yüzey grafiği

HC Emisyonu

Alkol yakıtlarının HC emisyon değerleri, saf dizel yakıtına kıyasla artmıştır. Alkol eklenmesiyle HC emisyonlarında artışın nedeni, alkol karışımlarının daha yüksek buharlaşma ısısı nedeniyle buharlaşmanın daha yavaş olması ve bu nedenle daha yavaş ve daha kötü yakıt-hava karışımı sağlanması, artan sprey penetrasyonunun istenmeyen şekilde odacık duvarlarına yakıt çarpmasına (ve bu nedenle alevin sönmesine) ve halka boşluk bölgelerinde yumuşama ve yastıklanmaya neden olmasına bağlanabilir (Rakopoulos ve ark., 2008).



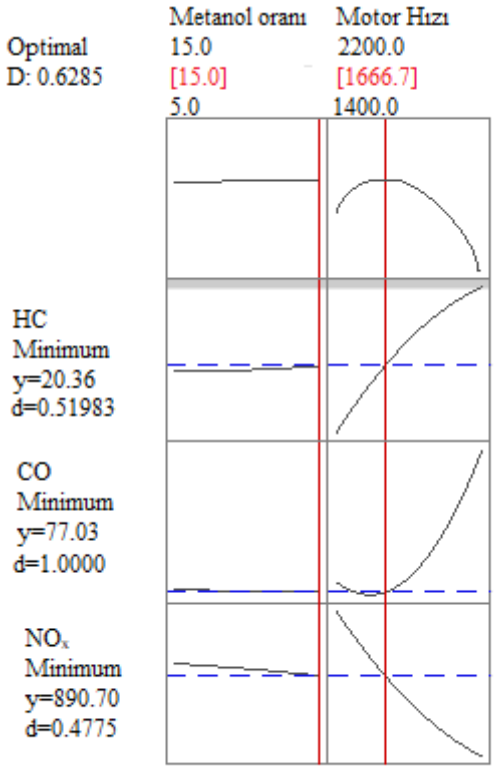
Şekil 4. Metanol karışım oranı ve motor hızı karşısında HC emisyonları için 3 boyutlu yüzey grafiği

Model Doğrulama Deneyleri

YYM yaklaşımı, dizel motorun en iyi istenen emisyonlarına dayalı olarak yakıt hazırlığındaki metanolün optimal karışım oranının belirlenmesi için kullanılmıştır. Giriş değişkenleri ve yanıt değişkenleri için sayısal optimizasyon Şekil 5'te gösterilmiştir. Bu tahmin değerleri NO_x, CO ve HC emisyonlarını minimize etmek için optimal çözümü temsil eder. Grafikte, %15 metanol oranında ve 1666.7 rpm motor hızında, kombinasyonlu istenen faktörde en yüksek pikin yaklaşık %62,85 olduğu gözlemlenmiştir. Onay testleri optimal çözümün sonuçlarını test etmek için 3 deneme gerçekleştirilmiştir ve ortalama sonuçlar Tablo 6'da sunulmuştur. Önerilen optimal nokta için gözlemlenen maksimum hata %5,5 ve minimum hata %0,92 olarak belirlenmiştir.

Tablo 6. Gözlemlenen ve tahmin edilen değerler için karşılaştırmalar

	NOx	CO	HC
Optimal şart	890.7	77.03	20.36
Deneysel test	882.5	76.15	21.48
% Hata	0.92	1.14	5.5



Şekil 5. Giriş parametrelerinin egzoz emisyonları üzerindeki etkilerinin optimizasyonu

SONUÇLAR

Bu çalışmada, motorin ve metanol karışımlarının üçlü karışım (%5, %10, %15) olarak hazırlanarak 4 zamanlı 6 silindirli dizel motorda emisyon değerlerindeki değişimler ölçülmüş olup egzoz emisyon değerlerini (NO_x, CO, HC) belirlemede metanol karışım ve motor hızının tahmini ve optimizasyonu yanıt yüzey metodu başarıyla uygulanmıştır. Elde edilen sonuçlar aşağıda verildiği şekildedir:

- İstatistiksel analiz, motorların emisyon özelliklerini en çok etkileyen önemli parametreleri belirlemekte çok yararlıdır. En az deneysel test sayısıyla en doğru sonuçları elde etmek için sağlanır.
- NO_x, CO ve HC emisyonları için R^2 katsayısı sırasıyla 0.9996, 1.00 ve 0.9992 olarak belirlenmiştir.
- En iyi yanıtlar NO_x, CO ve HC için sırasıyla 890.7 ppm, 77.03 ppm ve 20.36 ppm olarak hesaplanmıştır.
- NOx, CO ve HC için hata oranı sırasıyla %0,92, %1.14 ve %5,5 olarak bulunmuştur.
- Elde edilen sonuçlar, RSM tasarımının motor işletim parametrelerinin optimizasyonunda etkili bir şekilde kullanılabileceğini göstermektedir.

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SELECTED PHYSICAL, MECHANICAL AND CHEMICAL PROPERTIES OF GROUNDNUT KERNEL FOR PROCESSING OF GROUNDNUT

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Abstract
Engineering properties are essential in delivering a high-quality product and a basic understanding of groundnut kernel is necessary for the development and improvement of technology for its processing. This study investigates some selected physical, chemical and mechanical properties of groundnut kernel. Groundnut kernels at 8.50% moisture content were used for the study. One hundred sample of groundnut kernels were used to determine some of the selected physical properties of groundnut kernels using standard equations and formulae. The groundnut kernel was tested for their strength properties under compression when loaded under an INSTRON Universal Testing Machine while the chemical properties were determined using recommended standard equations and formulae. The data obtained were subjected to statistical analysis using Microsoft Excel package. The length, width, thickness, geometric diameter, arithmetic mean diameter, sphericity, surface area, aspect ratio, true density, bulk density and porosity of 1.28 ± 0.18 cm, 0.81 ± 0.12cm, 0.87 ± 0.12 cm, 0.96 ± 0.10 cm, 0.99 ± 0.09 cm, 0.76 ± 0.10 %, 2.92 ± 0.58 cm, 0.64 ± 0.13 %, 1.08 ± 0.21 g/cm^2, 0.569 g/cm^2 and 45.42 % were obtained respectively. On four different surfaces, static coefficient of friction varied from 0.29 to 0.36, while the angle of repose was 25°±4°. The stress at break of 130.40 ± 232.5 MPa, strain at break of 2.16 ± 0.68 mm/mm, deformation at break of 25.34 ± 7.94 mm, force at break of 11.29 ± 20.10 kN and energy to break of 20.99 ± 41.70 J were obtained respectively. The mineral compositions obtained include sodium, potassium, magnesium, calcium, phosphorus, iron, and zinc content of 60.75 ± 0.07 ppm, 98.0 ± 1.41 ppm, 5.34 ± 0.02 ppm, 71.55 ± 0.07 ppm, 1.10 ± 0.005 ppm, 1.80 ± 0.35 ppm, and 60.15 ± 0.21 ppm respectively. Ash, fat, crude fibre, crude protein and carbohydrate content of 1.97 ± 0.02%, 42.69 ± 0.46 %, 3.90 ± 0.03 %, 38.38 ± 0.18%, and 5.37 ± 0.26% were gotten respectively. The physicochemical characteristics of free fatty acid, peroxide value, saponification value and iodine value of 1.99 ± 0.03 mg/kOH/g, 0.02 ± 0.001Meq/kg, 253.73 ± 1.81mg/kOH/g, and of 36.68 ± 0.8 g/100g respectively. This study has provided information on some engineering properties of groundnut kernel for designing improved agricultural machinery for planting, harvesting, processing and storage of groundnut.
Keywords: Engineering Properties, Mineral Composition, Physico-Chemical, Proximate Composition, Static Friction.

INTRODUCTION

Groundnut (Arachis hypogaea L.) is a multi-purpose legume crop widely cultivated in sub-Saharan Africa (SSA) (Abady *et al*., 2019). Groundnut otherwise known as *Arachis hypogaea* is regarded as one of the most important protein- rich and it occupies the fifth position as oilseed crop globally (El-Sayed *et al*., 2001). It is grown as annual crop on about 19 million hectares of land in tropical regions and the warmer areas of temperate regions of the world (Adejumo *et al*., 2005; Davies, 2009). Groundnut is cultivated on 26.4 million ha with production of 37.10 million metric tons worldwide. Developing countries constitute 97% of the global area and 94% of the global production of this crop (FAOSTAT, 2008). The manual processing of groundnut are time consuming and laborious, the condition prevalent at this level is generally unsanitary and inherent unhygienic conditions. The knowledge of physical and mechanical properties of groundnut like any other biomaterial is fundamental because it facilitates the design and development of equipment for harvesting, handling, conveying, cleaning, delivering, separation, packing, storing, drying, mechanical oil extraction and processing of agricultural products, their physical properties have to be known (Mohsenin, 1980; Aviara *et al*., 2013). Presently, the equipment used in processing groundnut have been generally designed without taken into cognizant the physical properties of groundnut which include the size, mass, bulk density, true density, sphericity, porosity, coefficient of static friction, angle of repose and resultant systems leads to reduction in working efficiency and increase in product losses (Manuwa and Afuye, 2004). Researchers around the world has published various results and findings with respect to groundnut. Although, some focused on the mechanical, some researched on aerodynamics properties while some emphasized the micro and macro nutrients to make it fit for storage purposes. According to Firouzi et al. (2009) who posits that physical properties of a material is proportional to the available moisture content of that biomaterials. He emphasized that the static friction, surface area, angle of repose and dimensions are all subjected to the moisture content of the material. The findings of Firouzi et al. (2009) are similar to that of Aydin (2007) but there was a disparity when comparing it to the works of Olajide and Igbeka (2003). Meanwhile, Bagheri et al. (2011), worked on the mechanical and rheological properties of groundnut. His research indicated that the rupture force has an upward trend from initial moisture content to a certain amount of moisture content, whereas after that moisture content the rupture force have a decent tendency after subjecting the groundnut to various stress and strain. He concluded that when the moisture content exceeds the moisture content value, the type of rupture converts to a doughy rupture progressively, for all of the tested varieties.

The result obtained was consistent with that of Braga et al. (1999) who also did same study on macadamia nut. In addition, the chemical properties of the groundnut were investigated by various researchers which include proximate analysis, physicochemical properties and mineral compositions. It was observed that the moisture content was 5.80%, ash content 3.08%, crude fibre 3.70%, crude protein 38.61%, fat content 47% and carbohydrate (by difference) 1.81%. The fat, protein and ash contents are similar to the reports of Nelson and Carlos (1995) which indicated the fat content among 29 cultivars range between 47.0%- 50.1%, protein 26.3%-30.9%, and ash 2.4-2.7%. The moisture content and crude fibre content agreed with that of NAS (1980) of 5.0% and 3.0% respectively. Furthermore, the saponification value, of 193.20mgKOH/g agreed with Pearson's (1981), 187-196mgKOH/g. The saponification value makes it useful in soap making. Iodine value 38.71g/100g indicates low degree of unsaturation and classified the oil as non-drying oil (80-100g/100g) as recorded for most edible oil Pearson (1981). Acid value of 5.99mgKOH/g which was close to Arachis (4.0mgKOH/g) by Pearson (1981) and Soyabean 4.279mgKOH/g (Akanni *et al.,* 2005). The free fatty acid was 3.0mgKOH/g, this indicates some percentage of fatty acid present in the oil and that the oil may likely undergo oxidation.The basic engineering properties exhibited by agricultural materials which include mechanical, rheological, physical, thermal, electrical and electromagnetic properties. The ever-increasing importance of agricultural products together with the complexity of modern technology for their production, processing and storage need a better knowledge of their engineering properties so that machines, processes and handling operations can be designed for maximum efficiency and the highest quality of the final end products (Mohsenin, 1970). Adequate information is not available for the physical, mechanical and chemical properties of some varieties of groundnut kernel. This research aims to properly determine and evaluate the physical, chemical, proximate and mineral constituent of the groundnut for efficient designing of its processing materials by the Agricultural engineer and food processors.

METHODOLOGY

2.1 Raw Materials, Equipment and Machine Used

The material (groundnut kernel) was obtained from a local market in Akure, Ondo State, Nigeria, sub-Saharan Africa. The kernels were sorted visually for size, maturity level and physical damage. Aside from the bio-materials sourced, other items, equipment and machines used during the experiments includes: vernier calliper, measuring cylinder, electronic weighing

balance, oven, cans, plywood, mild steel, stainless steel and galvanized steel, INSTRON 3369 Universal testing machine, water, adjustable inclined plane, protractor.

2.2 Determination of Physical and Mechanical Properties

The physical properties of the groundnut kernels were determined using standard formulae and equations as presented in Table 1 prior to the determination of the mechanical properties of the groundnut kernels. The mechanical properties of groundnut kernels were carried out utilizing INSTRON 3369 Universal testing machine. The groundnut kernels were subjected to compression test at loading rate of 30 mm/min (Adetola *et al*., 2020). The mechanical properties determined include the stress at break in MPa, strain at break in mm/mm, deformation at break in mm, force at break of in kN and energy to break in J.

Table 1: Determination of Physical Properties of Cassava Tubers

Property	Method or equation for determining of physical properties	Reference
L (cm)	Measuring tape	Olukunle and Akinnuli, 2012
W (cm)	Digital vernier caliper	Olukunle and Akinnuli, 2012
T (cm)	Measuring three different segments of the cassava tubers using digital vernier caliper	Olukunle and Akinnuli, 2012.
D_g (cm)	$D_g = (LWT)^{1/3}$	Ozguven and Vursavus, 2005; Akaaimo and Raji, 2006.
D_a (cm)	$D_a = \frac{LWT}{3}$	Mohsenin, 1986
R_a (%)	R_a =W/T100%	Burum, 2004.
S_a (cm^2)	$S_a = \pi D_g^2$	Yalcin *et al*, 2007 and Olukunle and Akinnuli, 2012.
S_p (cm)	$S_p = \frac{(LWT)^{1/3}}{L}$ 100%	Yalcin *et al*, 2007 and Olukunle and Akinnuli, 2012.
ε (%)	ε = (1 - $\frac{\rho_b}{\rho_t}$) x 100	Akaaimo and Raji, 2006.
Mt (kg)	A digital weighing balance 10 kg was used in weighing each of the cassava tubers	Yalcin *et al*, 2007 and Olukunle and Akinnuli, 2012.
Vt (m^3)	By putting a known mass of a (unit) sample into a cylindrical container of water, change in level of the liquid in the cylinder gives the unit volume	Ozguven and Vursavus, 2005.
ρ_t (kg/m^3)	$\rho_t = \frac{W_t}{V_t}$	Akaaimo and Raji, 2006) and Yalcin *et al*, 2007.
α (°)	The apparatus consisting of plywood box with a fixed stand attached with a protractor and an adjustable plate at the surface	Tabatabaeefar, 2003.
μ	μ = tan α	Yalcin *et al*, 2007 and Olukunle and Akinnuli, 2012.

Source: Adetola *et al.*, 2020.

Where L is the length in cm, W is the width in cm, T is the thickness in cm, D_g is the size in cm, D_a is the arithmetic diameter in cm, R_a is the aspect ratio in %, S_a is the surface area in cm^2,

S_p is the sphericity in cm, ε is the porosity in %, Mt is the true mass in kg, Vt is the true volume in m^3, ρ_t is the true density in kg/m^3, α is the angle of repose in ° and μ is the coefficient of static friction.

2.3 Determination of Chemical Properties

2.3.1 Proximate composition

The proximate composition such as moisture content, ash, fibre, fat and protein content were determined according to the official method of analysis described by AOAC, 2005.

2.3.1.1 Determination of moisture content

The moisture content was determined by oven drying method. The percentage moisture was calculated using equation 1 as described by the Association of Official and Analytical Chemist (AOAC, 2005). Each sample of 5g was weighed using analytical balance into previously weighed Petri-dishes. The weighed sample in the petri dish was allowed to dry in an oven at 100- 105 ^{0}C for 3 hours. The sample was removed and cooled in desiccators to room temperature and the weight was noted, then it was returned into the oven at 105 ^{0}C for 30min until a constant weight was obtained for each sample. The differences in weight between each Petri-dish and dried residue was recorded as the percentage of the initial sample.

$$mc = \frac{w_1 - w_2}{w_s} x100\% \quad (1)$$

Where mc is the moisture content in %, w_1 is the final weight of the crucible + sample in g, w_2 is the initial weight of crucible + sample in g and w_s is the weight of sample in g.

2.3.1.2 Determination of protein content

The crude protein content was determined using Equations 2 and 3 as recommended by AOAC, 2005. A finely grounded sample of 0.5g was weighed into a digestion flask and kjeldahl catalyst tablet was added, 10 ml of concentrated. H2SO4 was added and digested for 4 hours until a clear solution was obtained (blue green color). The digest was cooled and transferred into 100 ml volumetric flask and made up to mark with distilled water. 20 ml of boric acid was dispensed into a conical flask and 5 drops of indicator and 75 ml of distilled water was added to it. 10 ml of the digest was dispensed into Kjedahl distillation flask, the conical and the distillation flask were fixed in place and 20 ml of 2% NaOH was added through the glass funnel into the digest. The steam exit was closed and timing started when the solution of the boric acid and indicator turned green. The distillation was done for 15 minutes and the distillate was titrated with 0.05NHCl solution till the appearance turned to pink colour. A blank was also run through all

steps as above. Therefore, the crude protein content was determined by multiplying percentage Nitrogen by a constant factor of 6.25.

$$pc = nx6.25 \quad (2)$$

Where, pc is the crude protein content in %, n is the percentage total nitrogen

$$n = tv\ x\ amn\ x\ nHcl\ x4 \quad (3)$$

Where, n is the total nitrogen in %, amn is the atomic mass of nitrogen in g, $nHcl$ is the normality of hydrochloric acid used in moles.

***2.3.1.3* Determination of fat content**

Fat was determined by the ether extract method using the Soxhlet apparatus as described by the AOAC, 2005 (Equation 4). Fat was determined by ether extract method using Soxhlet apparatus. 1g of dried sample was weighed and wrapped in filter paper, placed in fat free thimble plugged lightly with cotton wool and extracted with petroleum ether (N-Hexane) in soxhlet apparatus set up for 5 hours. Water and heater were turned on to start extraction. After 4-6 siphoning, ether was allowed to evaporate and beaker was disconnected before the last siphoning. Extract was transferred into clean glass dish with ether washing and evaporated ether on water bath. The residue extract in dish was then placed in an oven at 105ºC for 2 hours and cooled in a desiccator and weighed.

$$fc = \frac{(w_{fp}+w_s)-w_r}{s_w} x100\% \quad (4)$$

Where, fc is the of fat content in %, w_{fp} is the weight of filter paper in g, w_s is the weight of sample in g and s_w is the sample weight in g.

***2*.3.1.4 Determination of ash content**

The percentage ash was calculated using (AOAC, 2005) as presented in Equation 5. Clean empty crucible was placed in a muffle furnace at 600ºC for an hour, cooled in desiccator and weighed (w_1). One gram of each sample was weighed in crucible (w_2). The sample was ignited over a burner with the help of blowpipe until it is charred. Then the crucible was placed in a muffle furnace set at 550 ^{0}C and left for 12-24hrs. The appearances of gray white ash indicated complete oxidation of all organic matter in the sample. The crucible with the sample was cooled and weighed (w_3).

$$ac = \frac{w_3-w_1}{w_2} x100\% \quad (5)$$

Where ac is the ash content in %, $w_3$is the weight of the sample with crucible before ashing in g, w_1 is the weight of the sample in g and w_2 is the weight of the sample with crucible after ashing in g.

***2.3.1.5* Determination of crude fibre content**

The crude fibre content was determined using Equation 6 as recommended by AOAC, 2005 and Adetola *et al.*, 2021. The sample 5g was accurately weighed into flask, 200 ml of running water and 1.25 ml H2SO4 was added. The mixture was heated under reflux for 30 minutes. The hot mixture was filtered through a fibre muslin cloth. The obtained filtrate was thrown off and the residue was returned to the fibre flask of which 200 ml of running water and 1.25g NaOH was added and heated for another 30 minutes. The residue was removed using N-hexane and ethanol and finally transferred into already weighed crucible. The crucible and the residue were oven dried at 105^{o}C overnight to drive off the moisture. The oven dried crucible containing the residue was cooled in a desiccator and later weighed to obtain the W1. The crucible with W1 was transferred to the muffle furnace for ashing at 550 ^{0}C for 4 hours.

$$cfc = \frac{w_1 - w_2}{w_s} x100\% \quad (6)$$

Where cfc is the crude fibre content in %, $w_1$is the oven dried crucible containing the residue in g, w_2 is the crucible containing white or grey ash (Free of carbonaceous materials) in g and w_s is the weight of sample in g.

***2.3.1.6* Determination of carbohydrate content**

The total carbohydrate was determined by difference method using Equation 7 as described by AOAC, 2005. The sum of percentages moisture, ash, crude lipid, crude protein and crude fibre was subtracted from 100%.

$$Cbh = 100 - (mc + pc + fc + ac + cfc) \quad (7)$$

Where Cbh is the total carbohydrate in %, mc is the moisture content in %, pc is the protein content in %, fc is the fat content in %, ac is the ash content in %, and cfc is the crude fibre content in %.

1.4 Determination of Physico-chemical characteristics

The Physico-chemical characteristics such as free fatty acids, iodine value, peroxide value, and saponification value were determined according to the official method of analysis described by AOAC, 2005.

1.4.1 Determination of acid value or free fatty acids (FFA)

The free fatty acid was determined by mixing twenty-five ml diethyl ether with twenty-five ml alcohol and 1ml phenolphthalein solution (1percent) and carefully neutralize with 0.1M KOH. The oil or melted fat of 1.10g was dissolved in the mixed neutral solvent and titrate with aqueous 0.1M KOH shaking constantly until a pink colour which persists for fifteen seconds is obtained

1.4.2 Determination of Iodine Value

The iodine value was determined by pouring the oil into a small beaker. A small rod was added and weigh out a suitable quantity of the sample by difference into a dry glass stoppered bottle of about two 50ml capacity. The approximate weight in g of the oil to be taken was calculated by dividing 20 by the highest expected iodine value. Carbon tetrachloride of 10ml was added to the oil or melted fat and dissolve. 20ml of Wiji's solution was added, the stopper was inserted (previously moistened with potassium iodine solution) and allow to stand in the dark for 30minutes. 15ml of potassium iodide solution (10percent) was added and 100ml water mixed and titrated with 0.1M thiosulphate solution using starch as indicator just before the end point. A blank was carried out at the same time commencing with 10ml of carbon tetrachloride.

1.4.3 Determination of peroxide value

The peroxide value was determined by weighing out 1g of oil or fat into a clean dry boiling tube and while still liquid 1g powder of potassium iodide was added and 20ml of solvent mixture (2 vol. glacial acetic acid + 1 vol. chloroform). The tube was placed in boiling water so that the liquid boils within 30seconds and it was allowed to boil vigorously for not more than 30 seconds. The content was poured quickly into a flask containing 20ml of potassium iodide solution (five percent). The tube was washed twice with twenty-five ml of water and titrated with 0.002M sodium thiosulphate solution using starch. A blank was performed at the same time.

2.4.4 Determination of saponification value

The saponification value was determined by weighing 2g of the oil or fat into a conical flask and adding exactly twenty-five ml of the potassium hydroxide solution. A reflux condenser was attached and heat the flask in boiling water for 30 seconds. 1ml of phenolphthalein (1percent) solution was added and titrated hot the excess alkali with 0.5M hydrochloric acid (titration). A blank was carried out at the same time (titration).

1.5 Mineral composition

The mineral contents of the test samples were determined by the dry ash extraction method following each specific mineral element as described by AOAC (2000). 2g of the samples was burnt to ash on a muffle (as in ash determination and the resulting ash was dissolved in 20ml of dilute hydrochloric acid (1MHCl) and 20 ml of nitric acid, then diluted to 400ml volumetric flask using distilled water. The solution was used for the various analysis of mineral.

1.5.1 Determination of sodium content

The sodium content of the samples was determined by photometric method. The instrument was set up according to the manufacture's instruction. The equipment was switched on and allowedto stay for about 10min. The gas and air inlets were opened as the start knob was turned on. The equipment being self-igniting, the flame was adjusted to a non-luminous level until a blue colour was obtained. Meanwhile a standard Sodium solution was prepared and was diluted to concentrations of 2, 4, 6, 8, 10 ppm. Starting with the least concentration of 2 ppm, all the standard solution were sucked into the instrument and caused to spray over the non-luminous flame. The readings were recorded and later plotted into a standard curve and used to extrapolate to Sodium level in the sample. After the standard, the sample solutions were siphoned in turns into the instrument with their reading recorded. The concentration of the test mineral in the sample was calculated with reference to the curve and obtained with reference to Equation 8.

$$Na_{100g}^{mg} = 100\mathrm{Vt}\,XDW \qquad (8)$$

Where Na is the sodium content, Vt is the total extract volume, X is the concentration of Sodium from the graph, D is the dilution factor, and W is the weight of sample used.

2.5.2 Determination of magnesium, iron and calcium content

Magnesium, iron and calcium were determined by Flame Atomic Absorption spectrophotometer, as described by AOAC, (2005). About 0.5ml of each sample was digested in 20 ml each of acid solution of HNO_3, H_2SO_4. The corresponding solution was heated until white fumes appeared. The clear solution was diluted up to 50 ml with distilled water and filtered with Whatman filter paper no.1. The standard working solutions of elements of interest were prepared to make the standard calibration curve. Absorption for a sample solution uses the calibration curves to determine the concentration of particular element in that sample. Cathode lamps used as radiation source. Air acetylene gas was used for all the experiments. This method provides both sensitivity and selectivity since other elements in the sample will not generally

absorb the chosen wavelength and thus, will not interfere with the measurement. Triplicate experiments were performed for each sample.

2.6 Statistical Analysis

The data obtained was analysed using the Microsoft Excel package 2019. The average value, standard deviation, minimum value and maximum value of the collected data were determined using the package.

3. RESULTS AND DISCUSSION

The results obtained for groundnut kernel at 8.5% moisture content wet basis are presented in Tables 2, 3 and 4 respectively.

3.1 Physical Properties

The measured parameters are average length, width, thickness. The derived parameters are geometric mean diameter, arithmetic mean diameter, surface area, aspect ratio, sphericity and porosity. At the moisture content level of 8.5%wb, Table 2 shows that the average length, width, thickness, geometric mean diameter and arithmetic mean diameter are (1.28 ± 0.18) cm, (0.81 ± 0.12) cm, (0.87 ± 0.12) cm, (0.96 ± 0.10) cm and (0.99 ± 0.09) cm respectively. The results are found to have a slight difference to that of Firouzi *et al.* (2009). The reliance on the three primary dimensions of length, width and thickness of the seed may be the cause of the increase in geometric property values. When assessing the projected area of a particle traveling through a turbulent or nearly turbulent region of an air stream, the geometric mean diameter is helpful. As a result, it is a helpful parameter to have when designing systems to separate seeds from other materials (Gharibzahedi et al., 2010). Olajide and Igbeka (2003) obtained the average groundnut kernel length, width, and thickness at 4.6% d.b., of 8.54, 3.55, and 6.93 mm, respectively. Corresponding values were 65.4, 41.3, and 13.7 mm for oilbean seeds (Oje and Ugbor, 1991) and 31.50, 23.70, and 22.00 mm for shear kernel (Olajide *et al.*, 2000). As a result, groundnut kernels are smaller than shea kernels and oilbean seeds. Recently, Omobuwajo *et al.*, 1999) emphasized the significance of these and other characteristic axial dimensions in determining aperture sizes and other parameters in machine design.When developing seed sizing, grading, and equipment for separating it from undesired materials (Ogunjimi *et al.*, 2002), the values of these physical dimensions would be crucial factors to take into account.The results show that surface area, aspect ratio, sphericity and porosity are (2.92 ± 0.58) cm^2, (0.64 ± 0.13) %, (0.76 ± 0.10) % and (45.42 ± 10.24) % respectively. The aspect ratio and sphericity of any grain or fruit determines its ability to roll or slide. The sphericity values indicate that the seed is almost spherical in shape and rolls easily on surfaces, particularly

in hoppers and dehulling machinery. Elevated sphericity and aspect ratio suggest that the seeds are heading toward a spherical form. These characteristics are helpful when designing equipment for dehulling.

The true density of each kernel was derived from the ratio of true mass to true volume which constitute an important consideration for material selection, machine component design and design of groundnut processing machine. The result of sphericity obtained by Firouzi *et al.* (2009) is in contrary to that obtained from this finding. The average true mass and volume of groundnut kernel are (0.49 ± 0.12) g and (0.47± 0.13) cm^3 while the true density is (1.08 ± 0.21) g/cm^3. True density is useful in figuring out how to separate food products from unwanted ingredients because, as noted by Fellow (2000), leaning is a crucial step in the food processing process. Grain and kernel samples can be subjected to the sinking and floating method since the densities of all the food products (fruits, seeds, nuts, and kernels, among others) are higher than those of water. This is in contrary to the result obtained by Firouzi *et al.* (2009). The bulk mass and volume of the groundnut kernel are 41.27g and 72.50 cm^3 while the bulk density is 0.569 g/cm^3. The bulk density as reported by Firouzi *et al.* (2009) ranges from 0.539 g/cm^3 to 0.435 g/cm^3 which is slightly in contrary to result obtained from findings.

Table 2: Physical Properties of Groundnut Kernel

Properties	Mean	SD	Min	Max
L (cm)	1.28	0.18	0.72	1.96
W (cm)	0.81	0.12	0.14	1.01
T (cm)	0.87	0.12	0.19	1.08
D_g (cm)	0.96	0.10	0.51	1.16
D_a (cm)	0.99	0.09	0.75	1.20
R_a (%)	0.64	0.13	0.10	1.10
S_a (cm^2)	2.92	0.58	0.83	4.20
S_p (cm)	0.76	0.10	0.36	1.04
ε (%)	45.42	10.24	5.13	75.25
Mt (kg)	0.49	0.12	0.22	0.86
Vt (m^3)	0.469	0.13	0.10	1.00
ρ_t (kg/m^3)	1.08	0.21	0.60	2.30

Where L is the length in cm, W is the width in cm, T is the thickness in cm, D_g is the size in cm, D_a is the arithmetic diameter in cm, R_a is the aspect ratio in %, S_a is the surface area in cm^2, S_p is the sphericity in cm, ε is the porosity in %, Mt is the true mass in kg, Vt is the true volume in m^3, ρ_t is the true density in kg/m^3.

3.2 Coefficient of Friction and Angle of Repose

The average values of coefficient of static friction of groundnut kernel for different surfaces as shown in Table 3 as 0.29 ± 0.12 for wood,0.32 ± 0.15 for stainless steel, 0.37 ± 0.18 for mild steel and 0.32 ± 0.15 for glass. This information is useful in designing components such as the hopper, shaft etc and determination of machine performance evaluation parameters such as efficiency, throughput capacity, percentage broken seed etc. The angle of repose ranges from 4^o to 33^o. As reported by Bagheri *et al*. (2011) the result obtained from the coefficient of static friction of groundnut on different surfaces is in contrary to that obtained from findings. According to Olajide and Igbeka (2003), the average static coefficients of friction against plywood that had grain perpendicular to the direction of motion, galvanized steel, and both were 0.47, 0.54, and 0.57, respectively. The angle at which chutes must be positioned to achieve a consistent flow of material through the chute is determined using the static coefficient of friction.

Table 3: Coefficient of Static Friction of Groundnut Kernel

Coefficient of Static Friction	Mean	SD	Min	Max
Wood	0.29	0.13	0.07	0.65
Stainless Steel	0.32	0.14	0.12	0.81
Mild Steel	0.37	0.18	0.11	1.00
Glass	0.32	0.15	0.07	0.78

3.3 Mechanical Properties

The values of the result obtained from the determination of mechanical properties of groundnut kernel are shown in the Table 4. The measured parameters are compressive force, toughness (strain energy) and Young's modulus. The compressive force is needed to cause crop to rupture. The force required to rupture the groundnut kernel was about 11.28 ± 20.13 kN. Toughness or strain energy is defined as the energy absorbed by the groundnut kernel prior to the kernel rupture per unit volume (Burubai *et al.,* 2008). Results showed toughness of the groundnut kernel as 20.99 ± 41.69 J. This is the measure of the stiffness and rigidity of the specimen. In other word it shows how easily the kernel surface can be deformed. The result obtained showed the value to be 531.56 ± 862.35 MPa**.** Comprehending the properties of agricultural materials in terms of stress, strain, and deformation is crucial for the development of equipment and

machines used in processing and handling, as well as for comprehending the material's response to applied force.

Table 4: Mechanical Properties of Groundnut Kernel

Mechanical properties	**Mean**	**SD**	**Min**	**Max**
Force (KN)	11.28	20.13	0.43	47.23
Energy (J)	20.99	41.69	1.49	95.57
Young Modulus (MPa)	531.56	862.35	1.85	1992.26

3.4 Chemical Properties

The values of the result obtained from the determination of chemical properties of groundnut kernel are presented in Tables 5, 6 and 7. The measured parameters are the proximate composition, physico-chemical characteristics and mineral composition of groundnut kernel.

3.4.1 Proximate composition

The mean values of the result obtained from proximate composition were as follows: Moisture Content (7.70 ± 0.01) %, Ash content (1.97 ± 0.02) %, Fat Content (42.69 ± 0.46) %, Crude fibre (3.90 ± 0.03) %, Crude protein (38.38 ± 0.18) %, and Carbohydrate content (5.37 ± 0.26) %. From the perspective of nutrition and textural quality, the total oil and protein content are significant. The prepared products' nutritional value and textural quality are crucial factors in determining their general acceptability (Sahadeva, 2014). The result for moisture content, crude fibre, crude protein and carbohydrate is slightly higher while the ash content and fat content is lower than that reported by Atasie *et al*. (2009).

Table 5: Proximate Composition of Groundnut Kernel

Proximate Composition	**Mean**	**SD**	**Min**	**Max**
Moisture Content (%)	7.70	0.01	7.695	7.712
Ash content (%)	1.97	0.02	1.954	1.977
Fat content (%)	42.69	0.46	42.360	43.014
Crude fibre (%)	3.90	0.03	3.876	3.921
Crude protein (%)	38.38	0.18	38.250	38.500
Carbohydrate content	5.37	0.26	5.188	5.553

3.4.3 Physico-chemical characteristics

The physico-chemical characteristics are as follows; free fatty acid (1.99 ± 0.03) mg/kOH/g, peroxide value (0.02 ± 0.001) Meq/kg, Saponification (253.73 ± 1.81) mg/kOH/g, and iodine value (36.68 ± 0.8) g/100g. The physico-chemical characteristics discussed by Atasie *et al*. (2009) differs from that in findings.

Table 6: Physico-chemical characteristics of Groundnut Kernel

Physico-chemical characteristics	Mean	SD	Min	Max
Free fatty acid (Mg/kOH/g)	1.99	0.03	1.96	2.01
Peroxide Value (Meq/kg)	0.02	0.00	0.02	0.02
Saponification (mg/kOH/g)	253.73	1.81	252.45	255.01
Iodine value (g/100g)	36.68	0.80	36.11	37.24

3.4.3 Mineral composition

From the results obtained, the sodium content is (60.75 ± 0.07) ppm, potassium (98.0 ± 1.41) ppm, magnesium (5.34 ± 0.02) ppm, calcium (71.55 ± 0.07) ppm, iron (1.10 ± 0.005) ppm, zinc (1.80 ± 0.35) ppm, and phosphorus content (60.15 ± 0.21) ppm. The result of mineral composition of groundnut obtained by Atasie *et al*. (2009) is in contrary to that obtained in findings. Zhao (2012) reported that each kilogram of shelled peanut kernels contained 35–45 g of peanut skin. A significant quantity of antioxidants found in peanut skins are beneficial to overall health. To reap the health benefits, the peanut skins are also added when making peanut butter. As a result, when the peanut butter with skins is prepared, the values in this study will aid in estimating the quantity of skins that may be present.

Table 7: Mineral Composition of Groundnut Kernel

Mineral Content	Mean	SD	Min	Max
Sodium, Na (ppm)	60.75	0.0707	60.7	60.8
Potassium, K (ppm)	98.0	1.4142	97.0	99.0
Phosphorus, P (ppm)	60.15	0.2121	60.00	60.30
Magnesium, Mg (ppm)	5.3435	0.0148	5.333	5.354
Calcium, Ca (ppm)	71.55	0.0707	71.5	71.6
Iron, Fe (ppm)	1.1035	0.0049	1.100	1.107
Zinc, Zn (ppm)	1.80	0.3536	1.50	2.00

4.CONCLUSIONS

The physical, mechanical and chemical (proximate, physico-chemical and nutrient content) properties of groundnut kernel purchased from a local market were determined. It is proposed that the effect of moisture content on the properties measured should be investigated. The engineering properties determined in this study constitute an important baseline data for the scientific design and development of various machines for handling and processing of the groundnut kernel.

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THE INFLUENCE OF NURSING TEAMWORK ON THE QUALITY OF CARE

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Abstract
Nursing is a profession inherently linked to teamwork. Collaboration and coordination among nursing team members impact the quality of care provided in healthcare institutions. This review aimed to analyze and discuss the influence of nursing teamwork on the quality of care. It is an integrative review. The search for original articles of primary research was conducted in the second week of February 2024, in the Scopus database. The review was guided by the following question: "What is the literature's perspective on the influence of nursing teamwork on the quality of care?" The terms used were: "nursing," "teamwork," and "care." Original research articles published in English in scientific journals within the last 10 years, including nurses as participants, whose full texts were available online, and that met the review's objectives were included. Initially, 14 articles were found, of which six were included in this review. The selected articles were assessed using the Mixed Methods Appraisal Tool (MMAT). It was identified that the way nursing teams work varies according to the department; however, nursing teamwork always impacts the quality of care, regardless of the sector. It was also observed that role and function ambiguities, difficulties in adapting to changes, exhausting work schedules, poor communication, professional training failures, inadequate leadership styles and nursing shortages are among the obstacles to forming cohesive nursing teams. In conclusion, nursing professionals should receive education to work as a team. Additionally, nurse managers play fundamental roles in developing healthy work environments that promote the formation and maintenance of cohesive nursing teams. It is important to note that the leadership styles adopted by nurse managers guide the attitudes of other team members, as nurse managers are role models for their followers. Thus, collaboration, effective communication, and coordination among nursing team members are strongly influenced by nurse managers.
Keywords: health management, leadership, nurse administrators, nursing, quality of health care, teamwork

Introduction

Due to rapid population growth, extended life expectancy, increased public awareness of health, and the dissemination of advanced technologies in the field, the demand for healthcare services has gradually risen. Additionally, intense competition within the sector has heightened the importance of the concept of quality in healthcare, which is widely discussed nowadays (Alzoubi et al., 2023; García-Moyano et al., 2019). In the pursuit of quality in healthcare services, teamwork emerges as a fundamental element (Bhowmik, 2021; Monalisa et al., 2023). In this context, the role of the nursing team, which represents the largest professional group in healthcare institutions, holds a prominent position (Alzoubi et al., 2023; Bıyık & Türe, 2020; Sahputra et al., 2021).The quality in healthcare services goes beyond the mere execution of technical procedures; it is intrinsically linked to the ability to address not only the physical but also the psychosocial needs of patients and the community (Sahputra et al., 2021). Thus, quality nursing care is based on a holistic approach that recognizes the uniqueness of each individual. This approach encompasses empathy, effective communication, and attention to the cultural and emotional characteristics of individuals (Frisch & Rabinowitsch, 2019). As members of the nursing team are consistently close to patients, they play fundamental roles in ensuring the quality of healthcare in addition to acting as important links between other healthcare workers and patients (Supri et al., 2019; Yang et al., 2022).Nursing care is a complex process so in its quality assessment, various factors are involved. The analysis of health indicators is commonly used as a technique in evaluating nursing care. These indicators include infection rates, patient falls, pressure ulcers, incorrect medication administration, hospital readmissions, and patient satisfaction, among others (Bıyık & Türe, 2020). Additionally, the qualification and training of the nursing team, the availability of necessary resources and equipment, as well as the overall working environment conditions are considered (Sahputra et al., 2021; Vituri et al., 2015). It is understood, therefore, that adequate infrastructure is fundamental for the team to work cohesively and provide efficient and safe care (Bhowmik, 2021). The evaluation of nursing professionals, including factors related to teamwork, effective communication, and interprofessional cooperation, is essential to ensure a collaborative approach in healthcare institutions (Zhao et al., 2021).Nursing is a profession intrinsically linked to teamwork. Nursing team members work based on interdependence and collaboration. For the nursing team to provide comprehensive and effective care, they must share knowledge and experiences and have common goals (Campbell et al., 2020; Olsen et al., 2020). Thus, the attitudes of nursing managers and the leadership styles they adopt should be emphasized, as management plays a

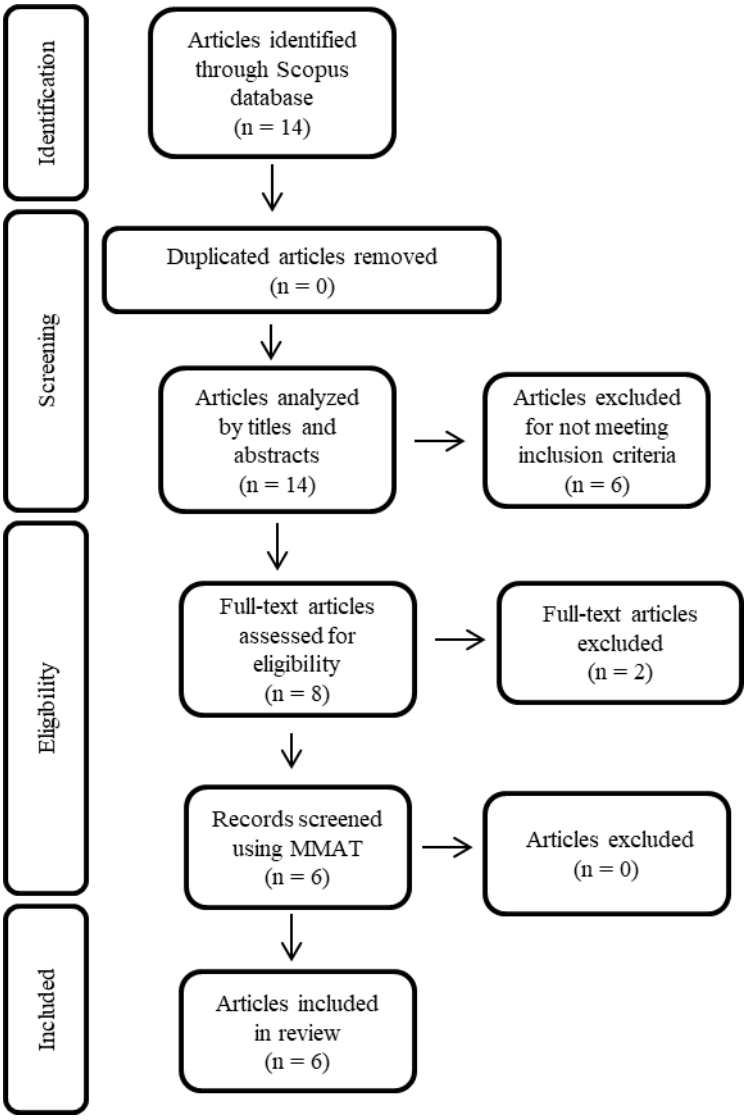
crucial role in forming and maintaining cohesive and collaborative nursing teams (Bhowmik, 2021; Campbell et al., 2020).The interrelation between nursing teamwork and the quality of care is indisputable (Bhowmik, 2021; Campbell et al., 2020). Nursing team members, through collaboration and integrated efforts, enhance their ability to identify and address patient needs. The exchange of information among nurses through effective communication leads to well-informed decisions, ensuring a more coordinated, productive, and effective workflow (Zhao et al., 2021). In this context, the importance of exploring the synergy between nursing teamwork and the delivery of quality care becomes evident. Thus, the objectives of this literature review were to analyze and discuss the influence of nursing teamwork on the quality of care.

Materials and Methods

This is an integrative review conducted based on the five stages proposed by Whittemore and Knafl (2005). Firstly, the research problem was formulated. Subsequently, searches were conducted to access relevant literature. The gathered information was then analyzed and evaluated in detail, and finally, the data were reported.The following question guided the review: "What is the literature perspective on the influence of nursing teamwork on the quality of care?" The search for articles took place during the second week of February 2024, using the Scopus database. Articles were sought based on their titles. The terms used were: "nursing," "teamwork," and "care". Original research articles published in English in scientific journals within the last 10 years, including nurses as participants, whose full texts were available online, and that met the review's objectives were included.A total of 14 articles were found. After initial analysis, three articles were excluded because they were not conducted with nurses, two others were discarded as they were not original research articles, and one article was excluded because the full text was not available online. After reading the full texts, two more articles were excluded for not meeting the review's objectives. Following these exclusions, the remaining six articles underwent a methodological assessment using the Mixed Methods Appraisal Tool (MMAT; Hong et al., 2018). It was observed that the articles had high methodological quality, and none of them were excluded after the assessment. However, in two studies, a reduced number of participants limited the representativeness of the studied population. The research flowchart is shown in Figure 1.After the methodological analysis, the information obtained from the included articles was organized and appropriately interpreted, allowing for critical considerations on the topic. Important characteristics of the included articles are presented in Table 1. Ethical standards followed the principles of accuracy of

information and attribution of authorship for the utilized studies, which were cited and referenced according to established guidelines.

Figure 1. Research flowchart



Findings and Discussion

Of the six articles included in the review, two are cross-sectional studies, two are qualitative research, one is a correlational study, and one is a mixed-methods study. The articles were published in five different journals between the years 2019 and 2023. The number of participating nurses ranged from 16 to 992. Two articles were conducted in Iran, one in the Netherlands, one in South Korea, one in Sweden, and one in the United Kingdom.

References	Country	Design/ sample	Main results
Anderson et al. (2019)	United Kingdom	Mixed-Methods Study/ 65 Nurses + Assistants	Positive relationship between teamwork and quality of care
Baek et al. (2023)	South Korea	Cross-Sectional Study/ 992 Nurses	Improving teamwork in nursing can promote patient-centered care
Beiboer et al. (2023)	Netherlands	Qualitative Study/ 16 Nurses	Constructive collaboration within the nursing team can positively influence care
Ghezeljeh et al. (2021)	Iran	Correlational Study/ 213 Nurses	Inverse relationship between teamwork and missed nursing care
Nobahar et al. (2023)	Iran	Cross-Sectional Study/ 200 Nurses	Higher levels of teamwork are associated with a reduction in missed nursing care
Sandelin et al. (2019)	Sweden	Qualitative Study/ 16 Nurses	In the absence of teamwork, patient safety may be compromised

Table 1. Synthetic compilation of the included articles

All six articles pointed to the relevance of nursing teamwork for the effective and efficient delivery of care (Anderson et al., 2019; Baek et al., 2023; Beiboer et al., 2023; Ghezeljeh et al., 2021; Nobahar et al., 2023; Sandelin et al., 2019). Anderson et al.'s (2019) study emphasized the importance of the nursing team's adaptability to different day-to-day situations, as variations in work processes and factors inherent to the external environment influence teamwork and, consequently, the quality of care. According to the study, in addition to nursing teamwork being threatened by communication failures and role ambiguities, issues related to adapting to changes are also challenges that hinder teamwork among nursing team members. Therefore, leadership and coordination are important for the team to work in harmony (Anderson et al., 2019).It was determined through the studies included in this review that when there is interaction and collaboration among nursing team members, including nurse managers, the team provides care more efficiently and effectively (Anderson et al., 2019; Sandelin et al., 2019). Various factors can challenge teamwork in nursing. A previously conducted systematic review highlighted similar points to those identified in this integrative literature review, emphasizing that lack of communication, human resource shortages, role conflicts, and leadership styles can be obstacles to nursing teamwork (Zhao et al., 2021).

The relevance of coordination and collaboration among nursing team members became even more evident in Beiboer et al.'s study (2023), where it was highlighted that the fact that some nurses work in pairs and others work individually impacts teamwork. In another study, it was determined that, in the case of operating room nurses, the best experiences of safe and efficient work were perceived when two colleagues collaborated during surgery, with one acting as the scrub nurse and the other as the circulating nurse. This underscores how teamwork impacts the quality of care (Sandelin et al., 2019). The influence of the number of members in the nursing team and the dynamics of teamwork on the quality of care, i.e., how nursing team members collaborate with each other, and its impact on patient outcomes were also identified in another literature review, reinforcing the results of the present review (Zhao et al., 2021). Therefore, it is evident that nursing teamwork is an important strategy in promoting patient-centered care (Baek et al., 2023). Studies conducted in different departments such as wards (Beiboer et al., 2023), emergency rooms (Ghezeljeh et al., 2021), and intensive care units (Nobahar et al., 2023) indicated a negative relationship between nursing teamwork and the occurrence of missed nursing care. In other words, the more cohesive the nursing team, the fewer the care omissions. Nursing teamwork is even more crucial in surgical centers, where effective dialogue is essential to ensure mutual understanding of intraoperative procedures. Therefore, the presence of committed managers on the front lines is also crucial (Sandelin et al., 2019). Consequently, clinical leadership is essential for the quality of nursing care (Beiboer et al., 2023). A previous integrative review highlighted the need for nursing management to implement measures to encourage the formation of productive and efficient nursing teams, thus avoiding errors and missing care (Campbell et al., 2020). A systematic review conducted in 2023 identified the importance of teamwork, with an emphasis on effective communication, to prevent the incidence of missing nursing care (Monalisa et al., 2023). Thus, it is understood that literature reviews conducted earlier support the current review, emphasizing the importance of leadership for nursing teamwork, and the relevance of collaboration among nursing professionals for the provision of quality care.There is a noticeable need to develop educational programs that address practical methods to promote constructive teamwork and the delivery of quality nursing care (Baek et al., 2023; Beiboer et al., 2023; Ghezeljeh et al., 2021). Furthermore, the commitment of healthcare institutions' administrators, including nurse managers, in creating favorable work environments can facilitate the improvement of teamwork and, consequently, patient-centered care (Baek et al., 2023; Ghezeljeh et al., 2021). Among the efforts of health institutions' managers to promote favorable work environments, strategies related to the

formation and maintenance of a skilled nursing team (Baek et al., 2023), establishment of appropriate work schedules (Baek et al., 2023; Ghezeljeh et al., 2021), allocation of well-defined roles and tasks, setting common goals (Anderson et al., 2019), implementation of appropriate regulations, facilitation of processes, improvement in interpersonal relationships, and development of activities that stimulate motivation (Ghezeljeh et al., 2021) should be present. It is evident that factors directly related to nursing management, such as coordination and leadership, are crucial for the maintenance of cohesive nursing teams (Campbell et al., 2020). Additionally, teamwork should be emphasized from graduation and reinforced through continuous education programs in healthcare institutions (Olsen et al., 2020; Zhao et al., 2021). Despite this literature review providing valuable insights into the studied theme, some limitations should be highlighted. The fact that articles were searched only by titles and in a single database is a significant weakness of the review. Another limitation to be considered is that only articles published in English were included, potentially excluding important studies published in other languages. Therefore, in future research, it is recommended that more comprehensive searches be conducted.

Conclusion and Recommendations

This review aimed to analyze and discuss the influence of nursing teamwork on the quality of care. It was identified that collaboration and coordination among members of nursing teams impact the quality of care. It was also observed that there are many obstacles to the formation of cohesive nursing teams, such as poor communication, role and function ambiguities, difficulties in adapting to changes, exhaustive work schedules, deficiencies in professional training, inappropriate leadership styles, and nursing shortages.Educators should pay attention to the development of practical teaching methods that encourage nursing teamwork from the first years of education of these professionals. The crucial role of nurse managers in creating healthy work environments that support the formation and maintenance of cohesive teams should also be emphasized. It is important to note that the leadership styles adopted by nurse managers will guide the attitudes of other team members since nurse managers act as role models for their followers. Thus, collaboration, effective communication, and coordination among the members of the nursing team are strongly influenced by nurse managers.

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SAĞLIK ALANINDA EĞİTİM GÖREN ÖĞRENCİLERİN AFETLERE KARŞI PSİKOLOJİK HAZIRLIK DÜZEYLERİNİN BELİRLENMESİ

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Özet
Afet, "Tehlikeli olayların maruziyet, savunmasızlık ve kapasite koşullarıyla etkileşime girdiği herhangi bir ölçekte bir toplumun işlevselliğinin ciddi şekilde bozulmasına, insan, malzeme, ekonomik ve çevresel kayıplara neden olan olay" olarak tanımlanmaktadır. Afetler genellikle uyarı olmaksızın gerçekleşir ve ölüm, yaralanma, travmatik stres gibi önemli olumsuz etkilere neden olur. Coğrafi yapısı ve iklim özellikleri nedeniyle Türkiye, özellikle depremler olmak üzere çeşitli afet türlerinin sıkça yaşandığı bir konumda bulunmaktadır. Türkiye'deki afetlerden kaynaklanan can kaybının yaklaşık %60'ı depremlerden kaynaklanmış olup, can ve mal kaybına neden olan depremler ortalama olarak beş yılda bir meydana gelmektedir. Toplum düzeyinde felaketlere hazırlık, kişisel koruyucu davranışlar olarak tanımlanabilir ve bireyleri öngörülemeyen durumlardan korumayı amaçlar. Tüm felaket yönetimi modelleri, beklenmedik durumlar için hazırlıklı olmanın önemini vurgulamaktadır. Afetlere hazırlık konusundaki çoğu çalışma, fiziksel veya malzeme hazırlıkları içermektedir. Oysa ki afetler için psikolojik hazırlık da en az diğer hazırlıklar kadar önemlidir. Özellikle sağlık alanında eğitim gören öğrenciler, meslekleri gereği afet durumlarında önemli bir rol üstlenirler ve bu nedenle psikolojik olarak hazırlıklı olmaları gerekir. Söz konusu öğrencilerin meslekleri nedeniyle afet sırasında hızlı ve etkili bir şekilde müdahale etmek için gerekli becerilere ve kaynaklara sahip olmaları gerekmektedir. Psikolojik hazırlık, onlar için bu tür stresli ve travmatik durumlarla başa çıkmalarına yardımcı olabilir. Psikolojik hazırlık düzeylerinin belirlenmesi, bu öğrencilerin afet öncesi, sırası ve sonrasında yaşayabilecekleri duygusal ve psikolojik tepkileri anlamamıza ve bunlara uygun destek ve kaynakları sağlamamıza yardımcı olabilir. Sağlık alanında eğitim gören öğrenciler, çalışma hayatında afet sonrası toplumların rehabilite edilmesi ve sağlık hizmetlerinin yeniden sağlanması gibi kritik görevlerde yer alırlar. Bu nedenle, sağlık öğrencilerinin psikolojik olarak sağlam bir zeminde olmaları, etkili bir şekilde görevlerini yerine getirmelerine ve topluma destek olmalarına yardımcı olacaktır. Önerilen çalışma kapsamında İstanbul'da faaliyet gösteren bir devlet üniversitesinde öğrenim gören 3667 sağlık alanı öğrencisine afet tehdidi için psikolojik hazırlık ölçeği aracılığıyla sorular sorulmuş ve Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi, Sosyal Çevrenin Yönetimi, Dış Durumsal Çevre Bilgisi ve Yönetimi alt boyutları incelenmiştir. Bu alt boyutlardan Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi alt boyutunda cinsiyete göre farklılaşma tespit edilmiştir. Ayrıca ölçeğin alt boyutları incelendiğinde öğrencilerin öğrenim gördükleri fakültelere göre sonuçların farklılaştığı tespit edilmiştir.
Anahtar Kelimeler: Afet, acil durum, psikolojik hazırlık, sağlık

EVALUATING THE PSYCHOLOGICAL PREPAREDNESS LEVELS FOR DISASTERS AMONG HEALTH FIELD STUDENTS

Abstract
Disaster is defined as an event that significantly disrupts the functionality of a society at any scale due to the interaction of exposure to hazardous events with conditions of vulnerability and capacity, leading to human, material, economic, and environmental losses. Disasters often occur without warning and result in significant negative impacts such as death, injury, and traumatic stress. Due to its geographical structure and climatic characteristics, Turkey is situated in a location where various types of disasters, especially earthquakes, frequently occur. Approximately 60% of the fatalities resulting from disasters in Turkey are due to earthquakes, and earthquakes that cause loss of life and property occur on average every five years. Preparedness for disasters at the societal level can be defined as personal protective behaviors aimed at protecting individuals from unforeseen circumstances. All disaster management models emphasize the importance of being prepared for unexpected situations. Most studies on disaster preparedness focus on physical or material preparations. However, psychological preparedness is equally important for disasters. Particularly, students undergoing education in the healthcare field play a significant role in disaster situations due to their professions and thus need to be psychologically prepared. These students must have the skills and resources necessary to intervene rapidly and effectively during disasters due to their professions. Psychological preparedness can help them cope with such stressful and traumatic situations. Determining the levels of psychological preparedness can help us understand the emotional and psychological responses these students may experience before, during, and after disasters, and provide appropriate support and resources accordingly. Students in healthcare education play critical roles in tasks such as rehabilitating post-disaster communities and re-establishing healthcare services in their professional lives. Therefore, ensuring that healthcare students are psychologically resilient will help them perform their duties effectively and support the community. In the presented paper, questions were asked to 3667 healthcare students studying at a state university in Istanbul using a psychological preparedness scale for disaster threats, and the sub-dimensions of Management of one's Emotional and Psychological Response, Management of One's Social Environment, Knowledge and Management of the External Situational Environment were examined. Differentiation was observed in the sub-dimension of Managing Emotional and Psychological Response by gender. Additionally, when the sub-dimensions of the scale were examined, it was found that the results varied according to the faculties in which the students were enrolled.
Keywords: Disaster, emergency, psychological preparedness, health

GİRİŞ

Afet, "Tehlikeli olayların maruziyet, savunmasızlık ve kapasite koşullarıyla etkileşime girdiği herhangi bir ölçekte bir toplumun veya bir toplumun işlevselliğinin ciddi bir şekilde bozulması, insan, malzeme, ekonomik ve çevresel kayıplara ve etkilere neden olan olay" olarak tanımlanmaktadır (AFAD,2018). Afetler genellikle uyarı olmaksızın gerçekleşir ve ölüm, yaralanma, travmatik stres gibi önemli olumsuz etkilere neden olur. Coğrafi, topoğrafik yapısı ve iklim özellikleri nedeniyle Türkiye, özellikle depremler olmak üzere çeşitli afet türlerinin sıkça yaşandığı bir konumda bulunmaktadır (AFAD,2020). Türkiye'deki afetlerden kaynaklanan can kaybının yaklaşık %60'ı depremlerden kaynaklanmış olup, can ve mal kaybına neden olan depremler ortalama olarak beş yılda bir meydana gelmektedir (Clode,2010). Toplum düzeyinde felaketlere hazırlık, kişisel koruyucu davranışlar olarak tanımlanabilir ve bireyleri beklenmedik, öngörülemeyen durumlardan korumayı amaçlar. Tüm felaket yönetimi çerçeveleri ve modelleri, beklenmedik durumlar için hazırlıklı olmanın önemini vurgular (Malkina ve Pykh,2015). Tarihsel olarak, müdahale kurumları insanları ve ailelerini ölümden veya yaralanmadan korumak, mali ve ekonomik kayıpları önlemek veya en aza indirmek için yapılması gereken fiziksel veya malzeme hazırlıklarına odaklanmışlardır (McLennan vd., 2022). Bu nedenle, felaketlere hazırlık konusundaki çoğu çalışma, bu tür fiziksel veya malzeme hazırlıkları içermektedir. Daha yakın zamanda, felaket araştırmacıları, fiziksel ve malzeme hazırlığın yanı sıra psikolojik veya zihinsel hazırlığın önemine de dikkat çekmişlerdir. Clode (2010); McLennan, Reynolds ve Trigg (2019); Malkina-Pykh ve Pykh (2013); Roudini vd. (2017); Suhaimi ve Marzuki (2016) gibi araştırmacılar, felaket tehdidine karşı psikolojik hazırlığın fiziksel/malzeme hazırlık kadar önemli olduğunu savunmuşlardır (McLennan,2020; Roudini,2017; Suhaimi ve Marzuki ,2016). Sağlık alanında eğitim gören öğrenciler, afet durumlarında önemli bir rol üstlenirler ve bu nedenle psikolojik olarak hazırlıklı olmaları gerekir. Öğrenciler, afet sırasında hızlı ve etkili bir şekilde müdahale etmek için gerekli becerilere ve kaynaklara sahip olmalıdır. Psikolojik hazırlık, bu tür stresli ve travmatik durumlarla başa çıkmalarına yardımcı olabilir. Psikolojik hazırlık düzeyleri, bu öğrencilerin afet öncesi, sırası ve sonrasında yaşayabilecekleri duygusal ve psikolojik tepkileri anlamamıza ve bunlara uygun destek ve kaynakları sağlamamıza yardımcı olabilir. Sağlık alanında eğitim gören öğrenciler, afet sonrası toplumların rehabilite edilmesi ve sağlık hizmetlerinin yeniden sağlanması gibi kritik görevlerde yer alırlar. Bu nedenle, psikolojik olarak sağlam bir zeminde olmaları, etkili bir şekilde görevlerini yerine getirmelerine ve topluma destek olmalarına yardımcı olabilir. Çalışmanın motivasyonu bu alanda derinlemesine bir araştırma

gerçekleştirmektir. Afet teriminin literatürde çeşitli kurumlar ve farklı kaynaklar tarafından yapılmış tanımlamaları mevcuttur. Uluslararası yayınlarda ve birçok kaynakta ortak tanım olarak UNISDR tarafından 2009 yılındaki raporda geçen tanım kullanılmaktadır. Söz konusu tanımlamada afet: "Maruz kalma, korumasızlık ve sığa koşullarıyla etkileşime giren ve tehlikeli olaylar nedeniyle herhangi bir ölçekte bir topluluğun veya toplumun işleyişinin ciddi şekilde bozulması: insan, malzeme, ekonomik ve çevresel kayıplar ve etkiler" olarak belirtilmiştir (UNDRR,2009). Ülkemizin Afet ve Acil Durum Yönetmeliği Başkanlığının (AFAD) verilerinde afet, toplumun genelini veya toplumun bir kesimi için ekonomik, fiziksel ve sosyal kayıplar ortaya çıkaran günlük hayat akışını ve çeşitli insan aktivitelerini devamlılığını engelleyen veya durduran, maruz kalan toplumun kaynaklarının yetemediği doğa, teknoloji veya insan merkezli olay olarak tanımlanmaktadır (AFAD,2014). Afet türleri en genel ayrım ile doğal afetler ve insan kaynaklı afetler olmak üzere ikiye ayrılmaktadır. Doğal afetler toplumlar ve yaşam alanlarında tahribata ve yıkıma neden olur. Afet sonucu ortaya çıkan kaos ortamı yaralanmalara, can kayıplarına, çeşitli salgınlara sebebiyet verir. Yerleşim yerlerine verdiği zarar sonucu bölge planlamasında ve yatırım planlarında gerileme gerçekleşir (Ergünay, 2000). Ülkemizde en sık görülen doğal afet depremdir. Heyelanlar ve su baskınları depremden sonra ülkemizde en sık görülen doğal afetlerdir (Ergünay, 2007). İnsan kaynaklı afetler ihmalkarlık ve art niyet sonucu insanlığı direkt veya direkt olmayan yollarla etkileyen afetlerdir. Terör eylemleri, biyolojik silahlar, siber saldırılar, kimyasal ve endüstriyel saldırılar, salgınlar, besin zehirlenmeleri, tehlikeli maddelerin taşınması sonucu meydana gelen kazalarda bu kategoride değerlendirilir (Altun, 2018).Afetler söz konusu olduğundan doğal olarak afet yönetimi kavramı ortaya çıkmaktadır. Afet yönetiminin amacı, afet sonucu meydana gelen olayların engellenmesi ve afet sonucu olaylarda ve durumlarda en az hasarı almak için afet öncesinde, afet anında ve afet sonrasında gereken faaliyetlerin gösterilmesi, afet sonucu zararı azaltmasıyla iyileştirme ve müdahale çalışmaları için gerekli düzenlemelerin yapılması ile yönlendirme faaliyetleriyle gerekli amaçlarla yönetilmesidir. Afet yönetimi dört basamaktan oluşmaktadır. Zararı azaltma, hazırlıklı olmak, müdahale ve iyileştirme çalışmalarıdır (Kadıoğlu ve Özdamar, 2008). Afet yönetimi döngüsünde zararı azaltmak ve hazırlık afet öncesi basamaklar iken müdahale ve iyileştirme afet sonrası basamaklardır.Zararı Azaltmak: Bu basamak, uzun vadede risk yaratacak durumları belirlemeyi ve bu tehlikelere karşı kaybın azaltılması için önceden önlem almayı içerir. Bu faaliyetler bölgesel yerleşim, bölge yapısının incelenmesi, afet sonrası yerleşkelerin belirlenmesini organize etmek ve risk durumlarını değerlendirmektir (Altay ve Green, 2005).

Hazırlıklı Olmak: Bu basamak acil durum sırasında yetki ve görevlerin belirlenmesini, kaynakların organize edilmesini içerir. Acil durum sırası yüküm ve sorumlulukların belirlendiği, kaynak ve materyallerin önceden hazırlandığı basamaktır. Bu basamakta acil durum programları yapılmalı, yapılan programlarla ilgili çeşitli eğitimler verilmeli ve iletişim altyapıları geliştirilmelidir (Altıntaş ve ark. 2012).Müdahale: Afete sebebiyet veren olay ve buhran anında oluşan mal ve can kaybını engellemek veya en azda tutmak için yapılan çalışmalardır (kurtarma faaliyetleri). Görevli sağlık çalışanların psikolojisi ve emniyetinin sağlanması, ilk yardım ve travma bakımları, gıda güvenliği, salgınlar, cinsel ve üreme sağlığı ve ruhsal sağlık hizmetleri gibi ilk düzey sağlık hizmetleri afet tıbbının uygulamaları arasındadır (Copolla, 2007).İyileştirme: Bu basamak afetten etkilenen her türlü vatandaşların günlük hayatlarına yeniden entegre olmalarını içeren çalışmalar bütünüdür. Müdahale çalışmalarından sonra başlar ve afetin yarattığı etkinin büyüklüğün göre devam eder (Copolla,2007).Afetlerin insan yaşamında ve toplum içinde oluşturduğu felaket kaynaklı psiko-sosyal tesirleri vardır. Bu tesirleri psikolojik açıdan konulara ayırmak anlaşılırlığı açısından önemlidir. Afet öncesi, anında ve sonrasında psikolojik etkileri birbirinden farklılık göstermektedir (Swanson ve Smith, 2013). Afetlerin psiko-sosyal olarak bireyleri etkilemesi afet öncesi hazırlığa yönelimi sağlar. Bireyler bu durumda olası afet korkularını arttıracağı fikriyle afete yakalanacağı düşüncesini görmezden gelmeye çalışarak yatışmaya çalışırlar (Çorbacıoğlu, 2005). Afetlere yönelik psikolojik hazırlığı bireyin afete dönük psikolojik ve duygu içerikli davranışlarını idare etme özelliği kazandırması ile ilişkilendirilmektedir (Boylan,2016). Roudini ve ark. (2017) bireylerinin büyük bir kısmının afetlerin bireylerde yarattığı negatif psikolojik etkilerinden habersiz olduğunu belirtmişlerdir. Afetlere hazırlıkta genellikle daha temel ve acil fiziksel ihtiyaçlar temin edilmekte, kişileri afetlere psikolojik yönden hazırlamak görmezden gelinmekte ve buna yönelik faaliyetler arka plana atılmaktadır (Roudini vd., 2017). Tam tersine afetlerin gerçekleşmesi kesin olmasa bile bireyler ve toplumlar afetlere psikolojik yönden hazır olmaları, olası afetler gerçekleştiğinde onları daha bilinçli davranmaya itecektir ve bunun sonucu kritik yaralanma ve ölümler azalacaktır. Bu nedenle olası afetlerden önce psikolojik yönden afetlere hazır olmayı arttıracak eğitimler ve bilgiler, bu alanda işlevselliğin devamı için önemlidir (Oflaz, 2008). Demirbilek ve Gökkaya'nın yaptığı (2022) acil yardım ve afet yönetimi öğrencilerinin afetlere hazırlık durumları ile psikolojik sağlamlık durumlarının ilişkisinin inceledikleri araştırma sonucu acil durum afet yönetimi lisans öğrencilerinin aldığı eğitimin öğrencilerde pozitif bir etkide olduğu öğrencilerde afete hazırlık ve öz yeterliliklerini geliştirdiği söylenmektedir. Bu veriler doğrultusunda diğer

bölümlerdeki öğrencilerin müfredatlarına afet eğitimi konulmasının öğrencilerin psikolojik sağlamlıklarına katkı sağlayabileceği ön görülmüştür (Demirbilek ve Gökkaya,2022). Karakış (2019) hemşirelerle yaptığı çalışmasında psikolojik sağlamlık arttıkça hemşirelerde afetlere karşı hazırlanma düzeyinin de arttığı tespit etmiştir (Karakış,2019). Afet eğitimlerinin hedefi, bireylerin afetlere karşı dayanıklılıklarını güçlendirmek ve onları afetlere hazırlayarak iyileşme süreçlerinin etkinliğini artırmaktır (Ronan ve Towers, 2014). Afet eğitimlerinin bir diğer hedefi de bireylerin, kurumların vb. doğru bilgiye erişmesi ve bunu uygun zamanlama ile etkili bir şekilde kullanmasını sağlamaktır (Mızrak, 2018). Dünyada yapılan afet eğitimlerine "acil durum eğitimi", "karmaşık durumlarda eğitim", "hassas durumlar ve eğitim", "eğitim ve krizler", "eğitim ve kriz sonrası geçiş" ve "eğitim ve doğal afetler" gibi isimleri kullanılmaktadır (Mangione vd., 2013). Afet eğitimlerinde öğrenme ve öğretme tekniklerini çeşitlendirmek; tahliye alanlarını, barınma yerlerini, afetlerde hayatlarını kaybedenlerin mezarlarını ziyaret etmek gibi etkinlikler afet risk azaltma çalışmalarında amaca hizmet edebilir ve bireylerin farkındalıklarını arttırabilir (Adiyoso ve Kanegae, 2012). Okulda, ailede ya da kendi çabalarıyla afet eğitimi almış bireylerin afet sırasında bilgi ve becerilerini kullanmada, afet sonrasında ise hayatta kalma davranışlarına bakılan çalışmalarda eğitimlerin hem teorik hem de pratik olarak uygulandığında daha etkili olduğu ortaya görülmektedir (Codreanu vd., 2014). Afet eğitimlerinin hedeflerine ulaşabilmesi için, uzman ve deneyimli eğitmenler tarafından gerekli olan doğru bilgi, uygun teknikler ve etkili uygulamalarla bireylere aktarılmalıdır. Aksi halde bireyler yanlış bilgiler öğrenebilirler ve konuya ilgilerini kaybedebilirler (Mızrak, 2018). Afetlere hazırlık aşamasında kullanılan yazılımlar çalışmaları verimli hale getirebilir. Eğitimlerde Sanal Gerçeklik (Virtual Reality/VR) ve Artırılmış Gerçeklik (Augmented Reality / AR) gibi uygulamaların kullanılması, gerçeğe yakın deneyim yaşatacağından, etkinliği geliştirebilir (Acar ve Çağdaş, 2019).

MATERYAL VE YÖNTEM

Afet tehditlerine karşı psikolojik olarak hazırlıklı olmak, insanların acil uyarı döneminin ve tehlikenin etkileriyle başa çıkabilme yeteneklerini artırabilir. Bu durum, insanların kendilerini daha güvende hissetmelerine, daha kontrollü davranmalarına ve daha iyi hayatta kalma kararları almalarına yardımcı olabilir. Ayrıca, bireyleri psikolojik olarak afetlerin etkilerine hazırlamak, ev halkını afet kaynaklı travmanın yol açabileceği zararlı psikolojik sıkıntılardan ve uzun vadeli ruh sağlığı sorunlarından koruyarak afetlerin olumsuz zihinsel etkilerini azaltabilir (Roudini ve ark., 2017; Zakur, 2023). Bu nedenle, kriz öncesi psikolojik hazırlık, insanların duygularını

öngörmelerine, tanımalarına ve kontrol etmelerine yardımcı olarak daha iyi başa çıkmalarını sağlayabilir. Belirli bir risk altındaki topluluklarda psikolojik hazırlığın bir parçası olarak değerlendirilmesi gereken unsurlar, o topluluğun karşılaşabileceği doğal tehlike tehditlerinin yanı sıra pratik ve maddi yerel ihtiyaçlarını ve mevcut kaynaklarını da göz önünde bulundurmalıdır. Bu unsurların tümü, kültürel olarak kabul edilebilir olmalıdır. Bu nedenle, belirli topluluklardaki bireylerin, karşılaşabilecekleri felaket türleriyle başa çıkmak için psikolojik olarak nasıl hazırlıklı olacaklarını belirlemek için araştırmalara ihtiyaç vardır.Önerilen çalışma kapsamında İstanbul'da faaliyet gösteren bir devlet üniversitesinde öğrenim gören 3667 sağlık alanı öğrencisine afet tehdidi için psikolojik hazırlık ölçeği aracılığıyla sorular sorulmuştur. Çalışmada Görgün vd. tarafından Türkçe versiyonunun geçerlik ve güvenirliği çalışılan 26 maddelik Avustralya Afet Tehditlerine Psikolojik Hazırlık Ölçeği kullanılmıştır (Görgün vd., 2023). Anket (soru onam formu) iki bölümden oluşmaktadır. 1.Sosyodemografik veri formu: Sosyodemografik veri formunun kullanım amacı uygulanan anketlere katkı sağlayan bireyler hakkında detaylı bilgi edinmektir. Anket ve belirli formları pekiştirmek, istenilen verileri tamamlamak üzere sorular oluşturulmuştur. Yaş, cinsiyet, gibi bilgilere bu şekilde ulaşılmaktadır.2. Afet Tehdidi İçin Psikolojik Hazırlık Ölçeği envanteri:Bu form Zulch tarafından 2019 yılında geliştirilmiştir. Örgün vd. tarafından 2023 yılında Türkçeye uyarlanmıştır. Ölçeğin orijinali 26 ifadeden oluşmaktadır ve cronbach alfa değeri 0,93 tür. Türkçe 'ye uyarlanması ise 21 sorudan oluşmakta ve cronbach alfa değeri 0,95'tir. Söz konusu değerler 0,6 üzerinde olduğundan ölçeğin güvenilir olduğu kabul edilmektedir.

Afet Tehdidi için Psikolojik Hazırlık Ölçeği

	Kesinlikle Katılmıyorum	Katılmıyorum	Kısmen Katılıyorum	Kesinlikle Katılıyorum
1.Şiddetli deprem, sel, orman yangını veya salgın hastalık gibi doğal afet durumlarında ne yapacağımı ve hangi önlemleri alacağımı bilirim.	1	2	3	4
2.Deprem, sel, orman yangını veya salgın hastalık gibi doğal afet uyarısı durumunda hazırlık malzemelerinin yerini kolayca bulabilirim.	1	2	3	4
3.Deprem, sel, orman yangını veya salgın hastalık gibi yaklaşan doğal afet dönemi için evimi nasıl yeterince hazırlayacağımı biliyorum.	1	2	3	4
4.Deprem, sel, orman yangını veya salgın hastalık gibi doğal afetler için kullanımıma sunulan hazırlık malzemelerine aşinayım.	1	2	3	4
5.Çok şiddetli bir deprem, sel, orman yangını veya salgın hastalık gibi doğal afet durumunda güvende kalmak için hangi ev hazırlık önlemlerinin alınması gerektiğini biliyorum.	1	2	3	4
6. Deprem, sel, orman yangını veya salgın hastalık gibi yaklaşan bir doğal afetin belirtilerini tanıyorum	1	2	3	4
7.Deprem, sel, orman yangını veya salgın hastalık gibi doğal afetlere ilişkin acil bir durum gelişmesi halinde, evimde ve iş yerimde nelere dikkat etmem gerektiğini biliyorum.	1	2	3	4
8.Deprem, sel, orman yangını veya salgın hastalık gibi aşırı doğal afet olayları için kullanılan afet uyarı sistemi mesajlarını tanıyorum.	1	2	3	4
9. Çok şiddetli deprem, sel, orman yangını veya salgın hastalık gibi doğal afetlerin evim üzerindeki etkileri hakkında bilgi sahibiyim	1	2	3	4
10.İçinde bulunabileceğim stresli durumlarla başa çıkabilme yeteneğime oldukça güveniyorum	1	2	3	4
11.Şiddetli bir deprem, sel, orman yangını veya salgın hastalık gibi doğal afet durumunda endişe ve korkumla başa çıkabilirim.	1	2	3	4
12.Zor durumlarda duygularımı oldukça iyi yönetebildiğimi düşünüyorum.	1	2	3	4
13.Gerektiğinde zorlu durumlarda kendimle konuşabilirim.	1	2	3	4
14.En zor durumlarda soğukkanlı ve sakin gözükürüm	1	2	3	4
15.Şiddetli bir deprem, sel, orman yangını veya salgın hastalık gibi doğal afet durumunda kendimi sakinleştirmek için hangi stratejileri kullanabileceğimi biliyorum	1	2	3	4
16.Kendimi deprem, sel, orman yangını veya salgın hastalık gibi bir doğal afetin içinde bulsaydım, duruma karşı tepkimi nasıl yöneteceğimi bilirdim	1	2	3	4
17. Çevremdekilerin/başkalarının sıkıntıda olup olmadığını kolaylıkla anlayabilirim	1	2	3	4
18. Başkaları sıkıntıdaysa, onları nasıl sakinleştireceğimi bilirim	1	2	3	4
19. Şiddetli bir deprem, sel, orman yangını veya salgın hastalık gibi doğal afet uyarısı durumunda, başkalarını sakinleştirmek için hangi stratejileri kullanabileceğimi biliyorum.	1	2	3	4
20. Zorlu durumlarda duygularımı oldukça iyi tanımlayabilirim	1	2	3	4
21. Genellikle zor veya stresli olabilecek durumlara zihinsel olarak hazırlanırım	1	2	3	4

Verilerin analizi SPSS 25 paket programı kullanılarak gerçekleştirilmiştir. Kategorik değişkenler için yüzde ve frekans değerleri; nicel değişkenler için ise normal dağılıma uygunluk durumlarına göre aritmetik ortalama ve standart sapma ya da medyan, minimum ve maksimum değerleri sunulmuştur. Kategorik değişkenlerle nicel değişkenlerin karşılaştırılmasında; öncelikle verilerin normal dağılıma uygunlukları Shapiro-Wilk testi kullanılarak sınanmıştır. İki kategori içeren kategorik değişkenlerle nicel değişkenlerin karşılaştırılmasında bağımsız örneklem T testi, ikiden çok kategori içeren değişkenlerle nicel değişkenlerin karşılaştırılmasında tek yönlü varyans analizi (ANOVA) kullanılmıştır. Araştırma ile ilgili yapılan Power analizine göre %5 hata payı %80 güç ile gerekli örneklem büyüklüğü 689 olarak hesaplanmıştır; buna göre bu çalışma için minimum gerekli örneklem sayısı 689 olarak belirlenmiş olup çalışmada 3667 kişiye ulaşılmıştır.

BULGULAR

Önerilen çalışma kapsamında İstanbul'da faaliyet gösteren bir devlet üniversitesinde öğrenim gören 3667 sağlık alanı öğrencisine afet tehdidi için psikolojik hazırlık ölçeği aracılığıyla sorular sorulmuş ve araştırmaya 2824 kız öğrenci ve 843 erkek öğrenci katılmıştır. Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi, Sosyal Çevrenin Yönetimi, Dış Durumsal Çevre Bilgisi ve Yönetimi alt boyutları incelenmiştir. Çalışmadan elde edilen bulgulara göre; bu alt boyutlardan *Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi* alt boyutunda cinsiyete göre farklılaşma tespit edilmiştir. Bu alt boyutta elde edilen sonuçlara göre erkek öğrencilerde duygusal ve psikolojik tepki yönetimi daha başarılı olarak tespit edilmiştir. İlgili sonuçlar Tablo 1'de verilmiştir.

Tablo 1. Cinsiyet & Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi İlişkisi

	N	Ortalama	Standart Sapma	Maksimum	Minimum	Medyan	F1	F2	F3
F1	3667	3,165	0,572	4	1	3,111	1		
F2	3667	3,045	0,658	4	1	3,000	0,668	1	
F3	3667	3,120	0,669	4	1	3,000	0,649	0,749	1
						Yaş	-0,078	-0,033	-0,045

		N	Ortalama	Standart	t	t
F1	Kadın	2824	3,16	0,632	-0,633	0,527
	Erkek	843	3,18	0,553		
F2	Kadın	2824	3,00	0,647	-7,795	0,000
	Erkek	843	3,20	0,655		
F2	Kadın	2824	3,11	0,714	-0,880	0,379
	Erkek	843	3,14	0,656		

Yaş	
Ortalama	21,16179284
Standart Sapma	3,229351221

Ayrıca ölçeğin alt boyutları detaylı incelendiğinde öğrencilerin öğrenim gördükleri fakültelere göre sonuçların farklılaştığı tespit edilmiştir. *Dış Durumsal Çevre Bilgisi ve Yönetimi* (F1) alt boyutu, *Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi* (F2) alt boyutu ve *Kişinin Sosyal Çevresinin Yönetimi* (F3) alt boyutuna göre; tıp fakültesi öğrencileri daha iyi farklılaşma gösterirken ilgili boyutlardan F1 alt boyutu için uluslararası tıp fakültesi öğrencilerinin, F2 ve F3 alt boyutları için eczacılık fakültesi öğrencilerinin daha düşük farklılaşma gösterdikleri tespit edilmiştir. İlgili sonuçlar Tablo 2, Tablo3 ve Tablo 4'te ifade edilmiştir.

Tablo 2. Dış Durumsal Çevre Bilgisi ve Yönetimi & Akademik Birim İlişkisi

Gruplar	Sayı	Toplam	Ortalama	Varyans
Hemşirelik Fakültesi	320	1019,556	3,186111	0,395379
Sağlık Bilimleri Fakültesi	1350	4252,778	3,150206	0,289468
Eczacılık Fakültesi	254	779,7778	3,069991	0,288841
Sağlık Hizmetleri MYO	1197	3878,556	3,24023	0,294465
Diş Hekimliği Fakültesi	225	686,2222	3,049877	0,354809
Tıp Fakültesi	6	19,77778	3,296296	0,161317
Uluslararası Tıp Fakültesi	246	752,2222	3,057814	0,582081
Yaşam Bilimleri Fakültesi	69	218,6667	3,169082	0,266742

ANOVA

Varyans Kaynağı	*SS*	*df*	*MS*	*F*	*P-değeri*	*F ölçütü*
Gruplar Arasında	15,41763	7	2,202518	6,812891	4,63357E-08	2,012083
Gruplar İçinde	1182,907	3659	0,323287			
Toplam	1198,324	3666				

Tablo 3. Kişinin Duygusal ve Psikolojik Tepkisinin Yönetimi & Akademik Birim İlişkisi

Gruplar	Sayı	Toplam	Ortalama	Varyans
Hemşirelik Fakültesi	320	980	3,0625	0,45322
Sağlık Bilimleri Fakültesi	1350	4069,111	3,014156	0,390651
Eczacılık Fakültesi	254	730,8889	2,877515	0,443436
Sağlık Hizmetleri MYO	1197	3732,778	3,118444	0,427039
Diş Hekimliği Fakültesi	225	681,4444	3,028642	0,396001
Tıp Fakültesi	6	19,44444	3,240741	0,629218
Uluslararası Tıp Fakültesi	246	746,4444	3,034327	0,62245
Yaşam Bilimleri Fakültesi	69	204,6667	2,966184	0,495753

ANOVA

Varyans Kaynağı	*SS*	*df*	*MS*	*F*	*P-değeri*	*F ölçütü*
Gruplar Arasında	15,7103	7	2,244328	5,222072	6,09743E-06	2,012083
Gruplar İçinde	1572,555	3659	0,429777			
Toplam	1588,266	3666				

Tablo 4. Kişinin Sosyal Çevresinin Yönetimi & Akademik Birim İlişkisi

Gruplar	Sayı	Toplam	Ortalama	Varyans
Hemşirelik Fakültesi	320	1000,6667	3,1270833	0,4916362
Sağlık Bilimleri Fakültesi	1350	4151,3333	3,0750617	0,4251333
Eczacılık Fakültesi	254	747,66667	2,9435696	0,442565
Sağlık Hizmetleri MYO	1197	3851,3333	3,2174882	0,4001696
Diş Hekimliği Fakültesi	225	693,66667	3,082963	0,4563801
Tıp Fakültesi	6	20,333333	3,3888889	0,2407407
Uluslararası Tıp Fakültesi	246	749	3,0447154	0,6868813
Yaşam Bilimleri Fakültesi	69	226,33333	3,2801932	0,3582457

Varyans Kaynağı	*SS*	*df*	*MS*	*F*	*P-değeri*	*F ölçütü*
Gruplar Arasında	25,932218	7	3,7046026	8,3829571	3,364E-10	2,0120827
Gruplar İçinde	1616,988	3659	0,4419207			
Toplam	1642,9202	3666				

SONUÇ VE ÖNERİLER

Afetlerle mücadelede öncesi ve sonrası olarak yapılan gruplandırmalarda gerek afet öncesinde alınacak önlemlerde gerekse afet sonrası yapılacak işlemlerde süregelen geleneksel yaklaşım çoğunlukla fiziksel hazırlık veya önlemlerden bahsetmektedir. Yapıların, yaşam alanlarının afetlere dayanıklı oluşturulması, şehir planlamaları, tatbikatlar, sigortalamalar vb. uygulamalar afetlere fiziksel hazırlıkları içermektedir. Oysa günümüzde afetlere karşı psikolojik hazırlık en az fiziksel hazırlık kadar önem arz etmektedir. Her türlü afetle mücadelede her aşamada etkin rol alacak sağlık profesyonellerinin afetlere karşı psikolojik hazırlık düzeylerinin belirlenmesi bu noktada oldukça önemli hale gelmektedir. Bir sağlık profesyoneli, insanlara sistematik bir şekilde önleyici, iyileştirici veya rehabilite edici sağlık hizmeti sunan kişi olduğundan bu kişilerin psikolojik dayanıklılık seviyeleri, beklenmedik olaylar karşısındaki tepkileri, kendilerini toparlama süreçleri ve gerek kendileri gerekse içinde bulundukları çevre için kriz yönetebilme kabiliyetleri afetlerin başarılı yönetimi hususunda önemlidir. Afetlerde aktif olarak görev alacak sağlık profesyonelleri, etkilenen nüfusun demografik özelliklerini bilen, sosyal becerileri gelişmiş, iletişim yetenekleri güçlü, afetin farklı evrelerini, yas süreçlerini ve stresin doğasını anlama becerisine sahip olmalıdır. Ayrıca, kendileri ve diğer çalışanlar için stres yönetimi tekniklerini bilmeleri gerekmektedir. Gerektiğinde topluluklara etkili bir şekilde hitap etmek, medya ile iş birliği yapmak, toplu bakım merkezlerinde yönetimi sürdürmek, toplum liderleriyle iletişim kurmak ve bu ilişkiyi sürdürmek, organizasyonun dinamiklerini ve politik süreçlerini anlamak da sağlık profesyonelleri için hayati önem taşımaktadır. İfade edilen gerekçelerden dolayı sağlık profesyonelleri için henüz mesleklerini öğrendikleri öğrencilik

yıllarından itibaren afet yönetimi eğitimi hakkında teorik ve uygulamalı eğitimler almalarının faydalı olacağı düşünülmektedir.

Sağlık profesyonellerinin öğrencilik döneminden itibaren afet yönetimi eğitimi almaları, onların afetlere karşı psikolojik hazırlık seviyelerini önemli ölçüde artıracaktır. Bu eğitimler, sağlık profesyonellerine afetlerin farklı evreleri, etkileri ve yönetimi konularında derinlemesine bilgi sağlar. Özellikle afetlerin psikososyal etkileri ve insan davranışları üzerine odaklanan eğitimler, sağlık profesyonellerinin afet sırasında daha etkili ve duyarlı bir şekilde hareket etmelerini sağlayabilir. Bu şekilde, sağlık profesyonelleri afet anında karşılaşabilecekleri stres, belirsizlik ve travma gibi durumlarla daha iyi başa çıkabilirler. Ayrıca, afet yönetimi eğitimi alan profesyoneller, toplumların afet öncesi, sırası ve sonrasında ihtiyaç duyduğu sağlık hizmetlerini daha etkin bir şekilde planlayabilir ve uygulayabilirler. Bu sayede, sağlık profesyonelleri için afetlerin insan sağlığı üzerindeki etkilerini en aza indirme ve toplumların daha hızlı bir şekilde iyileşmesine katkıda bulunma potansiyellerinin artacağı düşünülmektedir.

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HARPAGOPHYTUM PROCUMBENS'İN YARA İYİLEŞMESİNE ETKİLERİNİN DEĞERLENDİRİLMESİ: BİR IN VITRO ÇALIŞMA

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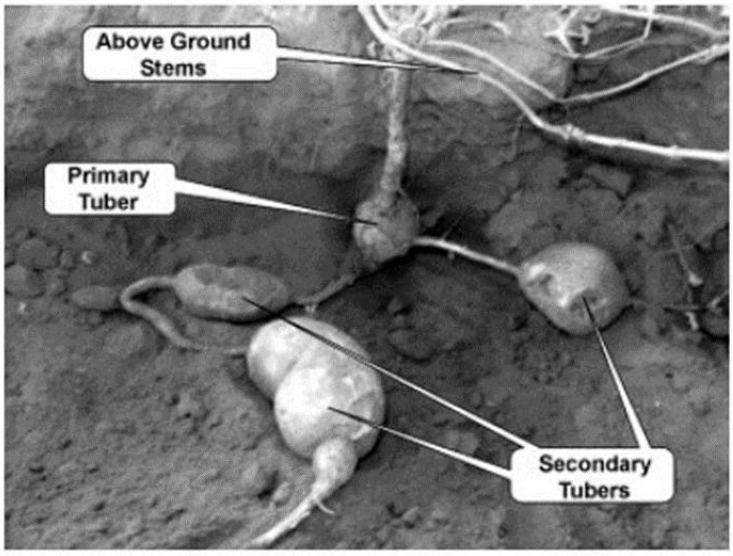
Özet
Bitkiler içerdikleri droglar nedeniyle geleneksel tıpta hastalıkların tedavisi için kullanılabilmektedir. Günümüzde mevcut modern tıp uygulamalarında yer alan tedavi etkinliği gösterilmiş ilaçlar genellikle aktif madde içeriği zengin olan bitki türlerinden saflaştırılarak veya biyoteknolojik uygulamalarla laboratuvar ortamında üretilmiş saf etken maddeleri kapsamakla birlikte tedavi aşamasında karşılaşılabilen yan etkiler nedeniyle yeni ve etkili ajanların veya destekleyici detavi ajanlarının kullanımını gerektirmektedir. *Harpagophytum procumbens*'in zengin glikozid, triterpenoid, fitosteroller, aromatik asit ve flavonoidler gibi biyoaktif madde içeriğinden dolayı, geleneksel tıpta kan hastalıkları, ateş, dispepsi, idrar yolu enfeksiyonları, yara ve yanık iyileşmesi ve birçok deri hastalığının tedavisi için kullanımı bildirilmiştir. Literatürde, hücre canlılığını koruyucu etkisi rapor edilmiş olan *Harpagophytum procumbens*'in yara iyileşmesi üzerinde potansiyel etkilerini fibroblast hücrelerinde araştırmış bir çalışmaya henüz rastlanmamıştır. Bu çalışmada fare fibroblast hücreleri (NIH/3T3) kullanılarak oluşturulmuş *in vitro* yara modelinde *Harpagophytum procumbens*'in potansiyel yara iyileştirici etkisi ışık mikroskopi tekniği kullanılarak değerlendirilmiştir. Çalışma sonuçlarında bu bitkinin yapay skar alanını konsantrasyon ve zamana bağlı olarak onardığı gösterilmiştir. Bu doğrultuda *Harpagophytum procumbens* bitkisinin yara iyileşmesinin tetikleyici veya kolaylaştırıcı etkisinin daha ileri mekanistik çalışmalar ve *in vivo* yara modellerinde araştırılması, ekstre içerisinde bulunan etken maddelerin ayrı ayrı izole edilerek ve farklı konsantrasyonlar halinde kombinlenerek uygulandıklarında hücre içinde etkileştiği hedef moleküllerin saptanması ve ilgili etkileşimlerin moleküler mekanizmalarının aydınlatılması için yüksek potansiyel taşıdığını düşünmekte ve bu konuda farmasötik ve farmakokinetik araştırmalar için *Harpagophytum procumbens* bitkisini önermekteyiz.
Anahtar Kelimeler: Harpagophytum procumbens, yara iyileşmesi, hücre proliferasyonu

EVALUATION OF EFFECTS OF HARPAGOPHYTUM PROCUMBENS ON WOUND HEALING: AN IN VITRO STUDY

Abstract
Plants can be used in traditional medicine for the treatment of diseases due to the drugs they contain. Today, drugs with proven treatment effectiveness in current modern medical practices generally include pure active substances purified from plant species rich in active substances or produced in the laboratory environment with biotechnological applications, but they require the use of new and effective agents or supportive detoxification agents due to the side effects that may be encountered during the treatment period. Due to the rich content of bioactive substances such as glycosides, triterpenoids, phytosterols, aromatic acids and flavonoids, *Harpagophytum procumbens* has been reported to be used in traditional medicine for the treatment of blood diseases, fever, dyspepsia, urinary tract infections, wound and burn healing and many skin diseases. In the literature, no study has yet been found that has investigated the potential effects of *Harpagophytum procumbens* on wound healing in fibroblast cells, whose protective effect on cell viability has been reported. In this study, the potential wound healing effect of *Harpagophytum procumbens* was evaluated using light microscopy technique in an *in vitro* wound model on mouse fibroblast cells (NIH/3T3). The study results have shown that this plant repairs the artificial scar area in concentration and time dependent manner. In this regard, further mechanistic studies and investigation of the triggering or facilitating effect of *Harpagophytum procumbens* plant on wound healing in *in vivo* wound models, to determine the target molecules with which the active substances of the extract interact in the cell when administered separately and combined in different concentrations, and to elucidate the molecular mechanisms of the relevant interactions are required. We think that it has high potential and we recommend the *Harpagophytum procumbens* plant for pharmaceutical and pharmacokinetic research on this subject.
Keywords: Harpagophytum procumbens, wound healing, cell proliferation

Giriş

Bitkiler drog içerdiklerinden dolayı geleneksel tıpta tedavi amaçlı kullanılabilmektedir. Günümüzde kullanılan modern tıp uygulamalarında tedavi etkinliği gösterilmiş ilaçlar yer almaktadır. Bu ilaçlar genellikle aktif madde içeriği zengin olan bitki türlerinden saflaştırılarak ya da biyoteknolojik uygulamalarla laboratuvar ortamında üretilmiş saf etken maddelerden oluşmaktadır. Tedavi için kullanımları sırasında karşılaşılabilen yan etkiler nedeniyle yeni ve etkili maddelerin veya destekleyici tedavi ajanlarının kullanımına ihtiyaç doğmuştur. Susam familyasının (Pedaliaceae) bir üyesi olan Güney Afrika bitkisi *Harpagophytum procumbens*'in genel bilinen adı Şeytan pençesi'dir. Son zamanlarda *H. procumbens* ikincil kök ekstraktları, çoğunlukla Avrupa'da kronik hastalıklar olmak üzere çeşitli hastalıklara geleneksel bir ilaç potansiyeli sunmaktadır. Avrupa Fitoterapi Bilimsel Kooperatifi (ESCOP), ağrılı osteoartritin semptomatik tedavisinde, bel ağrısının, iştah kaybının ve hazımsızlığın hafifletilmesinde *H. procumbens* kullanımını önermiştir (Brendler, Gruenwald, Ulbricht, & Basch, 2006). Bitkisel Tıbbi Ürünler Komitesi (HMPC), geleneksel kullanıma dayalı olarak hafif eklem ağrısı ve hafif sindirim bozukluklarının tedavisine yönelik endikasyonlarda kullanıma yönelik tartışma taslağı yayınlamıştır (Brendler et al., 2006). Klinik çalışmalarda *H. procumbens* içeren ürünlerin bel ağrısı veya osteoartrit tedavisindeki etkinliği test edilmiştir (Brien, Lewith, & McGregor, 2006; Denner, 2007). Steroid olmayan antiinflamatuvar ilaçlar (NSAID) ile eşdeğerlik ve üstün tolere edilebilirlik de dahil olmak üzere etkinlik ve iyi tolere edilebilirlik kanıtları literatürde rapor edilmiştir (Chrubasik, 2004). Klinik çalışmalarda kullanılan farklı çözücüler ile hazırlanmış ekstraktların Vioxx® ve Voltaren® resinat ile benzer etkinliğe sahip olduğu, ancak bu standart ilaçlardan daha yüksek tolere edilebilirliğe sahip olduğu gösterilmiştir (Lienert, Ruetten, Kuhn, & Wartenberg-Demand, 2005). Başka bir çalışmada, bilek, dirsek, omuz, kalça, diz ve sırt ağrısı için ortalama ağrı skorlarında istatistiksel olarak anlamlı azalmalar olduğu ve yaşam kalitesi ölçümlerinin başlangıç çizgisine kıyasla anlamlı bir artış gösterdiği rapor edilmiştir. Bu ekstraktların kullanıldığı zamanlarda eş zamanlı ağrı kesici ilaçların kullanımının durdurulması rapor edilmiştir (Grant, McBean, Fyfe, & Warnock, 2007). *Harpagophytum procumbens*'in sekonder yumrularındaki zengin glikozid, triterpenoid, fitosteroller, aromatik asit ve flavonoidler gibi biyoaktif madde içeriğinden dolayı, geleneksel tıpta kan hastalıkları, ateş, idrar yolu enfeksiyonları, yara ve yanık iyileşmesi ve birçok deri hastalığının tedavisi için kullanımı bildirilmiştir (Anauate, Torres, & de Mello, 2010). Literatürde, hücre canlılığını koruyucu etkisi rapor edilmiş olan *H. procumbens*'in yara iyileşmesi üzerinde potansiyel etkilerini fibroblast hücrelerinde araştırmış bir çalışmaya henüz rastlanmamıştır.



Figür 1. *Harpagophytum procumbens* kökleri (Stewart & Cole, 2005)

Bu çalışmada fare fibroblast hücreleri (NIH/3T3) kullanılarak oluşturulmuş *in vitro* yara modelinde *Harpagophytum procumbens'in* yara iyileştirici potansiyelinin ışık mikroskopi tekniği kullanılarak değerlendirilmesi amaçlanmıştır.

Materyal ve Metod

Hücre kültürü

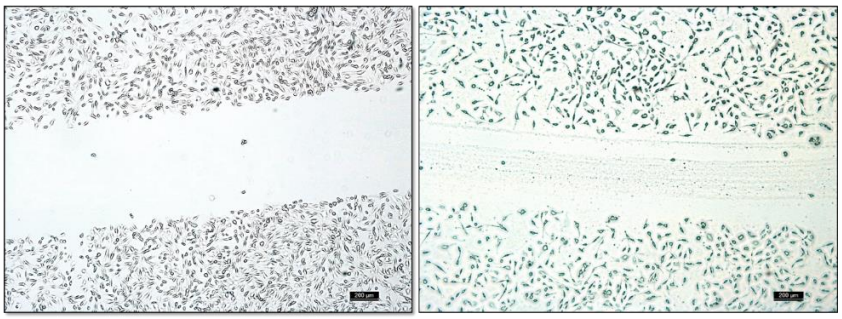
Çalışma kapsamında NIH/3T3 fare fibroblast hücreleri serum (%10, Fetal Bovine Serum/FBS) ve penisilin/streptomisin (%1) ile hazırlanmış Dulbecco's Modified Eagle Medium (DMEM) besi ortamında steril hücre kültürü inkübatöründe (37 °C, %5 CO_2) çoğaltılmıştır. Her 3 günde hücreler pasajlanmış ve konfluent hücreler yara deneyi oluşturulmasında kullanılmıştır (Sahinturk, Kacar, Vejselova, & Kutlu, 2018).

Yara iyileşmesi deneyi

NIH/3T3 fare fibroblast hücreleri serum (%10, Fetal Bovine Serum/FBS) ve penisilin/streptomisin (%1) içeren Dulbecco's Modified Eagle Medium (DMEM)'da standart şartlar altında (37°C, %5 CO_2) uygun nem içeren inkübatörde 6 kuyulu flaskların içine ekilmiş ve taban hücreler tarafından kaplanana dek inkübasyon yapılmıştır. Konfluent hücrelerin üzerinden besi ortamı uzaklaştırılmış ve 100 µL'lik steril pipet ucu kullanılarak yara boşluğu oluşturulmuştur. Deney sıfırıncı saati olarak bu aşamada oluşturulan yara boşlukları ışık mikroskobunda görüntülenmiştir. Bunun ardından her bir kuyuya 200 µg/mL *H. procumbens* içeren besi yeri eklenerek plakalar 24, 48, 72 ve 96. saatlerde ışık mikroskobunda görüntülenmiştir (Rodriguez, Wu, & Guan, 2005).

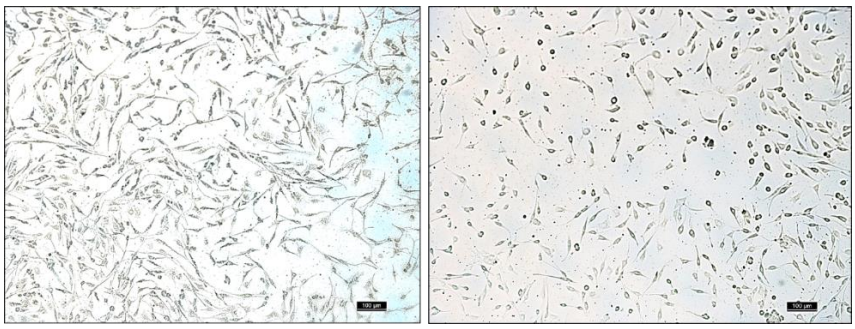
Bulgular ve Tartışma

Yara iyileşmesi deneyinde elde edilen bulgular 0, 24, 48, 72 ve 96. saatlerde elde edilen ışık mikroskobu görselleri ile Figür 2-6'da sırasıyla hem kontrol hem de *H. procumbens* uygulanmış deney grubu için gösterilmiştir.



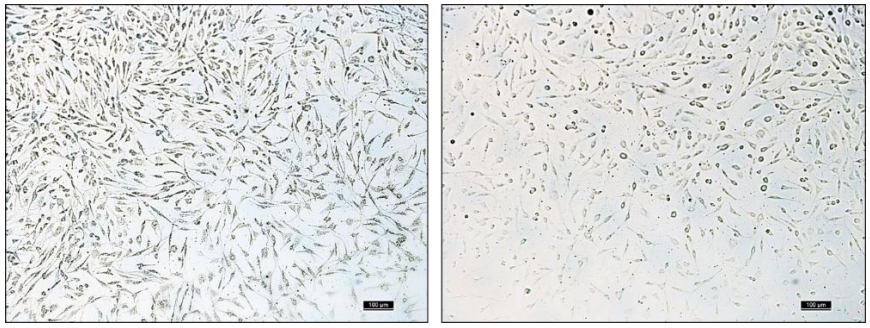
A **B**

Figür 2. Kontrol grubu (A) ve *H. procumbens* uygulanmış deney grubuna (B) ait 0. saat ışık mikroskobu görüntüleri (10X).



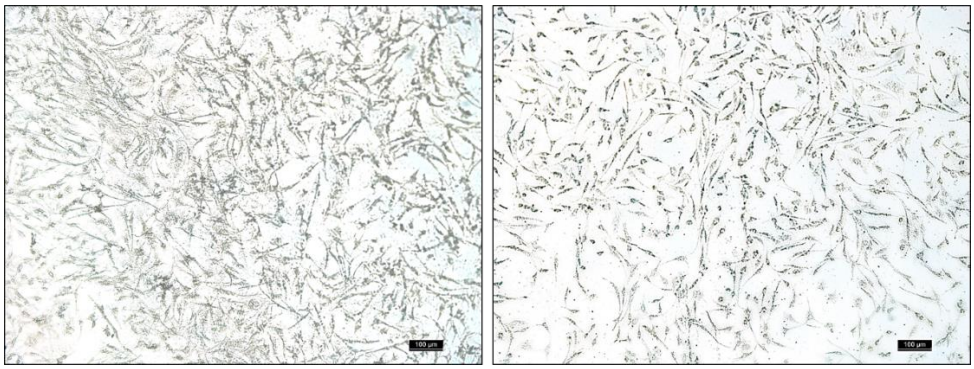
A **B**

Figür 3. Kontrol grubu (A) ve *H. procumbens* uygulanmış deney grubuna (B) ait 24. saat ışık mikroskobu görüntüleri (10X).



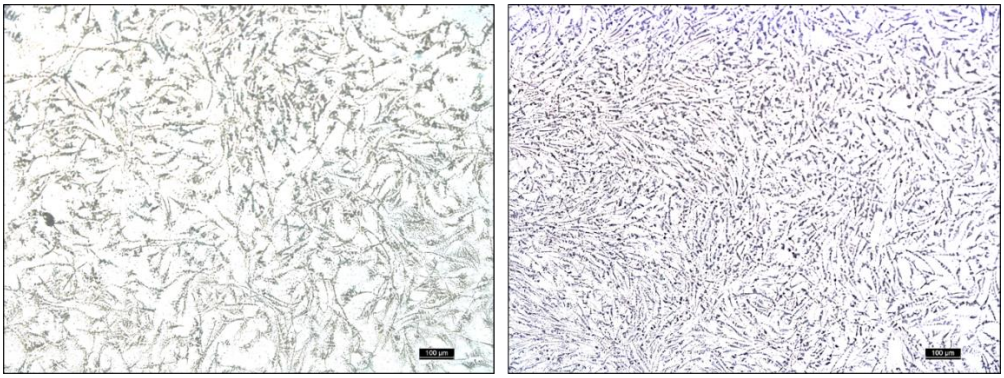
A **B**

Figür 4. Kontrol grubu (A) ve *H. procumbens* uygulanmış deney grubuna (B) ait 48. saat ışık mikroskobu görüntüleri (10X).



A **B**

Figür 5. Kontrol grubu (A) ve *H. procumbens* uygulanmış deney grubuna (B) ait 72. saat ışık mikroskobu görüntüleri (10X).



A **B**

Figür 6. Kontrol grubu (A) ve *H. procumbens* uygulanmış deney grubuna (B) ait 96. saat ışık mikroskobu görüntüleri (10X).

Yara iyileşmesi sürecinin birçok farklı etmene bağlı olduğu literatürde belirtilmiştir. Anjiyogenez yara iyileşmesi, menstruasyon döngüsü gibi fizyolojik şartlarda katkı sağlarken, anjiyogenezin aksaması kalp krizi, ateroskleroz, kanser ve metastaz gibi sağlık sorunlarına neden olmaktadır (Devasagayam et al., 2004). *H. procumbens* köklerinden elde edilen tozun yara iyileştirici ajan olarak kullanımı literatürde bildirilmiştir (Von Koenen, 1996). *H. procumbens* ana bileşenlerinden harpagositin osteoblast hücrelerinde proliferasyonu tetiklediği rapor edilmiştir (Chung et al., 2016). *H. procumbens* ekstraktlarının sıçan aortunda 5 günlük uygulama süresinde anjiyogenezi anlamlı bir şekilde inhibe ettiği rapor edilmiştir (Abdulhussein, HattabMutlag, Khamees, Sahib, & Ghazi, 2018). Vasküler endotelyal faktör sentezlenmesinin serbest radikaller varlığı sebebiyle engellenmesi aynı zamanda da *H. procumbens*'in metanol ektrelerinde yer alan sekonder metabolitler tarafından da engellenebildiğinden anjiyogenezin baskılandığı rapor edilmiştir. Aynı çalışmada, *H.*

procumbens ekstraktlarında bulunan flavonoidler nedeniyle antioksidan özellik göstererek serbest radikalleri uzaklaştırdığı rapor edilmiştir (Abdulhussein et al., 2018). Başka bir çalışmada, *H. procumbens* etil asetat fraksiyonunun sıçan beyin korteksi parçalarında hücre canlılığını koruduğu ve bu hücre canlılığının antioksidan özelliğe bağlı olduğu belirtilmiştir (Schaffer et al., 2013). Bu çalışmada doza ve zamana bağlı olarak fibroblast hücre proliferasyonunun arttığı bulunmuştur. *In vitro* ortamda oluşturulan yara iyileşmesinin de proliferasyon artışının gözlemlendiği konsantrasyonlarda artmış olduğu saptanmıştır. Literatüre benzer olarak değerlendirildiğinde, bu proliferasyon artışının *H. procumbens*'in içeriğinde bulunan sekonder metabolitlerin antioksidan özelliğine bağlanabileceği aynı zamanda da farklı konsantrasyonlarda bu etkinin farklılık gösterebileceği yorumlanmıştır. Yapay skar alanının kapanması (yara iyileşmesi) ve hücre proliferasyonun artışının ayrıntılı moleküler mekanizmasının aydınlatılabilmesi için daha ileri farmakolojik ve farmakokinetik etkinliklerin ekstre içeriğindeki etken maddeler özelinde çalışmalar yapılması gerektiği kanaatindeyiz ve bu konuda *H. procumbens*'i önermekteyiz.

Sonuç ve Öneriler

Çalışma sonuçlarında *H. procumbens*'in yapay skar alanını konsantrasyon ve zamana bağlı olarak onardığı gösterilmiştir. Bu doğrultuda *H. procumbens* bitkisinin yara iyileşmesinin tetikleyici veya kolaylaştırıcı etkisinin daha ileri mekanistik çalışmalar ve *in vivo* yara modellerinde araştırılması, ekstre içerisinde bulunan etken maddelerin ayrı ayrı izole edilerek ve farklı konsantrasyonlar halinde kombinlenerek uygulandıklarında hücre içinde etkileştiği hedef moleküllerin saptanması, ilgili etkileşimlerin moleküler mekanizmalarının aydınlatılması için yüksek potansiyel taşıdığını düşünmekte ve bu konuda farmasötik ve farmakokinetik araştırmalar için *Harpagophytum procumbens*'i önermekteyiz.

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ŞEYTAN PENÇESİ BİTKİSİNİN FARE FİBROBLAST HÜCRELERİNDE SİTOTOKSİSİTESİNİN DEĞERLENDİRİLMESİ

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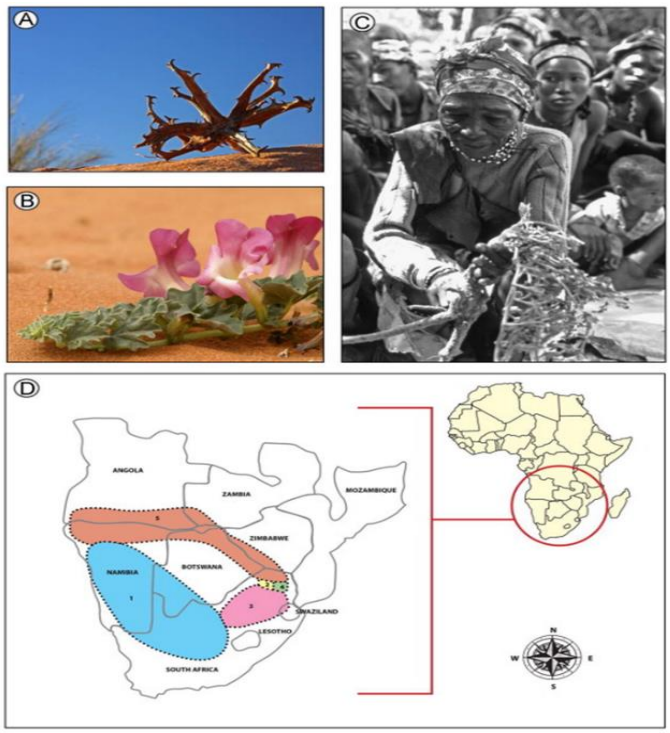
Özet
Şeytan pençesi Pedaliaceae familyasına ait, birçok biyoaktif madde içeren bir bitkidir. En çok Güney Afrika'da yayılım gösteren Şeytan pençesi geleneksel tıpta toz halinde, çay şeklinde veya topikal uygulamalarda geniş uygulamalara sahiptir. Geleneksel tıpta antiromatizmal, ağrı kesici ve antiinflamatuvar etkinlikleri sebebiyle çokça kullanılan Şeytan pençesinin birçok deneysel çalışmada da antiinflamatuvar, antiromatizmal ve analjezik gibi farmasötik özellikleri Alzheimer, romatoid artrit, osteoporoz, diyabet gibi hastalıkla bağlantılı olarak rapor edilmiştir. Bununla birlikte anjiyojenezi inhibe ederek antikanser ve antimetastatik özellik gösterdiğinden dolayı alternative kanser tedavisinde kullanılabileceği ve kanser hücrelerinde sitotoksik etki gösterdiği bilinmektedir. Ayrıca, farklı hücrelerde gerçekleştirilen çalışmalarda antioksidan özelliği nedeniyle serbest radikalleri azaltarak hücre canlılığını koruma özelliğinin olduğu farklı Şeytan pençesi ekstresi formları için belirtilmiştir. Ancak, fibroblast hücrelerinde Şeytan pençesinin sitotoksisitesi veya proliferasyona etkisini gösteren bir çalışmaya henüz rastlanmamıştır. Bu nedenle bu çalışmada, fare fibroblast hücrelerinde (NIH/3T3) farklı konsantrasyonlar ve zaman aralıklarında Şeytan pençesi bitkisinin sitotoksisitesinin olup olmadığı MTT kolorimetrik testi kullanılarak araştırılmıştır. Elde edilen deney sonuçlarından Şeytan pençesi bitkisinin NIH/3T3 hücrelerinde sitotoksisiteye neden olmadığı aksine hücre proliferasyonunu zamana ve konsantrasyona bağlı olarak indüklediği saptanmıştır. Bu proliferasyon indükleyici özellik nedeniyle Şeytan pençesi bitkisini hücre canlılığını koruma potansiyelinin ve potansiyel hücre bölünmesini hızlandırıcı etkisinin ortaya moleküler mekanizmalarıyla birlikte konulması gerektiğini düşünmekte, proliferasyonu indükleyici mekanizması, hücre içerisinde etkileştiği hedef moleküller ve etkileşim şekilleri aydınlatılmak üzere daha ileri araştırmalar için önermekteyiz.
Anahtar Kelimeler: Şeytan pençesi, fibroblast, sitotoksisite

EVALUATION OF THE CYTOTOXICITY OF DEVIL'S CLAW PLANT ON MOUSE FIBROBLAST CELLS

Abstract
Devil's claw is a plant belonging to the Pedaliaceae family, containing many bioactive substances. Devil's claw, which is most common in South Africa, has wide applications in traditional medicine in powder form, tea form or topical applications. Devil's claw, which is widely used in traditional medicine due to its antirheumatic, analgesic and anti-inflammatory activities, has also been reported in many experimental studies in connection with diseases such as Alzheimer's, rheumatoid arthritis, osteoporosis and diabetes. However, it is known that it can be used in alternative cancer treatment because it shows anticancer and antimetastatic properties by inhibiting angiogenesis and has a cytotoxic effect on cancer cells. Additionally, in studies conducted on different cells, it has been stated for different forms of Devil's claw extract that it has the ability to protect cell viability by reducing free radicals due to its antioxidant properties. However, no study has yet been found showing the cytotoxicity or proliferation effect of Devil's claw on fibroblast cells. Therefore, in this study, whether the Devil's claw plant has cytotoxicity in mouse fibroblast cells (NIH/3T3) at different concentrations and time intervals was investigated using the MTT colorimetric test. From the experimental results obtained, it was determined that Devil's claw plant did not cause cytotoxicity in NIH/3T3 cells, on the contrary, it induced cell proliferation depending on time and concentration. Due to this proliferation-inducing feature, we think that the potential of the Devil's claw plant to protect cell viability and its potential cell division accelerating effect should be revealed together with its molecular mechanisms, and we recommend it for further research to elucidate its proliferation-inducing mechanism, the target molecules it interacts with in the cell and the interaction patterns.
Keywords: Devil’s claw, fibroblast, cytotoxicity

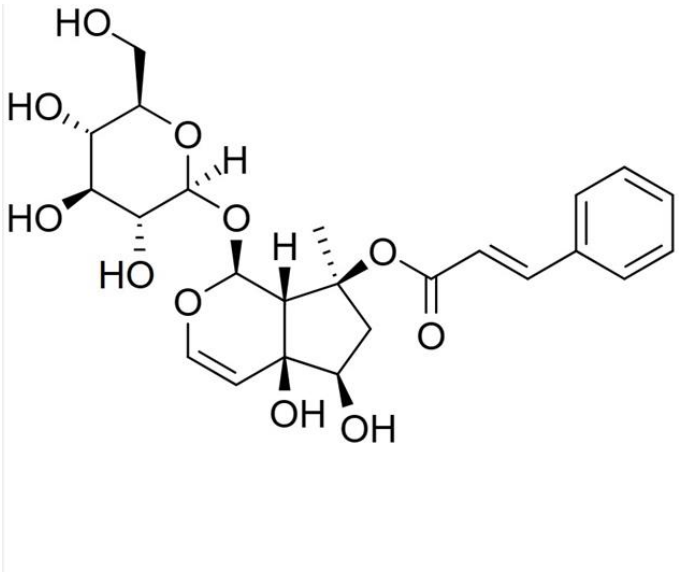
Giriş

Harpagophytum procumbens subsp. procumbens (Burch.) Pedaliaceae familyası üyesi, Güney Afrika'nın Kalahari bölgesinde yetişen önemli bir şifalı bitkidir. Kullanımı Güney Afrika'nın yerli San ve Khoi halkı arasında öne çıkmış olup daha geniş kitlelerce benimsenmiştir (Gxaba & Manganyi, 2022; Mncwangi, Chen, Vermaak, Viljoen, & Gericke, 2012). Etnobotanik kullanımlarından bazıları ateş, diyabet, ishal ve kan hastalığıdır. *H. procumbens*'in ikincil yumrularının ekstraktlarının dejeneratif romatoid artrit, osteoartrit, tendinit, böbrek iltihabı, kalp hastalığı, hazımsızlık, iştah kaybı ve yara iyileşmesinin tedavisinde etkili olduğunu göstermektedir (Clarkson, Campbell, & Smith, 2003; McGregor et al., 2005). *H. zeyheri* ve *H. procumbens* bitkileri Şeytan pençesi olarak bilinmektedir ve bu isimle kullanılmaktadır. *H. zeyheri*'de *H. procumbens*'e kıyasla daha düşük oranda biyolojik olarak aktif bileşen bulunmaktadır. *H. procumbens* genellikle tercih edilen ticari üründür ve katkı maddesi olarak ürünlere ilave edilmektedir (Georgiev, Alipieva, & Orhan, 2012; Ncube et al., 2021). Örneğin; *H. procumbens*, Nambiya'da ticari açıdan önemli bir bitki türü olup milli gelire yüksek katkı sağlamaktadır. Küresel satışlar değerlendirildiğinde ise yalnızca Almanya için yaklaşık 30 milyon Euro değerinde bir kümülatif satış hacmi rapor edilmiştir (Mncwangi et al., 2012; Soulimani, Younos, Mortier, & Derrieu, 1994).



Figür 1. H. procumbens görüntüsü ve yayıldığı coğrafya (Mncwangi et al., 2012)

Şeytan pençesi geleneksel tıpta toz halinde, çay şeklinde veya topikal olarak (merhem olarak) geniş uygulamalara sahiptir. Geleneksel tıpta antiromatizmal, analjezik ve antiinflamatuvar etkinlikleri sebebiyle çokça kullanılan Şeytan pençesinin birçok deneysel çalışmada da antiinflamatuvar, antiromatizmal ve analjezik gibi farmasötik özellikleri Alzheimer, romatoid artrit, osteoporoz, diyabet gibi hastalıklarla bağlantılı olarak rapor edilmiştir. Şeytan pençesi anjiyojenezi inhibe ederek antikanser ve antimetastatik özellik gösterdiğinden dolayı alternatif kanser tedavisinde kullanılabileceği ve kanser hücrelerinde sitotoksik etki gösterdiği rapor edilmiştir. Farklı hücre hatları üzerinde gerçekleştirilen çalışmalarda antioksidan özelliği nedeniyle serbest radikalleri azaltarak hücre canlılığını koruma özelliğinin olduğu farklı Şeytan pençesi ekstresi formları için belirtilmiştir (Ahmed, Afifi, & Hamdy, 2005; Gyurkovska et al., 2011).Şeytan pençesinin iki ana bileşeni harpagosid ve iridoid glikozittir. Ayrıca, harpagit ve prokumbit de Şeytan pençesinin içeriğinde yer almaktadır. Köklerinde ise iridoid glikozitler (Qi et al., 2006), şekerler, triterpenoitler (oleanolik ve ursolik asit), fitosteroller, aromatik asitler ve flavonoitler (luteolin ve kamferol) gibi temel kimyasal bileşikler bulunmaktadır (Anauate, Torres, & de Mello, 2010).



Figür 2. *H. procumbens* ana etken maddesi Harpagosit'in kimyasal yapısı (Peruru et al., 2020)

Literatürde, Şeytan pençesinin biyolojik aktivitelerinin lenfosit ve makrofaj hücrelerinde araştırılıp konsantrasyon ve zamana bağlı sitotoksik etkilerinin olduğu gösterilmiştir (Gyurkovska et al., 2011; Ncube et al., 2021). Ancak, fibroblast hücrelerinde Şeytan pençesinin sitotoksisitesi veya proliferasyona etkisini gösteren bir çalışmaya henüz rastlanmamıştır. Bu nedenle, mevcut çalışmada, Şeytan pençesi bitkisinin sitotoksisitesinin farklı zaman

aralıklarında fare fibroblast (NIH/3T3) hücrelerinde farklı konsantrasyonlar denenerek MTT kolorimetrik testi ile araştırılması amaçlanmıştır.

Materyal ve Metod

Hücre kültürü

Bu çalışmada kullanılan NIH/3T3 fare fibroblast hücreleri %10 serum (Fetal Bovine Serum/FBS) ve %1 penisilin/streptomisin içeren Dulbecco's Modified Eagle Medium (DMEM) besi yerinde standart hücre kültürü şartlarında (37°C, 5% CO_2) uygun nem içeren inkübatörde çoğaltılmıştır. Hücreler 3 günlük periyotlarla pasajlanmış ve tüm flaş tabanını kaplayan konfluent hücreler deneylerde kullanılmıştır (Sahinturk, Kacar, Vejselova, & Kutlu, 2018).

MTT kolorimetrik testi

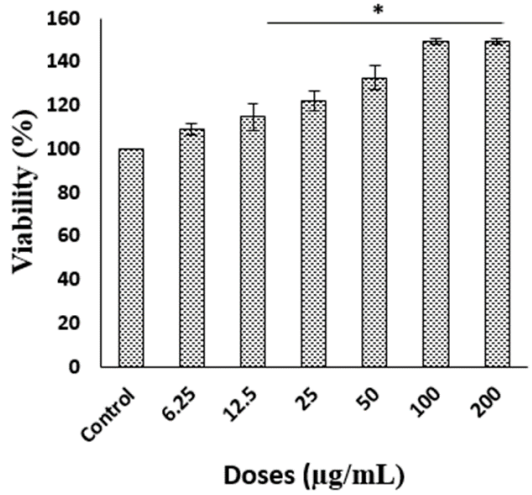
NIH/3T3 hücreleri 96 kuyulu plakalara ($5x10^3$/kuyu) ekilmiştir. Şeytan pençesi DMSO'da çözülmüş ve 200 µg/mL konsantrasyondan seri dilüsyonu seyreltilerek kuyulara dağıtılmıştır. Plakalar standart hücre kültürü şartlarında 24, 48, 72 ve 96 saat süre ile inkübe edilmiştir. Süre sonunda kuyucuklara 20 µL MTT (5mg/mL) ilave edilerek, 37 ºC'de 4 saat daha inkübe edilmiştir. İnkübasyon sonunda 200 µL/kuyu DMSO ilavesi yapılarak Synergy HTX (Bio-Tek, USA) plaka okuyucusunda 564 nm dalga boyunda absorbanslar okunmuştur. Elde edilen absorbans değerlerinden kontrol kuyusu absorbansına kıyasla yüzde canlılık değerleri hesaplanmıştır. Yüzde canlılık değerlerinden IC_{50} değerleri hesaplanmıştır (Sahinturk et al., 2018).

İstatistiksel analiz

Deneylerden elde edilen bulgular ortalama ± standart hata olarak belirtilmiştir. GraphPad 6.0 programı ile tek yönlü varyans analizi (ANOVA) kullanılarak değerlendirilmiş ve anlamlılık değerleri saptanmıştır. $p<0.5$ değerinin altında olanlar istatistiksel olarak anlamlı kabul edilmiştir.

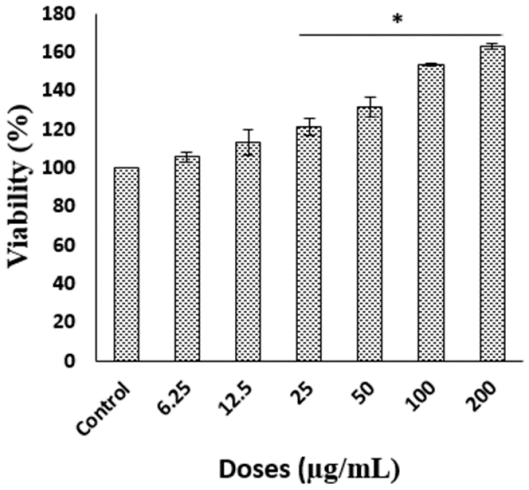
Bulgular ve Tartışma

Farklı zaman dilimlerinde NIH/3T3 hücrelerine uygulanan farklı *H. procumbens* konsantrasyonlarının hücre canlılığına etkileri Figür 3-6'da gösterilmiştir.



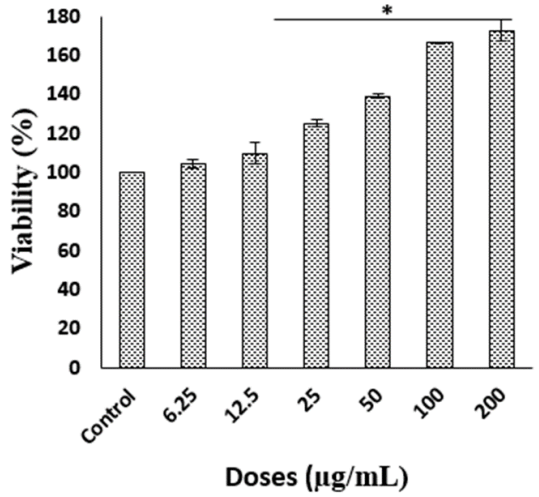
Control	100.00
6.25	110.97
12.5	110.39
25	125.50
50	128.79
100	150.10
200	148.55

Figür 3. NIH/3T3 hücre canlılığı üzerine *H. procumbens*'in 24 saatlik inkübasyon süresindeki etkileri.



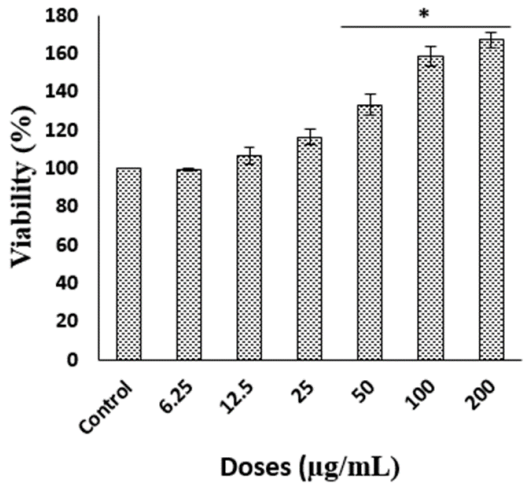
Control	99.86
6.25	107.54
12.5	108.64
25	124.41
50	127.87
100	154.08
200	161.83

Figür 4. NIH/3T3 hücre canlılığı üzerine *H. procumbens*'in 48 saatlik inkübasyon süresindeki etkileri.



Control	100.00
6.25	102.95
12.5	106.02
25	123.65
50	138.27
100	166.03
200	168.74

Figür 5. NIH/3T3 hücre canlılığı üzerine *H. procumbens*'in 72 saatlik inkübasyon süresindeki etkileri.



Control	100.00
6.25	98.51
12.5	103.59
25	113.44
50	129.29
100	155.09
200	164.22

Figür 6. NIH/3T3 hücre canlılığı üzerine *H. procumbens*'in 96 saatlik inkübasyon süresindeki etkileri.

In vitro çalışmalarda makrofaj hücrelerine uygulanan Şeytan pençesi bitkisinin su, etanol ve dietil asetat ekstrelerinin diklofenaka kıyasla farklı sitotoksik etki gösterdiği raporlanmıştır (Ncube et al., 2021). Literatürde Şeytan pençesinin TH1 (lenfosit) hücrelerinde konsantrasyona bağlı sitotoksisiteye neden olduğu belirtilmiştir (Hostanska, Melzer, Rostock, Suter, & Saller, 2014). Bu çalışmada, literatürde yer alan sitotoksisite bulgularının aksine, NIH/3T3 hücreleri üzerine *H. procumbens*'in proliferasyonu tetikleyici etkisinin konsantrasyona ve zamana bağlı olarak mevcut olduğu gösterilmiştir. Bu proliferasyonu indükleyici etkinin deneylerde kullanılan hücre türüne, konsantrasyon aralığına, *H. procumbens* türü ve ekstre elde edilen bitki kısmına bağlı olabileceği değerlendirilmiştir.

Sonuç ve Öneriler

Elde edilen deney sonuçlarından Şeytan pençesi bitkisinin NIH/3T3 hücrelerinde sitotoksisiteye neden olmadığı, aksine hücre proliferasyonunu zamana ve konsantrasyona bağlı olarak indüklediği saptanmıştır. Bu proliferasyon indükleyici özellik nedeniyle Şeytan pençesi bitkisini hücre canlılığını koruma potansiyelinin ve potansiyel hücre bölünmesini hızlandırıcı etkisinin ortaya moleküler mekanizmalarıyla birlikte konulması gerektiğini düşünmekte, proliferasyonu indükleyici mekanizması, hücre içerisinde etkileştiği hedef moleküller ve etkileşim şekilleri aydınlatılmak üzere daha ileri araştırmalar için önermekteyiz.

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SOCIAL SUSTAINABILITY PERCEPTIONS OF OSUN OSOGBO FESTIVAL AT NIGERIA'S WORLD HERITAGE SITE

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ABSTRACT
There is a growing interest in integrating social sustainability along with environmental and economic impacts to tourism analysis and planning. Hence, social sustainability of Osun festival in a UNESCO World heritage site, Nigeria was assessed to harness the host communities' perceptions of tourism's social sustainability. Fourteen host communities in Osogbo and Olorunda Local Government Area were selected for the study, three hundred and eighty-four (384) copies of questionnaires were administered to residents within ages 18 years and above. Data obtained were analyzed using descriptive statistics and Pearson's correlation. Findings from the study revealed that 54.5% of the respondents were male, 53.9% were married, Secondary School education was highest (50.8%) and 51.6% were self-employed. Overall, 57.3% of the respondents were actively involved in Osun festival while 37.0% were attendees. Perception that Osun festival is the most important event in the community was highest with mean value of 4.39, the festival contributes to communities cultural enrichment (mean = 4.38) and preservation of cultural heritage in the community is positively influenced by Osun festival had a mean value 4.25. Moreover, residents' positive perception of tourism sustainability was enhanced by the economic benefits of the festival. Furthermore, the festival has been socially sustainable in the region because the preservation and promotion of local culture and traditions promotes tourism (mean=4.45), the empowerment program (4.37), and community participation in decision making improve tourism social sustainability (4.44). There is a significant relationship between the residents' involvement in Osun festival and their year of residency, origin and religion ($p<0.05$). The study concluded that community residents' ideology and opinions are critical for promoting and improving tourism social sustainability and it is recommended that the management of the Osun Osogbo World Heritage site develop long-term collaborative initiatives with host communities and various stakeholders to foster commitment to the adoption of sustainability practices.
Keywords: Tourism, Social sustainability, Community, Festival, UNESCO

1. INTRODUCTION

Globally, tourism is regarded as an effective tool and contributor to reduce the rate of poverty in addition to aiding the economic development of some locals and communities around the world. Mondal & Samaddar (2021) revealed that the environment, local community and economy are the three pillars of sustainability, which are also the essential part of responsible tourism. Sustainable tourism encompasses the economic, social and environmental sustaining, which aligns with the United Nations' Sustainable Development Goals (SDGs). Sustainable tourism plays an important role by promoting and increasing the economic growth of a tourism destination, which helps to attain economic sustainability. Within the process of developing a sustainable tourism sector, the local community is the key element, as it is directly affected by its evolution (Eshliki & Kaboudi, 2017). Della et al. (2019) observed that involvement of local businesses and communities whilst ensuring that the economic benefits is equally share among all stakeholders is one of the many roles and functions embedded and carried out in sustainable tourism.Therefore, the notion of social sustainability acknowledges the relevance of communities' attitudes and support for tourist development in achieving long-term effects (Muresan et al., 2016). Social sustainability, a key element in sustainable tourism promote equitable development among the people, preservation of cultural heritage and improving the quality of life. Rastegar & Ruhanen (2021) provide an insight on the empowerment of the local communities and preservation of their cultural traditions and heritage through sustainable tourism with exchange of local knowledge. In alignment with SDGs 11, Sustainable tourism aims to enhance the quality of life for both residents and visitors. This is also achievable together with sustainable tourism practices within the destination (Ivars-Baidal et al., 2021).

The substantive aspect of social sustainability is concerned with the needs, rights, and general well-being of the local community, whereas the procedural dimension is concerned with the means of achieving those substantive aspects, such as improving information access, decision-making roles, empowerment, and democratic governance. In this context, understanding residents' perception of tourism social sustainability is crucial to Identify areas of concern and opportunities for improvement. For the sustainability of tourism destination and long term viability, responsible tourism practices and local community participation are essential for promoting equitable development among the people, preservation of cultural heritage and improving the quality of life are ways by which sustainable tourism helps to support social sustainability while it mitigates the negative impacts of tourism on the environment and also help to conserve the natural resources.

Festivals are notable occasions set aside either annually or occasionally to commemorate significant events in people's and communities lives and this include coronation, worship of god(s), rites of passage, history of origins, start of planting season, and many others (Ezenagu, 2016). Festivals have some benefits it contributes to tourism by attracting visitors, increasing local economies, and improving the overall tourist experience. However, festivals have a widespread economic impacts and can offer unique cultural experiences by allowing visitors to interact with local culture and immerse themselves in the host community's traditions and customs. In lieu of this, tourism stakeholders and investors must understand the significance of festivals and fully realize their potential for attracting tourists and contributing to long-term tourism growth.The Osun Festival is an annual cultural celebration that takes place in Osogbo, the capital city of Osun State in southwestern Nigeria. The festival is dedicated to Osun, the Yoruba goddess of fertility and water. It has deep historical and religious significance for the people of Osogbo and has been celebrated for centuries. The two weeks festival celebration takes place in August, begins, and ends in the town palace of Ataoja. On the 12th day, the entire Osogbo population undertakes a procession into the World Heritage Sacred Grove in Osogbo. The votary maid (Arugba), the Ataoja, leads the procession of devotees, supported by high chiefs, to the Osun courtyard, which is located around the first palace within the grove, the point of offering on the riverbank (NCMM, 2023).The Osun Festival is culturally significant which attracts tourists from different parts of the world, exposing them to the rich cultural heritage of the Yoruba people. It showcases various aspects of Yoruba cultural practices, including music, dance, art, and religion. Through participation in the festival, residents of Osogbo metropolis are able to reconnect with their cultural roots and maintain a sense of identity and belonging (Elizabeth, 2014). The residents are able to reinforce their cultural identity and strengthen their sense of belonging to the community. This connection to heritage is crucial for maintaining a cohesive and sustainable society (Olatumile, 2019). Exploring residents' perceptions of the festival's impact on their community and cultural identity will provide insights into the role of cultural festivals in enhancing social sustainability of tourism at the site. This study is based on three objectives: (i) to assess residents' involvement in Osun Osogbo festival, (ii) assess the residents' perception of the social impacts of Osun festival tourism on the local community and (iii) explore the factors influencing residents' perceptions towards tourism social sustainability of Osun Osogbo festival. The study aims to analyze the residents' perception of tourism social sustainability of the Osun festival and recommend strategies for promoting socially sustainable tourism. Moreover, the research will fill gaps in the existing literature and contribute to the

broader discourse on social sustainability of tourism for promoting sustainable tourism practices and community engagement in tourism planning.

2. MATERIALS AND METHODS

Study Area: The study was carried out in Osogbo. Osogbo is the capital of Osun State, Nigeria and it is located between 6º 55' to 8º 15'N and 4º 10' to 5º 10'E. Osogbo has a total area of 250 Km^2. It is bound in the north by Olorunda Local Government Area, in the south by Ede North and Atakumosa Local Government Areas, in the east by Obokun and Boripe Local Government Areas, and in the west by Egbedore Local Government Area. Osun Osogbo Sacred Grove (OOSG) is 75 hectares of undisturbed rainforest and the World Heritage Site is located in Osogbo Local Government Council, State of Osun, Nigeria, at 7° 45' 20" N /4° 33' 08"E and the main venue of Osun Osogbo festival (Procession to OOSG Plate 1). Osun State lies on a relatively flat plain of about 250 m above sea level within the western Nigeria plains. The climatic condition of Osogbo in Osun State, Nigeria, is characterized by a tropical climate, specifically falling under the Aw (Tropical savanna) climate classification according to the Köppen climate classification system. Osogbo falls within the lowland tropical rainforest vegetation characterized by multiple canopies and lianas, most of which have since been given to secondary forest and derived savannah due to intensive cultivation and bush burning for several years (Ogunfolakan et al., 2016).

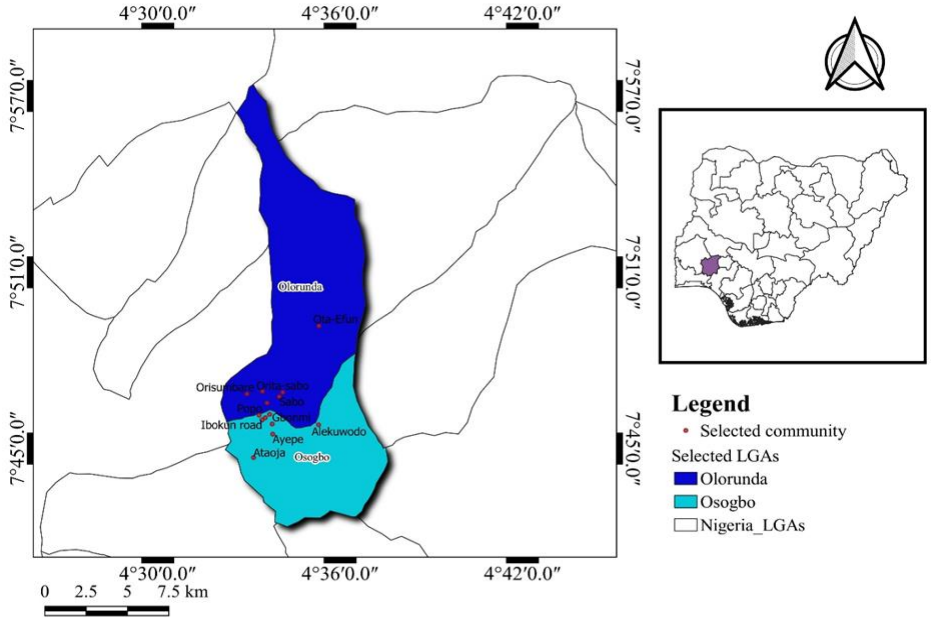


Figure 1: Map showing the selected communities in Osogbo, Osun State, Nigeria



Plate 1: Procession into the Osun Osogbo World Heritage Sacred Grove

2.1 Data Collection

The study adopted quantitative method of data collection. Data were obtained through administration of structured questionnaire with the residents of Osogbo to assess their perception of tourism social sustainability. Fourteen (14) host communities in Osogbo and Olorunda Local Government Areas were selected for the study. Krejcie and Morgan sample size table cited in Abdullateef & Olajide (2013) was used to determine a population sample size of three hundred and eighty-four (384). Likert scale questionnaire was administered to 384 residents within ages 18 years and above (201 respondents in Osogbo and 183 respondents in Olorunda Local Government areas).

2.2 Data Analysis

The data were analyzed using descriptive statistics of frequencies, percentages, means and standard deviation, and inferential statistics. Inferential statistics tools used was Pearson's correlation for hypothesis testing. The variables on residents' perceptions of tourism's social sustainability of Osun Osogbo festivals at the heritage site were measured using Sözen (2019) five-point Likert scale, anchored from 1 (Strongly Disagree) to 5 (Strongly Agree). The mean of each statement was determined and used to categorize the responses as SA (4.21 - 5.00), A (3.41 - 4.20), Neutral (2.61 - 3.40), D (1.81 - 2.60), and SD (1.0 - 1.80).

3. RESULT AND DISCUSSION

The findings on the socio-demographics characteristics of the respondents revealed that 54.5% were male, 53.9% were married and 51.0% were between 26-45 years. This is in conformity with Adetola & Osanyinleye (2016) which had 55.0% as males and 59.5% married respondents in their study on tourism acceptability in the host communities of Osun Osogbo Sacred Groove.

In addition, 50.8% of the respondents had secondary school education and 48.7% practiced Christianity this compliments the work of Oladeji et al. (2021) with 48.3% as Christians in Osun Osogbo communities and contradicts Aleshinloye (2015) that had 36.8% of Secondary education in the study area. Furthermore, respondents with more than 20 years of residency were higher (34.1%), which is consistent with the findings of Ige et al. (2017), who discovered that the majority of residents in the Osogbo metropolis had lived there for more than 20 years.

Table 1: Socio-demographic characteristics of the respondents

Variables	Frequency (N=384)	Percentage (%)
Gender		
Male	209	54.4
Female	175	45.6
Age		
18 - 25 years	59	15.4
26 - 35 years	85	22.1
36 - 45 years	111	28.9
46 -55 years	71	18.5
56 - 65 years	33	8.6
above 65 years	25	6.5
Marital status		
Single	97	25.3
Married	207	53.9
Divorced/Separated	53	13.8
Widow/Widower	27	7.0
Educational Background		
Non-formal	60	15.6
Primary	45	11.7
Secondary	195	50.8
Tertiary	70	18.2
Adult Education	14	3.6
Household size		
1-3	72	18.8
4-6	217	56.5
7-9	82	21.4
10 and above	13	3.4
Religion		
Christianity	187	48.7
Islam	162	42.2
Traditionalist	35	9.1
Occupation		
Student	60	15.6
Civil servant	69	18.0
Self-employed	198	51.6
Private sector	23	6.0
Unemployed	3	0.8
Retiree	7	1.8
NGO’s	24	6.3
Origin		
Indigene	241	62.8
Non-Indigene	143	37.2
Years of residency		
1-5	59	15.4
6-10	56	14.6
11-15	51	13.3
16-20	87	22.7
Above 20 years	131	34.1

3.1. Residents' Involvement in Osun Festival

Residents' involvement in Osun Osogbo festival in the world heritage site was high as 37.0% attested to being attendees to witness the traditional rituals and other activities (Figure 2). This is in agreement with McCartney & Ip Si Kei (2018) that attendance is key factor in determining festival success. Levels of involvement was also high as Food/Market place vendors (20.8%) and 18.8% as performers and artists while only 5.7% were indifferent (Figure 3 and Plate 2). Tao et al. (2020) asserted that community members could participate in the festival as audience/spectators, performers, vendors, organizer/planners who are indispensable in the production of the festival.

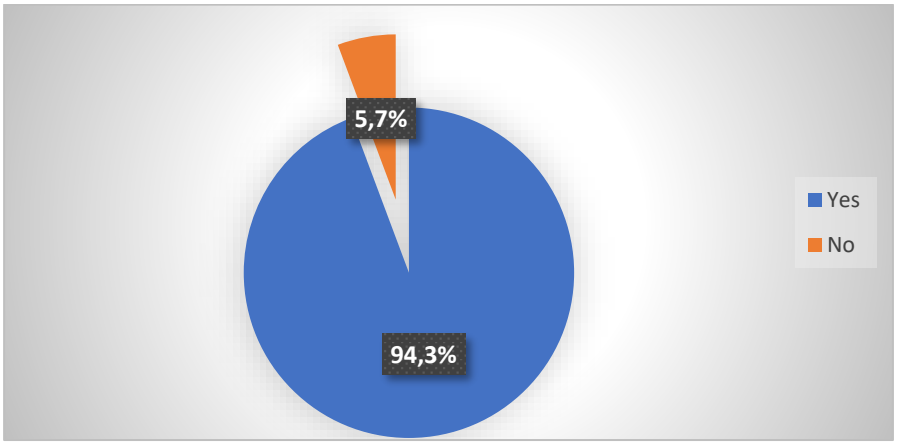


Figure 2: Are you involved in Osun Osogbo Festival?

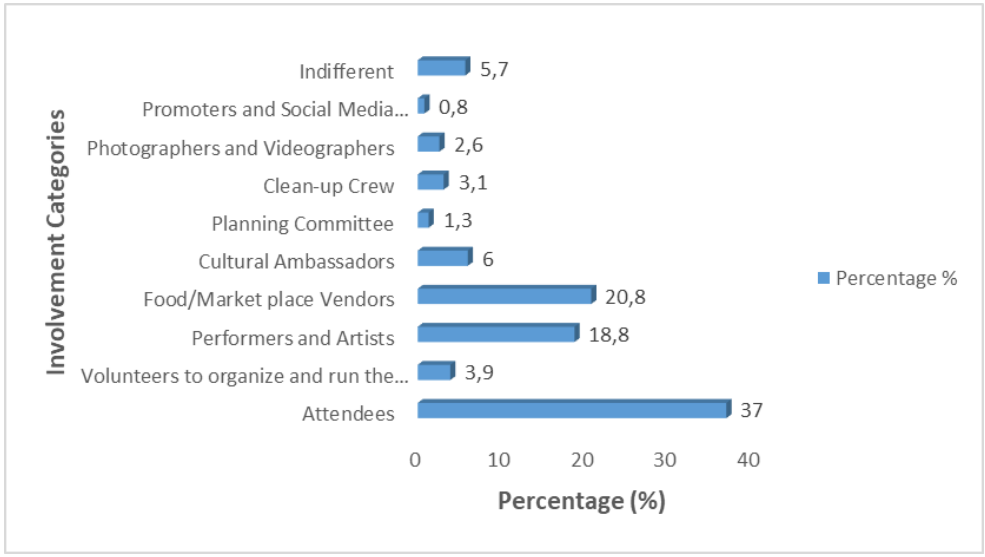


Figure 3: Residents Involvement in Osun Festival



Plate 2: Residents participate as market place vendors in the Osun Osogbo Festival.

3.2. Residents Perception of Osun Festival

The mean value of residents' perception of Osun festival ranges from 4.39-4.25. Opinions that Osun festival is an important event in the community had the highest mean (4.39), followed by Osun festival provides opportunities for residents to participate in cultural activities (4.36) while Osun festival enhances the community's sense of belonging had the least mean value of (4.25) indicating their strong agreement as shown in Table 2. Huong & Lee (2017) discovered that local residents with strong ties to their community had positive perceptions of tourism's impacts in terms of social, environmental, economic, and local benefits, resulting in increased support for tourism development. Also, Savinovic et al. (2012) reported that festival offers residents and visitors the opportunity to participate and witness festival rituals and activities. This helps to boost the region's tourism attractiveness and provide the residents and tourists with immersive experience.

Table 2: Residents Perception of Osun Festival

Residents Perception	SA %	A %	N %	D %	SD %	Mean	St. D	Remarks
Osun Ososgbo festival is an important event in the community	57.0	33.3	3.9	3.1	2.6	4.39	0.90	SA
State of community involvement in Osun festival is satisfactory	44.0	41.4	12.2	0.8	1.6	4.25	0.81	SA
Osun Ososgbo festival promote the positive image of the community	45.1	43.2	7.0	2.3	2.3	4.26	0.87	SA
Osun festival provides opportunities for residents to participate in cultural activities	50.0	39.8	7.6	1.6	1.0	4.36	0.77	SA
Osun festival enhances the community's sense of belonging	43.2	45.8	6.3	2.3	2.3	4.25	0.85	SA

3.3. Social Impacts of Festival

Most of the respondents strongly agreed that festival tourism in Osun Osogbo world heritage site contributes to the community's cultural enrichment, the festival positively influenced the state of cultural preservation in the community, Osogbo festival fosters social interaction between the residents and tourist with mean scores of 4.38, 4.25, 4.21 respectively (Table 3). This is in agreement with Liu et al. (2019) that festival provide opportunities for individuals to engage in cultural interaction and contributes to community cultural enrichment. The results also reflects the findings of Olatunmile (2019) that connection to heritage is crucial for maintaining a cohesive and sustainable society, reinforce their cultural identity and strengthen their sense of belonging. Woosnam et al. (2015) assert that the festival strengthens social cohesion and enhances community relationships as this encourages and fosters togetherness among the residents as they celebrate their cultural heritage.

Table 3: Social Impacts of Festival Tourism

Social Impacts	SA %	A %	N %	D %	SD %	Mean	St. D	Remarks
Osogbo festival encourages residents to engage in cultural dialogue with tourist	33.3	49.5	13.8	1.3	2.1	4.10	0.83	A
Osogbo festival fosters social interaction between the residents and tourist	37.8	42.9	10.9	1.3	0.8	4.21	0.75	SA
Osun Osogbo festival promotes cultural exchange between residents and tourists	36.5	44.5	15.6	0.8	2.6	4.11	0.88	A
The state of cultural preservation in the community is positively influenced by the Osun Osogbo festival	51.0	34.1	5.2	8.3	1.3	4.25	0.97	SA
Osun Osogbo festival contributes to the community's cultural enrichment	46.9	47.7	2.9	1.8	0.8	4.38	0.70	SA
The state of social cohesion in the community is improved due to Osun festival	34.4	48.2	9.4	3.1	4.9	4.03	1.00	A

3.4 Factors Influencing Tourism Social Sustainability

Economic benefits influence residents' perceptions of the social sustainability of tourism at the Osun festival (4.22), the level of community involvement in the festival's planning and organization (3.97), and disharmony between residents and tourists can affect tourism sustainability (3.89) as revealed in table 4. This is in agreement with Muresan et al. (2016) that the residents perceived economic benefits and its impacts on their lives influence tourism social sustainability. Likewise, the level of community involvement in the planning and organization of the festival affects residents' perception of its social sustainability was enunciated and supported by the findings of Surjadi et al. (2022) which revealed that by involving local community in planning and decision making will encourage them to promote sustainability and attain positive sustainable residency.

Table 4: Factors Influencing Tourism Social Sustainability

Factors	SA %	A %	N %	D %	SD %	Mean	Std.D	Remark
Actions and behavior of tourists during the festival impact residents' perception.	36.5	36.2	14.8	2.6	9.9	3.86	1.22	A
Level of community involvement in the planning and organization of the festival affects residents' perception of its social sustainability.	33.3	45.3	12.8	2.6	6.0	3.97	1.05	A
Residents perception of tourism sustainability is influenced by economic benefits	45.6	40.9	7.8	2.3	3.4	4.22	0.93	SA
Disharmony between residents and tourists can affect tourism sustainability	42.4	34.9	5.5	3.9	13.3	3.89	1.35	A

3.5 Enhancement of Tourism Social Sustainability

Table 5 presents the respondents opinion on the enhancement of Tourism Social Sustainability with mean values ranging from 4.50-3.89. Residents in the host community of Osun Osogbo Sacred Grove (OOSG) emphasized and strongly agreed that the preservation and promotion of local culture and traditions with mean value (4.45), empowerment programs (4.44) and agreed to safety and security in the host community of tourist destination as keys for enhancement of social sustainability of tourism at the groove. This corroborates with the findings of Vu Hoang (2021) that there is a close relationship between the conservation and promotion of cultural heritage and tourism development. Also, Bozdaglar (2023) reported that Empowerment programs play a crucial role in promoting tourism social sustainability. This is also consistent with the findings of Bello (2021) that emphasized on the importance of empowerment programs

and training of the residents as it can create employment and entrepreneurship opportunities for them.

Table 5: Enhancement of Tourism Social Sustainability

Enhancement of tourism social sustainability in OOSG	SA %	A %	N %	D %	SD %	Mean	St. D	Remark
Local community involvement in decision making helps to promote tourism sustainability	45.8	44.6	6.8	0.8	2.3	4.30	0.82	SA
Empowerment programs enhance tourism social sustainability	52.9	41.1	3.9	1.3	0.8	4.44	0.70	SA
Maximized economic benefits of tourism for the local residents promote tourism	50.8	40.6	5.5	1.8	1.3	4.37	0.78	SA
Preservation and promotion of local culture and traditions promote tourism	56.5	35.7	5.5	0.8	1.6	4.45	0.76	SA
Safety and security in the host community of tourist destination	33.1	45.3	9.4	2.3	9.9	3.89	1.18	A

Furthermore, results of the correlation between resident's involvement in Osun Festival and their socio-demographics characteristics show that there is a significant relationship between the resident's involvement and their religion, origin and years of residency (table 6). This is supported by the findings of the Wang et al., (2021) which emphasizes the influence of religious festival marketing on devout believers and tourists, highlighting the retention of religious rituals' essence and spirit in festivals. Woosnam & Aleshinloye (2015) emphasized the role of the relationship between residents and tourists in explaining perceived impacts of festivals, indicating a potential connection to residents' years of residency.

Table 6: Relationship between resident's involvement in Osun Osogbo Festival and their socio-demographic characteristics

Variables	**Correlation Value (r)**	**(Sig; 2-tailed)**	**Remark**
Gender	-0.061	0.236	Not significant
Age Range	-0.014	0.777	Not significant
Marital status	0.037	0.472	Not significant
Educational Background	0.070	0.169	Not significant
Household size	-0.053	0.296	Not Significant
Religion	-0.252	0.000	Significant
Occupation	-0.021	0.685	Not significant
Origin	0.217	0.000	Significant
Years of residency	-0.193	0.000	Significant

$p<0.05$

4. CONCLUSION

The findings of this study add to the existing literature on social sustainability in tourism by investigating the social sustainability perception of the Osun Osogbo festival at Nigeria's World Heritage site. It was found out that Osun Festival is an important event in the communities, which encourage and promote the participation of the residents in the event. Perceptions of the festival's social impacts is high as it contribute to community cultural enrichment and encourage interaction between visitors, residents and management of the grove. The study further revealed that economic benefits and their level of involvement influenced the perception of the residents towards tourism social sustainability. To ensure that this is sustained, the benefits derived from tourism must improve the overall quality of life for residents and have positive economic impact. Preservation and promotion of local culture and traditions, capacity of residents, as well as enlightening them to actively participate more in and benefit from tourism activities can lead to more sustainable practices among residents and improve tourism’s social sustainability.

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TÜRK SPORUNDA SPOR TESİSLERİ SORUNU

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Özet
Spor tesislerini stadyumlar, spor salonları, yüzme havuzları, tenis kortları, bilardo salonları ile bireylerin egzersiz yapmak ve spor müsabakalarını da izlemek üzere bir araya geldiği yerlerden oluşan alanlar olarak tanımlayabiliriz. Bu araştırmanın amacı Türk sporunda spor tesisleri sorunun incelenmesidir. Araştırmada nitel araştırma yöntemlerinden doküman analizi yöntemi tercih edilmiştir. Araştırmada ilk olarak Türk sporunda spor tesisleri sorunu ile ilgili akademik makeleler, tezler, dergiler, gazeteler ve kitap dokümanlarına ulaşıldı ve orijinallikleri kontrol edildi. Daha sonra ayrıntılı inceleme yapılarak araştırma ile alakalı yayınlar belirlendi. Belirlenen dokümanlar okunarak yorumlanmıştır. Spor tesisleri, barındırdıkları yoğun aktivitelerden dolayı yüksek oranda aşınma ve yıpranma yaşamaktadır. Bununla birlikte aydınlatma, havalandırma, ısıtma, soğutma, yetersiz otopark alanları, spor tesislerininin tasarımı, personel yetersizliği ile tesislerin işletilmesinin doğru yapılmaması hem tesislere hem de sporculara ve seyircilere zarar verebilmektedir. İnsanlar spor tesislerini kullanırken hem spor hem de sağlık amaçlı tesislere yönelmektedirler. Ancak teknolojik gelişmelerin tesislerde istenilen şekilde yer almaması, tesislerin yerleşim yerlerinden uzak yapılması, spor tesislerindeki dağılımının adil bir şekilde olmaması, temizlik ve hijyen durumunun yetersiz olması, tesislerde kütüphane, kantin, ilk yardım odaları vb. olanaklarının yetersiz olduğu belirlenmiştir. Son yılarda ülkemizde devletimizin katkılarıyla önemli spor tesisleri yapılmış ve birçok sporcunun yetiştirilmesine katkı sağlanmıştır. Ancak, tesis sayısının artması, antrenör ve yönetici görevlendirilmesinin yapılmasına rağmen tesislerin planlanması, işletilmesi ve kullanılmasında istenilen seviyeye ulaşılamamıştır. Spor kulüpleri de tesisleşmede yetersiz kalmaktadır. Sonuç olarak; spor tesislerinin eksikliği bazı bölgelerdeki bireylerin spor aktivitelerine katılamaması, sportif becerilerinin geliştirilememesi ve bu bireylerin dezavantajlı duruma düşmeleri anlamına gelmektedir. Spor tesislerinin azlığı ve ayrılan bütçenin eksikliği bu alanda daha fazla devlet ve özel sektör yatırımına ihtiyaç olduğunu söyleyebiliriz.
Anahtar Kelimeler: Spor, Tesis, Spor Tesisi

SPORTS FACILITIES PROBLEM IN TURKISH SPORTS

Abstract
We can define sports facilities as areas consisting of stadiums, gyms, swimming pools, tennis courts, billiard halls and places where individuals come together to exercise and watch sports competitions. The aim of this research is to examine the sports facilities problem in Turkish sports. Document analysis method, one of the qualitative research methods, was preferred in the research. In the research, firstly, academic articles, theses, magazines, newspapers and book documents related to the problem of sports facilities in Turkish sports were accessed and their originality was checked. Then, a detailed review was conducted and publications relevant to the research were identified. The specified documents were read and interpreted. Sports facilities experience high levels of wear and tear due to the intense activities they host. However, illumination, ventilation, heating, cooling, insufficient parking areas, design of sports facilities, lack of personnel and improper operation of the facilities can harm both the facilities, the athletes and the spectators. When people use sports facilities, they turn to facilities for both sports and health purposes. However, it was determined that technological developments were not included in the facilities as desired, the facilities were built far from residential areas, the distribution of the sports facilities was not fair, the cleaning and hygiene conditions were inadequate, and the facilities such as libraries, canteens, first aid rooms, etc. were insufficient. In recent years, important sports facilities have been built in our country with the contributions of our state and contributed to the training of many athletes. However, despite the increase in the number of facilities and the appointment of coaches and managers, the desired level has not been reached in the planning, operation and use of the facilities. Sports clubs are also inadequate in terms of facilities. In conclusion; The lack of sports facilities means that individuals in some regions cannot participate in sports activities, their sports skills cannot be developed, and these individuals become disadvantaged. We can say that there is a need for more state and private sector investments in this area due to the scarcity of sports facilities and the lack of allocated budget.
KeyWords: Sports, Facility, Sports Facility

GİRİŞ

Spor ülkemizde milyonlarca vatandaşın hayatında önemli bir rol oynamaktadır. Gerek spor salonlarında, stadyumlarda, okullarda gerekse televizyon kanallarında, gazetelerde ve sosyal medya aracılığı ile insanların önemli bir kısmı sporu takip etmekte ya da spor aktivitelerine katılım sağlamaktadır. İnsanların hem spor aktivitelerine katılım sağlaması hem de sporu takip etmeleri için spor tesislerine ihtiyaç vardır. Spor tesislerinin olmadığı yerlerde birçok spor aktivitesi yapılamamaktadır. Spor tesisleri bireylerin sağlıklı olması, fiziksel aktivitelere katılım sağlaması ve sosyalleşmesinde önem arz etmektedir. Sporda başarıyı etkileyen en önemli faktörlerden biride iyi şekilde yapılan spor tesisleridir. Spor ancak tesis, eğitim, donanım ve spor organizasyonundan oluşan temel faktörlerin bir arada bulunduğu bir ortamda var olur ve gelişir. Spor tesisi denilince akla sadece antrenman veya müsabakaların yapıldığı spor alanı gelmemelidir. Spor tesisi terimi; eğitim tesisleri, beslenme ve dinlenme sosyal tesisleri, yaralanma ve tedavilerde kullanılacak ilk yardım ve rehabilitasyon merkezleri ile eğitim için gerekli film, video, kütüphane gibi salonları da içerir. Diğer bir deyişle spor tesisi, her türlü spor ve gençlik faaliyetlerinin yapıldığı kapalı veya açık sosyal hizmet amaçlı yapılmış spor tesisi olarak anlaşılmalıdır. Ayrıca spor tesislerinin sporcular için yeterli ve uygun olması, daha fazla ve daha iyi spor tesislerinin yapılması, daha fazla aktivite ve gelişim anlamına gelir (İntegralgroup, 2022).Bir ülkenin sporda başarılı olması eğitim, bilim ve teknolojik gelişmelerin yanında toplumun gelişmişliği ve izlenen politikalarla da ilişkilidir. Bu nedenle ülkeler spora daha fazla eğilerek sporda başarılı olmak için gerekli tedbirleri almalıdır (Yaman Yılmaz ve Algün Doğu, 2021). Spor tesisleri ve yapımı teknolojinin ilerlemesine paralel olarak gelişip değişmektedir (Bilgin, 1990). Spor tesislerinin dünyada yayılması ile birlikte ihtiyaçların artması ve bunun doğal sonucu olarak çok amaçlı işletmelerin yapımı, verimli kullanım açısından kaçınılmaz olmuştur. İnsanlar hem spor hem de sağlık amaçlı tesislere yönelirken, aynı işletme içinde farklı bireysel ve toplumsal ihtiyaçların giderilmesi gereği ortaya çıkmaktadır (Ceyhun, 2008). Nacar (2011) 'a göre; sporun toplumda önem kazanması ve yayılması bununla birlikte devamlı başarıların elde edilmesinde sahip olunan tesislerin işletilmesi, nitelikleri, nicelikleri yeterlilik ve doğru politikalara da bağlıdır. Spor eğitimi veren kurumlar, spor tesislerinin planlanması ve kapasitelerinin artırılması, şüphesiz ki spor eğitim kalitesini artıracaktır. Spor eğitimi veren kurumlarda, spor tesislerinin varlığı o kurumun performansında önemli bir yer tutar. Ayrıca spor tesisleri bir kurumun toplum karşındaki imajını belirler. Bu nedenle tesisleşmenin kulüpler ve sporcular üzerindeki etkisinin büyük önem taşıdığı ve ülkelerin sporcu yetiştirmek için yaptığı yeniliklerin tesisleşme ile başladığı

sonucuna varılmaktadır.Günümüzde her ilde ve ilçede futbol sahaları bulunmaktadır. Bunların elbette ki kapasitesi ve kalitesi tartışılabilir. Ancak diğer spor dallarında bu kadar yaygın bir tesis yapılanması yoktur. Futboldaki tesis yapılanması konusunda ise kapasite ve kalite konusunda sorunlar bulunmaktadır. Avrupa'da çok büyük kapasiteli ve kaliteli stadyumlar bulunurken, Türkiye'deki kapasitesi yüksek ve kaliteli stadyumların sayısı bir elin parmaklarını geçmeyecek kadar azdır. Ancak onlarda da sorunlar yok değildir. Futbol tesislerinde devlet yardımları yapılmaktadır. Anadolu kulüpleri olarak tabir edilen küçük takımların spor tesislerinde devlet yardımı ile son yıllarda modern tesisleşmeye sağlanmaya başlanmıştır. Tesislerin kapasitesinin yüksek olması ve kalitelerinin iyi olması, futbol izleme keyfini artıracağı gibi güvenlik açısından ve şiddet olaylarının önlenmesi açısından da önemlidir. Dünya kupası müsabakalarına talip olan Türkiye'nin bu noktada nicelik ve nitelik olarak yetersiz olan başta stadyumları olmak üzere tüm spor dallarındaki tesislerin iyileştirilmesi gerekmektedir (Gürsoy, 2014). Bu araştırmanın amacı Türk sporunda spor tesisleri sorunun incelenmesidir.

MATERYAL VE METOT

Araştırmada nitel araştırma yöntemlerinden doküman analizi yöntemi tercih edilmiştir. Araştırmada ilk olarak Türk sporunda spor tesisleri sorunu ilgili akademik makeleler, tezler, dergiler, gazeteler ve kitap dokümanlarına ulaşıldı ve orijinallikleri kontrol edildi. Daha sonra ayrıntılı inceleme yapılarak araştırma ile alakalı yayınlar belirlendi. Belirlenen dokümanlar okunarak yorumlanmıştır.

BULGULAR

Bugün tesisleşme anlamında kulüpler önemli adımlar atmaktadırlar. Bir kulübün varlıkları açısından böylesine yatırımlar, uzun vadede önemli menfaatler sağlayacaktır. Sportif amaçlı komplekslerle ilgili olabileceği gibi (stadyum, spor sahası, antrenman sahası, kamp tesisleri vb.), sosyal ve idari amaçlı (dernek binaları, yönetim merkezleri, sosyal tesisler vb.) da olabilmekte. Ancak başta yeni stadyumların inşası ve renovasyonu olmak üzere uzun yıllara yayılan ve büyük bütçeler gerektiren bu tür projeler, beraberinde ciddi bir ek finansman ihtiyacını getirmektedir. Operasyonel gider bütçesinde iki yakası bir araya gelmeyen, faiz ve kur farkı gibi finansal giderlerin ağır yükünü taşıyan, gelir projeksiyonlarında işlerin sık sık beklendiği kadar rayında gitmeyebildiği bir ortam oluşturmaktadır (Sezgin, 2016).

Özen ve ark. (2012), araştırmalarında Türk spor yönetiminde yerel yönetimlerin spora tesis ve malzeme olarak katılımlarının oldukça az olduğu, sporu yaygınlaştırma çalışmaları için yeterli olanaklara sahip olunmadığı, Berkant ve Hekimoğlu (2021), araştırmalarında sporcu yetiştirilmemesinin en önemli nedenlerinin tesis yetersizliği ve malzeme eksikliği olduğunu, Özer ve Dikmen, (2020), araştırmalarında bireylerin tesislerden yeterince yaralanamadığını, Güler ve Ekinci (2021), spor tesislerinin temininde sorunlar yaşandığını, Tekin ve ark. (2020), tesislerin olmamasının fiziksel aktivitelere katılıma engel durumların olduğunu ifade etmişlerdir.Spor tesisleri ile ilgili bir diğer sorun ise Devletin mülkiyetindeki spor saha ve tesislerinin talepte bulunulması halinde isteyen yahut daha güçlü olan spor kulübüne tahsis edilmesi, kiralanması, kullanım hakkının uzun süreli devredilmesi, aynı spor branşında faaliyet gösteren diğer kulüpleri zor durumda bırakmaktadır. Zira kullanım hakkını eline geçiren kulüp diğer kulüplerin bu spor saha ve tesislerinden yararlanmasına izin vermemekte ya da işin ticaretini yaparak ve tesis bakımından tekelleşerek devletin belirlediği meblağdan daha yüksek kullanım bedeli istenmektedir (İmamoğlu ve ark., 2007). Bu durum ise spor tesisleri olmayan spor kulüplerini sıkıntıya sokabilmektedir.Ayrıca, farklı kamu kurumlarına ait spor tesislerinin ortak kullanımı ve mesai saatleri dışında hizmet verilmemesinde de sıkıntılar yaşanmaktadır. Bu nedenle, spor tesislerinin bölgesel ve branşlar bazında dengeli dağılımını ve etkin kullanımını sağlayacak tesis politikalarının geliştirilmesi ihtiyacı bulunmaktadır (T. C. Kalkınma Bakanlığı, 2014).Demiröz (2009), tesislerde yapılan sportif organizasyonların, işletmecilik boyutları ve yönetim fonksiyonları açısından, planlama, organize etme, yürütme, denetim ve kontrol süreçlerinin antrenör ve sporcuların beklenti ve ihtiyaçlarına cevap veremediği, spor tesislerinde aktivite yapılması için verilen sürenin ve kişilerin boş zamanlarında spor yapma isteği ile tesislerin gün içinde açık kalma ve uygun ortam oluşturabilme uyumunun yetersiz olduğunu belirlemiştir. Çiçek (2022), araştırmasında tesislerin kütüphane, internet, kantin, tv odası, yönetici, sağlık görevlisi, masör, sağlık kabini, ilk yardım odaları vb. olanaklarının ise yetersiz olduğunu belirlemiştir.Çelik (2018), araştırmasında temizlik ve hijyen durumunun, saha ve zeminin, spor malzemelerinin, sağlık kabini ve ilk yardım odalarının, sosyal aktivite alanlarının ve engelli sporculara yönelik tesislerin yeterliliğinin antrenör ve sporcuların beklenti ve ihtiyaçlarını karşılamadığı belirlenmiştir.

TARTIŞMA VE SONUÇ

Sporu oluşturan bileşenlerden biri de spor tesisleridir. Topluma en iyi şekilde spor hizmeti verilmesinde spor tesislerinin niteliği önemli bir kriterdir. Sporun yaygınlaştırılmasında spor tesislerinin sayı ve çeşitliliğinin, toplumun spora ilişkin beklenti ve ihtiyaçlarının belli bir politika çerçevesinde ele alınması gerekmektedir (Karataş ve ark., 2011).

Ülkemizde alt yapıdan sporcu yetişememesinin temel nedeni olarak tesisleşme yetersizliği olduğu görülmektedir. Antrenman yapılacak tesislerin azlığı, var olanların da yeterli düzeyde olmadığını söyleyebiliriz (Çevik ve Onağ, 2019). Halkın ilgi duyduğu halde spor yapmasına engel teşkil eden faktörlerin başında yeterli spor tesisinin olmamasının geldiği tespit edilmiştir (Karataş ve ark., 2011). Ünal (2001), Çanakkale'de yaptığı çalışmada, Şahin (2007), Karaman ilindeki yaptığı çalışmada, sporu yapmak istediğiniz halde spor yapmaya mani olan haller nelerdir sorusuna bölgede istenilen branşa ait tesisinin bulunmamasının neden olduğu cevabı verilmiştir. Yavaş ve ark. (2017); Günakan ve Ataçocuğu (2021), ülkemizdeki tesis sayısı ihtiyacı karşılamada yetersiz olduğunu belirlemişlerdir. Kubat ve Yildiz (2022), antrenörlerin kulüplerin tesislerine ilişkin tesisleşme ile ilgili problem yaşadıkları ve çözüm olarak fonksiyonel tesisler inşa edilmesini, tesislerde beslenme ve barınma imkânlarının sağlanmasını, tesislerin içinde sporcuların öğrenim görecekleri okulların açılmasını önermişlerdir. Spor tesisleri sayısının artması, planlı bir şekilde organize edilmesi ile sporcu sayılarında da artış olacaktır. Örnek olarak; Türkiye Tenis Federasyonu Başkanı Cengiz Durmuş lisanslı sporcu sayısı 2013'te 27 bin civarında iken 2023'te 102 bin 352'ye kadar yükseldiğini, Türkiye Tenis Federasyonu tarafından 600'u ulusal, 200'ün üzerinde turnuva düzenlenirken, ülke genelinde oteller, kulüpler, belediyelerin tesisleriyle amatör ve profesyonel olarak binlerce kort bulunduğunu belirtmiştir (Zeyrek, 2023).Ülkemizde sporun şimdiye kadar yeterince yaygınlaştırılamamasındaki faktörlerden birisi, spor tesislerindeki dağılım ve kalite eksikliği ile bunların optimal ölçülerde kullanılmamasıdır. Tesisler planlanırken bölgelerarası nüfus artışı, coğrafi konum, iklim ve demografik yapıyı dikkate alan ulusal düzeyde spor tesis politikaları oluşturulmadığından bölgesel ve spor branşları bazında dengesizlikler ortaya çıkmıştır (T. C. Kalkınma Bakanlığı, 2014). Sonuç olarak; ülkemizde Devletimizin katkılarıyla son zamanlarda önemli spor tesisler yapılmış ve birçok milli sporcu, profesyonel sporcu ve amatör sporcunun yetiştirilmesine katkı sağlanmıştır. Tesis sayısının artması ile birlikte vatandaşlarımızda bu tesislerde spor yapma imkânına kavuşmuştur. Tesis sayısının artması, antrenör ve yönetici görevlendirilmesi yapılmasına rağmen tesislerin planlanması, işletilmesi ve kullanılmasında

istenilen seviyeye ulaşılamamıştır.Tesisler inşa edilirken, tek tip projeler ile şehirlerin ihtiyaçları düşünülmeden tasarlanması, tesislerin yeterli donanıma sahip olmaması, teknolojik gelişmelerin tesislerde istenilen şekilde yer almaması, özellikle yerel yönetimlerin istekleri doğrultusunda yapılan tesislerin çoğunun doğru planlanmadığı (bölgede ihtiyaç olmamasına rağmen bir birine çok yakın yerlerde 3 tane yüzme havuzunun yapılması gibi), yapılan tesislerin yerleşim yerlerinden uzak yapılması, tesis yöneticilerinin çoğunluğunun spor eğitimi alanında uzman olmaması nedeni ile tesisleri kullanan vatandaşların memnuniyet düzeylerinin azalmasına ya da tesislerin kullanmamasına neden olmaktadır.Kamu kurumları, yerel yönetimler, spor kulüpleri, spor kuruluşları spor tesisleri planlamalarını yaparken birbirleriyle iletişim halende olmaları, projeler üzerinde fikir alıverişinde bulunmaları tesislerin kullanımı ve her vatandaşın spor faaliyetlerine katılım sağlamaları açısından önem arz etmektedir.

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FUTBOL KULÜPLERİNDE KURUMSALLAŞMA

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Özet
Spor kulüpleri, sürdürülebilirliklerini ve uzun vadeli başarılarını sağlamak, diğer kulüplerle rekabet edebilmek ve mali açıdan kâr elde edebilmek için kurumsallaşmaya ihtiyaç duyarlar. Kurumsallaşma, kulüplerin daha profesyonel bir yönetim anlayışı benimsemesini sağlar, kulüplerin işletme süreçlerini daha etkin bir şekilde yürütmesine ve daha etkili kararlar almasına olanak tanır. Bu araştırmanın amacı, ülkemiz futbol kulüplerindeki kurumsallaşmanın mevcut durumunun incelenmesidir. Araştırmada nitel araştırma yöntemlerinden doküman analizi yöntemi tercih edilmiştir. Araştırmada ilk olarak Türk futbolunda kurumsallaşma ile ilgili akademik makeleler, tezler, dergiler, gazeteler ve kitap dokümanlarına ulaşıldı ve orijinallikleri kontrol edildi. Daha sonra ayrıntılı inceleme yapılarak araştırma ile alakalı yayınlar belirlendi. Belirlenen dokümanlar okunarak yorumlanmıştır. Ülkemiz futbol kulüplerindeki kurumsallaşmanın mevcut durumu incelendiğinde, kulüp yönetimlerindeki kişilerin alanlarında uzmanlaşmamış, görev, yetki ve sorumluluk alanları ile ilgili bilgiye sahip olmadıkları, kişiye bağlı yönetimlerin yaygınlaştığı, hukuki, mali ve yönetsel sorunların olduğu, kulüplerin gelişimi için sistemli bir planlamanın olmadığı, altyapıya yeterli önemin verilmediği, Türkiye Futbol Federasyonu tarafından alınması gereken tedbirlerin zamanında alınmadığı, sorunların çözümünde futbolun tüm paydaşları ile fikir alış verişinde bulunulmadığı bu sebeplerden kaynaklı futbol kulüplerinin kurumsallaşma çabalarının ideal standartlarda olmadığı belirlenmiştir. Sonuç olarak, Türkiye'deki futbol kulüplerinin kurumsallaşma sürecinde başarılı oldukları söylenemez. Futbol kulüplerinin uzun vadede rakipleriyle mücadele etmesi ve güçlü bir kurumsal yapı için futbol kulüplerinde profesyonel bir yönetim anlayışının benimsenmesi gerekmektedir.
Anahtar Kelimeler: Futbol, Kurumsallaşma, Yönetim, Kulüp Yönetimi.

INSTITUTIONALIZATION IN FOOTBALL CLUBS

Abstract
Sports clubs need institutionalization to ensure their sustainability and long-term success, to compete with other clubs and to make financial profits. Institutionalization enables clubs to adopt a more professional management approach, allowing clubs to carry out business processes more effectively and make more effective decisions. The purpose of this research is to examine the current status of institutionalization in football clubs in our country. Document analysis method, one of the qualitative research methods, was preferred in the research. In the research, firstly, academic articles, theses, magazines, newspapers and book documents related to institutionalization in Turkish football were accessed and their originality was checked. Then, a detailed review was conducted and publications relevant to the research were identified. The specified documents were read and interpreted. When the current state of institutionalization in football clubs in our country is examined, it can be seen that the people in club management are not specialized in their fields, do not have knowledge about their areas of duty, authority and responsibility, personal management has become widespread, there are legal, financial and managerial problems, there is no systematic planning for the development of the clubs, and sufficient importance is not given to infrastructure. It has been determined that the institutionalization efforts of football clubs are not at ideal standards due to these reasons, that the required measures are not taken by the Turkish Football Federation in a timely manner, that there is no exchange of ideas with all stakeholders of football in solving the problems. As a result, it cannot be said that football clubs in Turkey are successful in the institutionalization process. In order for football clubs to compete with their rivals in the long term and to have a strong corporate structure, a professional management approach must be adopted in football clubs.
Keywords: Football, Institutionalization, Management, Club Management.

GİRİŞ

Futbol, sosyal etkisi ve gençliğe aktardığı kayda değer katkıdan ötürü, bir oyundan daha fazla anlam taşımaktadır. Futbol milyonlarca kişinin ilgisini çekerken, futbol kulüplerinin yönetimleri ise, milyonları temsil etmektedir. Bu nedenle, futbol kulüplerini yönetenlerin, bu kulüpleri en yüksek standartlarda yönetme sorumluluğu bulunmaktadır. Özellikle 1990'lı yılların başından itibaren endüstriyel sürece doğru yönelen futbol, kulüpleri de sportif organizasyonların yanı sıra ekonomik organizasyonlara dönüştürmektedir. Futbolun bu değişen yapısı, kulüplerde ‘‘kurumsal yönetim’’ uygulamalarını zorunlu hale getirmiştir. Kurumsal yönetimin sağlanabilmesi ise; kurum içi hiyerarşisi doğrultusunda doğru planlama, doğru iş bölümü, çalışanlara sağlanacak rahat çalışma ortamı ve onlara verilecek değerle birlikte oluşacak örgüt kültürüne bağlıdır (Yıldız, 2017).Günümüzde futbol oyunu tüm dünyada herhangi bir ticari sektör gibi serbest pazar norm ve kurallarına tabi görülmektedir. Gelecek dönemlerde gerek yönetsel gerekse de ekonomik olarak ayakta kalabilir olmayan herhangi bir spor kulübü futbol dünyası içinde varlığını sürdürmekte güçlük çekecektir. Bu bağlamda, spor kulüpleri çağdaş işletmeciliğin başarı getiren yöntemlerini yürütmek ve kurumsal yönetimin gereklerini uygulamak konumundadırlar (Katırcı ve Uztuğ, 2009).Spor kulüpleri, başka kulüplerle rekabet düzeyinde var olabilmek ve kâr elde edebilmek için kurumsallaşmaya ihtiyaç duymaktadırlar. Kurumsallaşma, işletmelere, çevrede meydana gelen değişimlere uyum sağlamakta kolaylık sağlayabilmektedir. Aynı zamanda kurumsallaşma, işletmenin içyapısında yer alan faktörlere de etki edebilmektedir. Bu faktörler arasında örgütsel bağlılık, örgütsel performans ve iş tatmini de yer alabilmektedir (Kekül ve Genç, 2023). Kurumsallaşmayı sağlamak için gerek duyulan bazı temel ilkeler mevcuttur. Kurumsallaşmayı oluşturan unsurlar profesyonelleşme, formalleşme, otonomi, kültürel güç, saydamlık, sosyal sorumluluk ve tutarlılıktır (Apaydın, 2007).Kurumsallaşma, işletme yapısının belirli ilke ve standartlara göre yeniden yapılandırılması, yönetici ve çalışanların işin ehli kişilerden olması ve işletmenin bilgiye dayalı bir anlayış içinde çalışması demektir (Uzunçarşılı vd., 2000, akt, Şahman ve ark., 2008). Kurumsallaşmada kişilerden çok tüzel kişilik ön plana çıkmaktadır. Diğer bir ifadeyle amaç; bireylere göre bir işleyiş değil, tamamen bireylerden bağımsız olacak şekilde, modern yapıda bir iş ve işleyiş bilinciyle hareket etmek ve bu sistemli organizasyon yapısını; yönetim, tedarik, üretim, insan kaynakları, finans vb. işletmenin fonksiyonlarına yayarak, sistemin tüm organizasyona hâkim kılınmasını sağlamaktır (Taş ve Akdemir, 2005, akt. Kekül ve Genç, 2023).

Spor kulüplerinin idari, mali ve hukuki pek çok sorunu olduğu düşünüldüğünde kulüp yönetiminde yönetişimin geliştirilmesi de bu sorunların çözülmesinde önemli bir yaklaşım olacaktır. Bu, aynı zamanda kulüplerin kurumsallaşması yönünde de atılmış önemli bir adım olacaktır. Kulüpte yönetişim ve kurumsal yönetim ilkelerinin uygulanması, kulüp idaresindeki aksaklıkların hemen tespitinin ve Yönetim Kurulunun harekete geçmesinin sağlanması yanında, oluşan zarar ve ziyanın belirlenmesi, kulübün pay sahiplerinin, paydaşlarla, taraftar/tüketiciyle olan ilişkilerinin koordine edilmesi, yönetim kurulu üyelerinin ve yöneticilerin performans değerlendirmesi, diğer kulüp çalışanlarının kariyer planlaması ve ödüllendirilmesi ile ilgili işlevlerin yerine getirilmesinde önemli sonuçlar doğuracaktır. (T.B.M.M., 2011). Bu araştırmanın amacı, ülkemiz futbol kulüplerindeki kurumsallaşmanın mevcut durumunun incelenmesidir.

MATERYAL VE METOT

Araştırmada nitel araştırma yöntemlerinden doküman analizi yöntemi tercih edilmiştir. Araştırmada ilk olarak ülkemiz futbol kulüplerindeki kurumsallaşmanın mevcut durumu ile ilgili akademik makeleler, tezler, dergiler, gazeteler ve kitap dokümanlarına ulaşıldı ve orijinallikleri kontrol edildi. Daha sonra ayrıntılı inceleme yapılarak araştırma ile alakalı yayınlar belirlendi. Belirlenen dokümanlar okunarak yorumlanmıştır.

BULGULAR

Spor kulüplerinin kuruluş statüleri, farklı üst yapılara karşı sorumluluklarının olması, yapısal ve yasal sorunlar, kulüpler arasında haksız rekabet ve gelir eşitsizliğinden kaynaklanan sorunlar, kurumsallaşma anlayışındaki sorunlar, kişiye bağlı yönetimden kaynaklı sorunlar, maddi gelir elde etmede yaşanan sorunlar ve sportif sonuçlara endeksli olmaktan kaynaklanan sorunlar gibi başlıca nedenlerden dolayı kurumsallaşma sürecinde bir takım sıkıntılar yaşadıkları ortaya çıkmaktadır. Ayrıca UEFA kriterlerinin uygulanması ile başlayan spor kulüplerinde yeniden yapılanma çalışmalarına spor kulüplerine özgü yasal ve kanuni düzenlemeler ile katkı sağlanması gerektiği, kurumsallaşmayı yasalara bağlayarak kulüpler için zorlayıcı bir özellik olarak oluşturulması, spor kulüplerinde görev alacak kişilerin alanlarında uzmanlaşmış, bilgi ve deneyim sahibi olması gerektiği ve başkan veya yönetim kurulunun maddi gücüne dayalı olan kulüp yönetim sistemi yerine sürdürülebilir bir yönetim sisteminin spor kulüplerinde var olması gerektiği görülmüştür (Sönmezoğlu, 2013). Çöten (2007), Türkiye Süper Lig kulüplerini örnek alarak profesyonel futbolun idari ve teknik yapılanmasını analiz

ettiğinde Süper Lig kulüplerinin yönetim etkinliklerini ideal standartlarda olmadıklarını belirlemiştir. Kulüp idari ekibinde yer alan elemanların görev, yetki ve sorumluluk alanları ile ilgili bilgiye sahip olmamalarının örgütte iletişim güçlüklerine yol açtığı, sorumluluk alanlarının ve görev dağılımının açık şekilde belli olmaması sistemli bir işleyişin olmadığını, kulüplerin profesyonel yöneticiler tarafından idare edilmediğini, kulüplerin sistematik bir şekilde planlaması yapılmış amaçlar doğrultusunda hareket etmediğine, kulüp yöneticilerinin görev yaptığı alanlarda uzman olmadıklarını belirlemiştir Ülkemizde de spor kulüpleri kurumsallaşamama nedeniyle hukuki, mali ve yönetsel birçok sorunla karşı karşıya kalmıştır. Birçok spor branşında gelir kaynağı bulmakta sıkıntılar yaşanmakta, amatör düzeyde destek bulmakta zorluklar çekilmesi nedeniyle de halkın spora aktif katılımı sağlanamamaktadır. Bireysel yetkinlik ve kuruluş kalitesi dolayısıyla rekabet açısından eksiklikler ortaya çıkmakta bu nedenle de spor kulüpleri ciddi sıkıntılar yaşamaktadır (T.B.M.M., 2011) Türkiye profesyonel liglerinde yer alan futbol kulüplerinin yönetimsel, organizasyon, idari, teknik, sağlık, eğitim, destek kadroları yetersiz oldukları için çok ciddi sorunlar yaşamaktadırlar. Bu sorunlar ise işin nihayetinde sportif boyutta saha içine yansımakta ve başarısız sonuçlar ortaya çıkmaktadır (Öz, 2020).Avşar ve Kurtipek (2024), Galatasaray spor kulübü ile ilgili araştırmalarında başarı için kişilerin öne çıkarılmasından ziyade kurumsallaşmaya yönelik sistemin oluşması gerektiği, kulüp yönetiminde finansal ve yönetsel açıdan kurumsallaşmanın sağlanamadığı sonucuna ulaşmışlardır. Üye sayısının artmasıyla seçilecek bir yönetimin, sorumlulukları tüzükle belirlenmiş ve maaşları genel kurulda açıklanan profesyonel yöneticilerin ve kulüp öz kaynaklarından çıkacak sporcularla elde edilecek katma değeri yüksek sportif başarıların Galatasaray'ın kurumsallaşması için önemli görülmektedir (Avşar ve Kurtipek, 2024).Taştan (2021), araştırmasında profesyonel futbol kulüp yöneticilerinin sportif ve finansal başarısızlıklarının nedenleri ile ilgili yaptıkları açıklamalara ilişkin içerik analizi incelendiğinde katılımcılar, profesyonel futbol kulüplerinin sportif ve finansal başarısızlıklarının nedenlerini sırasıyla %26,52 ile kulüp yöneticilerini, %23,48 ile kulüplerin ekonomik yönetimlerini, %16,67 ile altyapı ihtiyacını ve altyapıdan oyuncu yetiştirmeyi, %14,39 ile Türkiye Futbol Federasyonu tarafından yapılması beklenen ekonomik tedbirleri ve kulüplerin mali denetimlerini, %12,12 ile transferler ile yaşlı ve pahalı transferleri, %5,30 ile sonuncu sırada devlet desteği olarak sıralanmıştır.Biçer ve ark. (2022), araştırmalarında profesyonel futbol kulüplerinin oyuncular, altyapı, menajerler, teknik direktörler, kulüpler ve taraftarlarla sorunlarının olduğu tespit etmişlerdir. Türkiye'deki futbol kulüp yöneticilerinin

başarılı olabilmeleri için sportif başarının yanında birçok unsuru göz önünde bulundurması ve futbolun tüm paydaşları ile sorunlarını en iyi şekilde çözmesi gerekmektedir.

Kurumsallaşmanın ülkemizde ve dünyadaki önemine yapılan vurgu farklı sektörleri de içine alarak her geçen gün artmaktadır. Çünkü kurumsallaşma örgütlerin kendilerini geleceğe taşımalarında ve yer aldıkları sistem içerisinde kendilerini kabul ettirmede önemli bir rol oynamaktadır. Örgütler kurumsallaşarak meşruluk, tahmin edilebilirlik ve istikrar kazanmakta, ayrıca işletme kaynaklarını artırarak çevreye uyum sağlamaktadırlar. Örgütlerin kurumsallaşma sürecinin temelinde, 'biçimsel faaliyet yapısı', 'biçimsel organizasyon yapısı', 'profesyonelleşme', 'yetki devri', 'kültürel güç', 'kurumsal çevreye uyum', 'kurumsal sosyal sorumluluk', 'toplumsal değer ve normlara uyum', 'şeffaflık ve hesap verebilirlik' ve 'biçimsel yapıya uyum' esasları bulunmaktadır. Tarım, sanayi, hizmet vb. sektörlerdeki örgütlerde çıktı; ürün, performans göstergesi; kâr ya da bir buluş, varlıklar; entelektüel sermaye, know-how, şerefiye gibi değerler olurken, spor sektöründe bu unsurlar nispeten farklılaşmaktadır. Sporda çıktı sportif başarıdır. Sportif başarı içinse finansal güç, varlığın sürdürülmesinde gerekli kaynakları elde etmek için faaliyetlerin kârlılıkla sonuçlanması, örgüte bağlı ve uzmanlık sahibi çalışan/yönetici ve sporcuların varlığı gereklidir (Dağlı Ekmekçi ve İrmiş, 2015).

TARTIŞMA VE SONUÇ

Kurumsal sürdürülebilirlikte, futbol kulüpleri sürdürülebilirlik performanslarının artırılması için sürdürülebilirliğin ekonomik, çevresel ve sosyal etkenlerinin tüm stratejik ve operasyonel süreç ve karar mekanizmalarına dâhil etmeleri gereklidir. Ancak, futbol kulüplerinin ekonomik, sosyal ve çevresel kaynakları nasıl kullandıklarını, ne kadar verimli kullandıklarını ya da olumsuz etkileri bertaraf etmek için ne gibi önlem aldıklarını söylemek mümkün değildir (Darama, 2021).Kulüpler, birbirlerine benzeme eğilimi göstererek kurumsallaştıklarını düşünmektedirler. Ancak kulüplerin kurumsallaştıklarını düşünmelerine rağmen finansal durumlarının zararda olması, kurumsallaşma ilkelerini yerine getirmedikleri sonucunu ortaya çıkarmaktadır. Kulüplerin finansal ve sportif başarısının arttırılması için bir iktisadi örgütün yapması gereken kurumsallaşma ilkelerini, kişisellikten uzak, profesyonel kurumsal yönetim anlayışı ile kararlılıkla uygulaması gerektiği değerlendirilmektedir (Taştan ve Donuk, 2021).Kurumsallaşabilen yapı, ortak aklın yönetim ve denetimine giren; sistematik yönetimin hâkim yönetim yapısı hâline geldiği; şeffaflığın, hesap verebilirliğin ve katılımcılığın ana ekseni olduğu yönetsel örgütlenmeyi tanımlamaktadır. Sporda kamu, federasyonlar, kulüpler, teknik direktörler, sporcular, hakemler, taraftarlar ve medya gibi pek çok aktör ve paydaş

bulunmaktadır. Bunların tamamının fikirlerini aktarabileceği bir üst yönetim mekanizması geliştirilmesi, bütün sorunların yansıtılması yanında; birlikte çözüm bulunması açısından da önem taşımaktadır (T.B.M.M., 2011).

Kulüplerin kurumsal yönetim yapılarını bir an önce oluşturmaya başlamaları gerekir. Kurumsal yönetimin yerleşmesi bir süreçtir. Bu uygulama ile kulüplere etkinlik, şeffaflık, hesap verebilirlik, açıklık, devamlılık gelecektir. Kurumsallaşmanın yolu şirketleşmeden değil, yönetimde evrensel ilkelerin uygulanmasından geçmektedir. Futbol kulüplerinin arzulanan sportif ve mali başarısının elde edilebilmesinin temel şartı futbol kulüplerinin profesyonel yöneticiler tarafından yönetilmesi ve kulüplerin kurumsallaşmasıdır (Uluyol, 2014).Günümüz dünyasında en yaygın spor branşı olarak kabul edilen futbolun, geniş kitlelerin katılımıyla bu varlığını sürdüreceği tüm otoriteler tarafından kabul görmektedir. Futbol yönetim ve organizasyonlarının bilimsel metotlar ışığında, futbol yönetimi uzmanları ve kuruluşları ile birlikte, günümüz şartlarına uygun, geniş katılımlı ve paylaşımcı ortamlarda ele alınarak "Modern Futbol Yönetimine" uygun planlanıp değerlendirilmesi, futbolunun gelişerek, yaygınlaşmasının yanı sıra, uluslararası rekabet şansını artırarak, verimlilik esasına dayalı, istihdam ve katma değer yaratarak, kitlelere ulaştırılması gerekmektedir (Devecioğlu ve ark., 2014)Kulüpler, kurumsal değerlerini arttırmak, varlıklarının sürdürülebilirliği sağlamak ve endüstriyel futbolun sağladığı maddi ve manevi yararlardan uzun süreler yararlanabilmek için bu rekabetçi düzen içerisinde öncelikle organizasyon yapılarını sağlamlaştırmak ve rekabete uygun bir hale getirmek zorundadır. Bu nedenle kulüpler verimli ve etkin bir biçimde işleyen iç denetim mekanizmaları oluşturmak ve oluşturulan bu iç denetim mekanizmalarının sağlıklı, verimli ve etkin bir biçimde işletilmesini sağlamak zorundadırlar (Tanış, 2015). Sonuç olarak; Türkiye'deki futbol kulüplerinin kurumsallaşma sürecinde başarılı oldukları söylenemez. Ülkemizdeki futbol kulüplerinde spor yönetimini bilmeyen yöneticilerin çoğunlukta olması nedeniyle kulüp içi çatışmalar yaşanmakta kulüplerin kötü yönetilmesine, etkili kararların alınamamasına ve kurumsal yapılarının zayıflamasına neden olmaktadır. Türkiye'deki birçok futbol kulübü sağlıklı bir kurumsallaşma yapısı oluşturamaması nedeniyle gelir kaynaklarını çeşitlendirememekte ve mali açıdan sorunlar yaşamaktadırlar. Çoğu kulüp harcamalar hakkında üyelerini şeffaf bir şekilde bilgilendirmediği için kulübün imajı olumsuz etkilenmektedir. Kulüplerin altyapılarında sporcu yetişmemesi, hukuki sorunlar, kulüp tüzüklerinin güncelliğini yitirmesi ya da tüzük maddelerinin uygulanmaması, kulüp yöneticilerinin siyasilerin etkisinde kalması da futbol kulüplerinin kurumsallaşma sürecini olumsuz etkilemektedir. Futbol

kulüplerinin uzun vadede rakipleriyle mücadele etmesi ve güçlü bir kurumsal yapı için futbol kulüplerinde profesyonel bir yönetim anlayışının benimsenmesi, finansal denetimlerin ve altyapı yatırımlarının arttırılması gerekmektedir.

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Özet
Günümüzde inşaat sektörü dünya genelinde trilyon doları bulan önemli bir hacme sahiptir. Bu sektörde, çalışan sayılarının çok yüksek olduğu büyük şirketlerle birlikte, çalışan sayılarının daha az olduğu orta ve düşük ölçekli firmalarda bulunmaktadır. Özellikle orta ve düşük ölçekli şirketler incelendiğinde, yönetim organizasyonlarında ve stok takiplerinde ajanda, not defteri veya excel gibi geleneksel sayılabilecek yöntemlerle yürüttükleri görülmektedir. Bu geleneksel yönetim yaklaşımı günümüzdeki bilişim teknoloji çözümlerinin çok uzağında kalmaktadır. Bu çalışma kapsamında literatür ve piyasadaki ürün olarak kullanılabilen uygulamalar incelenmiştir ve inşaat firmalarıyla ihtiyaç analizi için görüşmeler yapılmıştır. Mevcut kullanılan uygulamalar incelenirken depo stok takibinin tutulması için inşaatta kullanılan yüzlerce malzemenin sisteme tek tek elle tanımlanmasının oldukça zahmetli olduğu gözlemlenmesine rağmen bu problemi çözmek adına derin öğrenme destekli bir uygulamaya rastlanmamıştır. Bu çalışmada orta ve düşük ölçekli firmalar için herhangi bir sistem odası, sunucu gibi bir planlamaya ihtiyaç olmaksızın web uygulaması üzerinden hizmet alıp firmalarını yönetebilecekleri, ayrıca stok takibini derin öğrenme desteğiyle fotoğraf çekerek hızlı bir şekilde sisteme aktarabilecekleri bir uygulama geliştirilmiştir. Geliştirilen sistemde veri tabanı olarak Firebase kullanılmıştır. Ara yüz Bootstrap kütüphanesi kullanılarak kullanıcı dostu olarak geliştirilmiştir. Stok takibi için geliştirilen derin öğrenme modelinin eğitiminde Python programlama dili ve YOLO-V8 kütüphanesi kullanılmıştır. Web uygulaması fotoğraf eklendiğinde anlık olarak fotoğraftaki demirleri adet bilgisiyle birlikte veri tabanına işlemektedir. Bu sayede malzemelerin tek tek sayılma işlemi için gereken iş gücünün azaltılması sağlanmıştır.
Anahtar Kelimeler: İnşaat Otomasyonu, Derin Öğrenme, YOLO-V8, Görüntü İşleme

CONSTRUCTION MANAGEMENT AND IMAGE PROCESSING BASED INVENTORY TRACKING AUTOMATION

Abstract
InToday, the construction sector holds a significant volume worldwide, reaching trillions of dollars. Within this sector, there are large companies with high numbers of employees as well as medium and small-scale firms with fewer employees. Particularly when examining medium and small-scale companies, it is observed that they manage their management organizations and inventory tracking using methods that could be considered traditional, such as agendas, notebooks, or Excel. This traditional management approach falls far behind the current information technology solutions.In this study, applications that can be used as literature and in the market were examined, and discussions were held with construction companies for needs analysis. While examining the existing applications, it was observed that manually defining hundreds of materials used in construction for inventory tracking is quite laborious, yet no deep learning-supported application has been encountered to solve this problem.In this study, an application has been developed for medium and small-scale firms, where they can manage their businesses via a web application without the need for any infrastructure like a system room or server. Additionally, they can quickly transfer inventory tracking data to the system by taking photos with deep learning support. Firebase was used as the database in the developed system, and the interface was developed to be user-friendly using the Bootstrap library. Python programming language and the YOLO-V8 library were used for training the deep learning model developed for inventory tracking. When a photo is added to the web application, it instantly processes the rebars in the photo along with the quantity information into the database. This reduces the manpower required for counting materials individually.
Keywords: Construction Automation, Deep Learning, YOLO-V8, Image Processing

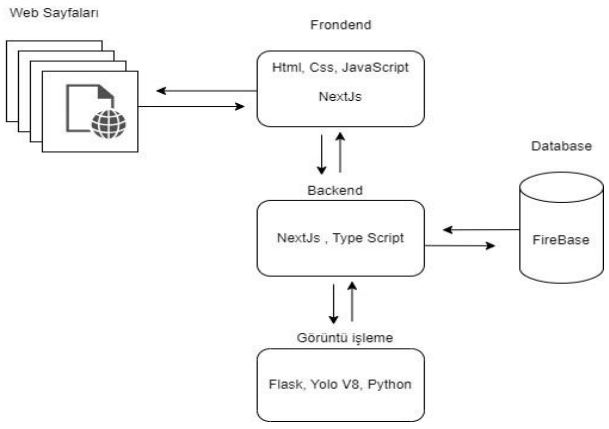
GİRİŞ

Endüstri 4.0 ilk olarak 2011 yılında Hannover fuarında ortaya atılmıştır. Bu tarihte n iki yıl sonra, 2013 yılında Almanya'da stratejik girişim alanı olarak belirlenmiştir(L. Da Xu vd., 2018). Dördüncü sanayi devrimi olarak adlandırılan bu gelişme ile endüstrinin farklı alanlarında Endüstri 4.0'a olan ilgi artmıştır. Endüstri 4.0 temel olarak bilişim teknolojileri ile endüstriyi bir araya getirmeye hedef almaktadır. Bu kapsamda 3d yazıcılar(Uygunoğlu vd., 2019), IOT cihazları(UYGUNOĞLU & TOPÇU, 2020), giyilebilir teknolojiler(Akçamete Güngör, 2018), arttırılmış gerçeklik(Shirazi & Behzadan, 2014), yapay zeka(Y. Xu vd., 2022), ve genel olarak yazılım teknolojilerinin endüstri içerisinde sektörüne uygun şekilde kullanılması, endüstrideki farklı sektörler ile bilişim sektörünü bir araya getirmektedir. Bu yenilikçi teknolojilerin kullanılmasıyla birlikte insan gücüne olan ihtiyacın azalması ve verimliliğin arttırılması amaçlanmaktadır(Maskuriy vd., 2019). Verimliliğin artırabilmek için ilk olarak endüstrinin dijital bir dönüşüme ihtiyacı olduğu görülmektedir. Günümüzde bazı sektörlerde bu dönüşüme hızlı bir şekilde adapte olabilirken özellikle inşaat sektörü gibi sektörler bu dönüşüme hızlı adapte olamamışlardır(Betül AKBAY vd., 2023). İnşaat sektörü içerisinde birbirini takip eden birçok alt iş sürecini barındıran yönetimsel anlamda takibinin yapılması oldukça karmaşık bir yapıya sahiptir[atıf]. Türkiye ekonomisinde önemli bir yere sahip olan inşaat sektörü gümüz dünyasındaki teknolojinin gerisinde kalmaktadır. Özellikle orta ve düşük ölçekli firmalar kağıt üzerinde veya excel tablolarında kayıt tutmak gibi geleneksel yöntemler kullanarak işletmelerini sürdürürken, etkin bir süreç yönetimi gerçekleştirememektedirler(Betül AKBAY vd., 2023). Etkin bir süreç yönetimi için sektöre ihtiyaçlarına uygun şekilde hazırlanmış otomasyon yazılımlar kullanılması, burada oluşan verimsizliğin önüne geçebilecektir. İnşaat sektöründe işletme süreçlerini etkin bir şekilde yönetebilmek için üretilmiş ücretli yazılımlar bulunmaktadır. Ürün olarak satılan PirCloud(*Pir*, t.y.), Yapıtaşı Erp(*Yapıtaşı Bilgi CRM*, t.y.), Imperium(*Imperium - İnşaat Yönetim Yazılımı*, t.y.), Tekprosis(*İnşaat Yazılımı - Tekprosis*, t.y.), İnşaat Erp(*İnşaat ERP - Uyumsoft*, t.y.) ve OPwire(*Opwire App*, t.y.) yazılımları incelenmiştir. Bu alan yapılmış birçok uygulama olmasının yanında reel sektörde kullanım oranın düşük olması, yapılan literatür araştırmalarında, adaptasyon zorlukları, teknolojik becerilerin zayıf olması, bilişim yatırımının düşük olması gibi sebeplerden kaynaklandığı öne sürülmüştür(Maskuriy vd., 2019). Bu durumda sektör çalışanlarındaki dijital beceri ve adaptasyonun artması için, inşaat sektörü için geliştirilecek uygulamaların kullanıcı dostu ara yüzler ve yapay zeka desteğiyle kullanım kolaylığı sağlaması gerekmektedir. Bu çalışma kapsamında inşaat sektörün ihtiyaçları ve

mevcut yazılımların zayıf olduğu yönleri tespit edilerek, kullanıcı dostu ara yüzlere sahip ve yapay zeka desteğiyle insan iş gücünü maliyetlerini düşürmeyi hedefleyen bir otomasyon yazılımı geliştirilmiştir. Geliştirilen yazılım projelerin gelişiminin raporlanması, ustaların performanslarının izlenmesi, maaşlar, sigorta bilgileri, bütçe yönetimi gibi tüm sürecinin takip edilmesini sağlamaktadır. Web uygulaması olarak geliştirilen bu yazılım NextJS, TypeScript, JavaScript HTML dillerini kullanmaktadır. Ayrıca stok takibi yapılırken gelen inşaat malzemelerinin tespit ve sayım işlemlerinin kayıt altına alınabilmesi için derin öğrenme yöntemleri kullanılmıştır. Günümüzde nesne tespiti için oldukça yaygın kullanılan YOLOv8 kütüphanesi prototip olarak demir bağları için eğitilmiş ve anlık olarak uygulama üzerinden bir fotoğraf yüklenmesiyle resimde bulunan demir bağlarının kaç tane olduğu bilgisini hesaplayıp uygulamadaki stoka ekleyebilmektedir(Hussain, 2023). Bu sayede şantiyeye gelene malzemelerin stok takibi sadece fotoğraf çekilerek hızlı bir şekilde yapılabilecektir.

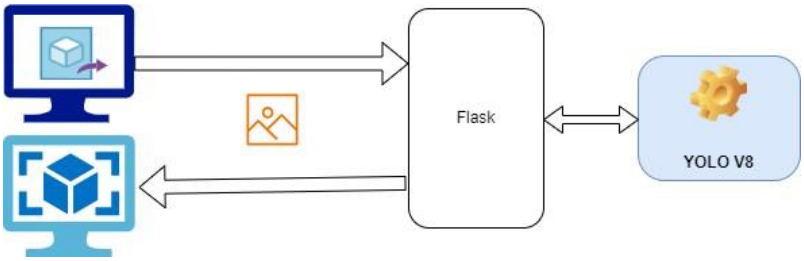
METOT

Bu çalışmada sektörde faaliyet gösteren cedde inşaat firması ile görüşmelere yapılarak ihtiyaç analizi oluşturulmuştur. Belirlenen analiz ile stok takibi, isçi yönetimi, maaş avans işlemleri, sigorta işlemleri, günlük puantaj, proje yönetimi gereksinimlerinin olduğu tespit edilmiştir. Bu gereksinimleri karşılamak için bir web uygulama geliştirilmiştir. Web uygulaması geliştirilirken backend için NextJs programlama dili frontend için HTML, JavaScript, Css, BootStrap programlama dilleri ve kütüphaneleri kullanılmıştır. Stok takibi modülünde geliştirilen görüntü işleme işlemleri için Python dili ile YOLO v8 kütüphanesi kullanılmıştır. Geliştirilen uygulamanın mimarisi Şekil 1'de sunulmuştur.



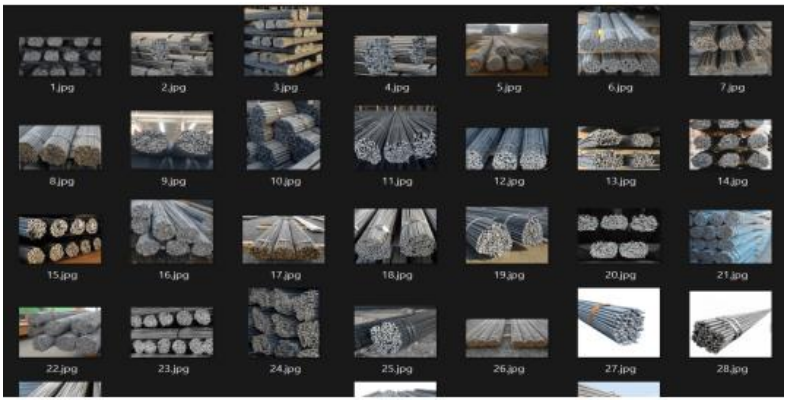
Şekil 1. Web uygulama mimarisi

Web uygulamasını mimarisi incelendiğinde oluşturulan web sayfaları backend ile haberleşmektedir. Backend kısmında ise veri tabanı olarak firebase üzerinde veri depolama ve veri okuma işlemlerini gerçekleştirmektedir. Stok takibi modülünden görüntü işleme için bir resim yüklendiğinde, backend kısmından farklı bir port üzerinde python tabanlı çalışan flask uygulamasına resim verisini göndermektedir. Burada önceden eğitilmiş olan model resim üzerinde nesne tespiti yapıp, tespit ettiği nesneleri işaretleyip geri döndürmektedir. Geri dönen resimde tahmin yüzdesi 50'den büyük olanlar saydırılarak ekrana yazdırılmaktadır. Kullanıcı yapay zeka tarafından yapılan sayımı güncelleyebilmektedir. Görüntü işleme akış şeması aşağıdaki Şekil 2'de sunulmuştur.



Şekil 2. Görüntü işleme süreç akışı

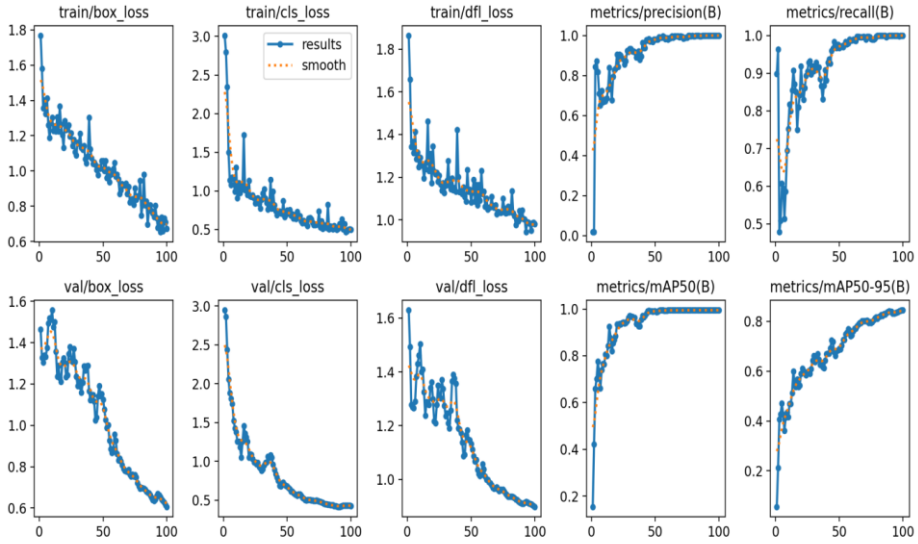
Görüntü işleme için model eğitimini, web uygulamasında hariç olarak Google Colab platformu üzerinde YOLO V8 kütüphanesi kullanılarak gerçekleştirilmiştir. Eğitim için Google görsellerden bir demir bağı fotoğrafları indirilerek bir veri seti oluşturulmuştur. Oluşturulan veri setinin örnek görselleri Şekil 3'te sunulmuştur.



Şekil 3. Örnek veri seti

Toplam 50 tane resim ile oluşturulan veri setinin %270 'i eğitim %30'u test için ayrılmıştır. Model eğitimi 100 epoc sürdürülmüştür. Yaklaşık iki saat süren eğitim sonucunda %99.4'lük

bir başarım elde edilmiştir ve eğitim loss, percision, recall grafikleri aşağıdaki Şekil 4'te verilmiştir.



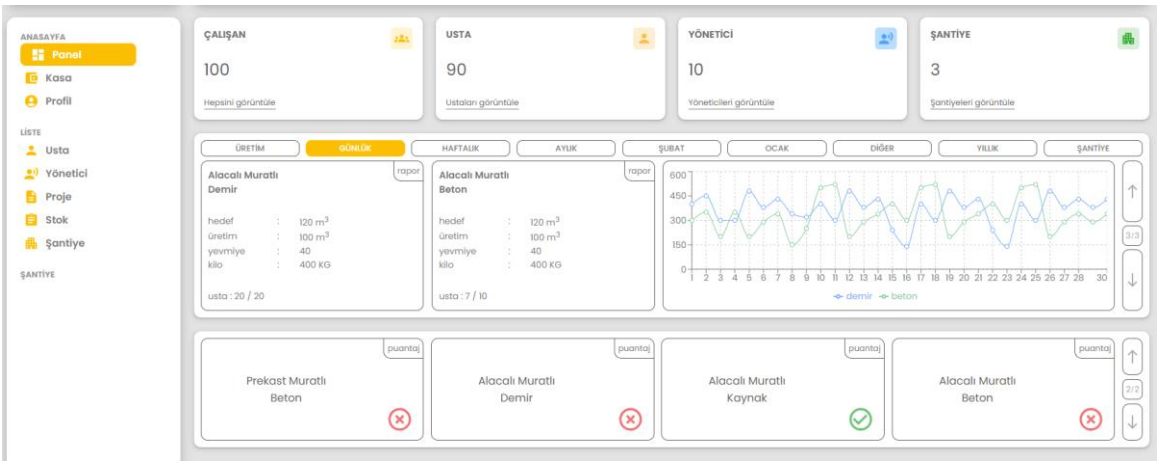
Şekil 4. Yapay zeka eğitim grafikleri

Çalışmanın devam eden bölümlerinde uygulamanın detayları kullanıcı ara yüzleriyle birlikte anlatılmıştır. Sonrasında sonuçlar ile birlikte değerlendirme yapılmıştır.

GÖRÜNTÜ İŞLEME DESTEKLİ İNŞAAT YÖNETİM OTOMASYONU: AKBARET

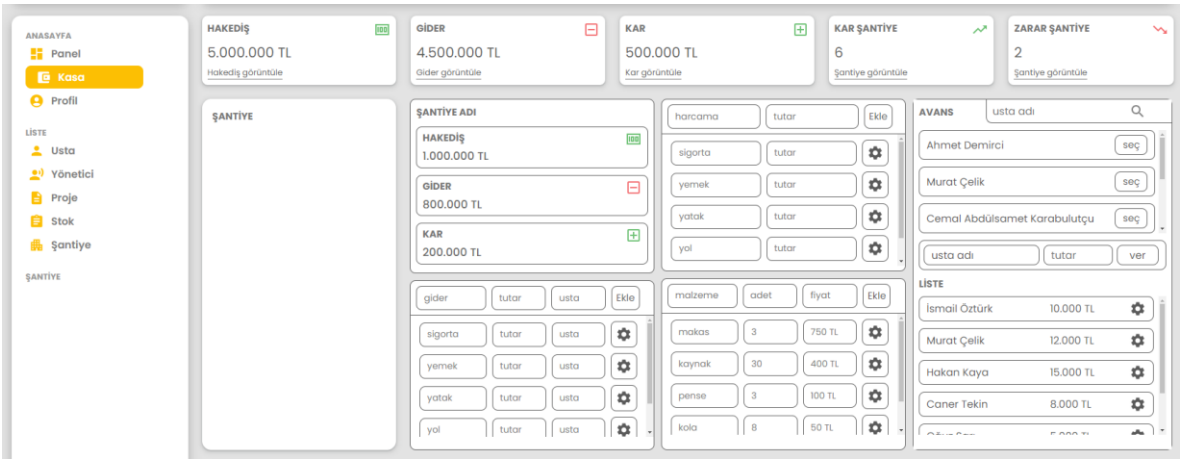
Akbaret; inşaat sektöründeki işletme süreçleri etkin bir şekilde yönetilmesine yardımcı olmayı hedefleyen yapay zeka destekli bir web uygulamasıdır. Uygulama kullanışlılığı arttırmak için mümkün olduğunca sade ve kullanıcı dostu bir tasarım uygulanmıştır. Uygulama dahsboard, kasa, proje, stok ve şantiye modüllerinden oluşmaktadır.

Yönetici uygulamaya giriş yaptığında Şekil 5'te görünen panel ekranıyla karşılaşmaktadır. Bu ekran çalışan sayısı, usta sayısı, şantiye sayısı ve günlük haftalık olarak seçenekleri olan üretim raporlarının bulunduğu özet bilgi veren bir sayfadır.



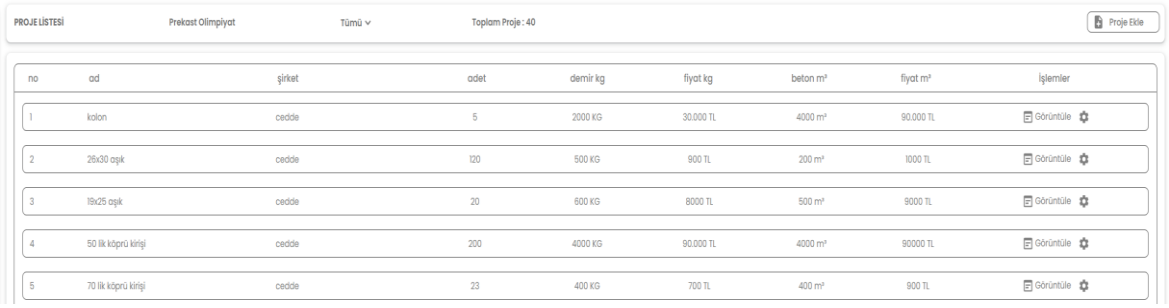
Şekil 5. Yönetici giriş ekranı

Firmanın finansal olarak bilgilerinin yönetildiği kısım kasa modülüdür. Bu modülde toplam hakkediş, toplam gider, toplam kar bilgileri sayfanın üst bölümünde yer alırken, alt kısımda ise bu verilerin girilip yönetildiği alt paneller bulunmaktadır. Oluşturulan ara yüz aşağıdaki Şekil 6'da sunulmuştur.



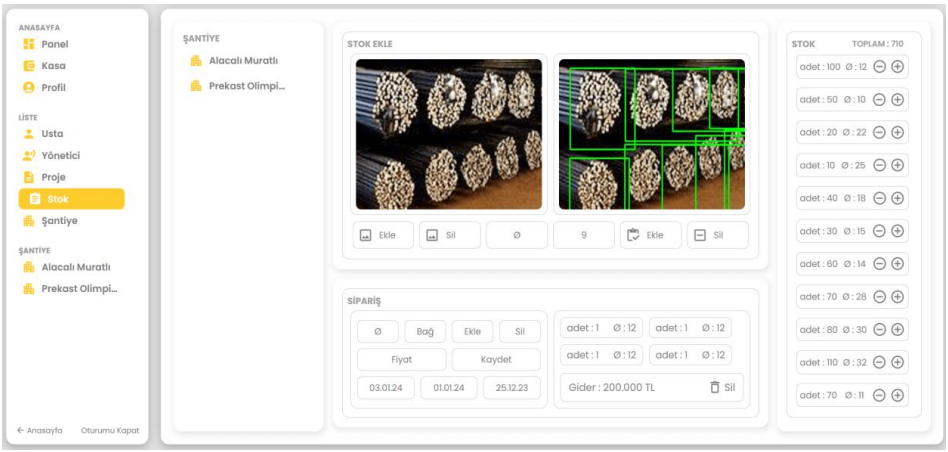
Şekil 6. Kasa modülü

Uygulamada projelerin yönetildiği ekranda yeni proje ekleme, düzenleme ve silme gibi işlemler yapılabilmektedir. Burada eklenen projeler diğer kasa, usta, dashboard gibi ekranlarda projeye bağlı yönetim süreçleri takip edilebilmektedir. Proje ekranı Şekil 7'de sunulmuştur.



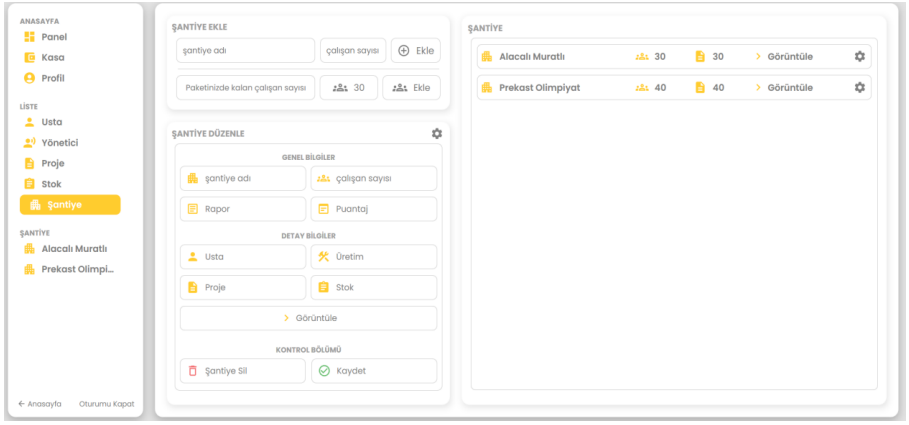
Şekil 7. Proje modülü

Bu çalışmanın ortaya koyduğu en önemli yenilik stok takibi modülünde yapılmıştır. Şekil 8'de sunulan stok takibi modülü kullanıcının eklediği resimdeki demir bağlarını sayarak veri tabana yazmaktadır. Sayılan adetler liste şeklinde kullanıcıya gösterilerek herhangi bir hata olması durumunda tekrar düzenleme olanağı sağlanmıştır.



Şekil 8. Stok takip modülü

Sektörde çalışan firmalar birden fazla şantiyede faaliyet gösterebilmektedirler. Bu sebeple projeler farklı şantiyeler altında yönetilebileceği bir şantiye modülü eklenmiştir. Şantiye ekle, sil, güncelle gibi işlemlerin yapılabildiği şantiye yönetim modülü Şekil 9'da gösterilmektedir.



Şekil 9. Şantiye modülü

Çalışmanın devam eden bölümünde sonuçlar ve gelecekte yapılabilecek çalışmalar için önerileriler verilmiştir.

SONUÇ

Bu çalışmada inşaat sektörüne özel günlük ve haftalık puantaj, proje yönetimi, stok takibi, ve şantiye yönetimi, işçi yönetimi için bir web uygulaması geliştirilmiştir. Uygulama sektörden alınan ihtiyaç analiziyle birlikte literatürdeki inşaat sektörünün dijital dönüşüme adaptasyonunun eksikleri değerlendirilmiştir. Sektör çalışanlarının geleneksel yöntemlerden vazgeçip dijital bir yönetim uygulama adapte olmalarını kolaylaştırmak için kullanıcı dostu bir ara yüz tasarımı gerçekleştirilirmiştir. Uygulama geliştirilirken NextJs, TypeScript, Html, JavaScript, Css teknolojileri ve veri tabanı olarak firebase kullanılmıştır.

Şantiyede birçok çeşitte mal geldiği ve bu malların stok takibinin yapılması oldukça önemli bir adımdır. Gelen ürünlerin tek tek sayılması, gelen ürün sayısının çok fazla olduğu düşünüldüğünde zahmetli bir iş olmaktadır. Burada oluşan sayma işlemini hızlandırmak için yapay zekadan faydalanılmıştır. Demir bağları tespiti ve sayımı için bir veri seti oluşturulmuştur. Oluşturulan veri seti YOLO V8 ile eğitilmiş ve %99.4 başarım elde edilmiştir. Eğitilen modele web uygulaması üzerinden fotoğraf yüklenerek tahmin ve saydırma işlemi yapılabilmektedir. Sayılan demir adetleri kullanıcı onayı ile otomatik olarak veri tabanına yazılarak stok takip işlemini kolaylaştırmaktadır.

Çalışmada prototip olarak oluşturulan veri seti sadece demir bağlarını kapsamaktadır. İnşaatta stok takibi yapılan birçok çeşitte ürün vardır. Bu sebeple stok takibi tüm ürünler için yapay zeka desteği sağlayamamaktadır.

Gelecekte yapılacak çalışmalarda veri seti inşaatta kullanılan tüm ürünler için genişletilip YOLO ile tekrardan eğitilirse tüm stok takibi sürecinde yapay zekadan faydalanılabilir. Böylelikle stok sayımı için harcanan iş yükü maliyetleri düşürülebilir.

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İNŞAAT MÜHENDİSLİĞİ ÖĞRENİMİNDE ULAŞILMAK İSTENEN BAŞARI DÜZEYİNİN BELİRLENEBİLMESİ İÇİN BİR MODEL

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Özet
Monte Carlo benzetimi, Çok sayıda tekrarlanan rastgele örneklemelerle, bir takım nümerik sonuçlar elde etmeye yarayan ve bilimin birçok alanında yaygın olarak kullanılan bir sayısal hesaplama algoritmaları sınıfıdır. Bilgisayar programları, geçmiş verileri analiz etmek ve bir eylem seçimine dayalı olarak bir dizi gelecekteki sonucu tahmin etmek için bu yöntemi kullanır. Yüksek Öğrenimde başarılı olmanın önemli kriterlerinden birisi final sınavlarında alınacak notların düzeyidir. Bu çalışmada Düzce Üniversitesi İnşaat Mühendisliği Bölümü'nü kazanan bir öğrencinin meslek derslerinden ne kadar başarılı olabileceği araştırılmıştır. Bu amaca yönelik olarak mezuniyet durumuna gelmiş 20 bölüm öğrencisine, 22 adet meslek dersleri final sınavlarından bekledikleri notlar ile aldıkları notlar arasındaki farkların yüzdeleri sorulmuştur. Alınan yanıtların (+) ve (-) olmak üzere ortalamalarını almıştır. Bu değerler beklenen değerlerden artı ve eksi yönlerde maksimum sapma oranlarına karşılık gelmektedir. Monte Carlo Yöntemi kullanarak Üçgen Dağılım için ayrı, PERT Dağılımı için ayrı olmak üzere iki ayrı simülasyon yapılmıştır. Böylece sınavlardan beklenen notlara ulaşmanın ne oranda mümkün olabileceği istatistiki olarak belirlenmeye çalışılmıştır. Buna ek olarak bir öğrencinin ilgili dersleri aldığında final sınavından beklediği puan tahminlerini tutturma ihtimalleri her bir ders ve dağılım için belirlenmiştir. Sonuç olarak beklenenden daha fazla sapma yaşanan derslere daha çok önem ve süre vererek çalışılması gerektiği, öngörülen sınav sonuçlarının hangi oranda gerçekleşebileceği değerlerine ulaşılmıştır. Benzer değerlendirmeler her bölüm ve ders için yapılabilir. Daha doğruya yakın değerlere ulaşabilmek için daha çok veri üzerinden çalışılması gerektiği açıktır.
Anahtar Kelimeler: İnşaat Mühendisliği Öğrenimi, Monte Carlo Simülasyonu, Başarı Düzeyi

A MODEL FOR DETERMINING THE ACHIEVEMENT LEVEL IN CIVIL ENGINEERING EDUCATION

Abstract
Monte Carlo simulation is a class of numerical computation algorithms that are widely used in many fields of science and are used to obtain a number of numerical results with a large number of repeated random samplings. Computer programs use this method to analyze past data and predict a set of future outcomes based on a choice of action. One of the important criteria of being successful in higher education is the level of grades to be taken in the final exams. In this study, it was investigated how successful a student from Düzce University Civil Engineering Department can be in vocational courses. For this purpose, 20 department students, who have graduated, were asked about the percentages of the differences between the grades they expected from the final exams of 22 vocational courses and the grades they received. The averages of the responses received were (+) and (-). These values correspond to the maximum deviation rates in the positive and negative directions from the expected values. Using Monte Carlo Method, two different simulations were made for the Triangular Distribution and separately for the PERT Distribution. Thus, it has been tried to determine statistically how much it is possible to reach the expected grades in the exams. In addition, the probability that a student will meet the score predictions expected from the final exam when he/she takes the relevant courses has been determined for each course and distribution. As a result, it has been reached the values that it is necessary to study by giving more importance and time to the courses with more deviations than expected, and at what rate the predicted exam results can be realized. Similar evaluations can be made for each department and course. It is clear that more data should be studied in order to reach more accurate values.
Keywords: Civil Engineering Education, Monte Carlo Simulation, Level of Success

Giriş

Bir üniversitenin temel görevleri; araştırma yapmak, bilim üretmek, üst düzeyde eğitim sağlamak, üretime, uygulamaya ve gelişen teknolojiye uyum sağlayabilecek insan gücünü hazırlamak şeklinde özetlenebilir. Ayrıca, evrensel ve ulusal kültürü ve insani değerleri özümseyen, uygar ve demokrat bireyleri yetiştirmek de bir üniversitenin görevleri arasındadır. Üniversitenin bu yöndeki eğitimi, yalnız günümüz koşullarına uymakla kalmayıp, gelecekteki ilerleme ve gelişmeleri de kapsayacak şekilde oluşturulmalıdır. Üniversiteler özgür düşünen, duyarlı, öğrenen, çağını yakalayıp aşmaya çalışan, üreten, değişime ve gelişmelere açık, uygar ve demokrat bireylerin ve meslek adamlarının yetiştirilmesini sağlamak durumundadırlar. [1] Mühendislik eğitiminde amaç, tasarım yeteneklerinin geliştirilmesi ve tasarım sorunlarının çözülmesidir. Mühendislik, analizden başlayarak toplumun ihtiyaçlarını karşılayan senteze uzanan bir yol olarak görülmelidir. Mühendislik eğitiminin temel ölçüsü, mühendislik kariyeri süresince sürekli üretken olabilen ve gelişmelere açık profesyonel mezunlar yetiştirebilmektir. Mühendislik eğitiminde ana hedef, toplumun ihtiyaçlarına çözüm oluşturabilecek niteliklere sahip elemanlar yetiştirmektir.[2]Mühendisliğin temeli, analiz edilen konunun incelenerek problem yapısının belirlenmesi ve gelişen teknoloji desteğiyle daha önce üzerinde inceleme yapılmamış özgün çalışmaların ortaya konması felsefesi üzerinedir.[3]Mühendislik eğitiminde ana prensip, mühendislik kariyeri boyunca sürekli üreten ve her türlü gelişime açık mezunlar yetiştirmektir. Mühendislik eğitimindeki amaç, toplumun ihtiyaçlarına çözüm oluşturabilecek niteliklere sahip mezunların topluma kazandırılmasıdır.[4]Modern mühendislik eğitiminde, öğrenciye dar kapsamlı teknik bilgi kazandırmak yeterli değildir. Değişen ve gelişen teknoloji toplumunun felsefesi; sadece teknik problemlere yönelip bu problemleri çözme yeteneğine sahip mühendisler yetiştirmek yerine, soruna bir bütün olarak bakabilen mühendisler yetiştirmeye doğru gitmektedir. Mühendislik eğitimi, öğrencinin ufkunu açmalı ve temel problemlerin ve çözüm metotlarının ortaya konmasını gerektirmektedir. Modern mühendislik eğitiminde hedeflenen mühendislik esaslarını ve bu esaslar dahilinde öğrenmeyi öğretmektir.[5]2002 yılında Avustralya'da, Queensland University of Technology'e başlayan öğrencilerin 2006 yılı sonunda akademik başarı durumlarını inceleyen araştırma sonuçları, öğrencilerin sadece % 20'sinin dört yıl sonunda mühendis olarak mezun olduklarını bulmuştur. Aynı gruptaki öğrencilerin % 60'ının ise mühendislik eğitimlerini yarım bıraktıkları ortaya çıkmıştır.[6] Bunun yanında İngiltere'de yapılan bir araştırmanın sonuçlarına göre; mühendislik öğrencilerinin %18'i üniversitedeki ilk yılın sonunda mühendislik eğitimini bırakmaktadırlar. Aynı araştırmada, mühendislik fakültesindeki öğretim üyelerinin %38'inin

mühendislik öğrencilerinin bu başarısızlıklarını, öğrencilerin yetersiz matematik bilgilerine bağladıkları bulunmuştur.[7]Özcan ve diğerleri, Kocaeli Üniversitesi Mühendislik Fakültesinden Bologna Süreci'ne dahil olarak mezun olmuş 3984 öğrencinin veriler üzerinden istatistiki analizler yapmışlardır. Elde edilen bulgulara göre mezunların fakülte ortak ders başarısı ve mezuniyet başarıları, ilişkili ve anlamlı derecede farklıdır. Bölümler arasında fakülte ortak derslerdeki başarı düzeyi farklılık göstermektedir. Mezunların genel mezuniyet başarısının her bölüm için bölüme giriş şekli, cinsiyet, öğretim türü, mezuniyet dönemi gibi değişkenlere bağlı olarak farklı olduğu sonucuna ulaşılmıştır.[8]Güner ve Çomak, Destek Vektör Makineleri yöntemini kullanarak riskli öğrencileri tahmin etmiştir. 2007 yılında Pamukkale Üniversitesi mühendislik fakültesine başlayan 434 öğrencinin üniversiteye giriş sınavı sonuçlarına ait verilerin kullanıldığı araştırma sonuçlarına göre; öğrencilerin matematik, fen bilimleri, Türkçe testlerinin sonuçları ile lise mezuniyet başarı puanlarının, matematik I dersindeki başarılarını tahminde önemli rol oynadığı bulunmuştur.[9]Hasan Burak Ağır ve arkadaşlarının yaptığı çalışmada, Kahramanmaraş Sütçü İmam Üniversitesi Ziraat Fakültesi öğrencilerinin öğrenim başarısını etkileyen faktörlerin belirlenmesi hedeflenmiştir. Öğrencilere yapılan anket çalışmasından elde edilen veriler değerlendirilip, lojistik regresyon analizi kullanılarak başarıyı etkileyen faktörler incelenmiştir. Yapılan incelemelerden elde edilen sonuçlara göre öğrencilerin başarısını etkileyen faktörlerin cinsiyet, mezun olunan lise türü, daha önce bitirilen yüksekokul programı ve annenin çalışma durumu olarak belirlenmiştir.[10] Günümüzde bilgisayar teknolojisinin ve programlarının gelişmesinin bir sonucu olarak, üniversite öğrencilerinin akademik başarılarını etkileyen parametreleri ve riskli öğrencileri belirleyebilmek için son yıllarda yapılan çalışmalarda, makine öğrenmesi yöntemi ve karar destek sistemleri oldukça yoğun olarak kullanılmıştır. Örneğin, iki farklı çalışmada Vandamme vd., [11] Belçika'da, Kovacic [12] Yeni Zellanda'daki üniversite öğrencilerinin akademik performanslarını tahminde belirleyici olan faktörleri "Veri Madenciliği" yöntemini, Chourdhury [13] ise "Çoklu Regresyon" yöntemini kullanarak belirlemeye çalışmışlardır. Affendey vd. [14], Bilgisayar Mühendisliği öğrencilerinin akademik performanslarının tahmininde "Naive Bayes" yöntemini kullanarak, ilk dönem alınan bilgisayar yazılım programı dersinin en belirleyici etmen olduğunu bulmuşlardır.Çağıltay ve Tokdemir, yaptıkları çalışmada, farklı öğrenme stillerine sahip kişilerin mühendislik eğitimindeki başarı durumlarını incelemişlerdir. Çalışmada Atılım Üniversitesi Bilgisayar Mühendisliği Bölümü birinci sınıf öğrencileri ile yapılan bir durum değerlendirmesi yapılmaktadır. Çalışmanın sonuçlarının mühendislik eğitimi veren birimlere, gerek eğitimlerinin genel başarısını artırıcı ve gerekse

öğrencilerin kişisel başarılarını artırıcı yönlendirici bilgiyi sağlaması hedeflenmiştir. Bu çalışmanın sonuçlarına göre, araştırmaya katılan öğrenciler içinde derste başarılı olanların büyük bir kısmının (% 85) David Kolb tarafından mühendislik alanındaki başarı oranının yüksek olduğu belirlenen iki öğrenme stilinden birisine sahip oldukları gözlenmiştir. Oysaki dersin genel başarı oranı % 43'dür. Bu durum David Kolb tarafından belirlenen öğrenme stilleri ile paralellik göstermektedir.[15]Bir kişinin kendi performansı hakkındaki algısını üstbiliş becerileri bağlamında açıklayan araştırmalarda "kalibrasyon" terminolojisinden yararlanılmıştır. Bir kişinin bir görevi tamamlarken performansına ilişkin başarı tahmini ile gerçekte ortaya koyduğu performans arasındaki uyum derecesi kalibrasyon olarak tanımlanmaktadır.[16-18]Monte Carlo simülasyonu, belirsiz bir olayın olası sonuçlarını öngören matematiksel bir tekniktir. Monte Carlo simülasyonu, tahmininde bir belirsizlik veya rastgelelik unsuru içerebilen olasılık temelli bir modeldir. Monte Carlo simülasyonu, her birinin olasılığı büyük bir rastgele veri örneği havuzundan gelecek şekilde birden fazla olası sonuç sunar. Belirleyici bir tahminden daha net bir resim sağlar. Makine öğrenimi (ML), girdi ve çıktı verileri arasındaki ilişkiyi anlamak üzere yazılımı eğitmek için büyük bir girdi ve çıktı (G/Ç) veri örneği kullanan bir bilgisayar teknolojisidir. Monte Carlo simülasyonu ise bir sistemde meydana gelen olası sonuçları tahmin etmek için girdi verisi örneklerini ve bilinen bir matematiksel modeli kullanır.[19]

Amaç ve Yöntem

Bu çalışmada Düzce Üniversitesi İnşaat Mühendisliği Bölümü'nü kazanan bir öğrencinin meslek derslerinden ne kadar başarılı olabileceği araştırılmıştır. Bu amaca yönelik olarak mezuniyet durumuna gelmiş 20 bölüm öğrencisine, 22 adet meslek dersleri final sınavlarından bekledikleri notlar ile aldıkları notlar arasındaki farkların yüzdeleri sorulmuştur. Alınan yanıtların (+) ve (-) olmak üzere ortalamalarını almıştır. Bu değerler beklenen değerlerden artı ve eksi yönlerde maksimum sapma oranlarına karşılık gelmektedir. Monte Carlo Yöntemi kullanarak Üçgen Dağılım için ayrı, PERT Dağılımı için ayrı olmak üzere iki ayrı simülasyon yapılmıştır. Böylece sınavlardan beklenen notlara ulaşmanın ne oranda mümkün olabileceği istatistiki olarak belirlenmeye çalışılmıştır. Buna ek olarak bir öğrencinin ilgili dersleri aldığında final sınavından beklediği puan tahminlerini tutturma ihtimalleri her bir ders ve dağılım için belirlenmiştir.

Bulgular ve Tartışma

20 öğrencinin 22 adet meslek dersi için beklediklerinden en az ne kadar eksik not aldıkları ve en fazla ne kadar fazla not aldıklarına dair verilerin birleştirilmesi ile oluşturulan sınır değerleri içeren tablo aşağıda Tablo1.'de verilmiştir.

Tablo 1. Simülasyonda kullanılacak minimum ve maksimum uç değerler

En az (-)	Dersler	En çok (+)
19,9	Statik	0
22,5	Mukavemet I	14,4
17,5	İstatistik	14
18,5	Malzeme Bilimi	13
30,4	Akışkanlar Mekaniği	0
35,7	İnşaat Jeolojisi	12
16,7	Yapı Statiği I	20
24	Mukavemet II	14,3
15,7	Topoğrafya	10
10	Yapı Malzemesi	9,4
15	Karayolu İnşaatı	17
9	Yapı İşletmesi	22,6
25,6	Hidrolik ve Hidroloji	10
15,3	Betonarme I	27
26,1	Zemin Mekaniği	11,5
16,6	Çelik Yapılar	20
12,5	Yapı Statiği II	12,5
17,1	Metraj ve Keşif	6,7
18,9	Betonarme II	15
32,5	Yapı Dinamiği	10
24	Temel İnşaatı	12,5
0	Mühendislik Ekonomisi	11

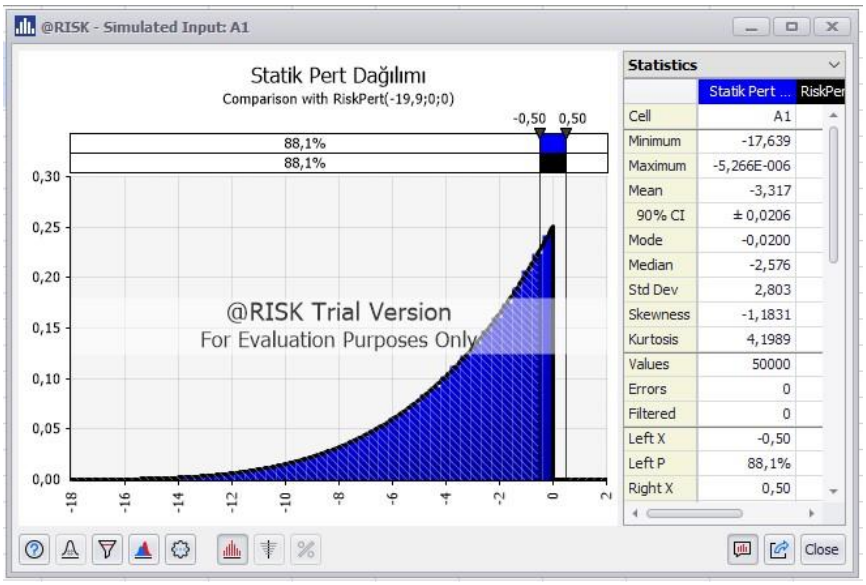
Yeni bir öğrencinin ilgili derslerden girdiği sınavlardan beklediği notlar aşağıdaki Tablo2.'de verilmiştir.

Tablo 2. Yeni öğrencinin ilgili ders sınavlarından sonra beklediği notlar

Dersler	Beklenen Notlar
Statik	62
Mukavemet I	73
İstatistik	88
Malzeme Bilimi	80
Akışkanlar Mekaniği	61
İnşaat Jeolojisi	48
Yapı Statiği I	79
Mukavemet II	61
Topoğrafya	58
Yapı Malzemesi	57
Karayolu İnşaatı	66
Yapı İşletmesi	65
Hidrolik ve Hidroloji	58
Betonarme I	69
Zemin Mekaniği	37
Çelik Yapılar	42
Yapı Statiği II	55
Metraj ve Keşif	81
Betonarme II	64
Yapı Dinamiği	38
Temel İnşaatı	59
Mühendislik Ekonomisi	62

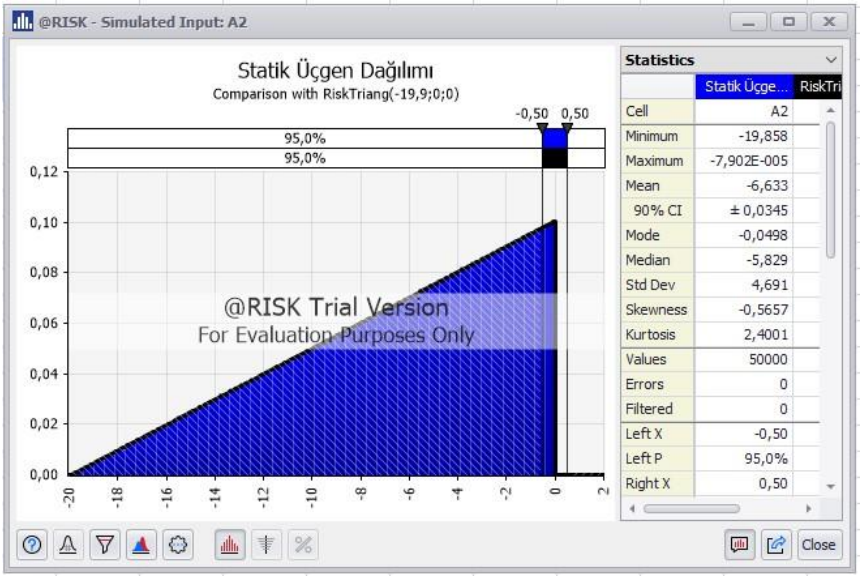
Tablo 2.'deki beklenen değerler ve Tablo 1.'deki dağılım uç noktaları esas alınarak yapılan Monte Carlo Simülasyonları sonucu elde edilen sonuçlar aşağıdaki gibidir.

Statik dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



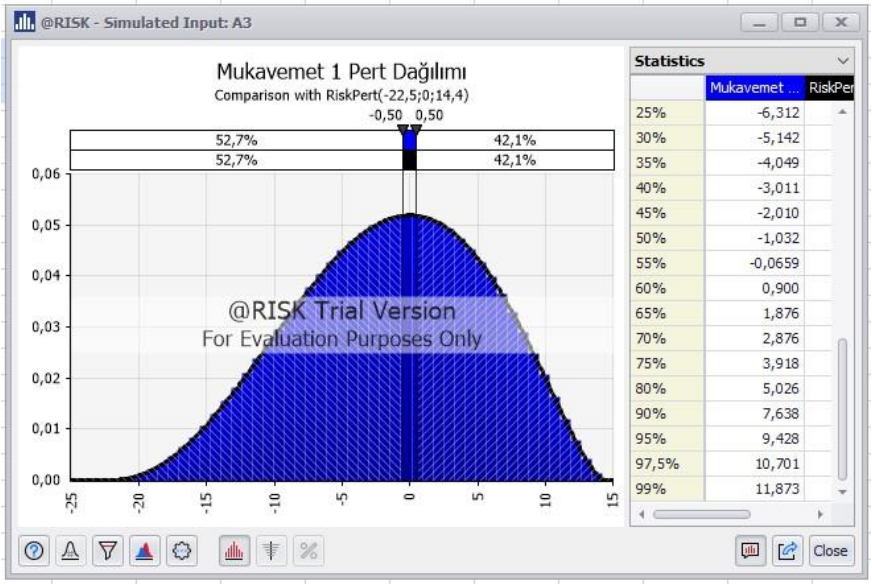
Öğrencinin bu dersten beklediği not 62 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %11,9 dur. Öğrenci %88,1 ihtimalle beklediği notun %19,9 eksiğini alacaktır. Bu durumda öğrencinin alacağı not 50 olacaktır.

Statik dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



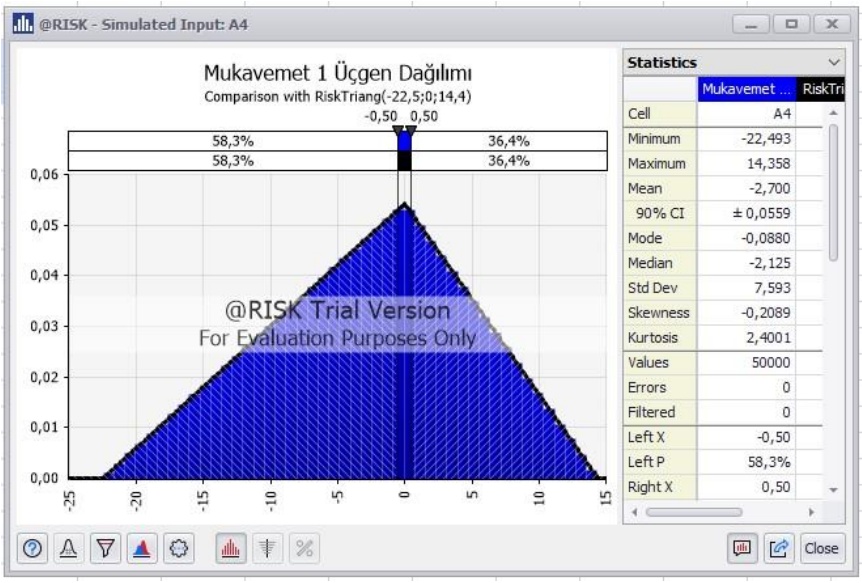
Öğrencinin bu dersten beklediği not 62 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5 dir. Öğrenci %95 ihtimalle beklediği notun %19,9 eksiğini alacaktır. Bu durumda öğrencinin alacağı not 50 olacaktır.

Mukavemet 1 dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



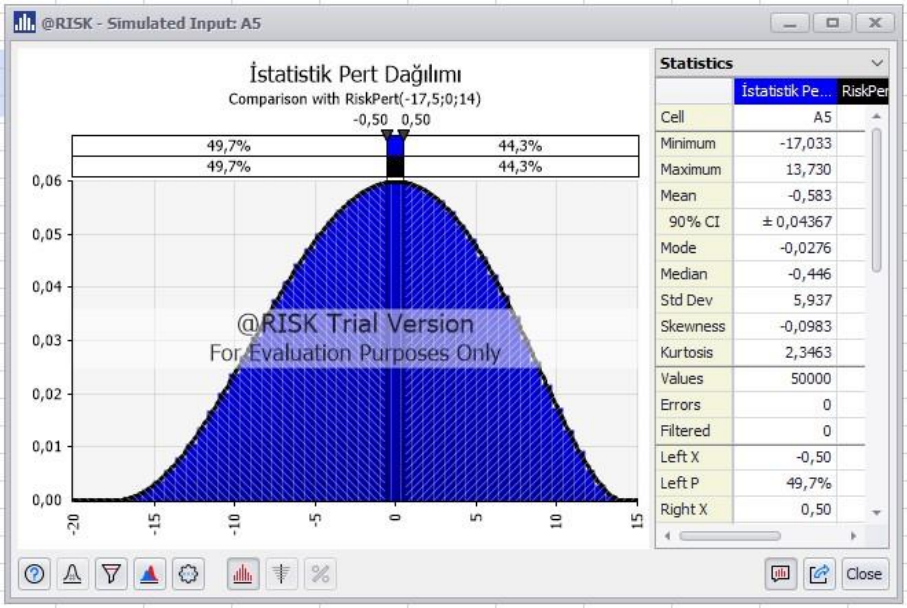
Öğrencinin bu dersten beklediği not 73 tür. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,2 dir. Öğrenci %52,7 ihtimalle beklediği notun %22,5 eksiğini, %42,1 ihtimalle beklediği notun %14,4 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 56 olacaktır.

Mukavemet 1 dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



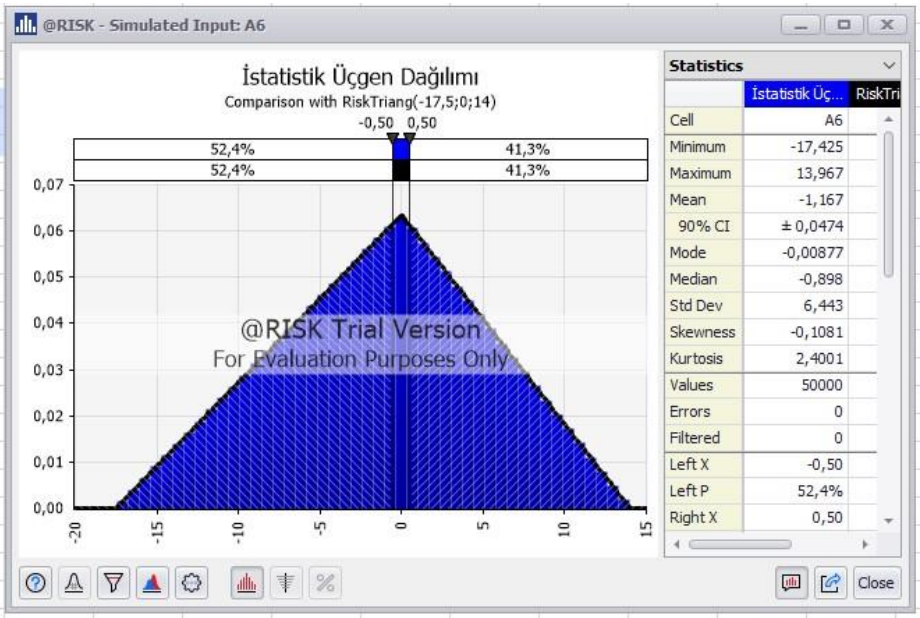
Öğrencinin bu dersten beklediği not 73 tür. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,3 tür. Öğrenci %58,3 ihtimalle beklediği notun %22,5 eksiğini, %36,4 ihtimalle beklediği notun %14,4 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 56 olacaktır.

İstatistik dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



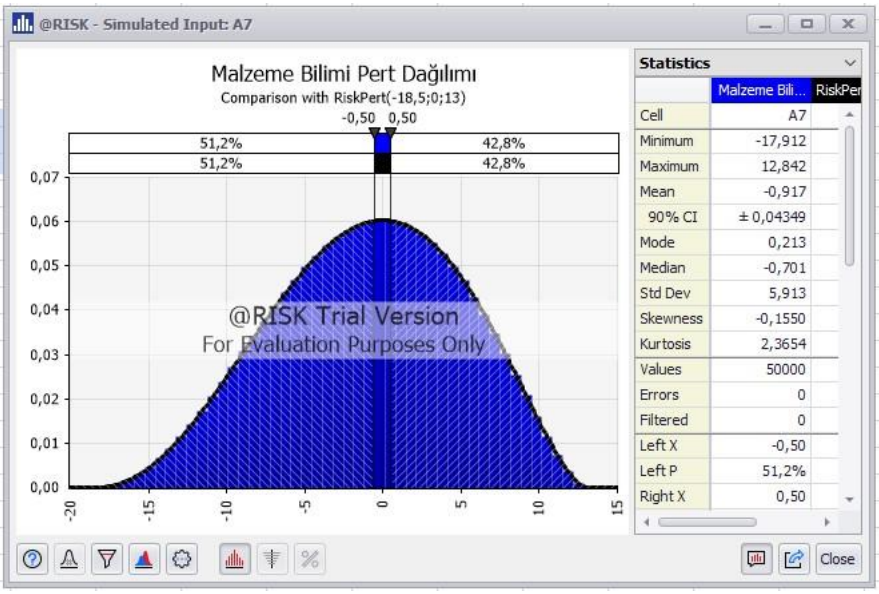
Öğrencinin bu dersten beklediği not 88 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6 dır. Öğrenci %49,7 ihtimalle beklediği notun %17,5 eksiğini, %44,3 ihtimalle beklediği notun %14 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 73 olacaktır.

İstatistik dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



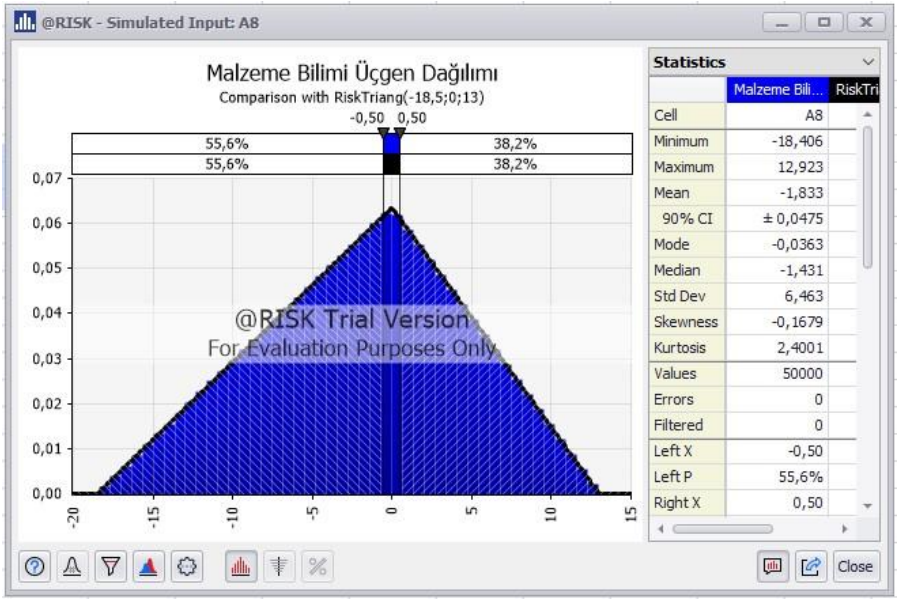
Öğrencinin bu dersten beklediği not 88 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6,3 tür. Öğrenci %52,4 ihtimalle beklediği notun %17,5 eksiğini, %41,3 ihtimalle beklediği notun %14 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 73 olacaktır.

Malzeme Bilimi dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



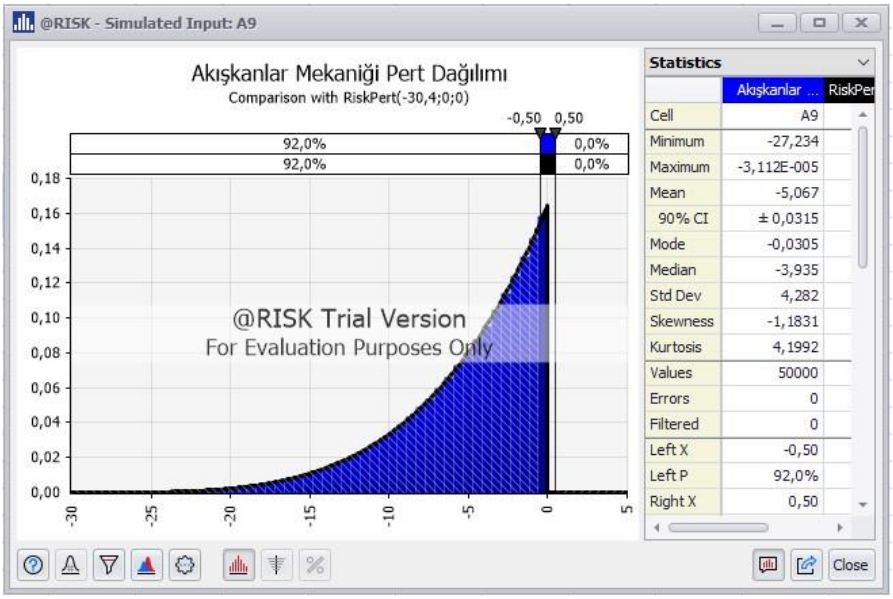
Öğrencinin bu dersten beklediği not 80 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6 dır. Öğrenci %51,2 ihtimalle beklediği notun %18,5 eksiğini, %42,8 ihtimalle beklediği notun %13 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 65 olacaktır.

Malzeme Bilimi dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



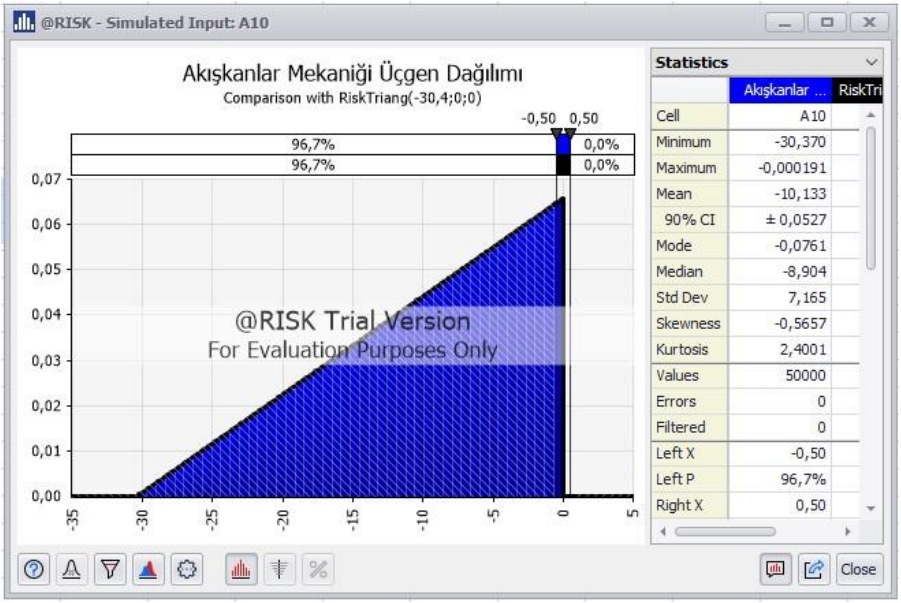
Öğrencinin bu dersten beklediği not 80 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6,2 dir. Öğrenci %55,6 ihtimalle beklediği notun %18,5 eksiğini, %38,2 ihtimalle beklediği notun %13 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 65 olacaktır.

Akışkanlar Mekaniği dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



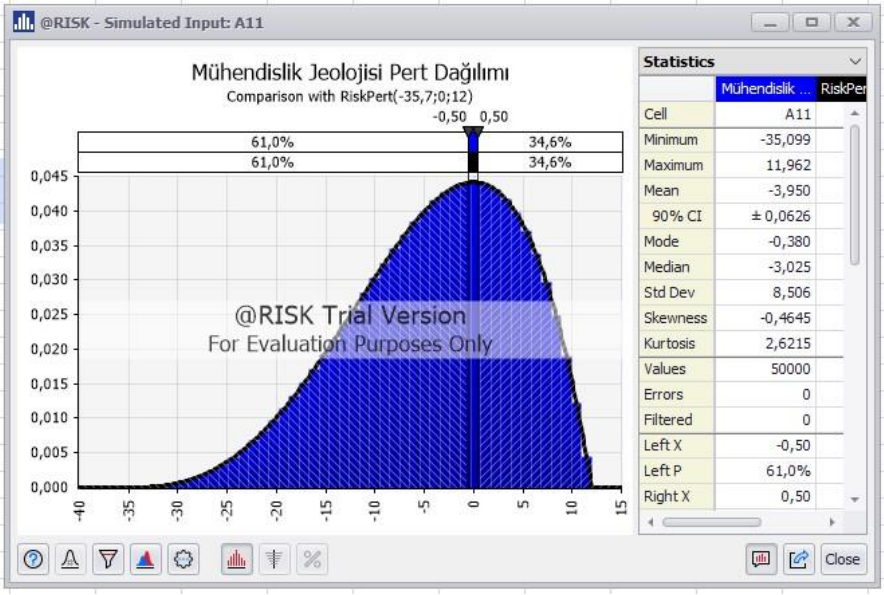
Öğrencinin bu dersten beklediği not 61 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %8 dir. Öğrenci %92 ihtimalle beklediği notun %30,4 eksiğini alacaktır. Bu durumda öğrencinin alacağı not 42 olacaktır.

Akışkanlar Mekaniği dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



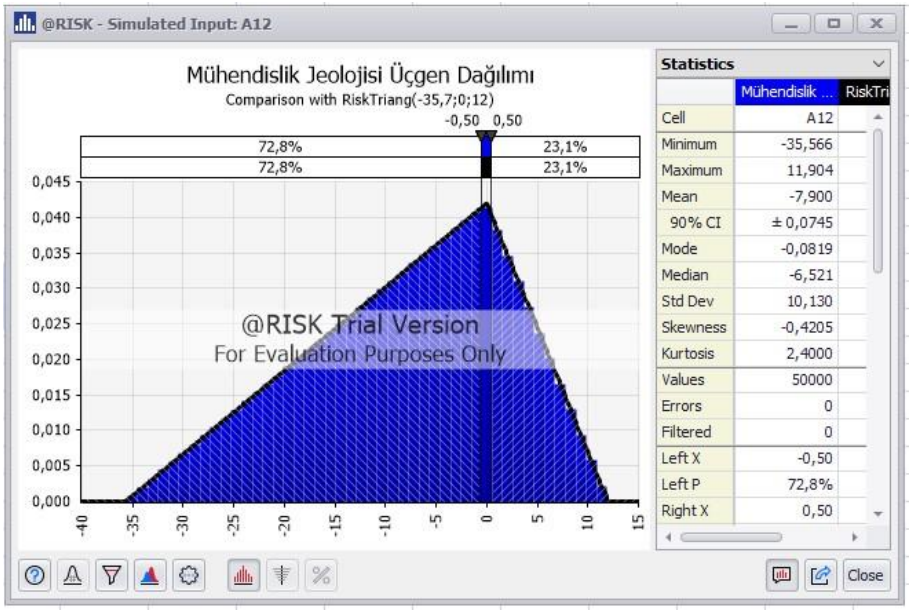
Öğrencinin bu dersten beklediği not 61 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %3,3 tür. Öğrenci %96,7 ihtimalle beklediği notun %30,4 eksiğini alacaktır. Bu durumda öğrencinin alacağı not 42 olacaktır.

Mühendislik Jeolojisi dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



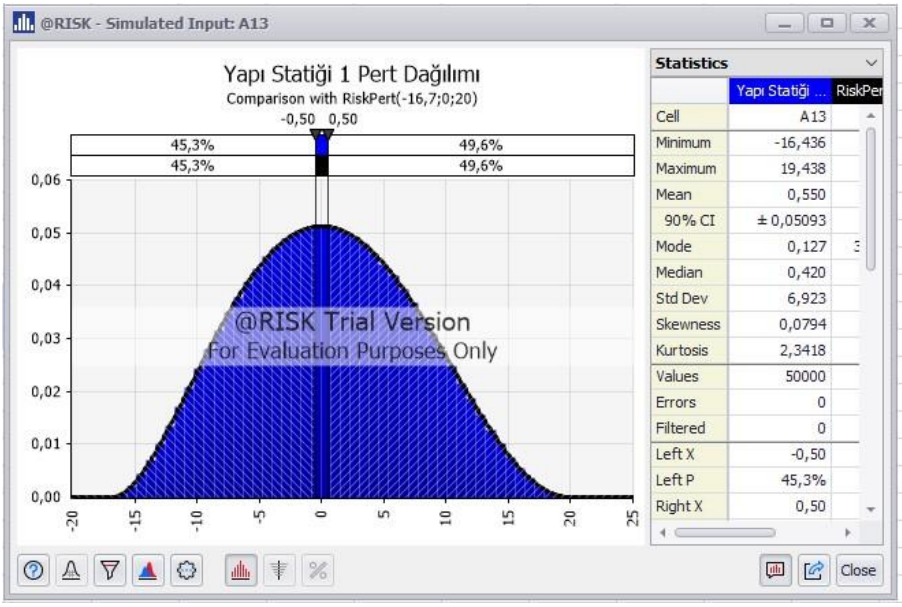
Öğrencinin bu dersten beklediği not 48 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %4,4 tür. Öğrenci %61 ihtimalle beklediği notun %35,7 eksiğini, %34,6 ihtimalle beklediği notun %12 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 31 olacaktır.

Mühendislik Jeolojisi dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



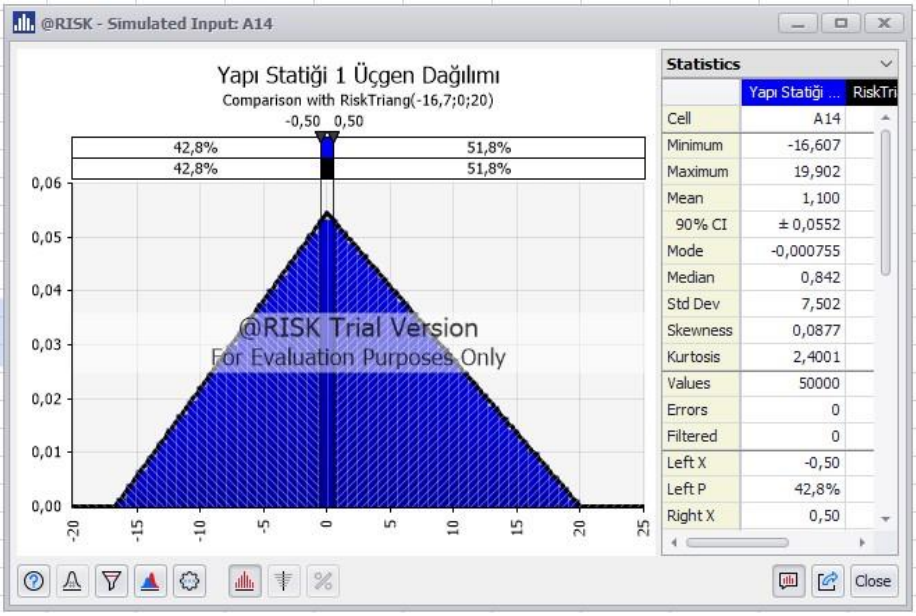
Öğrencinin bu dersten beklediği not 48 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %4,1 dir. Öğrenci %72,8 ihtimalle beklediği notun %35,7 eksiğini, %23,1 ihtimalle beklediği notun %12 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 31 olacaktır.

Yapı Statiği 1 dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



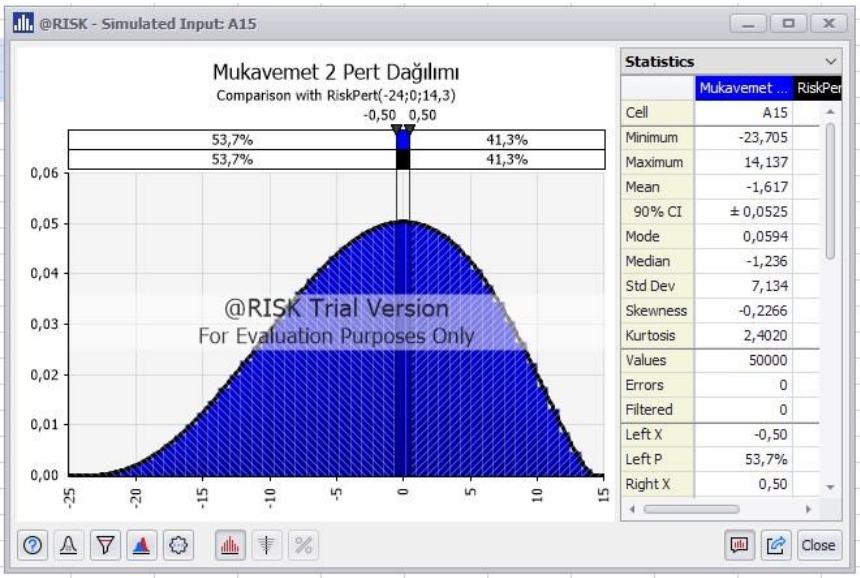
Öğrencinin bu dersten beklediği not 79 dur. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,1 dir. Öğrenci %45,3 ihtimalle beklediği notun %16,7 eksiğini, %49,6 ihtimalle beklediği notun %20 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 95 olacaktır.

Yapı Statiği 1 dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



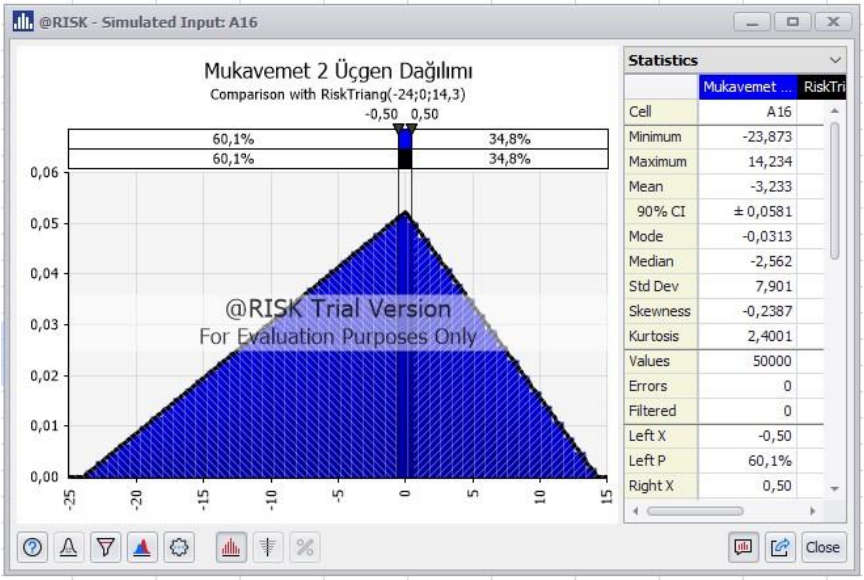
Öğrencinin bu dersten beklediği not 79 dur. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,4 tür. Öğrenci %42,8 ihtimalle beklediği notun %16,7 eksiğini, %51,8 ihtimalle beklediği notun %20 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 95 olacaktır.

Mukavemet 2 dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



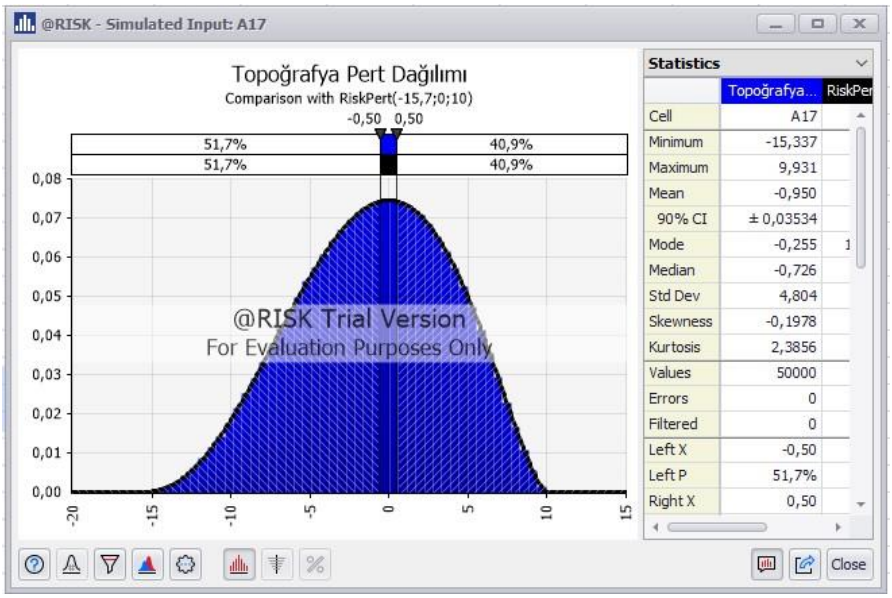
Öğrencinin bu dersten beklediği not 61 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5 dir. Öğrenci %53,7 ihtimalle beklediği notun %24 eksiğini, %41,3 ihtimalle beklediği notun %14,3 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 46 olacaktır.

Mukavemet 2 dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



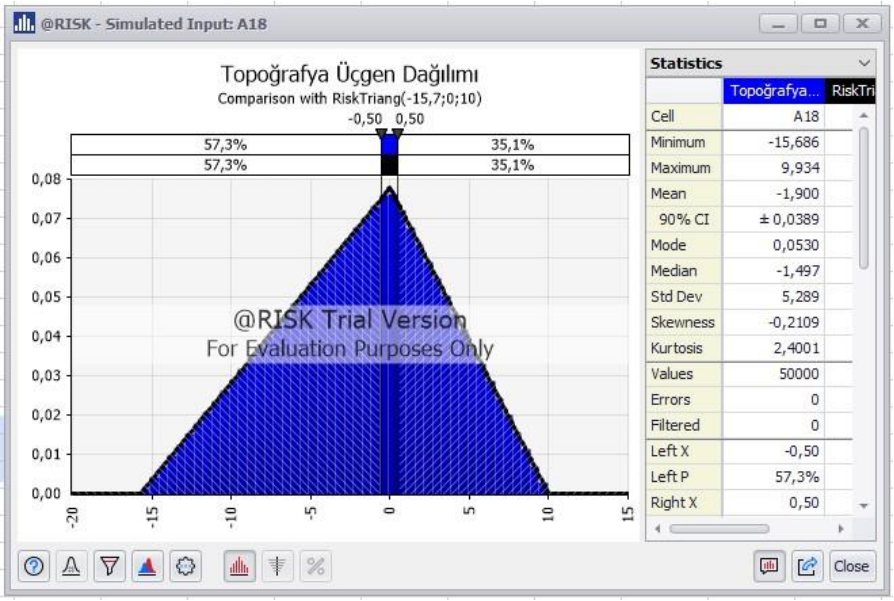
Öğrencinin bu dersten beklediği not 61 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,1 dir. Öğrenci %60,1 ihtimalle beklediği notun %24 eksiğini, %34,8 ihtimalle beklediği notun %14,3 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 46 olacaktır.

Topoğrafya dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



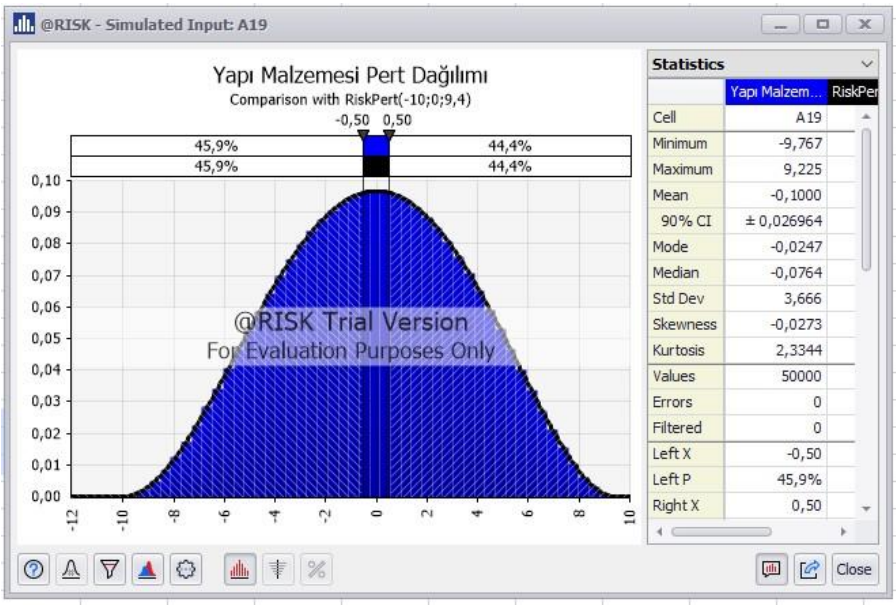
Öğrencinin bu dersten beklediği not 58 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %7,4 tür. Öğrenci %51,7 ihtimalle beklediği notun %15,7 eksiğini, %40,9 ihtimalle beklediği notun %10 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 49 olacaktır.

Topoğrafya dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



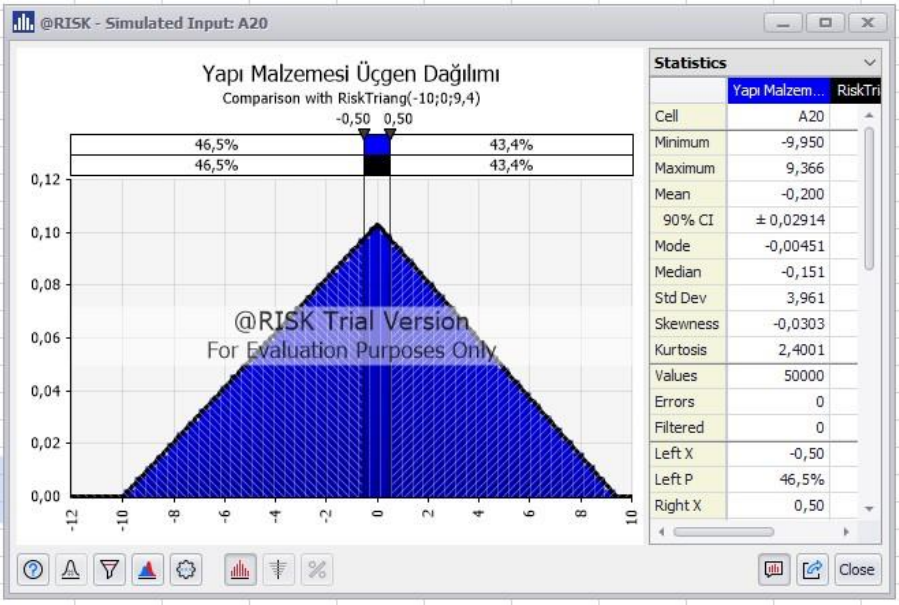
Öğrencinin bu dersten beklediği not 58 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %7,6 dır. Öğrenci %57,3 ihtimalle beklediği notun %15,7 eksiğini, %35,1 ihtimalle beklediği notun %10 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 49 olacaktır.

Yapı Malzemesi dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



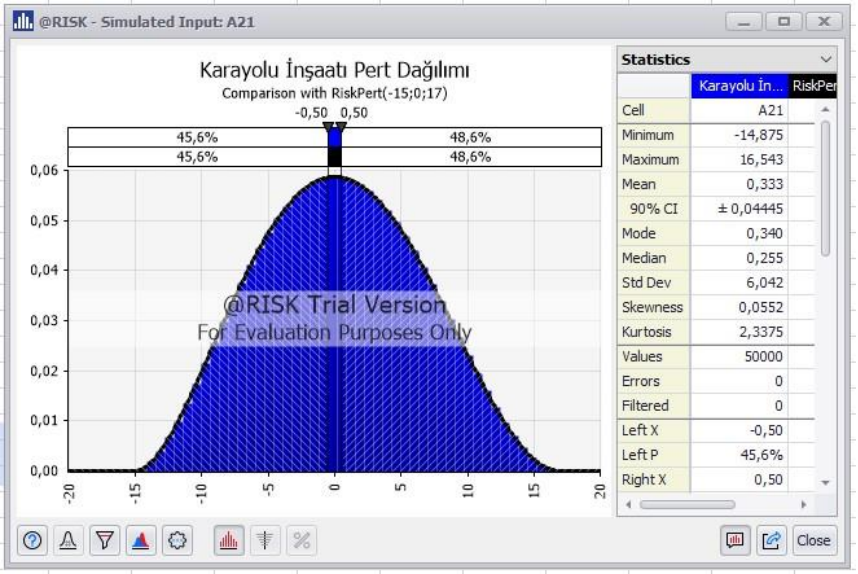
Öğrencinin bu dersten beklediği not 57 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %9,7 dir. Öğrenci %45,9 ihtimalle beklediği notun %10 eksiğini, %44,4 ihtimalle beklediği notun %9,4 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 51 olacaktır.

Yapı Malzemesi dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



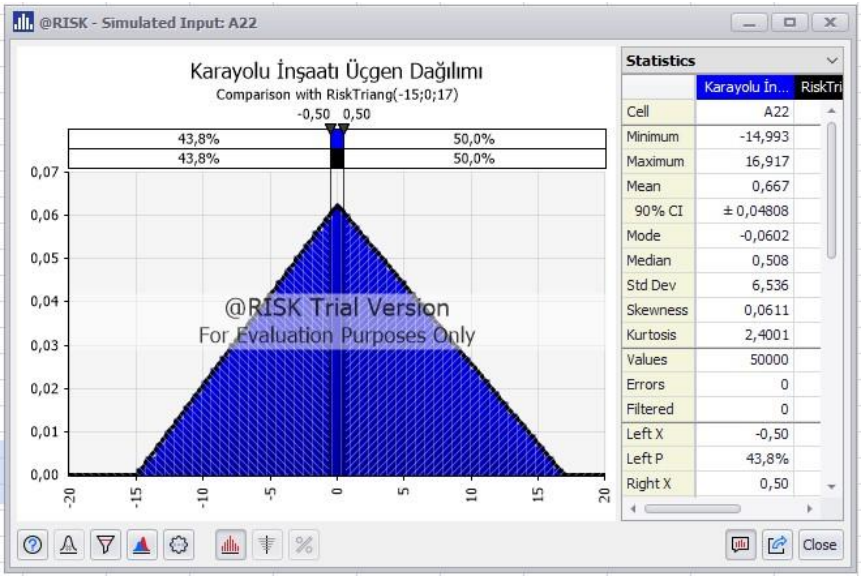
Öğrencinin bu dersten beklediği not 57 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %10,1 dir. Öğrenci %46,5 ihtimalle beklediği notun %10 eksiğini, %43,4 ihtimalle beklediği notun %9,4 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 51 olacaktır.

Karayolu İnşaatı dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



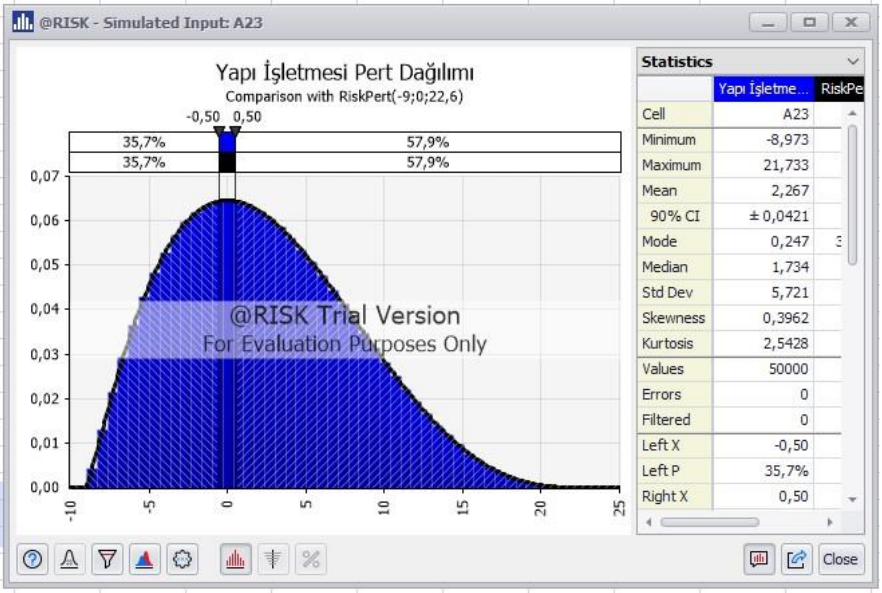
Öğrencinin bu dersten beklediği not 66 dır. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,8 dir. Öğrenci %45,6 ihtimalle beklediği notun %15 eksiğini, %48,6 ihtimalle beklediği notun %17 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 77 olacaktır.

Karayolu İnşaatı dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



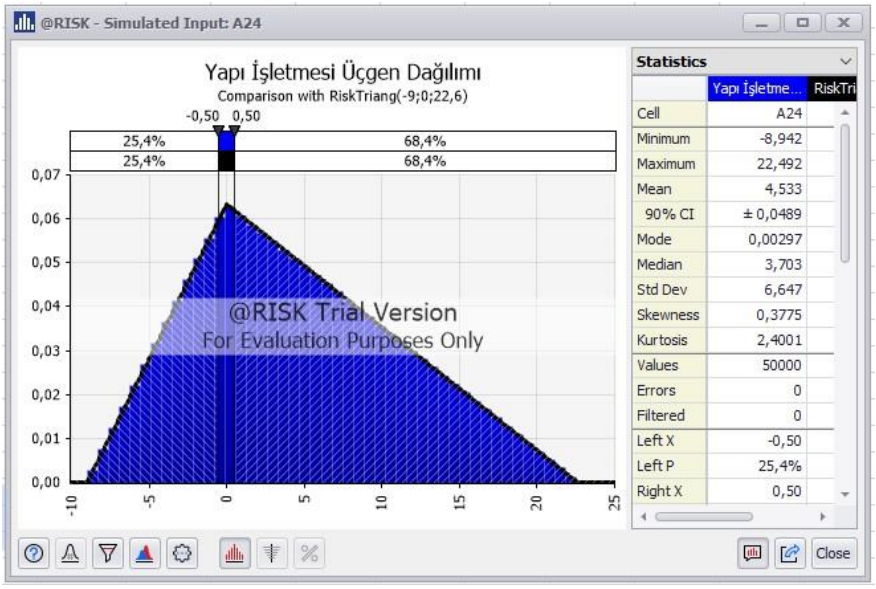
Öğrencinin bu dersten beklediği not 66 dır. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6,2 dir. Öğrenci %43,8 ihtimalle beklediği notun %15 eksiğini, %50 ihtimalle beklediği notun %17 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 77 olacaktır.

Yapı İşletmesi dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



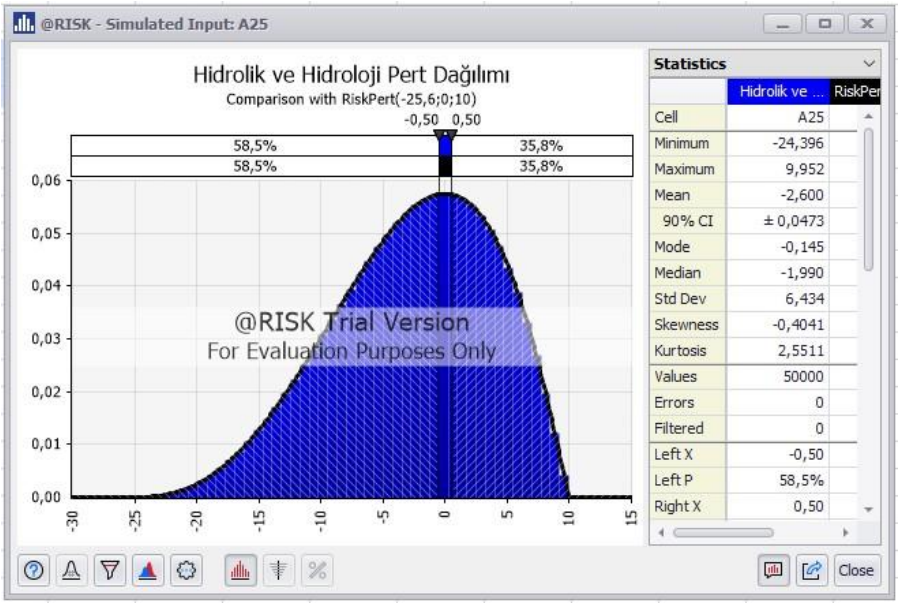
Öğrencinin bu dersten beklediği not 65 tir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6,4 tür. Öğrenci %35,7 ihtimalle beklediği notun %9 eksiğini, %57,9 ihtimalle beklediği notun %22,6 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 80 olacaktır.

Yapı İşletmesi dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



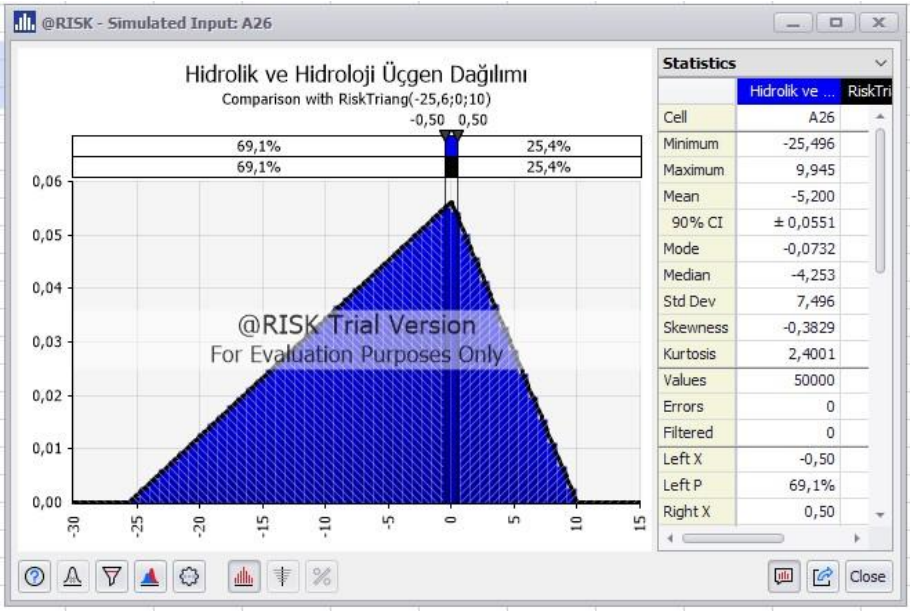
Öğrencinin bu dersten beklediği not 65 tir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %6,2 dir. Öğrenci %25,4 ihtimalle beklediği notun %9 eksiğini, %68,4 ihtimalle beklediği notun %22,6 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 80 olacaktır.

Hidrolik ve Hidroloji dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



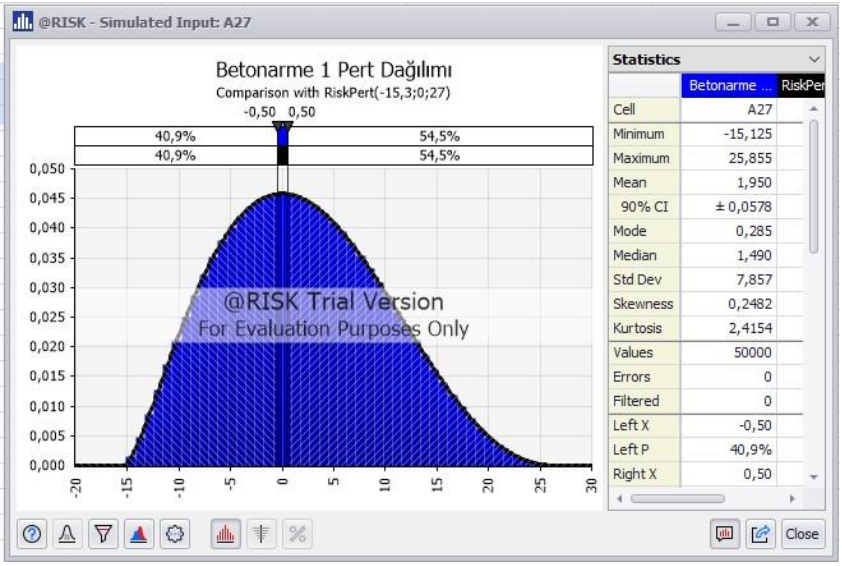
Öğrencinin bu dersten beklediği not 58 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,7 dir. Öğrenci %58,5 ihtimalle beklediği notun %25,6 eksiğini, %35,8 ihtimalle beklediği notun %10 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 37 olacaktır.

Hidrolik ve Hidroloji dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



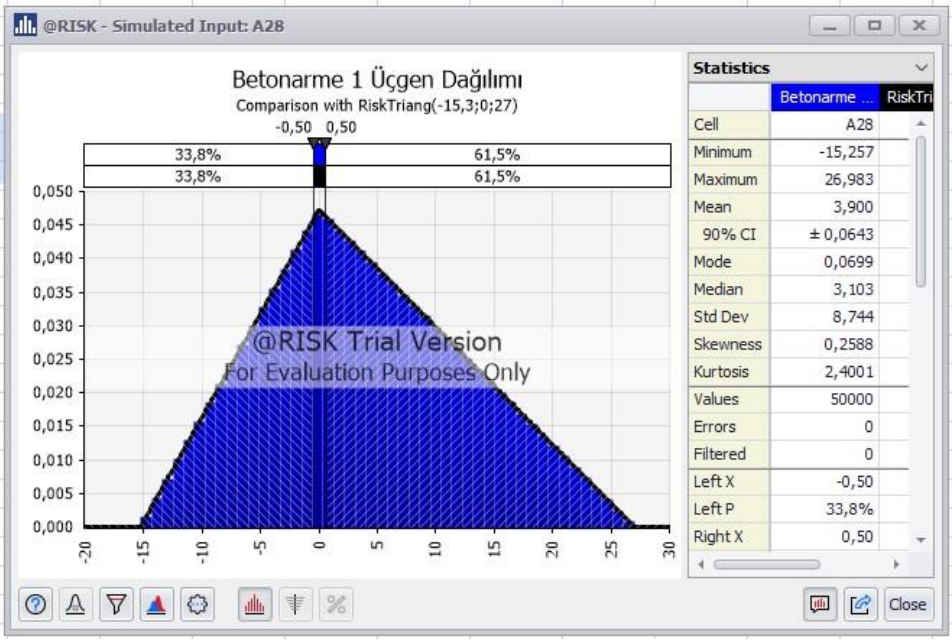
Öğrencinin bu dersten beklediği not 58 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,5 dir. Öğrenci %69,1 ihtimalle beklediği notun %25,6 eksiğini, %25,4 ihtimalle beklediği notun %10 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 37 olacaktır.

Betonarme 1 dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



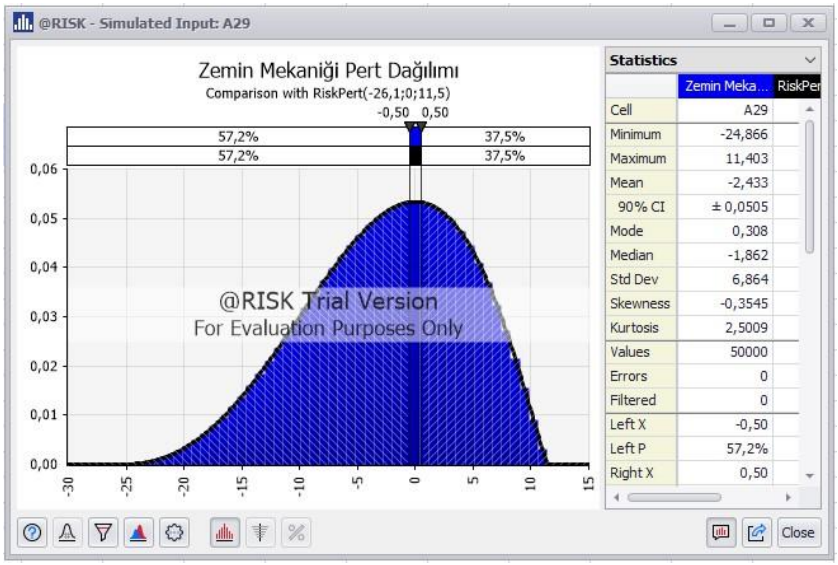
Öğrencinin bu dersten beklediği not 69 dur. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %4,6 dır. Öğrenci %40,9 ihtimalle beklediği notun %15,3 eksiğini, %54,5 ihtimalle beklediği notun %27 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 88 olacaktır.

Betonarme 1 dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



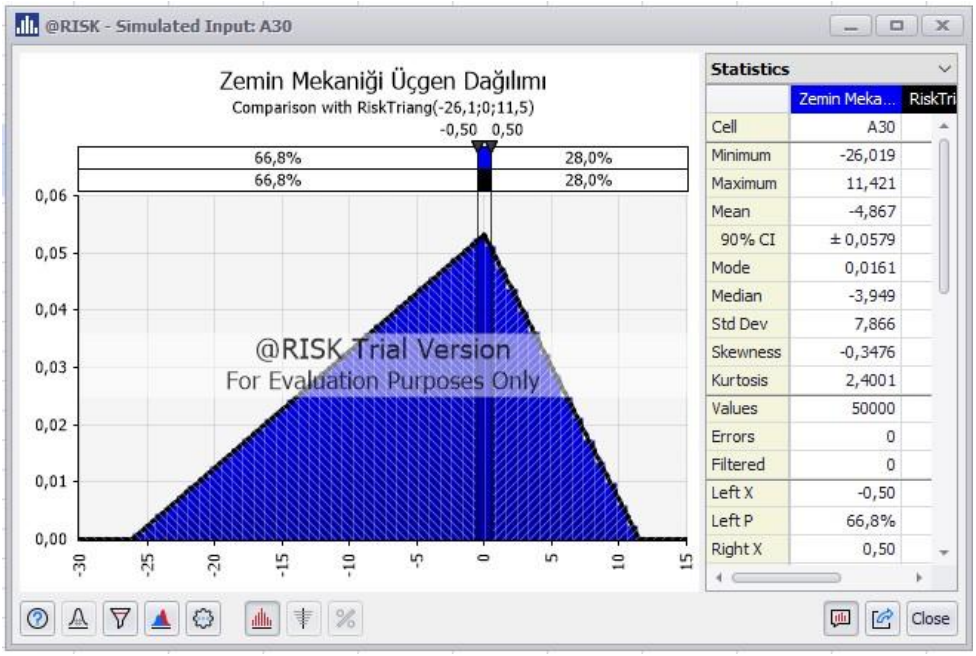
Öğrencinin bu dersten beklediği not 69 dur. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %4,7 dir. Öğrenci %33,8 ihtimalle beklediği notun %15,3 eksiğini, %61,5 ihtimalle beklediği notun %27 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 88 olacaktır.

Zemin Mekaniği dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



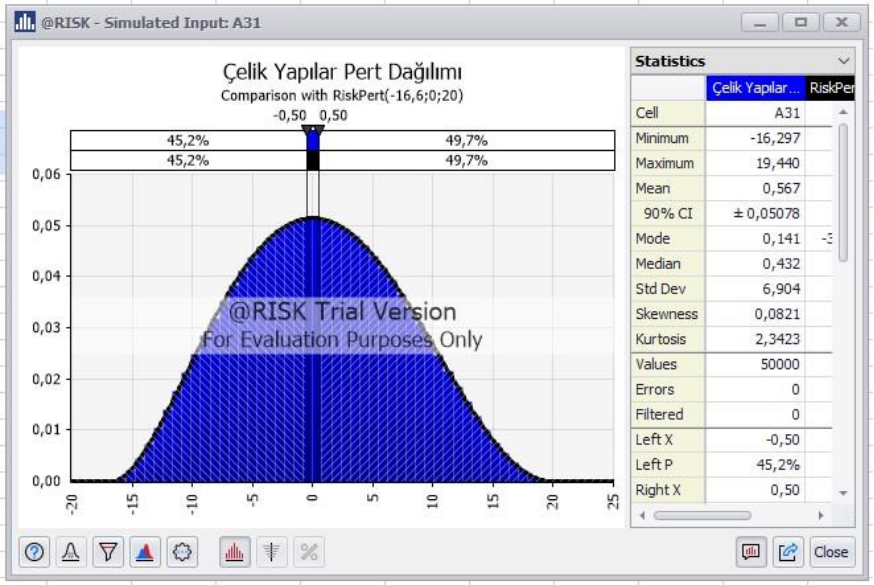
Öğrencinin bu dersten beklediği not 37 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,3 tür. Öğrenci %57,2 ihtimalle beklediği notun %26,1 eksiğini, %37,5 ihtimalle beklediği notun %11,5 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 27 olacaktır.

Zemin Mekaniği dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



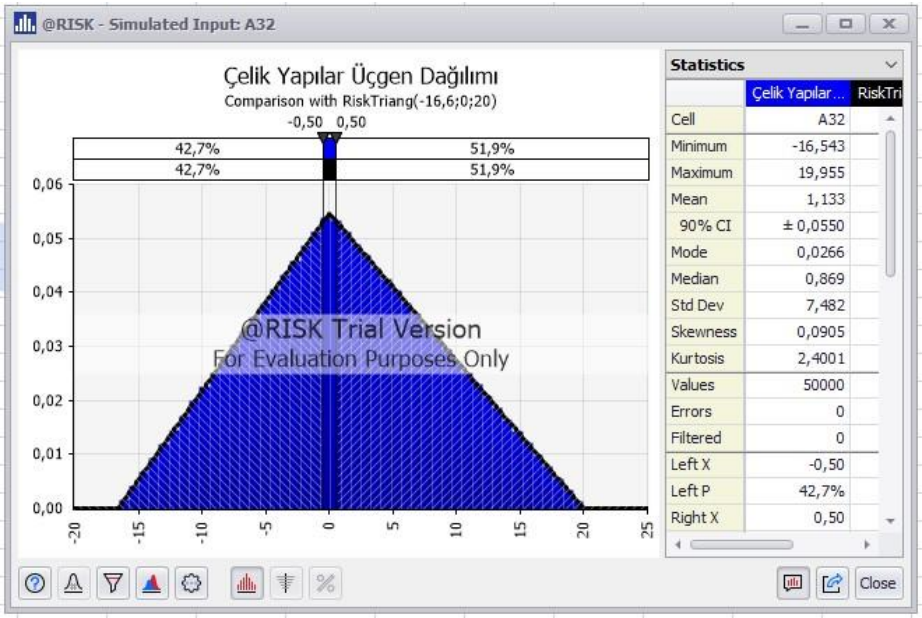
Öğrencinin bu dersten beklediği not 37 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,2 dir. Öğrenci %66,8 ihtimalle beklediği notun %26,1 eksiğini, %28 ihtimalle beklediği notun %11,5 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 27 olacaktır.

Çelik Yapılar dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



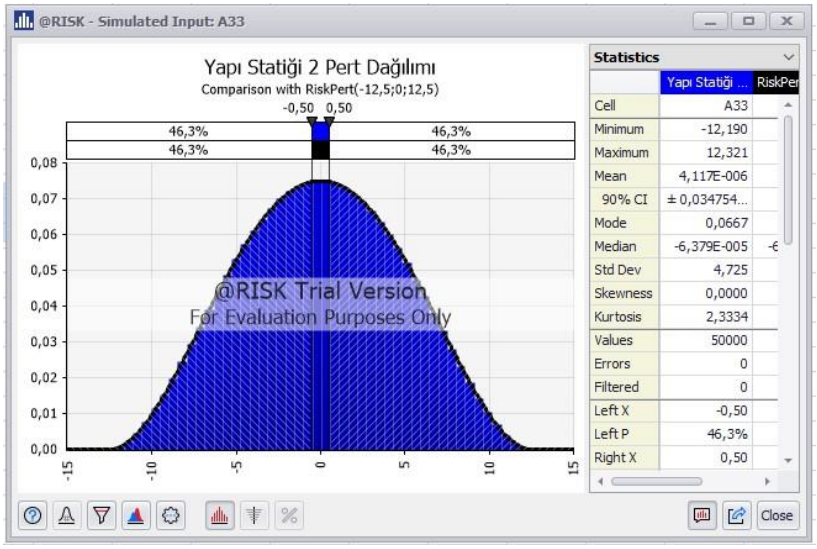
Öğrencinin bu dersten beklediği not 42 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,1 dir. Öğrenci %45,2 ihtimalle beklediği notun %16,6 eksiğini, %49,7 ihtimalle beklediği notun %20 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 50 olacaktır.

Çelik Yapılar dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



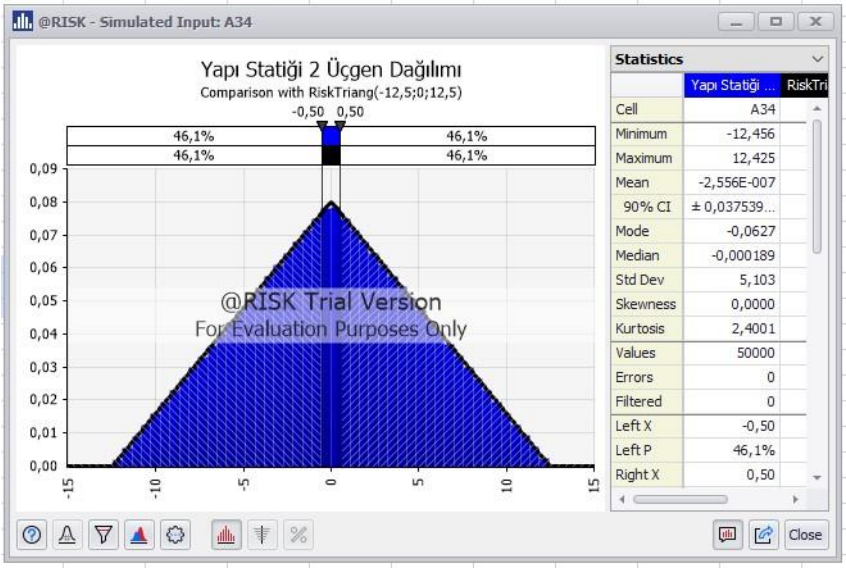
Öğrencinin bu dersten beklediği not 42 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,4 tür. Öğrenci %42,7 ihtimalle beklediği notun %16,6 eksiğini, %51,9 ihtimalle beklediği notun %20 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 50 olacaktır.

Yapı Statiği 2 dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



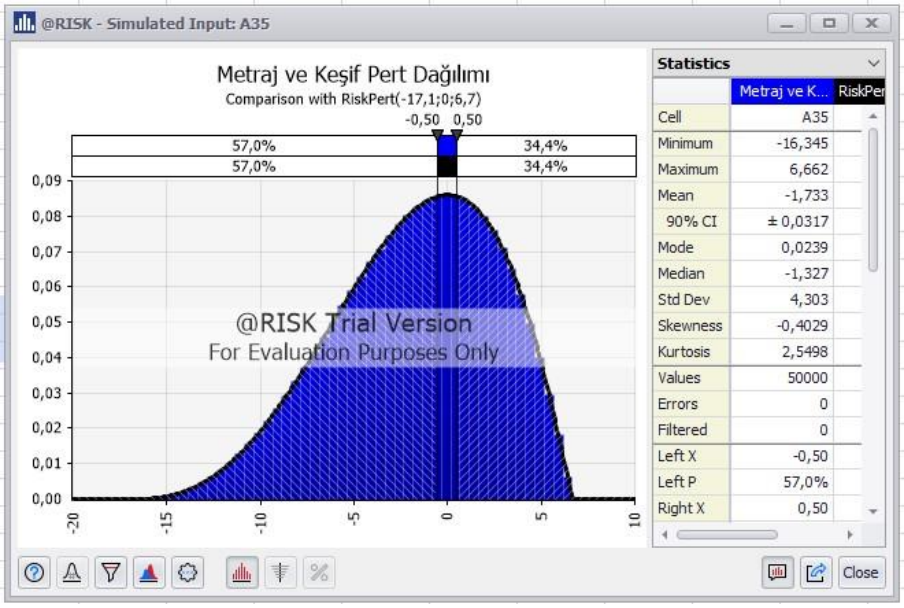
Öğrencinin bu dersten beklediği not 55 tir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %7,4 tür. Öğrenci %46,3 ihtimalle beklediği notun %12,5 eksiğini, %46,3 ihtimalle beklediği notun %12,5 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 48 ya da 62 olacaktır.

Yapı Statiği 2 dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



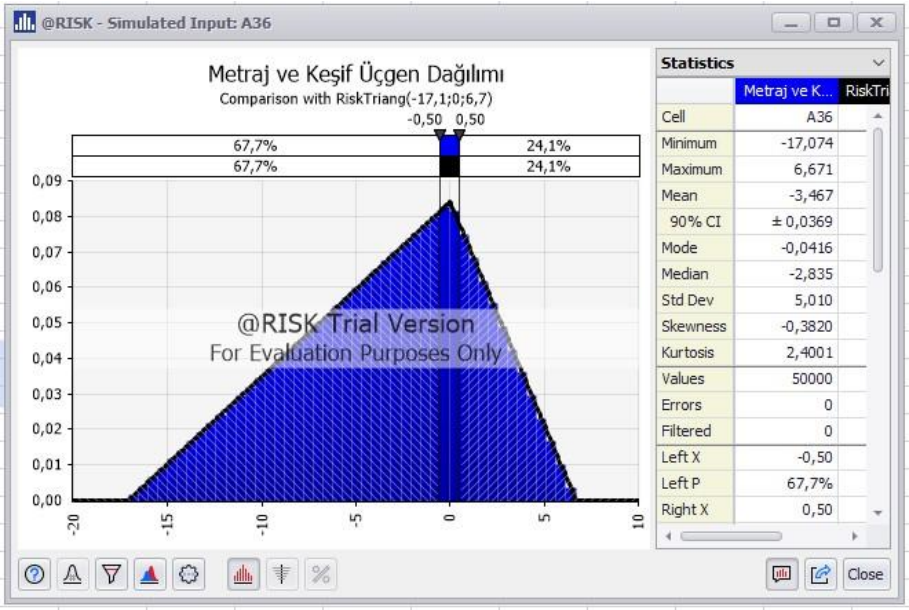
Öğrencinin bu dersten beklediği not 55 tir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %7,8 dir. Öğrenci %46,1 ihtimalle beklediği notun %12,5 eksiğini, %46,1 ihtimalle beklediği notun %12,5 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 48 ya da 62 olacaktır.

Metraj ve Keşif dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



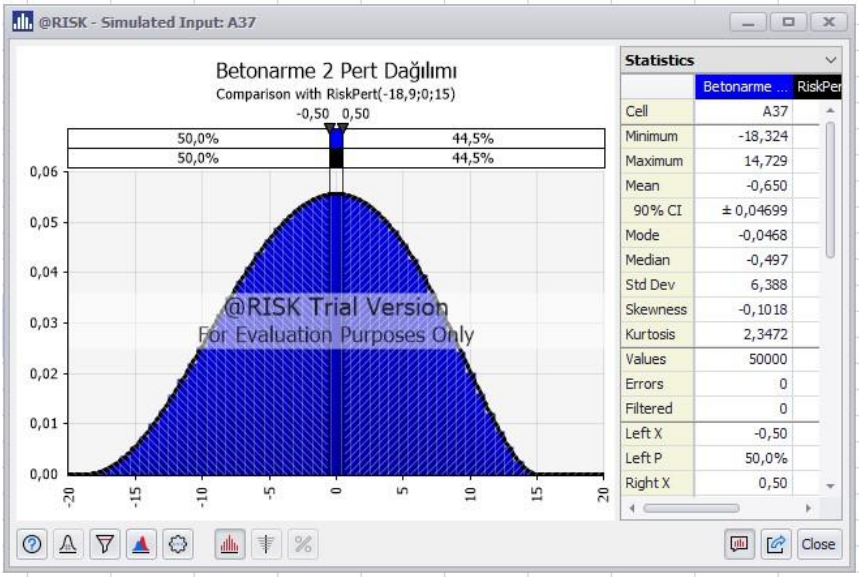
Öğrencinin bu dersten beklediği not 81 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %8,6 dır. Öğrenci %57 ihtimalle beklediği notun %17,1 eksiğini, %34,4 ihtimalle beklediği notun %6,7 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 67 olacaktır.

Metraj ve Keşif dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



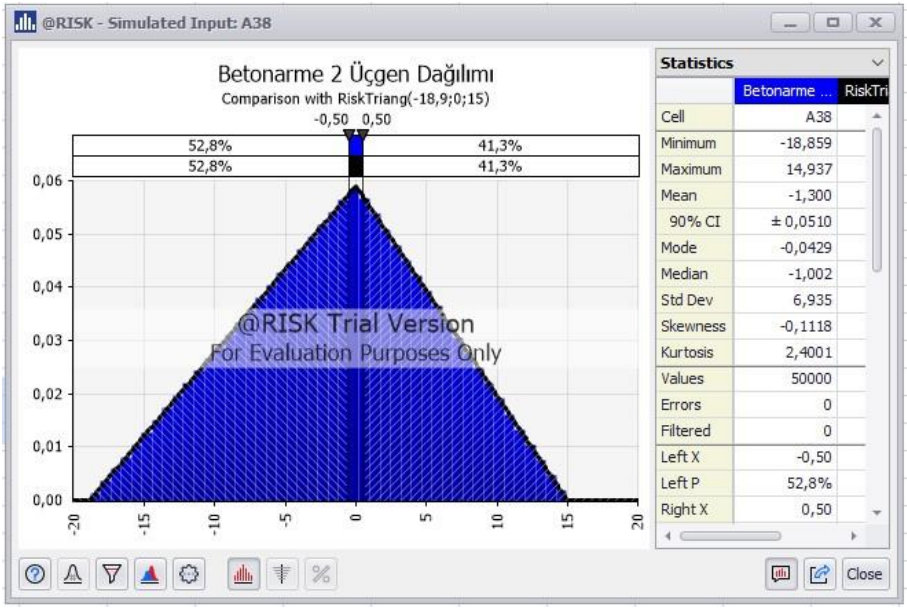
Öğrencinin bu dersten beklediği not 81 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %8,2 dir. Öğrenci %67,7 ihtimalle beklediği notun %17,1 eksiğini, %24,1 ihtimalle beklediği notun %6,7 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 67 olacaktır.

Betonarme 2 dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



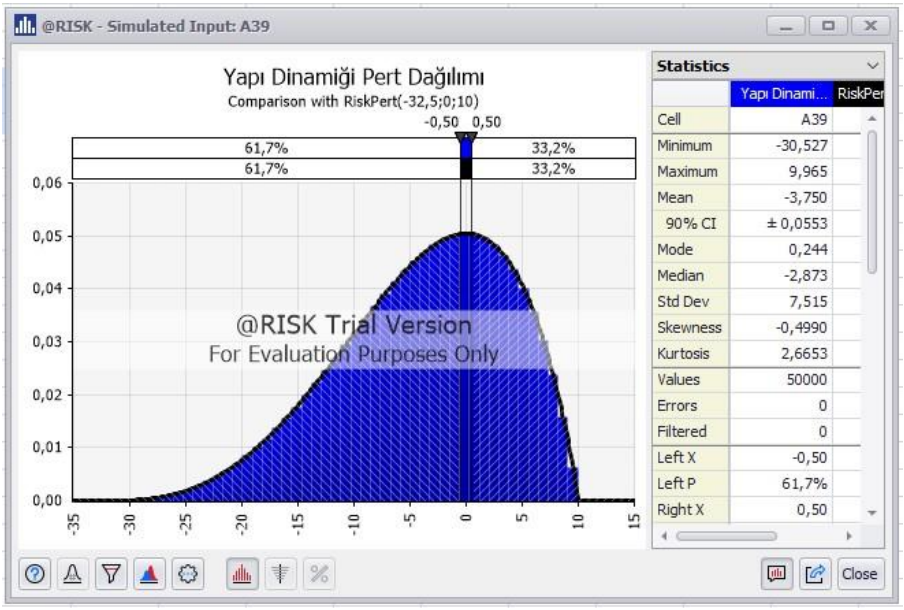
Öğrencinin bu dersten beklediği not 64 tür. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,5 dir. Öğrenci %50 ihtimalle beklediği notun %18,9 eksiğini, %44,5 ihtimalle beklediği notun %15 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 52 olacaktır.

Betonarme 2 dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



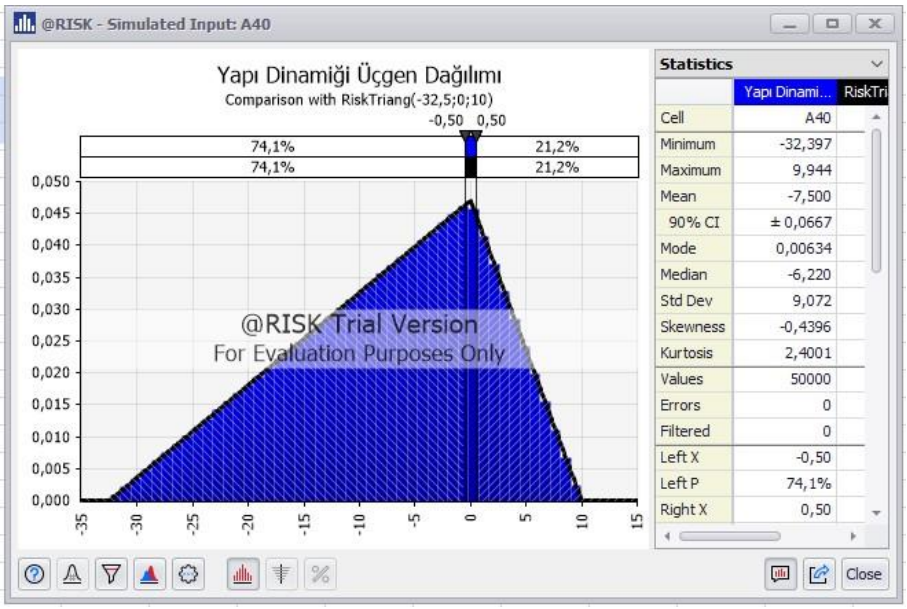
Öğrencinin bu dersten beklediği not 64 tür. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,9 dur. Öğrenci %52,8 ihtimalle beklediği notun %18,9 eksiğini, %41,3 ihtimalle beklediği notun %15 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 52 olacaktır.

Yapı Dinamiği dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



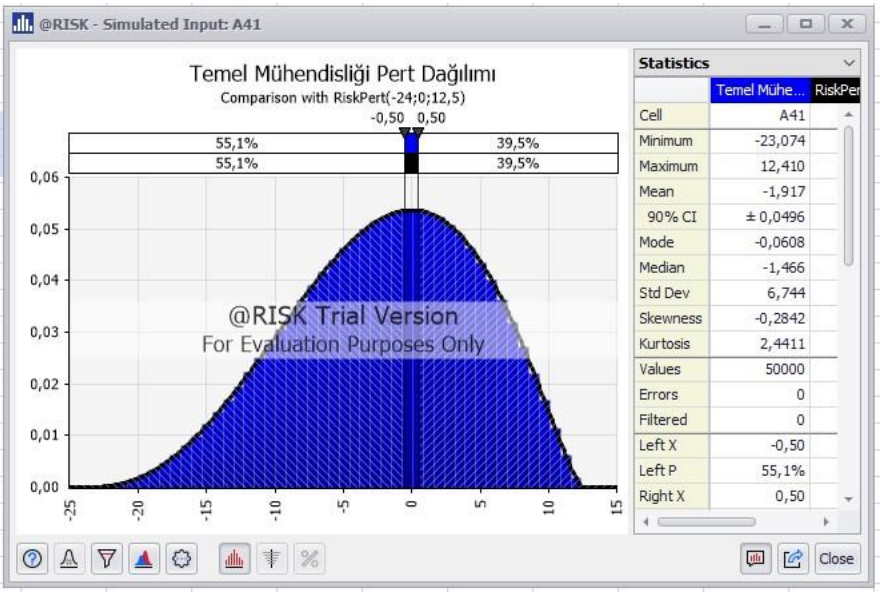
Öğrencinin bu dersten beklediği not 38 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,1 dir. Öğrenci %61,7 ihtimalle beklediği notun %32,5 eksiğini, %33,2 ihtimalle beklediği notun %10 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 26 olacaktır.

Yapı Dinamiği dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



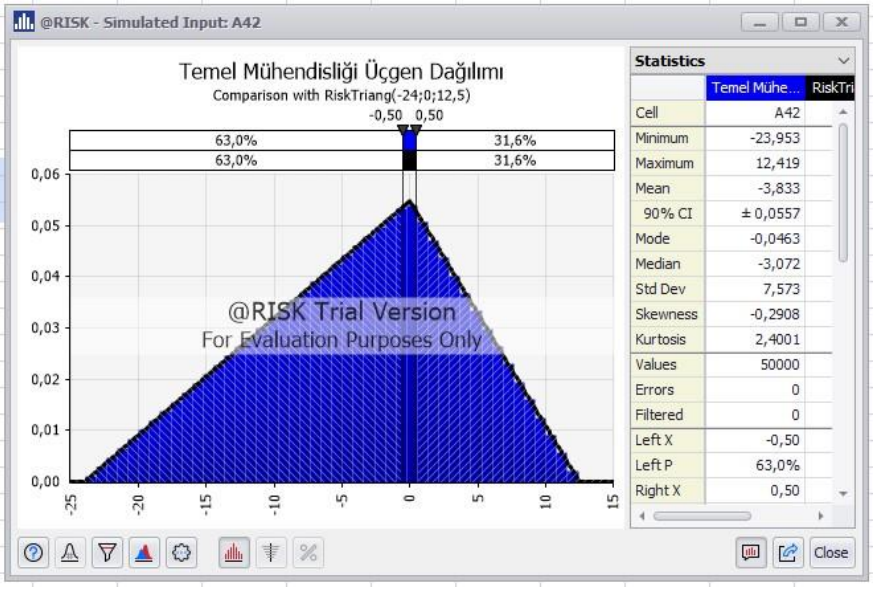
Öğrencinin bu dersten beklediği not 38 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %4,7 dir. Öğrenci %74,1 ihtimalle beklediği notun %32,5 eksiğini, %21,2 ihtimalle beklediği notun %10 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 26 olacaktır.

Temel Mühendisliği dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



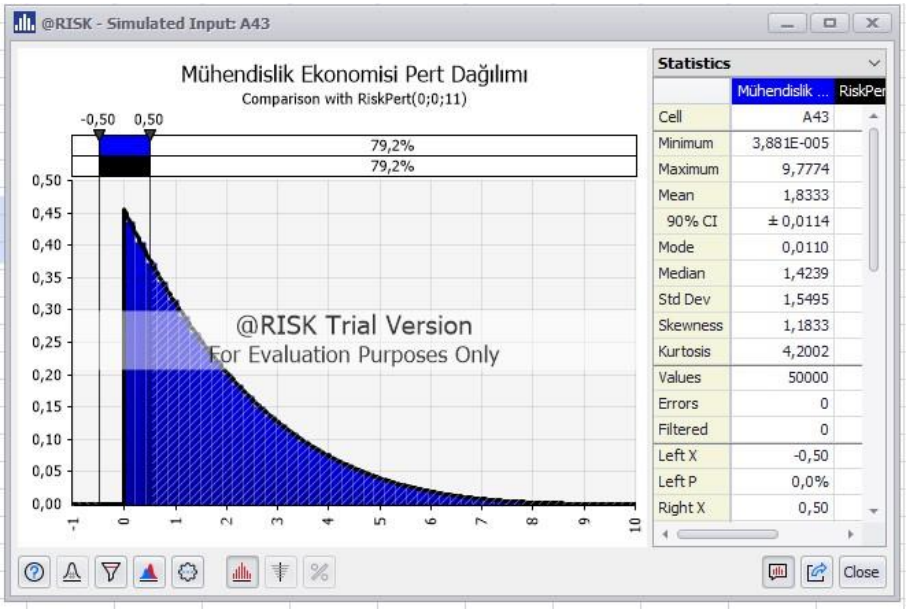
Öğrencinin bu dersten beklediği not 59 dur. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,4 tür. Öğrenci %55,1 ihtimalle beklediği notun %24 eksiğini, %39,5 ihtimalle beklediği notun %12,5 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 45 olacaktır.

Temel Mühendisliği dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



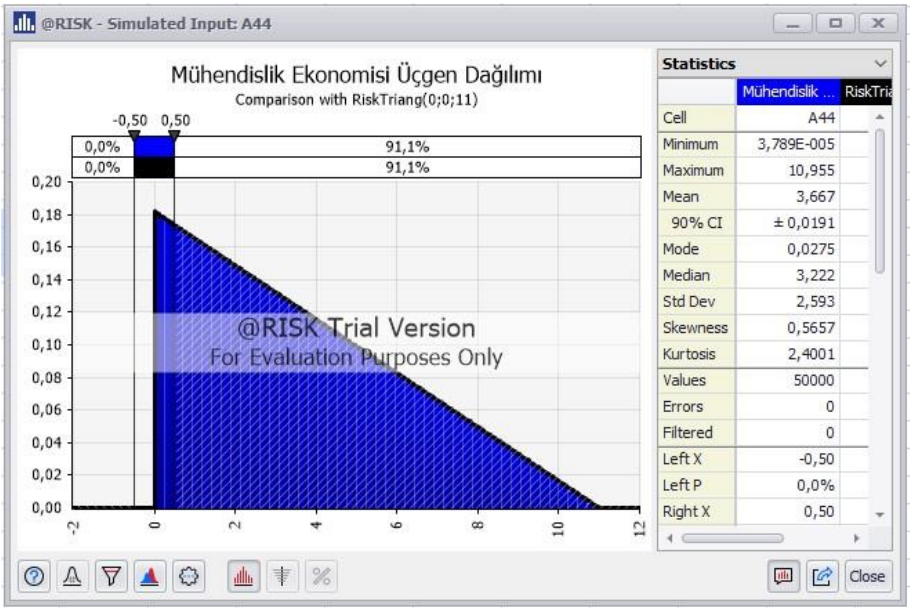
Öğrencinin bu dersten beklediği not 59 dur. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %5,4 tür. Öğrenci %63 ihtimalle beklediği notun %24 eksiğini, %31,6 ihtimalle beklediği notun %12,5 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 45 olacaktır.

Mühendislik Ekonomisi dersi için monte carlo simülasyonu PERT dağılımı sonucu aşağıdaki gibidir;



Öğrencinin bu dersten beklediği not 62 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %20,8 dir. Öğrenci %79,2 ihtimalle beklediği notun %11 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 69 olacaktır.

Mühendislik Ekonomisi dersi için monte carlo simülasyonu ÜÇGEN dağılımı sonucu aşağıdaki gibidir;



Öğrencinin bu dersten beklediği not 62 dir. Bu grafiğe göre öğrencinin beklediği notu alma ihtimali %8,9 dur. Öğrenci %91,1 ihtimalle beklediği notun %11 fazlasını alacaktır. Bu durumda öğrencinin alacağı not 69 olacaktır.

Sonuç olarak beklenenden daha fazla sapma yaşanan derslere daha çok önem ve süre vererek çalışılması gerektiği, öngörülen sınav sonuçlarının hangi oranda gerçekleşebileceği değerlerine ulaşılmıştır. Benzer değerlendirmeler her bölüm ve ders için yapılabilir. Daha doğruya yakın değerlere ulaşabilmek için daha çok veri üzerinden çalışılması gerektiği açıktır.

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Son erişim tarihi 12.04.2024

8. SINIF FEN BİLİMLERİ ÖĞRETİMİNDE "BASINÇ" KONUSUNDA "AÇIK HAVA DENEYLERİNİN" KULLANILMASI ÜZERİNE BİR EYLEM ARAŞTIRMASI

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Özet
Bu çalışmada öğrencilerin basınç konusuna olan ilgi ve isteklerini artıracak açık hava deneyleri ile daha verimli bir öğrenmenin sağlanabilmesi amaçlanmıştır. Çalışma grubunu, 2021-2022 eğitim öğretim döneminin birinci döneminde Afyonkarahisar Halımoru merkez köyünün Bozdoğan Halımoru Ortaokulunun 8-A şubesindeki 9 tane sekizinci sınıf öğrencisinden bir grup oluşturmaktadır (n=9). Uygun örnekleme yöntemi kullanılmıştır. Katılımcıların da aktif olduğu bu çalışmada duruma uygunluğu nedeniyle nitel araştırma yöntemlerinden eylem araştırması yöntemi tercih edilmiştir. Araştırmacılardan biri tarafından bir eylem planı hazırlanmış ve uygulanarak bu eylem araştırmasının başarısına bakılmıştır. Bu çalışma hem nicel hem nitel deseni içeren karma desende bir yapıdadır. Veri toplarken nicel ve nitel araçlar kullanılmıştır. Çalışmanın nicel kısmında 20 soruluk çoktan seçmeli basınç başarı testi ölçeği ön ve son test olarak uygulanmıştır, nitel kısmında ise araştırmacılar tarafından hazırlanan beş açık uçlu soruluk görüşme formu ön ve son görüşmede kullanılmıştır ve uygulama sonunda tutulan öğrenci günlükleri kullanılmıştır. Verilerin analizinde Mann-Whitney U Testi ve betimsel analiz kullanılmıştır. Görüşme ve günlük verileri içerik olarak yorumlanarak değerlendirilmiştir. Çalışmada uygulama öncesi duruma göre istendik pozitif yönde önem arz edecek bir anlamlılık düzeyinde artış olmamıştır. Yapılan çalışmanın kısmen başarılı olmasından dolayı yeni önerilerde bulunulmuştur.
Anahtar Kelimeler: Açık Hava Deneyleri, Açık Hava Basıncı, Katı Basıncı, Sıvı Basıncı, TGA yöntemi

AN ACTION RESEARCH ON USING "OUTDOOR EXPERIMENTS" ON "PRESSURE" SUBJECT IN 8TH GRADE SCIENCE TEACHING

Abstract
It was aimed to solve the problem and provide a more efficient learning with outdoor experiments that would increase the interest and desire of the students on the subject of pressure. The study group consists of 9 eighth grade students in 8-A branch of Bozdoğan Halimoru Secondary School in Afyonkarahisar Halimoru central village in the first semester of the 2021-2022 academic year (n=9). Convenient sampling method was used. In this study, in which the participants were also active, the action research method, one of the qualitative research methods, was preferred due to its suitability for the situation. An action plan was prepared and implemented by one of the researchers, and the success of this action research was checked. This study has a mixed design structure that includes both quantitative and qualitative designs. Quantitative and qualitative tools were used while collecting data. In the quantitative part of the study, the multiple-choice pressure achievement test scale with 20 questions was applied as a pre-test and post-test. In the qualitative part, an interview form with five open-ended questions prepared by the researchers was used in the pre- and post-interview. And student diaries kept at the end of the application were used. The pressure achievement test was analyzed using the Mann-Whitney U Test, one of the nonparametric tests. Interview and diary data were interpreted as content and evaluated. In the study, there was no increase in the level of significance that would be of positive importance compared to the situation before the application. Due to the partial success of the study, new suggestions were made.
Keywords: Outdoor Experiments, Outdoor Pressure, Solid Pressure, Liquid Pressure, POE Strategy

Introduction

People are living in an era where there are constant changes and developments in many fields in terms of the production, utilization, and transmission of knowledge. Educators also strive to create conducive environments and make efforts to ensure more effective learning/teaching processes in order to actively engage today's students in the learning process. In this regard, various methods, techniques, environments, etc., are being explored from different perspectives, and continuous efforts are being made across a wide spectrum.The evolving technology and the pandemic conditions we are experiencing have led people to confine themselves within four walls, even isolating themselves from outdoor spaces. In this era of rapid scientific advancements and technological progress, the monotonous flow of life and lessons can appear dull to students, failing to capture their interest effectively. By enriching learning environments with diverse content, enhancing their quality, fostering children's curiosity, and preparing them for learning, we can make this process more productive.In our era of continuous change and development, teachers should aim to cultivate individuals who can research, analyze, and utilize scientific methods. Instead of directly imparting knowledge, they should equip students with the skills to access information. To achieve this, teachers must create learning environments where children can satisfy their curiosity, question, express their ideas, and establish cause-and-effect relationships. However, schools are typically designed with a focus on the idea that 'learning occurs within the classroom.' As a result, they often prioritize activities and resources within the classroom environment. Thus, the design of outdoor spaces in schools is often overlooked, and the potential of utilizing non-classroom areas as educational environments is neglected (Celep & Bacanak, 2013; Cited in: Civelek, Özyılmaz Akamca, 2017). However, outdoor spaces are equally important in education. Sometimes, teaching conducted in outdoor environments through hands-on experiences can be more engaging, effective, and stimulating, as it arouses curiosity. Children feel less constrained, which can directly or indirectly enhance teaching and learning. Teaching in outdoor environments is predominantly utilized in the literature within the scope of school gardens, excursion sites, and nature education settings. It can host important learning contexts while increasing motivation. Various definitions can be made about learning in outdoor environments. Ford (1986) defines it as the portion of the educational process that takes place outside the classroom, while according to Lewis (1975), it involves the utilization of all five senses in the learning process (Cited in: Brookes, 2004). Priest (1986) argues that in outdoor learning, all

senses are utilized, and experimental methods take precedence. The main characteristics of outdoor learning include education taking place outside the classroom, students being able to participate in activities, the use of real objects in education, the utilization of different senses in the learning process instead of rote memorization, and as a result, the activities capture students' interest (Tsai, 2006; Cited in: Tepe, Sarı & Ocak, 2020).Elliott and Davis (2009), in a study on activities conducted outdoors and in natural environments, expressed that students experienced a renewal and increase in their mental attention levels, as well as a decrease in stress levels and a sense of relaxation. They also noted that such activities fostered curiosity and a sense of inquiry (Cited in: Aynal Öztürk, 2013; Cited in: Tepe, Sarı & Ocak, 2020). Outdoor experiments can provide opportunities for students to actively participate and learn by doing, thereby facilitating experiential learning. The knowledge gained through outdoor experiments can be more meaningful and enduring in long-term memory. Outdoor experiments are often conducted with a focus on measuring interest and attitude, particularly with preschool students.

Studies on science education, which include plenty of examples from daily life, have shown that students struggle with certain aspects. It can be said that there are difficulties, especially in teaching the relationship between pressure and force, and this situation also affects daily life (Çepni, 2012; Cited in: Akgün, Tokur, Özkara, 2013). It is a topic that students find interesting and directly witness in their lives (She, 2002; Cited in: Akgün, Tokur, Özkara, 2013). Mengi and Emrahoğlu (2012) stated that the level of complete transfer of eighth-grade students' science and technology topics to daily life context is quite low. It is particularly noticeable that students struggle with transferring knowledge, especially in the topic of "Pressure." The reason for this is seen as the insufficient concretization of the topic.There are numerous studies indicating that the best achievement in science education is achieved through experiential learning (Akdeniz, Çepni, & Azar, 1999; Aycan & Yumuşak, 2002; Demirci, 1993; Ergin, Şahin-Pekmez, & Öngel-Erdal, 2005; Gürdal & Yavru, 1998; Hofstein & Lunetta, 1982; Odubunni & Balagun, 1991; Önen, 2005; Cited in: Sadıç, 2016).Güven and Gürdal (2002), in their study examining the effects of experiments on learning in high school physics classes, found that quality science education in educational institutions is possible through conducting experiments in classes. They observed that students who actively engage in experiments during lessons enjoy the classes more and that learning is more enduring. The most distinctive features that set apart science lessons from other subjects are providing opportunities for experimentation, observation, exploration, and the development of cognitive thinking through

the use of scientific process skills (Taşkın, 2008). Sadıç (2016) mentions that the frequent use of abstract expressions in science lessons often leads to students having difficulty in comprehension. He suggests that making expressions more concrete with appropriate methods and techniques tailored to the lesson can simplify learning. Using the prediction-observation-explanation (POE) method in practical applications of science experiments provides students with the opportunity to apply what they have learned, enabling them to relate scientific knowledge to the natural phenomena they encounter in their daily lives (White & Gunstone, 1992; Cited in: Şahin & Çepni, 2012). In the prediction stage of POE, students are prompted to think about the causes of events, activating their prior knowledge (Şahin & Çepni, 2012). In the observation stage of POE, students are given the opportunity to make observations related to their predictions (Şahin & Çepni, 2012). In the explanation stage of TGA, students are asked to combine their observations with their predictions to provide explanations. This allows the underlying reasons behind students' thoughts to be uncovered (White & Gunstone, 1992; Cited in: Şahin & Çepni, 2012).Studies in science education have shown that hands-on learning through experimentation plays a significant role. Based on research in this field, it has been determined that students encounter difficulties in understanding the concept of pressure. In the literature review regarding the topic of pressure, various instructional approaches have been employed, including the 5E instructional model, STEM model, four-stage diagnostic tests, modeling activities, problem-solving tasks, review strategies supported by constructivist learning approach, prediction-observation-explanation (POE) activities, V diagrams, activities based on scientific argumentation, concept cartoons, and the development of tests aimed at measuring student understanding. Efforts have been made to identify and address students' misconceptions about the topic, their ability to relate it to daily life, their domain knowledge, and the errors they make in problem-solving. Studies in this field also address aspects such as the impact on achievement, attitudes, and higher-order cognitive skills development. Despite numerous studies conducted in the relevant area, it is observed that the problems have not been fully resolved and certain difficulties persist.This study is important in terms of contributing to students' more meaningful and enduring learning of the pressure topic. While outdoor experiments are mostly conducted with preschool students, conducting this study with middle school students is also important in that regard. Unlike previous studies on the topic of pressure, this study opted for an action research method using outdoor experiments. In this study, the difficulties encountered by 8th-grade students in learning the topic of pressure in science lessons have been taken into account. The aim is to address these issues by utilizing outdoor

experiments to increase students' interest and enthusiasm for the topic of pressure, thereby achieving more effective learning. In this context, the research problem statement is determined as "Does the use of outdoor experiments contribute to alleviating the learning difficulties experienced by 8th-grade students in the topic of pressure?"

Sub-problems:

1-Is there a significant difference in the level of learning of the topic of pressure before and after the use of outdoor experiments among male and female students?

2-What are the students' opinions, interests, and enthusiasm regarding conducting experiments on the topic of pressure outdoors?

Limitations

The study is limited to conducting outdoor experiments on the topic of "3rd Unit: Pressure" within the scope of Science lessons with 9 eighth-grade students at Bozdoğan Halımoru Middle School in Halımoru Village, located in Afyonkarahisar province, during the first semester of the school year.

Method

The study employs a mixed-methods approach, incorporating both quantitative and qualitative research methods. Specifically, action research, a qualitative research method, is utilized to address the problem of increasing the interest and enthusiasm of 8th-grade students in the topic of pressure in Science lessons through outdoor experiments, aiming to achieve more effective learning. In action research, a group of individuals identifies a problem, takes action to address it, evaluates the effectiveness of their actions, and if the solution is deemed insufficient, they attempt to address the problem again (O'Brien, 2001). In the quantitative part of the study, a 20-item achievement test developed by Özcan, Koca, and Söğüt (2019) was used as both pre-test and post-test measures. In the qualitative part of the study, pre- and post-interviews consisting of open-ended questions developed by the researchers, as well as student journals (Appendix-5), were included.

Study Group

The study group consisted of a total of 12 eighth-grade students enrolled in the 8-A class of Bozdoğan Halımoru Middle School, a state school located in a village in the central district of

Afyonkarahisar province, during the first semester of the 2021-2022 academic year. However, 3 students who could not participate in all the activities were excluded from the study group, resulting in a revised study group of 9 students (n Total = 9). The study was conducted with a single group consisting of 6 female and 3 male students. The study group was selected using an appropriate sampling method, considering the study's structure, and was easily accessible in terms of opportunities, time, money, location, workforce, and other relevant factors. This selection method involved non-random sampling techniques tailored to the research design.

Data Collection Tools

In this study, a 20-item achievement test developed by Özcan, Koca, and Söğüt (2019) was used as a pre-test and post-test measure for teaching the topic of pressure. Additionally, a semi-structured interview form consisting of 5 open-ended questions prepared by the researchers was used for both pre-interviews and post-interviews. Researchers and students also kept journals at the end of the lessons.

Data Analysis

The validity and reliability of the achievement test used as pre-test and post-test measures were tested using the KR-20 internal consistency analysis. Additionally, due to the sample size ($n<30$) and non-normal distribution of the data, the Mann-Whitney U Test, a non-parametric analysis method, was preferred to evaluate the data according to gender. Content analysis method was employed for analyzing the qualitative data of the study. The data obtained from semi-structured pre-interview and post-interview forms were analyzed by two separate individuals who are experts in the field. Student journals were interpreted and evaluated at the end of the study.

Temporary Plan Draft of the Study:

- The purpose, significance, methodology, problems, etc. of the research are determined.
- First, students are informed about what will be done in the lesson at a level they can understand. For example, by bringing experiment materials to students and informing them that experiments will be conducted outdoors, attention is drawn to students' interest and curiosity about the study.
- A semi-structured open-ended preliminary interview is conducted with students about the topic of pressure. This interview measures students' prior knowledge, preparedness,

perceptions, and approaches before the study.

- A pre-test on the topic of pressure is administered to the students.
- An experiment in the outdoor environment is conducted with the POE model, and data are recorded.
- A semi-structured open-ended interview is conducted with students regarding the topic of pressure.
- Students are administered the post-test on the topic of pressure.
- The outdoor experiments focusing on the core topic of pressure are conducted appropriately within six class periods.
- The acquired data is recorded.
- The data is analyzed by experts in the field, discussed, and the results are interpreted.
- At the end of each session, students maintain student diaries while researchers keep researcher diaries.

Implementation

Before the implementation, a preliminary semi-structured interview was conducted, and a pre-test was administered using a validated and reliable pressure achievement test. The activities were conducted in an outdoor environment (within the school garden context) with 9 students, utilizing the POE (Predict, Observe, Explain) method. Six different pressure experiments were carried out within 2 class hours. In the initial stage of the activities, students were provided with necessary preliminary information. Predictions were obtained from each student individually and recorded.

SOLID PRESSURE:

EXPERIMENT: "Traces on the card and on the ground."

EXPERIMENT: "How many cardboard cups can you carry?"

EXPERIMENT: "Spaghetti - Balloon"

The experiments were then conducted with the participation of students, and they were asked to interpret their predictions and observations based on the deductions made from their observations. Subsequently, researchers took notes. Necessary explanations were provided to the students within the framework of the activity. The students kept a daily journal. Researchers also kept a journal on each working day. The responses given by the students after the POE study were categorized into themes based on their proximity to each other.

(NOT: Due to the melting snow on the day of the experiment, only raised soil and very lightly moistened mud were used in the first experiment with snow and soil.) After the application, a final semi-structured interview was conducted, and the post-test was administered using the validated and reliable pressure achievement test.

Findings Pre-test and Post-test Findings

In this study, the test developed by Özcan, Koca, and Söğüt (2019) titled 'A Study on Developing a Test to Measure Middle School Students' Understanding of the Concept of Pressure' was used as both the pre-test and post-test.

Table 1. Details about Gender

Gender	n	f(%)
Female	6	66,7
Male	3	33,3
Total	9	100,0

Table 1 provides the numbers and percentage frequencies of female and male participants among the 8th-grade students involved in the study. It is observed that there were 6 female and 3 male students, totaling 9 students, participating in the study.

Table 2. Evaluation of the frequency-percentage distribution of the pre-test data

		n	F %			n	F %
1st Question	False	4	44,4	11th Question	False	0	,0
	True	5	55,6		True	9	100,0
	Total	9	100,0		Total	9	100,0
2nd Question	False	4	44,4	12th Question	False	5	55,6
	True	5	55,6		True	4	44,4
	Total	9	100,0		Total	9	100.0
3rd Question	False	1	11,1	13th Question	False	6	66,7
	True	8	88,9		True	3	33,3
	Total	9	100.0		Total	9	100,0
4th Question	False	5	55,6	14th Question	False	5	55,6
	True	4	44,4		True	4	44,4
	Total	9	100,0		Total	9	100,0
5th Question	False	6	66,7	15th Question	False	5	55,6
	True	3	33,3		True	4	44,4
	Total	9	100,0		Total	9	100,0
6th Question	False	1	11,1	16th Question	False	8	88,9
	True	8	88,9		True	1	11,1
	Total	9	100.0		Total	9	100,0
7th Question	False	1	11,1	17th Question	False	4	44,4
	True	8	88,9		True	5	55,6
	Total	9	100,0		Total	9	100,0
8th Question	False	5	55,6	18th Question	False	2	22,2
	True	4	44,4		True	7	77,8
	Total	9	100,0		Total	9	100,0
9th Question	False	1	11,1	19th Question	False	2	22,2
	True	8	88,9		True	7	77,8
	Total	9	100.0		Total	9	100,0
10th Question	False	4	44,4	20th Question	False	6	66,7
	True	5	55,6		True	3	33,3
	Total	9	100,0		Total	9	100,0

Table 2 presents the frequency and percentage distribution of correct and incorrect answers in the pre-test. It shows the number of students who answered each question correctly or incorrectly.

Table 3. Evaluation of Frequency-Percentage Distributions of the Post-Test

		N	F %
1st Question	False	2	22,2
	True	7	77,8
	Total	9	100,0
2nd Question	False	4	44,4
	True	5	55,6
	Total	9	100,0
3rd Question	False	2	22,2
	True	7	77,8
	Total	9	100.0
4th Question	False	5	55,6
	True	4	44,4
	Total	9	100,0
5th Question	False	2	22,2
	True	7	77,8
	Total	9	100,0
6th Question	False	0	,0
	True	9	100,0
	Total	9	100.0
7th Question	False	0	,0
	True	9	100,0
	Total	9	100,0
8th Question	False	4	44,4
	True	5	55,6
	Total	9	100,0
9th Question	False	3	33,3
	True	6	66,7
	Total	9	100,0
10th Question	False	5	55,6
	True	4	44,4
	Total	9	100,0
11th Question	False	0	,0
	True	9	100,0
	Total	9	100,0
12th Question	False	5	55,6
	True	4	44,4
	Total	9	100,0
13th Question	False	4	44,4
	True	5	55,6
	Total	9	100.0
14th Question	False	2	22,2
	True	7	77,8
	Total	9	100,0
15th Question	False	5	55,6
	True	4	44,4
	Total	9	100,0
16th Question	False	8	88,9
	True	1	11,1
	Total	9	100.0
17th Question	False	5	55,6
	True	4	44,4
	Total	9	100,0
18th Question	False	1	11,1
	True	8	88,9
	Total	9	100,0
19th Question	False	2	22,2
	True	7	77,8
	Total	9	100,0
20th Question	False	6	66,7
	True	3	33,3
	Total	9	100,0

Table 3 illustrates the frequency and percentage distributions of correct and incorrect answers in the post-test. It indicates how many individuals provided correct or incorrect answers for each question.

Table 4. Average Scores of Students' Pre-test and Post-test Results

	The mean of pre-test	The mean of post-test
1st student	0,50	0,60
2nd student	0,75	0,85
3rd student	0,70	0,80
4th student	0,80	0,80
5th student	0,65	0,50
6th student	0,45	0,45
7th student	0,40	0,60
8th student	0,40	0,55
9th student	0,60	0,60
Total	0,58	0,63

Table 4 displays the average scores of students' pre-test and post-test results. While there may not be an increase in the desired direction for every student, an overall positive difference is observed when looking at the general averages.

Table 5. Results of Mann-Whitney U Test for pre-test and post-test scores by gender

	Gender	N	F %	Mean	Mean	Std. Deviation	P	x̄
Pre-test	Female	6	66,7	6,17	,5833	,15207	,070	,58
	Male	3	33,3	2,67				
Post-test	Female	6	66,7	5,33	,6389	,14313	,598	,63
	Male	3	33,3	4,33				

Table 5. Percentile frequencies and significances of Mann-Whitney U Test results for pre-test and post-test scores by gender. There is no significant difference between pre-test and post-test scores by gender ($p > 0.05$); however, it appears that females answered more questions correctly than males in both pre-test and post-test. When comparing the pre-test and post-test scores, it is observed that the number of correct answers in the post-test is higher than in the pre-test. Although significant results were not obtained, there are slightly productive outcomes.

Pre-Interview and Post-Interview Findings

1- When asked about pressure, what comes to your mind?

In the pre-interview, students made definitions by associating pressure with concepts such as force and weight, indicating that they had some misconceptions about the topic, but they were able to indirectly describe pressure even if not directly. In the post-interview, students responded with descriptions such as "leaving a mark with a wheel on the ground, pricking a board with a pin, the pressure of a vertical force acting on a surface, the difference between stepping with one foot and two feet, pressure exerted on a surface, and the pressure exerted on the ground when sitting down." Although not all answers were entirely correct, they were able to describe what pressure is, even if indirectly. Compared to the pre-interview, they provided more accurate responses in the post-interview.

2- When asked about conducting experiments outdoors, what comes to your mind?

In the pre-interview, students initially confused outdoor experiments with outdoor pressure and provided answers in that direction. They mentioned experiments that couldn't be done in a classroom setting, outdoor experiments, and weather-related experiments in the schoolyard. In the post-interview, students talked about the experiments they conducted in the schoolyard as part of this study. It is evident from their responses that they now have a better understanding of what outdoor experiments mean, as they began to talk about experiments they conducted in their own backyard or in the schoolyard. They mainly mentioned the balloon experiment.

3- In which topics of science would you like to conduct outdoor experiments?

In the pre-interview, students provided answers related to pressure, acid-base reactions, friction, mirrors, and light. They mainly thought about topics covered in the eighth grade. In the post-interview, students gave more diverse responses compared to the pre-interview, mentioning topics such as recycling, movements of the sun-earth-moon system, shadows, sound, climate and weather, locating elements on the periodic table, meiosis-mitosis, speed, and parachute experiments.

4- Have you ever conducted experiments outdoors before? If so, what do you remember?

In the pre-interview, students mostly mentioned the vinegar-baking soda experiment and the recycling experiment with bottles that they had done with their teachers before. In the post-interview, students mentioned experiments related to pressure, balloon-spaghetti, recycling for a cat's nest, vinegar-baking soda, angles of sunlight, friction, and parachute experiments. It is evident that students remember what they learned better through conducting experiments.

5- How does conducting experiments outdoors make you feel?

In the pre-interview, students confused outdoor experiments with outdoor pressure, but in the post-interview, they mentioned feeling better because they got fresh air, understood

better, and had fun outside, making them happy. So, it can be understood that there are positive effects.

Findings of the pressure concept's TGA experiments conducted in outdoor environments:

Experiment 1: "Traces on Snow and Soil"



Prediction Stage: What changes might occur on the surface of the soil when you throw the same flat stone vertically onto the ground, first on its side and then upright? (What changes might occur on the surface of the soil when you drop the same water-filled bottle vertically onto the ground, first on its side and then upright?)

Student Predictions:

"The side with a larger surface area will leave less of a mark because as the surface area increases, the pressure decreases."

"The side with a smaller surface area will sink more, but I don't know why."

"The side with the cap will leave more of a mark because the weight is concentrated there, but I don't know why."

"Since the weights are the same, there won't be any change."

Student Observations: When asked about their observations, the most common responses from students were*: "The side with the larger surface area sank less"* and *"The side with the smaller surface area sank deeper."*

Comparison of Student Predictions and Observations:

"I correctly predicted the outcome of the experiment and its reason."

"I correctly predicted the outcome of the experiment but did not know that it was due to pressure."

"I correctly predicted the outcome of the experiment, but I did not know that pressure changes according to the surface area."

"I thought there would be no change because the weights were the same, but pressure varies according to the surface area."

Experiment 2: "How Many Cardboard Cups Can You Carry?"



Prediction stage: If there are 3 cardboard cups on one side and 17 cardboard cups on the other side, and we step on them with a board placed on top, do you think these cups will carry us? What changes do you expect in the cups? What are your predictions?

Student predictions:

"Fewer cups will be more crushed and broken."

"Cardboard cups won't carry us, and the cups on both sides will be equally crushed. There won't be any difference in crushing because they are all cardboard cups."

"The cups on the side with more cardboard will gradually crush."

Student observations: When asked about their observations, the most common responses from students were: *"The cups on the side with fewer cardboard cups immediately crushed and didn't carry us, but the cups on the side with more cardboard cups didn't crush and carried us."* and *"On the side with more cups, since the surface area is greater, less pressure was applied, and it carried us."*

Comparison of Student Predictions and Observations:

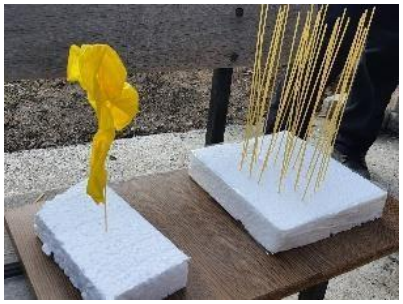
"I correctly predicted the outcome of the experiment."

"I correctly predicted the outcome of the experiment, but I didn't know that the reason was pressure."

"I correctly predicted the outcome of the experiment, but I didn't know that pressure changes according to surface area."

"I thought there wouldn't be any changes in the experiment, but it turns out that pressure varies according to surface area."

Experiment 3: "Spaghetti - Balloon"


Prediction Stage: Does the number of spaghetti noodles affect the bursting time of the balloon? Prediction stage: There are two setups with one placed on a styrofoam base and the other with 25 spaghetti noodles inserted into styrofoam. There are two identical balloons inflated to the same degree. When you gently press the balloons on these setups sequentially, do you think these balloons will burst? If they burst, which setup do you think the balloon will burst more easily in? Why? What are your predictions?

Student predictions:

"The balloon will burst more quickly on the side with fewer spaghetti noodles. But I don't know why."

"Increasing the number of spaghetti noodles will increase the surface area, applying less pressure to the balloon and causing it to burst more slowly."

"In the setup with many spaghetti noodles, the balloon will burst more quickly because it is pierced on all sides."

"Both setups will cause the balloons to burst immediately because the spaghetti noodles have sharp ends."

Student observations: When asked about their observations, students mostly responded with: "On the side with more spaghetti noodles, the surface area increased, causing the pressure to decrease and the balloon to burst more slowly."

Comparison of student predictions and observations:

"My prediction and observation for the experiment matched."

"I correctly predicted the outcome of the experiment but didn't know the reason behind it."

"I thought there would be no difference in the experiment, but it turns out that pressure varies according to surface area."

Experiment 4: “The Depth-Distance Relationship”






Prediction stage: What would be the distance sequence of the water coming out from the points marked A, B, and C on the water bottle when pierced with a thumbtack? Why? What are your predictions?

Student predictions:

“The water coming out of point C will travel the longest distance, followed by B, and the shortest distance will be from point A because the pressure is higher at the bottom.”

“The water coming out of point C will travel the longest distance, followed by B, and the shortest distance will be from point A, but I don't know why.”

“The water coming out of point A will travel the longest distance, followed by B, and the shortest distance will be from point C because the pressure is higher at the top.”

Student observations: When asked about their observations, the most common responses from students were: "The water from point C travels the longest distance, followed by point B, and the shortest distance is from point A. This is because the pressure is greater at depth."

Comparison of student predictions and observations:

“My prediction and observation from the experiment matched.”

“I correctly predicted the outcome of the experiment but didn't know the reason.1”

“I incorrectly predicted the outcome of the experiment; it turns out pressure is directly proportional to depth.”

Experiment 5: "Water Depth and Balloon Inflation"



Prediction Stage: What changes do you anticipate in the balloons when one end of the syringe tube, which has a balloon at each end, is immersed in a bucket of water filled with water? What are your predictions?

Student Predictions:

"The balloon pressed into the water-filled bucket will shrink because there is more pressure at depth."

"The balloon outside will inflate, but I don't know why."

"There won't be any change in the inflation of the balloons because there is air inside them."

"I have no idea, I don't know."

Student Observations: When asked about their observations, the most common response from the students was: "The balloon pressed into the water-filled bucket shrinks because there is more pressure at depth."

Comparison of student predictions with observations:

"I correctly predicted the outcome of the experiment."

"I correctly predicted the outcome of the experiment but did not know the reason."

"I thought there would be no change in the experiment, but the pressure changes according to the depth of the water. Would you like me to help with anything else?"

Experiment 6: "Cherry Juice in the Bottle"



Prediction stage: There is a jar containing some cherry juice with a candle placed inside. When we close the jar with the candle inside so it remains in the jar, what change will occur? What would happen if we light the candle and close the jar so it remains inside? What are your predictions?

Student predictions:

"When the bottle is closed over the burning candle, the candle inside the bottle may extinguish. I don't have any other ideas."

"The level of cherry juice remains the same, unchanged. I don't have any other ideas."

"I have no idea, I don't know."

Student observations: When asked about their observations, the most common responses from the students were: "When the bottle was closed over the burning candle, the cherry juice rose and filled the bottle." and "The candle inside the bottle extinguished when the air inside ran out."

Comparison of student predictions with observations:

"I correctly predicted that the candle would extinguish, but I did not know that the cherry juice would rise. This experiment is very interesting and fascinating."

"I incorrectly predicted the outcome; I did not know that the cherry juice would rise. This experiment is very interesting and fascinating."

"I couldn't predict the outcome. The liquid rose inside the bottle when the air inside was consumed by the candle. I didn't know this beforehand. This experiment is very interesting and fascinating."

Findings from Student Journals

Upon examining the student journals, it was evident that they were particularly surprised by the lack of crushing even when there were many cardboard cups stacked, as well as by the rising of the cherry juice even though they understood the experiments well and had a lot of fun

conducting them. They also mentioned feeling a bit chilly due to the cold weather. The majority of students recounted the experiments conducted during the session individually and reflected on the enjoyable time they had. Overall, it can be understood that students comprehended the experiments correctly, and they could be memorable and effective.

Discussion and Conclusion

In this study, a single-group pretest-posttest design was analyzed and interpreted using the SPSS 25 software package. In this study, due to the sample size being less than 30 and the distribution not being normal, as well as the need to evaluate the data according to gender, the nonparametric analysis method of Mann-Whitney U Test was preferred. As seen in Table 5, there is no significant difference between pre-test and post-test scores according to gender ($p > 0.05$). However, it appears that girls answered more questions correctly than boys in both pre-test and post-test. When comparing the pre-test and post-test, it is observed that there are more correct answers given in the post-test compared to the pre-test. Although significant results were not obtained, some productive outcomes have been achieved. Therefore, it can be said that the study was moderately successful. In interviews conducted with students using five open-ended questions, it was observed that students were able to express themselves more accurately and logically in the final interview compared to the initial one. The study has yielded positive differences. Students have become familiar with and enjoyed outdoor experiments. It can be said that the study has been productive. Upon reviewing the student journals, it is evident that the experiments have captured the students' interest and attention, and they have learned while having fun. The students have provided positive feedback in their journals.

In this study, aimed at addressing the difficulties 8th grade students face in learning the pressure topic in Science class and enhancing their interest and enthusiasm in the subject through outdoor experiments, the study has been partially successful. The absence of significant differences in quantitative data does not necessarily indicate that the study is entirely neutral; small but desired differences can still be observed. Conducting experiments using the POE method in an outdoor environment has proven to be beneficial in learning about pressure. The research has provided answers to its sub-problems. Aşkar (2002) mentions the effectiveness of outdoor activities in the evaluation of preschool education program materials in parallel with this study. The study by Uludağ and Erkan (2020), which examines the impact of a science education program containing activities in out-of-school learning environments on the scientific process skills of 60-72-month-old children, indicates a positive effect on cognitive process skills. The effectiveness of using outdoor environments parallels our study.

This study could be conducted over a longer period, with the learning environment and materials enriched, and interest and attitude scales could be used to make it more comprehensive. Conducting studies on other topics in outdoor environments could facilitate students' learning. Exploring the topic of pressure in outdoor settings using different methods could also be attempted. It would be beneficial to compare at least two different methods of studying pressure in outdoor environments with at least two groups. In future studies, having a larger number of participants in the study group and conducting the study with both experimental and control groups could provide more reliable and meaningful results. More emphasis should be placed on conducting outdoor activities with middle school students.

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Ek-1: Araştırmacı günlükleri:

03.01.2022

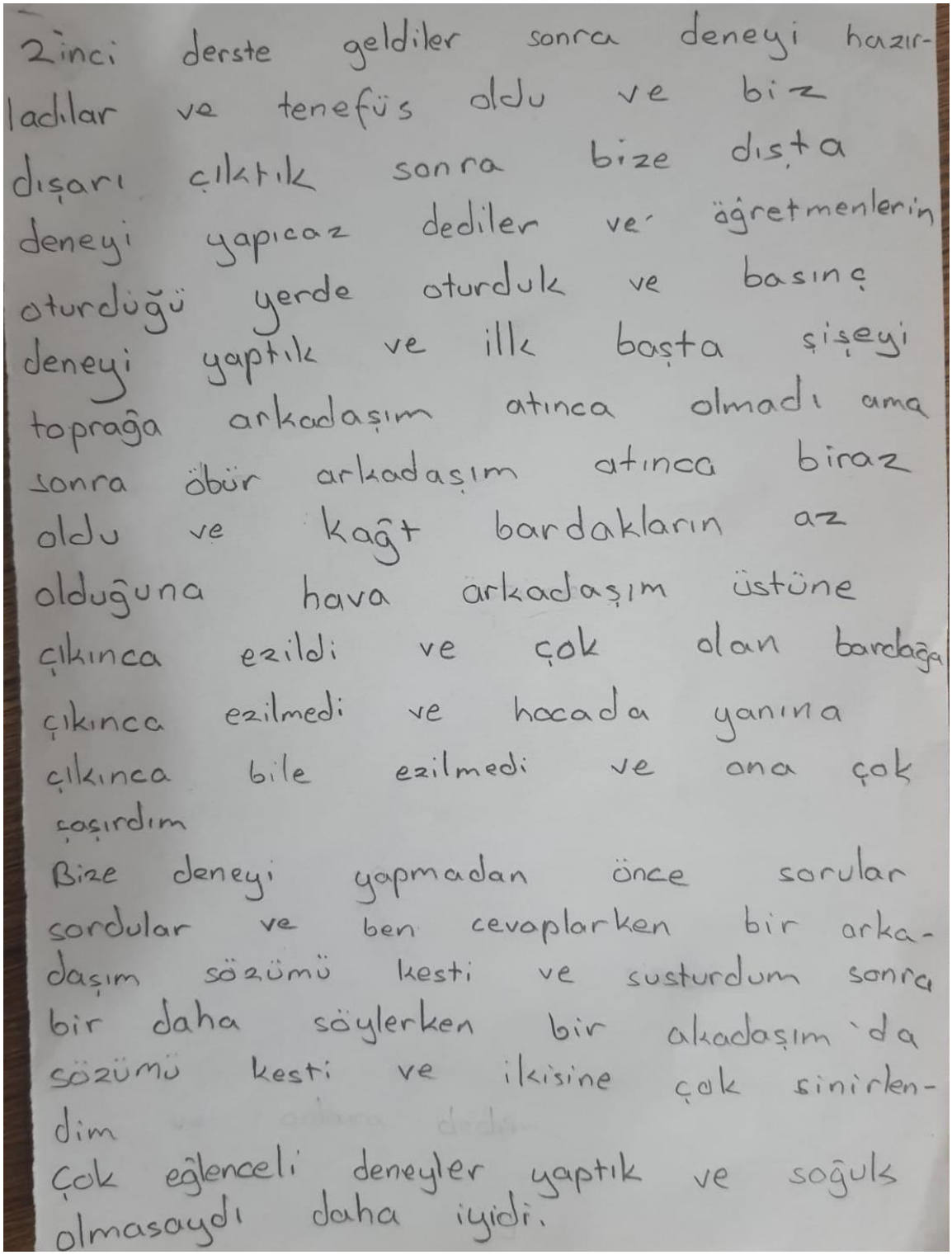
Bugün yine materyaller ile Halimoru Ortaokuluna gittik. Çocuklar yanımıza gelmeden önce küçük hazırlıkları yapmak için işe koyuldum. Birinci deneyde katı basıncının gözlenmesinde kullanmayı hayal ettiğim karlar eridiği için ben de bir çubuk bularak toprağı kabartmaya başladım, bir çubuk da çalışma arkadaşıma verdim ve birlikte toprağı kabarttık. Toprakta iz bırakacak uzun, yassı vb. farklı şekillerde 3 farklı taş buldum. Daha sonra bir serum hortumunun ucuna balon şişirip taktım ve solmaması için bağladım, ardından diğer ucuna da balon şişirip taktım ve ilk şişirdiğim balonun ipini çözdüm, balonlardaki hava biraz dengelendi. Daha sonra getirdiğim şeffaf kabın içerisine bir mumu eritip akıttım ve mumu sabitledim, sonra da kabın yarısına kadar vişne suyu doldurdum. Plastik şişenin üzerine CD kalemi ile A, B ve C noktalarını yazdım. Tahta, strafor köpük, su şişesi, bardak, spagetti makarna, cam şişe, balon, roptiye, maket bıçağı vb. malzemeleride kenardaki bir bankın üzerine koydum. Öğrenciler teneffüs bitiminde yanımıza geldiler. Önce merhabalaşıp ön bilgilendirme yaptım. Ne yapacağımızı anı hatları ile kısaca açıkladım. TGA (Tahmin-Gözlem-Açıklama (POE)) yöntemini nasıl kullanacağımızı örnekler vererek açıkladım. Daha sonra "1. Deney"i gerçekleştirmek üzere önceden kabarttığımız toprağın başına gittik. Ellerine önceden bulduğum taş, su şişesi vb. materyalleri verdim, bir kaç cümle ile sorular sorup öğrenci tahminlerini aldım ve defterime not ettim. Daha sonra öğrenciler materyalleri düşey (konumda toprağa dik açıyla) taşın/şişenin farklı yönleriyle sırayla attılar onlara rehberlik edecek sorular sorarak onlardan gözlemlerini alıp not ettim. Bir yandan da ara ara fotoğraflarını telefonumla çektim. Eş zamanlı hareket etmem biraz zorlasa da kolaylıkla üstesinden gelebildim. Sonra açıklama yapmalarına rehberlik ettim ve aldığım cevapları yine not ettim. Daha sonra düz beton bir zemin üzerine karton bardakları ters olarak dizdim ve tahtayı üzerlerine koydum ve "2. Deney"i de yine "1. Deney"deki gibi rehberlik ederek yönlendirdim, fotoğraflayıp, not ettim. Diğer araştırmacı arkadaşım ve kendim adıma tüm deneylerde verileri kaydettim. 3., 4. 5. ve 6. deneyler de bu yöntem ve bu adımlarla gerçekleşti. "Kardaki ve topraktaki izler", "Seni kaç karton bardak taşır", "Spagetti-Balon", "Su derinliği ile balon şişmesi", "Derinlik-uzaklık ilişkisi", "Şişedeki vişne suyu" deneyleri içerisinde çocukları en çok şaşırtanların başında ilk olarak "6. Deney: Şişedeki vişne suyu"nda vişne suyunun şişe içerisinde yükselmesi oldu, ikinci olarak "su derinliği ile balon şişmesi" adlı 4. deneyde balon ne kadar çok suyun dibine bastırılırsa balonun o kadar çok şişmesi oldu, üçüncü olarak da "2. Deney: Seni kaç karton bardak taşır"da, iki kişinin karton bardaklar üzerinde bulunan tahtaya birlikte çıkmalarına rağmen karton bardakların ezilmemesi oldu. Çocukların hepsi deneylerde aktif olarak rol oynadı. Çocukların en çok eğlendiği deney ise "Spagetti-Balon" adlı ikinci deneyde onlara balon dağıtmam ve şişirip sırayla spagetti batırdıkları strafor üzerine bastırıp patlatmaya çalışmaları oldu. Hatta bana başka balon yok mu diye sordular. Beni çok sevdiklerini yine deneyler yapmaya gelmemizi istediler.

Öğrencilerden biri bana "Ben de büyüyünce senin gibi olmak istiyorum." dedi ve bu beni çok mutlu etti. Çocuklar ilk güne göre daha sıcakkanlı ve rahattı. Uygulama sonrası günlük tutturduk, yine daha önce kullandıkları kod adları ile yazdılar. Bugün yapılan çalışmanın verimli geçtiğini düşünüyorum. Öğrencilerden alınan cevaplar bunu destekler niteliktedir. Umarım son test verilerinde bu değişimi görebiliriz.

Hazal

Ek-2: Araştırmacı günlükleri:

1. Örnek:



2inci derste geldiler sonra deneyi hazırladılar ve tenefüs oldu ve biz dışarı çıktık sonra bize dışta deneyi yapıcaz dediler ve öğretmenlerin oturduğu yerde oturduk ve basınç deneyi yaptık ve ilk başta şişeyi toprağa arkadaşım atınca olmadı ama sonra öbür arkadaşım atınca biraz oldu ve kağıt bardakların az olduğuna hava arkadaşım üstüne çıkınca ezildi ve çok olan bardağa çıkınca ezilmedi ve hocada yanına çıkınca bile ezilmedi ve ona çok şaşırdım

Bize deneyi yapmadan önce sorular sordular ve ben cevaplarken bir arkadaşım sözümü kesti ve susturdum sonra bir daha söylerken bir akadaşım da sözümü kesti ve ikisine çok sinirlendim

Çok eğlenceli deneyler yaptık ve soğuk olmasaydı daha iyidi.

THE INTERACTION OF ELECTROMAGNETIC RADIATION WITH (^{18}F) FLUORODEOXYGLUCOSE

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ABSTRACT

Positron emission tomography (PET) is a molecular imaging method used in the diagnosis, staging, evaluation of response to treatment, radiotherapy planning and prognosis determination of various malignancies. Its working principle is based on the formation of gamma anhylation photons with an energy of 511 keV. Before the PET scan, radiopharmaceuticals, which are a source of β^+ (positron) rays, are given to the body. Radioactive elements ^{18}F (Fluorine) and ^{68}Ga (Gallium) are commonly used. ^{18}F, which is most commonly used in PET/CT imaging of oncological studies, has a half-life of 109.8 minutes. Glucose metabolism appears to be increased in tumor cells compared to healthy cells. The tumor imaging technique of (^{18}F) labeled Fluorodeoxyglucose (FDG) is based on this. Thus, using (^{18}F)-FDG, most malignant tumors can be imaged noninvasively by increasing glucose metabolism. The structural formula of (^{18}F)-FDG is written as $C_6H_{11}O_5F_{18}$. Maximum effective dose equivalent: 0.11 rem/mCi (0.019 mSv/MBq).In this research, ionizing electromagnetic radiation (EMR) interaction parameters namely mass attenuation coefficients (μ_ρ), effective atomic number (Z_{eff}) and electron densities (N_{el}) of $C_6H_{11}FO_5$ compound have been computed in the energy range 1 keV–100 GeV. EMR interaction parameters evaluated in the this work could be beneficial in radiation dosimetry and therapy.

Keywords: Effective atomic number, Electron densities, Fluorodeoxyglucose, Mass attenuation coefficients

INTRODUCTION

Positron emission tomography (PET) is a molecular imaging method used in the diagnosis, staging, evaluation of response to treatment, radiotherapy planning and prognosis determination of various malignancies. PET/CT applications, which are created by combining images obtained from computerized tomography (CT) with PET scanners, have become significantly widespread. Its working principle is based on the formation of gamma anhylation photons with an energy of 511 keV. Before the PET scan, radiopharmaceuticals, which are a source of β^+ (positron) rays, are given to the body. Radioactive elements ^{18}F (Fluorine) and ^{68}Ga (Gallium) are commonly used. ^{18}F, which is most commonly used in PET/CT imaging of oncological studies, has a half-life of 109.8 minutes. Glucose metabolism appears to be increased in tumor cells compared to healthy cells. The tumor imaging technique of (^{18}F) labeled Fluorodeoxyglucose (FDG) is based on this. Thus, using (^{18}F)-FDG, most malignant tumors can be imaged noninvasively by increasing glucose metabolism (Kısaarslan, 2022). The structural formula of (^{18}F)-FDG is written as $C_6H_{11}O_5F_{18}$. Maximum effective dose equivalent: 0.11 rem/mCi (0.019 mSv/MBq) (Moltek, 2016).When a substance is subjected to EMR, some parameters that characterize the interaction of photons with the substance need to be determined. The mass attenuation coefficient (μ_ρ) is an important parameter that characterizes the penetration effect of ionizing EMR into the substance. The values of μ_ρ are used to derive other EMR interactions parameters namely effective atomic number (Z_{eff}) and electron densities (N_{el}). Z_{eff} and N_{el} are impotant coefficients used to determine the EMR penetration of a multi-element substance in medical radiation dosimetry. Z_{eff} provide correct information about the substance which exposed to EMR and Z_{eff} values of multi-element substance are used to calculate the absorbed dose for radiotherapy. (Aktas et. al., 2019).A lot of research has been done on the radioprotective effect of chemical substances. Isikli and Oto (2017) calculated some EMR shielding parameters such as mass attenuation coefficient (μ_ρ), effective atomic number (Z_{eff}), electron density (N_{el}) for different antioxidants. More et al. (2016) investigated the effective atomic number (Z_{eff}), the effective electron densities (N_{eff}), the total atomic cross-section and the total electronic cross-section for some amino acids. Kacal et al., (2017) investigated the μ_ρ, Z_{eff} and N_{el} of different enzyme inhibitors in the photon energy range from 1 keV up to 100 GeV. Kumar (2016) computed the effective Z_{eff} and N_{el} of nucleobases in DNA for the total and partial photon interaction processes in the energy range of 1 keV–100 GeV. Sayyed et al., (2017) studied the radioprotective effects of different analgesic and anti-inflammatory drugs for total photon interaction in the energy range of 1 keV–100 MeV using

WinXCom. Oto et al., (2020) investigated the interaction of gamma radiation with drugs used in cholinergic medicationsIn the present research, we calculated some important EMR interaction parameters namely μ_ρ, Z_{eff}, N_{el} of $C_6H_{11}FO_5$. To perform these calculations, the data obtained from WinXCom computer program were used. WinXCom program calculates photon interaction cross-sections and attenuation coefficients for any element, compound or mixture, at energies from 1 keV to 100 GeV (Gerward et al., 2001).

MATERIALS AND METHODS

The attenuation of EMR passing through a substance could be determined theoretically utulizing WinXCom code. This code is based on the mixture rule (Gerward et al., 2004),

$$\mu_\rho = \sum w_i (\mu_\rho)_i \quad (1)$$

where $(\mu_\rho)_i$ is the mass attenuation coefficient and w_i is the fractional weight of the *i*th constituent element. The mass attenuation coefficient (μ_ρ) is a measure of penetration of EMR for a substance. The obtained μ_ρ values were used to computed the effective atomic numbers and electron density of the investigated materials. Effective atomic number (Z_{eff}) is an benefical parameter in determining interaction of EMR with a substance. The effective atomic number (Z_{eff}) for total photon interaction is given by (Manohara et al, 2008):

$$Z_{eff} = \frac{\sum_i f_i A_i \left(\mu/\rho\right)_i}{\sum_j f_j \frac{A_j}{Z_j} \left(\mu/\rho\right)_j} \quad (2)$$

where f_i is the mole fraction, Z_i is the atomic number, A_i atomic mass and $(\mu/\rho)_i$ is the mass attenuation coefficient of the *i*th element in the substance. Electron density, N_{el} (the number of electrons per unit mass, electron/g) could be derived from (Manohara et al, 2008):

$$N_{el} = N_A Z_{eff} \frac{1}{\langle A \rangle} \quad (3)$$

where <A> is the mean atomic mass of the substance.

RESULT AND DISCUSSION

In the present work, the mass attenuation coefficients of $C_6H_{11}FO_5$ were calculated using WinXCom computer program and the outcomes were presented in Fig.1.

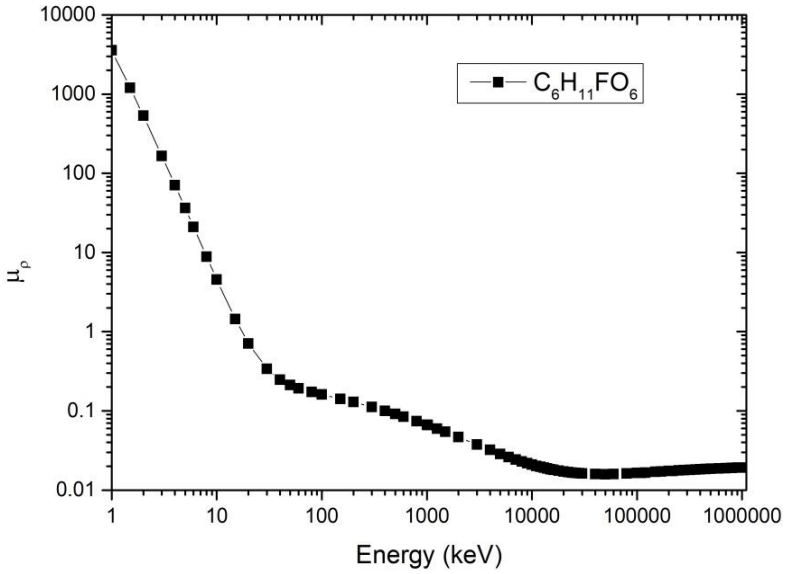


Fig. 1. The mass attenuation coefficients versus gamma energy.

There are three energy zones: i) low energy zone (0.001 MeV-0.1 MeV), ii) intermediate energy zone (0.1 MeV-10 MeV), iii) high energy zone (10 MeV and beyond). It has been observed that mass attenuation coefficients have large values in the low energy region, where the probability of photoelectric effect occurring is high. The reason of this result is that the cross section of photoelectric absorbing effect depends on atomic number as Z^{4-5}.It can be seen that in the medium energy region, the values of the mass attenuation coefficients decrease due to the linear dependence between the cross-section of Compton scattering and the atomic number Z. The probability of pair production effect increases in the high energy zone, and since the cross section is proportional to Z^2 the mass attenuation coefficient also increases. The effective atomic numbers (Z_{eff}) and the electron densities (N_{el}) were derived using the mass attenuation coefficients computed from WinXCom computer program. The variations of Z_{eff} and N_{el} with EMR energy for $C_6H_{11}FO_5$ are demonstrated in Figs. 2-3. It can be seen from the drawn figures that the highest values of Z_{eff} and N_{el} are found at low energies, and the Z^{4-5} dependence of the photoelectric effect cross-section contributes greatly to the values of Z_{eff} of the examined compound. The lowest Z_{eff} and N_{el} values are observed at intermediate energies where Compton scattering is dominant. It was observed that as the EMR energy increased towards higher energies, the effective atomic number values also increased. This may be due to the Z^2 dependence of pair production.

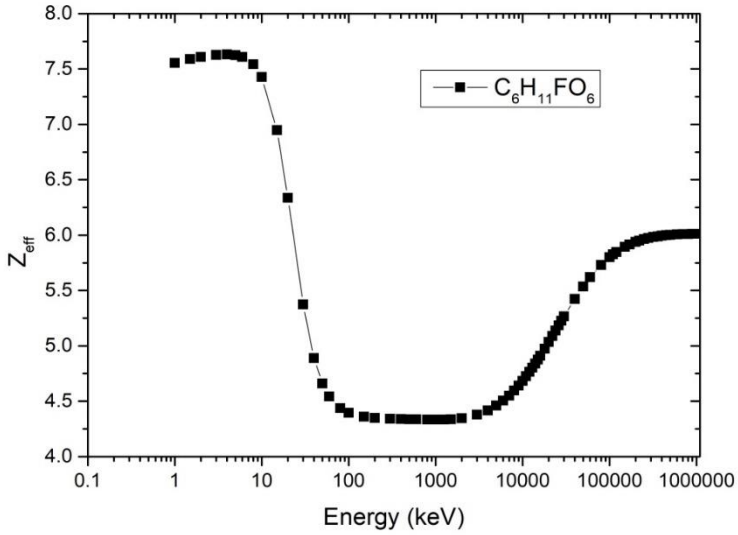


Fig.2. The values of effective atomic number versus gamma energy.

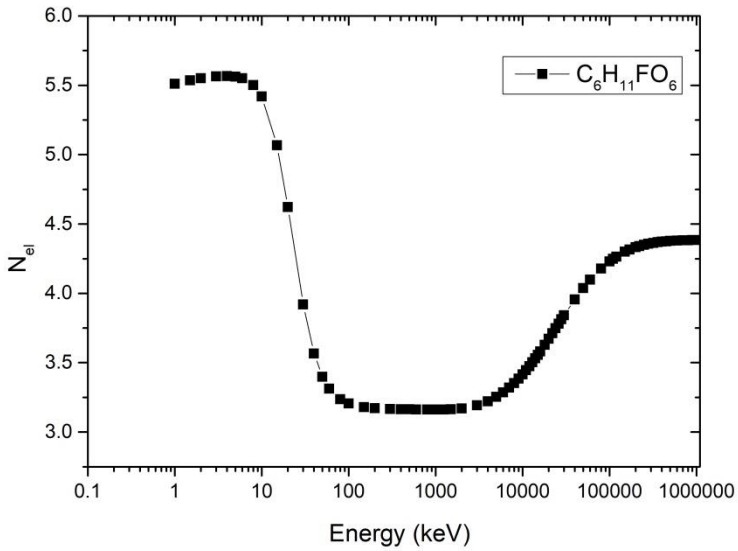


Fig.3. The values of electron density versus gamma energy.

CONCLUSIONS

The current study, the EMR interaction parameters of the compound $C_6H_{11}FO_5$ were examined theoretically. μ_ρ values in the energy range of 1 keV – 100 GeV were calculated using the WinXCom computer program. Z_{eff} and eN_{el} parameters of the compound were derived with the use of the values of μ_ρ. It was observed how the radiation interaction parameters of the radiopharmaceutical changed with the energy values.

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IMPROVING THE APPROACH TO SOFTWARE CONFIGURATION OF AUTOMATED CONTROL SYSTEMS USING EXPERIMENTAL-STATIC MODELS.

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ABSTRACT
The purpose of the article is to improve the approach to software configuration of automated control systems. The subject of the study is experimental-static models used in this process. The work was carried out using the theory of relations, graphs and matrices. As a result, a universal method for machine synthesis of corresponding models was obtained. The algorithm implemented on its basis allows you to automate the process of configuring control systems for distributed technological objects.The development of modern metallurgical production is accompanied by the intensive introduction of automated process control systems (APCS) in all its areas. A special class of tasks is represented by the automation of centralized control of distributed technological objects (mainly on a territorial basis). Such facilities include both main production units (sinter plants, converter shops, mines, etc.) and industrial energy, telecommunications and transport systems and networks. The latter play an important role in the technological cycle of metallurgical, mining and coke-chemical enterprises [1 – 3].The basis for the functioning of automated process control systems are mathematical models of production facilities and processes. Most modern automated process control systems are based on program logic, which determines the unity of the basic core software (software) of the systems themselves and experimental models for their research. However, complex distributed automation objects of a single series are characterized by different configurations of specific technical solutions. In this regard, it is necessary to adapt the software to a specific technical project, which is a separate stage in the design of the system itself [1, 4].Traditionally, this task is solved using configuration files created in xml, txt, cfg, dll, ini, etc. format. Their direct compilation requires highly qualified designers, incl. certain knowledge and skills in the field of programming. To simplify and speed up this procedure, multiple tools and computer-aided design (CAD) systems have been developed for such files, which are based on experimental-static models (ESM) of the corresponding objects [1, 4 – 6].However, a significant drawback of most of these CAD systems is the lack of their unification in relation to heterogeneous process control systems. Another disadvantage is the limitation of the dimensions of the designed objects due to the limited capabilities of the visualization tools for the user interface, the accumulation of analyzed information, etc.The goal of this work is to develop universal methods for synthesizing input ESMs for process control systems of large-dimensional objects on a computer.
Keywords: software configuration, automated control system, experimental-static model, machine synthesis, algorithm, distributed technological object.

INTRODUCTION

A distributed technological object can be characterized by a set, where A, U and Z are, respectively, subsets of local management and control objects, their functional properties and logical connections between them. This set can be constructed in such a way that each element corresponds to a single element that connects it with the element, as well as a subset that specifies its properties that reproduce its functions. Based on this, each of the subsets of Y defines relations on its other subsets or external sets [7]:

$$\begin{cases}(\forall a_i \in A) \to (\exists! \, z_{i,i+1} \in Z) : a_i(z_{i,i+1})a_{i+1} \\ (\forall a_i \in A) \to (\exists \{u_{ij}\} \in U) : a_i(u_{ij})\{f_{ijl}\}\end{cases} \to \begin{cases}A \subset Z \times Z \wedge U \times U \\ U \subset A \times F \\ Z \subset A \times A\end{cases}$$

where F={fijl} is the set of functions of the element ai, specified by its properties {uij} U.

The set F is a characteristic of the dynamic component of the process control system or its test model and is uniquely determined by the set U onto which it is bijectively mapped (F↔U). The relationship in formula (1), which must be embedded in the source code of the application software, connects the input ESM with the system itself. Therefore, the input model may not include the set F.

Based on expression (1), the set Y can be uniquely displayed by a connected, mixed and weighted p×q graph for which , where ΔU is an additional subset of the proper properties of vertices vi and edges ej in the graph GY to identify its elements. The correspondence GY↔Y is reproduced in one of the following ways:

$$\begin{cases}A \leftrightarrow V \\ Z \leftrightarrow E \\ U = U^G/\Delta U\end{cases} \vee \begin{cases}A \leftrightarrow E \\ Z \leftrightarrow V \\ U = U^G/\Delta U\end{cases} \vee \begin{cases}A \leftrightarrow G_Y^{T_h} \\ Z \subset V \times E \\ U = U^G/\Delta U\end{cases} \vee \begin{cases}A_1 \leftrightarrow V_1 \wedge A_2 \leftrightarrow G_Y^{T_p} \\ Z \subset V \times E \\ U = U^G/\Delta U\end{cases}$$

where are the trees of the graph GY;

– subsets reproduced by the vertices and trees of the graph GY (,), respectively.

The relation in formula (2) determines the incidence between the corresponding vertices and edges of the graph GY. Given that graph trees are always limited to vertices, matching is impossible [7].

Linking ESM with application software requires an analytical interpretation of the GY graph. An approach based on the direct use of topological matrices is not acceptable in this case for large-dimensional objects. The solution to this problem was found in the initial formation of

ordinary blocks of a matrix of vector elements, which reproduces both topological and parametric (weight) properties of the graphical model.

Such a matrix is called a complex topological matrix (CTM). Blocks are created on the basis of components formed by cuts and adjacent to the reference vertices: . Each component must have structural completeness, which consists of maintaining the integrity of each element when it is reproduced by trees. The developed procedure for forming CFT blocks is as follows [7, 8]:

1. Determining the direction of analysis of the graph GY=(V, E) and numbering its elements in such a way that any of its components, obtained by an arbitrary cut, has a continuous (continuous) end-to-end numbering of vertices and edges.

2. Unification of the powers of sets specified by vectors (,), by supplementing them with zero elements to the power of the most powerful vector: 3. Defining a set of ordered subsets of support vertices V'={V't} for partitioning the graph into components as follows:

- numbering of t sets is performed in the direction of graph analysis;
- each subset must form, according to the principle of contiguity with respect to its elements (vertices), two simple cuts E't and E"t;
- provided or supporting vertices are selected in such a way that they enclose the corresponding trees.

4. Determination of cuts E'={e'i} and E"={e"i}, the corresponding elements e'i, e"i of which are adjacent relative to the vertices v'i according to the following principles:

- for support vertices of sets with odd numbers, edges e"i, incident to the vertices, are assigned first in the direction of analyzing the graph relative to the support vertices, and edges e'i - second;
- for support vertices of sets with even numbers - on the contrary, edges e'i are assigned first in the direction of graph analysis relative to the corresponding support vertices, and edges e"i are assigned second.

The above rules can be expressed by the following relations f±1, φ1,2±1:

$$f^{1}(E'_t, E''_t) = f^{-1}(E'_t, E''_t) = \left[\left(e'_i \in E'_t\right) \wedge \left(e''_i \in E''_t\right)\right] \updownarrow \left[v'_i \in V'_t\right]$$

$$\varphi_1^1(V'_t) = \varphi_1^{-1}(E'_t) = \begin{cases} \left(e'_i \in E'_t\right) \downarrow \left(v'_i \in V'_t\right), \text{если } t = x \\ \left(e'_i \in E'_t\right) \uparrow \left(v'_i \in V'_t\right), \text{если } t = y \end{cases}$$

$$\varphi_2^1(V'_t) = \varphi_2^{-1}(E''_t) = \begin{cases} \left(e''_i \in E''_t\right) \uparrow \left(v'_i \in V'_t\right), \text{если } t = x \\ \left(e''_i \in E''_t\right) \downarrow \left(v'_i \in V'_t\right), \text{если } t = y \end{cases}$$

where x, y are, respectively, even and odd values of the number (index) t;

"↕" is a conventional symbol of contiguity;

"↓" is a conventional symbol of the incidence of an edge "to" the support vertex;

"↑" is a conventional symbol for the incidence of an edge "after" the support vertex.

5. Partitioning the graph into two ordered sets of components {GE'k} and {GE"k}, the elements of which have properties (3). The number k is assigned to them in the order in which the graph is analyzed, starting from one.

6. Compilation of CFT blocks for components GE'u and GE"w, where u and w are even and odd values of index k, respectively:

$$\left|M_{\kappa m м_k}\right| = \begin{vmatrix} \overline{m_{11}^k} & \overline{m_{12}^k} & \dots & \overline{m_{1c}^k} \\ \overline{m_{21}^k} & \overline{m_{22}^k} & \dots & \overline{m_{2c}^k} \\ \dots & \dots & \dots & \dots \\ \overline{m_{d1}^k} & \overline{m_{d2}^k} & \dots & \overline{m_{dc}^k} \end{vmatrix} \begin{matrix} i = \overline{1,\, c},\ p \geq r \\ j = \overline{1,\, d},\ d \geq r \\ \overline{m_{ij}^k} = \left\langle n_e,\, n_v,\, u_\chi^e,\, u_\psi^v,\, \theta \right\rangle \end{matrix}$$

where are topological-parametric vectors;

, are the numbers, respectively, of the edges and vertices of the complete CFT, which correspond to the row and column in which the element is located;

, – weight parameters for the corresponding element of the edge and vertex (indices χ and ψ determine the numbers of these elements in the weight vectors);

θ is a topological property of the corresponding edge and vertex element.

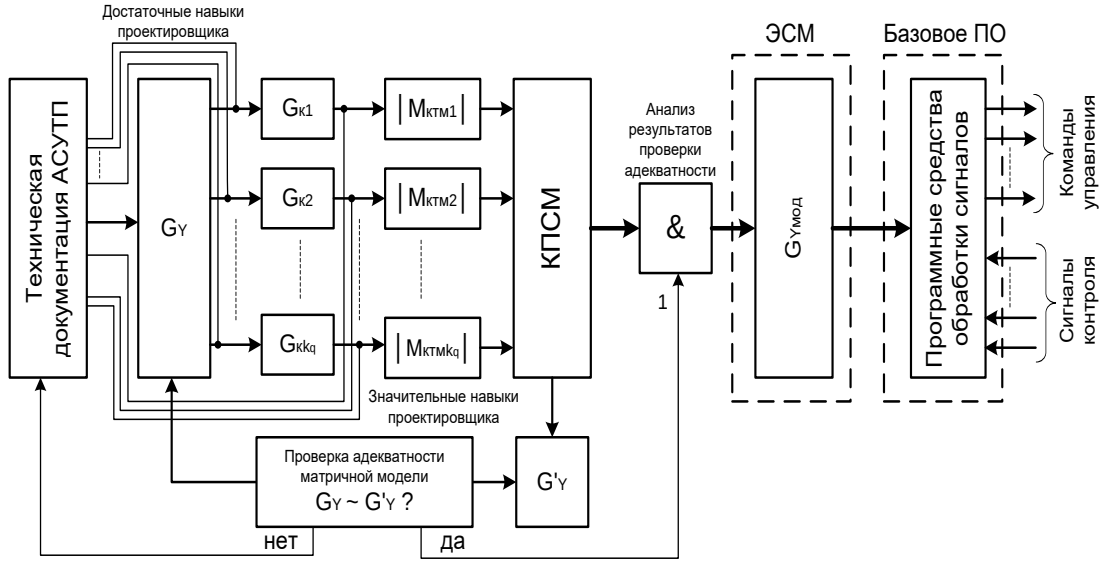
The values of the elements are assigned according to the following rule:

$$u_\chi^e = \begin{cases} u_1^e,\ если\ \ j = 1 + rh \\ u_2^e,\ если\ \ j = 2 + rh \\ \dots\dots\dots\dots\dots\dots\dots \\ u_r^e,\ если\ \ j = r + rh \end{cases}, \quad u_\psi^v = \begin{cases} u_1^v,\ если\ \ i = 1 + rs \\ u_2^v,\ если\ \ i = 2 + rs \\ \dots\dots\dots\dots\dots\dots\dots \\ u_r^v,\ если\ \ i = r + rs \end{cases}, \quad \begin{matrix} h = 0, 1, \dots, \left\lfloor \frac{c}{r} \right\rfloor, \\ \\ s = 0, 1, \dots, \left\lfloor \frac{d}{r} \right\rfloor, \end{matrix}$$

Based on formula (5), the minimum dimension of each matrix in formula (4), ensuring coverage of all vector elements for each vertex and edge of the graph, should be r×r: cmin=r, dmin=r.

The topological property θ = 0 ±1 is determined by the type of matrices and corresponds to direct or indirect relationships between the elements of the graph. The most obvious way is to use the incidence property.

Given the unity of the basic software of objects of the same type, machine synthesis of the ESM and its integration with the software is carried out according to the following scheme (Fig.1)



Rice. 1. Functional diagram of machine synthesis of ESM

CONCLUSION

The proposed method of ESM synthesis has the following advantages: universality of application for process control systems of any distributed objects, ease of implementation from the position of qualified designer (who has sufficient knowledge of the operating technology of the control object and its properties, encoded in the form of weight vectors), the ability to localize spatial areas of the object at different stages design, the ability to form test models only for a certain part of a large object.

At the same time, the main disadvantage of the method should be considered the presence of a minimum threshold for the dimension of CFT blocks, which, in the presence of multiple properties in the elements of a technological object, can lead to an excessive size of individual local areas. This drawback can be eliminated by superposition of local and global objects, which can be interpreted by the nested and outer matrices, respectively. The implementation of this approach requires additional research in this direction.

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HERMITE-BELL TABANLI APOSTOL-BERNOULLI POLİNOMLARI

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Özet
Son zamanlarda Duran ve ark. ikinci türden Bell tabanlı Stirling polinomlarını dikkate aldı. Bell polinomları ve ikinci türden Stirling sayılarıyla ilgili bazı toplama formülleri de dahil olmak üzere bazı yararlı ilişkiler ve özellikler verdiler. Daha sonra yüksek mertebeden Bell tabanlı Bernoulli polinomlarını tanıttılar ve bazı toplama formülleri ve türev özelliklerini içeren çok çeşitli formülleri araştırdılar. Ayrıca, umbral analizde daha yüksek dereceli Bell tabanlı Bernoulli polinomları için uygulamalar sağladılar. Daha sonra ikinci türden Hermite-Bell tabanlı Stirling polinomları ve α mertebesinden Hermite-Bell tabanlı Bernoulli polinomları tanımlanarak bazı özellikleri incelenmiştir. Yukarıdaki çalışmadan motive ve ilham alarak, bu çalışmada, ikinci türden Hermite-Bell tabanlı Apostol-Stirling polinomlarını ele alıyoruz ve Bell polinomları, Hermite polinomları ve Stirling sayısı ile ilgili bazı toplama formülleri dahil olmak üzere bazı yararlı ilişkiler ve özellikler elde ediyoruz. Daha sonra, α mertebesinden Hermite-Bell tabanlı Apostol-Bernoulli polinomlarını tanıtıyoruz ve bazı toplama formülleri ve türev özelliklerini içeren çok çeşitli formülleri araştırıyoruz. Ayrıca, α mertebeden Hermite-Bell tabanlı Apostol-Bernoulli polinomları için çeşitli kapalı toplam formülleri ve simetrik özdeşlikler elde ediyoruz.
Anahtar Kelimeler: Bernoulli polinomları, Bell polinomları, karışık tip polinomlar, ikinci tür Stirling sayıları, Hermite polinomları, toplam formülleri.

THE HERMITE-BELL-BASED APOSTOL-BERNOULLI POLYNOMIALS

Abstract
Recently, Duran et al. (Axioms 2021, 10(1), 29; https://doi.org/10.3390/axioms10010029) considered Bell-based Stirling polynomials of the second kind and derived some useful relations and properties including some summation formulas related to the Bell polynomials and the Stirling numbers of the second kind. Then, they introduced Bell-based Bernoulli polynomials of higher order and investigated multifarious correlations and formulas including some summation formulas and derivative properties. Moreover, the authors attained several interesting formulas of Bell-based Bernoulli polynomials of higher order arising from usual umbral calculus. Then, Hermite-Bell-based Stirling polynomials of the second kind and Hermite-Bell-based Bernoulli polynomials of order α were defined and some of their properties were investigated.Motivated and inspired by the above work, in this study, we consider Hermite-Bell-based Apostol-Stirling polynomials of the second kind and derive some useful relations and properties including some summation formulas related to the Bell polynomials, the Hermite polynomials, and Stirling number of the second kind. Then, we introduce Hermite-Bell-based Apostol-Bernoulli polynomials of order α and investigate multifarious correlations and formulas including some summation formulas and derivative properties. Also, we acquire diverse implicit summation formulas and symmetric identities for Hermite-Bell-based Apostol-Bernoulli polynomials of order α.
Keywords: Bernoulli polynomials, Bell polynomials, mixed-type polynomials, Stirling numbers of the second kind, Hermite polynomials, summation formulas.

Introduction

Special polynomials and numbers possess much importance in multifarious areas of sciences, such as physics, mathematics, applied sciences, engineering, and other related research fields covering, differential equations, number theory, functional analysis, quantum mechanics, mathematical analysis, mathematical physics, so on, *cf.* [1-14] and see also each of the references cited therein. Some of the most significant polynomials in the theory of special polynomials are the Bell, Euler, Bernoulli, Hermite, and Genocchi polynomials. Recently, the aforesaid polynomials and their diverse generalizations have been densely considered and investigated by many physicists and mathematicians, *cf.* [1-14] and see also the references cited therein.In this study, we consider Hermite-Bell-based Apostol-Stirling polynomials of the second kind and derive some useful relations and properties including some summation formulas related to the Bell polynomials and Stirling number of the second kind. Then, we introduce Hermite-Bell-based Apostol-Bernoulli polynomials of order α and investigate multifarious correlations and formulas including some summation formulas and derivative properties. Also, we acquire diverse implicit summation formulas and a symmetric identity for Hermite-Bell-based Apostol-Bernoulli polynomials of order α. Moreover, we analyze some special cases of the results.Throughout this paper, the familiar symbols C, R, Z, N and N_0 are referred to the set of all complex numbers, the set of all real numbers, the set of all integers, the set of all natural numbers, and the set of all non-negative integers, respectively.

The Stirling polynomials $S_2(n,k:x)$ and numbers $S_2(n,k)$ of the second kind are given by the following exponential generating functions (*cf.* [1-3,6-11]):

$$\sum_{n=0}^{\infty} S_2(n,k:x)\frac{t^n}{n!} = \frac{\left(e^t-1\right)^k}{k!}e^{tx} \quad \text{and} \quad \sum_{n=0}^{\infty} S_2(n,k)\frac{t^n}{n!} = \frac{\left(e^t-1\right)^k}{k!}. \tag{1.1}$$

In combinatorics, Stirling number of the second kind $S_2(n,k)$ counts the number of ways in which distinguishable objects can be partitioned into k indistinguishable subsets when each subset has to contain at least one object. The Stirling numbers of the second kind can also be derived by the following recurrence relation for $\zeta \in \mathrm{N}_0$ (*cf.* [2,4,9,14,16]):

$$x^n = \sum_{k=0}^{n} S_2(n,k)(x)_k, \tag{1.2}$$

where $(x)_n = x(x-1)(x-2)\cdots(x-(n-1))$ for $n \in \mathrm{N}$ with $(x)_0 = 1$ (see [1-3,6-11]).

Also, the Apostol-Stirling polynomials $S_{2,\lambda}(n,k:x)$ and numbers $S_{2,\lambda}(n,k)$ of the second kind are given by the following exponential generating functions (*cf.* [1,6,12-14]):

$$\sum_{n=0}^{\infty} S_{2,\lambda}(n,k:x)\frac{t^n}{n!} = \frac{\left(\lambda e^t - 1\right)^k}{k!} e^{tx} \text{ and } \sum_{n=0}^{\infty} S_{2,\lambda}(n,k)\frac{t^n}{n!} = \frac{\left(\lambda e^t - 1\right)^k}{k!}. \tag{1.3}$$

The bivariate Bell polynomials are defined as follows:

$$\sum_{n=0}^{\infty} Bel_n(x;y)\frac{t^n}{n!} = e^{y\left(e^t-1\right)}e^{xt}. \tag{1.4}$$

When $x=0$, $Bel_n(0;y) := Bel_n(y)$ called the classical Bell polynomials (also called exponential polynomials) given by means of the following generating function (*cf.* [2-5,8-11]):

$$\sum_{n=0}^{\infty} Bel_n(y)\frac{t^n}{n!} = e^{y\left(e^t-1\right)}. \tag{1.5}$$

The Bell numbers Bel_n are attained by taking $y=1$ in (1.5), that is $Bel_n(0;1) = Bel_n(1) := Bel_n$ and are given by the following exponential generating function:

$$\sum_{n=0}^{\infty} Bel_n \frac{t^n}{n!} = e^{\left(e^t-1\right)}. \tag{1.6}$$

The Bell polynomials considered by Bell [4] appear as a standard mathematical tool and arise in combinatorial analysis. Since the first consideration of the Bell polynomials, these polynomials have been intensely investigated and studied by several mathematicians, *cf.* [2-5,8-11] and see also the references cited therein.

The usual Bell polynomials and Stirling numbers of the second kind satisfy the following relation

$$Bel_n(y) = \sum_{m=0}^{n} S_2(n,m)y^m. \tag{1.7}$$

The Apostol-Bernoulli polynomials $B_{n,\lambda}^{(\alpha)}(x)$ of order α are defined as follows (*cf.* [1,6,12]):

$$\sum_{n=0}^{\infty} B_{n,\lambda}^{(\alpha)}(x)\frac{t^n}{n!} = \left(\frac{t}{\lambda e^t - 1}\right)^{\alpha} e^{xt} \quad \left(|t+\ln\lambda| < 2\pi;\ 1^{\alpha} := 1\right). \tag{1.8}$$

Setting $x=0$ in (1.8), we get $B_{n,\lambda}^{(\alpha)}(0) := B_{n,\lambda}^{(\alpha)}$ known as the Apostol-Bernoulli numbers of order α. We remark that when $\lambda = 1$ in (1.8), the polynomials $B_{n,\lambda}^{(\alpha)}(x)$ and numbers $B_{n,\lambda}^{(\alpha)}$ reduce to the classical Bernoulli polynomials $B_n^{(\alpha)}(x)$ and numbers $B_n^{(\alpha)}$ or order α. We also note that

when $\alpha = 1$ in (1.8), the polynomials $B_n^{(\alpha)}(x)$ and numbers $B_n^{(\alpha)}$ reduce to the classical Bernoulli polynomials $B_n(x)$ and numbers B_n. We remark that $B_{n,\lambda}^{(1)}(x) := B_{n,\lambda}(x)$ and $B_{n,\lambda}^{(1)} := B_{n,\lambda}$.

The generating function for the Hermite polynomials $H_n(x,y)$ is given by [7]:

$$e^{xt+yt^2} = \sum_{n=0}^{\infty} H_n(x,y)\frac{t^n}{n!}. \tag{1.9}$$

The Hermite-Bell mixed polynomials are given by (see [9])

$$\sum_{n=0}^{\infty} HB_n(x,y,z)\frac{t^n}{n!} = e^{xt+yx^2+z\left(e^t-1\right)}, \tag{1.10}$$

which reduce to usual Hermite polynomials (1.9) when $z = 0$ and familiar Bell polynomials (1.5) when $y = 0$.

Recently, the Hermite-Bell-based Stirling polynomials of the second kind and the Hermite-Bell-based Bernoulli polynomials of order α have been defined and some of their multifarious correlations and formulas including summation formulas, derivation rules, and correlations have been derived in [9].

Definition 1 *The Hermite-Bell-based Stirling polynomials of the second kind are introduced by the following exponential generating function:*

$$\sum_{n=0}^{\infty} {}_{HB}S_2(n,k:x,y,z)\frac{t^n}{n!} = \frac{\left(e^t-1\right)^k}{k!}e^{xt+yx^2+z\left(e^t-1\right)}. \tag{1.11}$$

Definition 2 *The Hermite-Bell-based Bernoulli polynomials of order α are defined by the following exponential generating function:*

$$\sum_{n=0}^{\infty} {}_{HB}B_n^{(\alpha)}(x;y,z)\frac{t^n}{n!} = \left(\frac{t}{e^t-1}\right)^{\alpha} e^{xt+yt^2+z\left(e^t-1\right)}. \tag{1.12}$$

Hermite-Bell-Based Apostol-Stirling Polynomials of the Second Kind

In this section, we introduce the Hermite-Bell-based Apostol-Stirling polynomials of the second kind and analyze their elementary properties and relations.

Here is the definition of the Hermite-Bell-based Apostol-Stirling polynomials of the second kind as follows.

Definition 3 *The Hermite-Bell-based Apostol-Stirling polynomials of the second kind are*

introduced by the following generating function:

$$\sum_{n=0}^{\infty} {}_{HB}S_{2,\lambda}\left(n,k:x,y,z\right)\frac{t^n}{n!}=\frac{\left(e^t-1\right)^k}{k!}e^{xt+yx^2+z\left(e^t-1\right)}. \tag{2.1}$$

Remark 1 *Replacing* $\lambda=1$ *in (2.1), we attain Hermite-Bell-based Stirling polynomials* ${}_{HB}S_2\left(n,k:x,y,z\right)$ *of the second kind in (1.11).*

Remark 2 *Replacing* $x=0$ *in (2.1), we attain extended Apostol-Bell-Stirling polynomials* ${}_{HB}S_2\left(n,k:y,z\right)$ *of the second kind, which are also a new generalization of the usual Stirling numbers of the second kind in (1.1) as follows:*

$$\sum_{n=0}^{\infty} {}_{HB}S_{2,\lambda}\left(n,k:y,z\right)\frac{t^n}{n!}=\frac{\left(\lambda e^t-1\right)^k}{k!}e^{yt^2+z\left(e^t-1\right)}. \tag{2.2}$$

Remark 3 *Replacing* $x=y=0$ *in (2.1), we obtain Apostol-Bell-Stirling polynomials* ${}_{Bel}S_{2,\lambda}\left(n,k:z\right)$ *of the second kind, which are also a new generalization of the usual Stirling numbers of the second kind in (1.1), as follows:*

$$\sum_{n=0}^{\infty} {}_{Bel}S_{2,\lambda}\left(n,k:z\right)\frac{t^n}{n!}=\frac{\left(\lambda e^t-1\right)^k}{k!}e^{z\left(e^t-1\right)}.$$

We now ready to give some properties of the ${}_{HB}S_{2,\lambda}\left(n,k:x,y,z\right)$ without their proofs.

Proposition 1 *The following correlation*

$${}_{HB}S_{2,\lambda}\left(n,k:x,y,z\right)=\sum_{u=0}^{n}\binom{n}{u}S_{2,\lambda}\left(u,k\right)HB_{n-u}\left(x;y,z\right) \tag{2.3}$$

holds for non-negative integer n.

Proposition 2 *The following relations*

$${}_{HB}S_{2,\lambda}\left(n,k:x,y,z\right)=\sum_{l=0}^{n}\binom{n}{l}\,{}_{HB}S_{2,\lambda}\left(l,k:y,z\right)x^{n-l} \tag{2.4}$$

and

$${}_{HB}S_{2,\lambda}\left(n,k:x,y\right)=\sum_{l=0}^{n}\binom{n}{l}\,{}_{Bel}S_{2,\lambda}\left(l,k:z\right)H_{n-l}\left(x,y\right) \tag{2.5}$$

hold for non-negative integers n and k with $n\geq k$.

Proposition 3 *The following summation formulae for Hermite-Bell-based Apostol-Stirling polynomials of the second kind*

$$ {}_{HB}S_{2,\lambda}\left(n,k:x_1+x_2,y,z\right)=\sum_{u=0}^{n}\binom{n}{u}\ {}_{HB}S_{2,\lambda}\left(u,k:x_1,y,z\right)x_2^{n-u} \tag{2.6}$$

and

$$ {}_{HB}S_{2,\lambda}\left(n,k:x,y,z_1+z_2\right)=\sum_{u=0}^{n}\binom{n}{u}\ {}_{HB}S_{2,\lambda}\left(u,k:x,y,z_1\right)HB_{n-u}\left(z_2\right) \tag{2.7}$$

hold for non-negative integers n and k with $n\geq k$.

Proposition 4 *The following relation*

$$ {}_{HB}S_{2,\lambda}\left(n,k_1+k_2:x,y,z\right)=\frac{k_1!k_2!}{\left(k_1+k_2\right)!}\sum_{u=0}^{n}\binom{n}{u}\ {}_{HB}S_{2,\lambda}\left(u,k_1:x,y,z\right)S_{2,\lambda}\left(n-u,k_2\right) \tag{2.8}$$

is valid for non-negative integer n.

Proposition 5 *The following relation*

$$ S_{2,\lambda}\left(n,k\right)=\sum_{u=0}^{n}\binom{n}{u}\ {}_{HB}S_{2,\lambda}\left(u,k:x,y,z\right)HB_{n-u}\left(-x,-y,-z\right) \tag{2.9}$$

holds for non-negative integer n.

Hermite-Bell-Based Apostol-Bernoulli Polynomials of Order α

In this section, we introduce Hermite-Bell-based Apostol-Bernoulli polynomials of order α and investigate multifarious correlations and formulas including summation formulas, derivation rules, and correlations with the Hermite-Bell based Apostol-Stirling numbers of the second kind.

We now consider Hermite-Bell-based Apostol-Bernoulli polynomials of order α as follows.

Definition 4 *The Hermite-Bell-based Apostol-Bernoulli polynomials of order* α *are defined by:*

$$ \sum_{n=0}^{\infty}\ {}_{HB}B_{n,\lambda}^{(\alpha)}\left(x;y,z\right)\frac{t^n}{n!}=\left(\frac{t}{\lambda e^t-1}\right)^{\alpha}e^{xt+yt^2+z\left(e^t-1\right)} \tag{3.1}$$

for $\left|t+\ln\lambda\right|<2\pi$ and $1^{\alpha}:=1$.

Some special cases of the Hermite-Bell-based Apostol-Bernoulli polynomials of order α are analyzed below.

Remark 4 *In the special case* $\lambda=1$ *in (3.1), we acquire the extended Hermite-Bell-based Bernoulli polynomials of order* α *in (1.12).*

Remark 5 *In the special case* $x=0$ *in (3.1), we acquire the extended Apostol-Bell-Bernoulli*

polynomials of order α, *which are also new extensions of the Bernoulli numbers of order* α *in (1.8), as follows:*

$$\sum_{n=0}^{\infty} {}_{HB}B_{n,\lambda}^{(\alpha)}(y,z)\frac{t^n}{n!}=\left(\frac{t}{\lambda e^t-1}\right)^{\alpha} e^{yt^2+z\left(e^t-1\right)}. \tag{3.2}$$

Remark 6 *In the special case* $x=0$ *in (3.1), we acquire Apostol-Bell-Bernoulli polynomials* ${}_{HB}B_{n,\lambda}^{(\alpha)}(y)$ *of order, cf. [8], as follows:*

$$\sum_{n=0}^{\infty} {}_{Bel}B_{n,\lambda}^{(\alpha)}(z)\frac{t^n}{n!}=\left(\frac{t}{\lambda e^t-1}\right)^{\alpha} e^{z\left(e^t-1\right)}.$$

Remark 7 *In the special case* $z=0$ *in (3.1), we acquire Bell-based Apostol-Bernoulli polynomials* ${}_{Bel}B_{n,\lambda}^{(\alpha)}(x;z)$ *of order, cf. [8], as follows:*

$$\sum_{n=0}^{\infty} {}_{Bel}B_{n,\lambda}^{(\alpha)}(x;z)\frac{t^n}{n!}=\left(\frac{t}{\lambda e^t-1}\right)^{\alpha} e^{xt+z\left(e^t-1\right)}.$$

Remark 8 *In the special case* $z=0$ *in (3.1), we acquire Hermite-based Apostol-Bernoulli polynomials* ${}_{HB}B_{n,\lambda}^{(\alpha)}(y)$ *of order, cf. [7], as follows:*

$$\sum_{n=0}^{\infty} {}_{H}B_{n,\lambda}^{(\alpha)}(x;y)\frac{t^n}{n!}=\left(\frac{t}{\lambda e^t-1}\right)^{\alpha} e^{xt+yt^2}.$$

We also note that

$${}_{HB}B_{n,\lambda}^{(1)}(x;y,z):={}_{HB}B_{n,\lambda}(x;y,z)$$

which we call the Hermite-Bell-based Apostol-Bernoulli polynomials.

We now perform to derive some properties of the Hermite-Bell-based Apostol-Bernoulli polynomials of order α and we provide the following theorems without their proofs that can be done by using (3.1) and series manipulation methods.

Theorem 1 *Each of the following summation formulae*

$${}_{HB}B_{n,\lambda}^{(\alpha)}(x;y,z)=\sum_{k=0}^{n}\binom{n}{k}B_{k,\lambda}^{(\alpha)}HB_{n-k}(x,y,z) \tag{3.3}$$

$${}_{HB}B_{n,\lambda}^{(\alpha)}(x;y,z)=\sum_{k=0}^{n}\binom{n}{k}B_{k,\lambda}^{(\alpha)}(x;y)Bel_{n-k}(z) \tag{3.4}$$

$${}_{HB}B_{n,\lambda}^{(\alpha)}(x;y,z)=\sum_{k=0}^{n}\binom{n}{k}{}_{HB}B_{k,\lambda}^{(\alpha)}(y,z)x^{n-k} \tag{3.5}$$

hold for $n\in \mathrm{N}_0$.

We provide an implicit summation formula for the Hermite-Bell-based Apostol-Bernoulli polynomials by the following theorem.

Theorem 2 *The following relationship*

$$ {}_{HB}B_{n,\lambda}^{(\alpha_1+\alpha_2)}\left(x_1+x_2;y_1+y_2,z_1+z_2\right)=\sum_{k=0}^{n}\binom{n}{k}\,{}_{HB}B_{k,\lambda}^{(\alpha_1)}\left(x_1;y_1,z_1\right){}_{HB}B_{n-k,\lambda}^{(\alpha_2)}\left(x_2;y_2,z_1\right) \tag{3.6}$$

is valid for $n\in \mathrm{N}_0$.

One of the special cases of Theorem 2 is given below:

$$ {}_{HB}B_{n,\lambda}^{(\alpha)}\left(x+1;y,z\right)=\sum_{k=0}^{n}\binom{n}{k}\,{}_{HB}B_{k,\lambda}^{(\alpha)}\left(x;y,z\right), \tag{3.7}$$

which is a generalization of the well-known formula for usual Apostol-Bernoulli polynomials given by

$$ B_{n,\lambda}\left(x+1\right)=\sum_{k=0}^{n}\binom{n}{k}B_{k,\lambda}\left(x\right)\ \text{(cf. [12]).}$$

We now provide derivative operator properties for the polynomials ${}_{HB}B_{n}^{(\alpha)}\left(x;y,z\right)$ as follows.

Theorem 3 *The difference operator formulas for the Hermite-Bell-based Bernoulli polynomials*

$$ \frac{\partial}{\partial x}\,{}_{HB}B_{n,\lambda}^{(\alpha)}\left(x;y,z\right)=n\,{}_{HB}B_{n-1,\lambda}^{(\alpha)}\left(x;y\right) \tag{3.8}$$

and

$$ \frac{\partial}{\partial z}\,{}_{HB}B_{n,\lambda}^{(\alpha)}\left(x;y,z\right)={}_{HB}B_{n,\lambda}^{(\alpha)}\left(x+1;y,z\right)-{}_{HB}B_{n,\lambda}^{(\alpha)}\left(x;y,z\right). \tag{3.9}$$

hold for $n\in \mathrm{N}$.

A recurrence relation for the Hermite-Bell-based Apostol-Bernoulli polynomials is given by the following theorem.

Theorem 4 *The following summation formula*

$$ HB_{n}\left(x;y,z\right)=\frac{\lambda\,{}_{HB}B_{n+1,\lambda}\left(x+1;y,z\right)-{}_{HB}B_{n+1,\lambda}\left(x;y,z\right)}{n+1}=\frac{\lambda}{n+1}\sum_{k=0}^{n}\binom{n+1}{k}\,{}_{HB}B_{k,\lambda}\left(x;y,z\right) \tag{3.10}$$

holds for $n\in \mathrm{N}_0$.

Remark 9 *The result (3.10) is an extension of the well-known formula for the Apostol-Bernoulli polynomials given by*

$$x^n = \frac{\lambda B_{n+1,\lambda}(x+1) - B_{n+1,\lambda}(x)}{n+1} \quad \text{(cf. [12,13]).}$$

An explicit formula for the Hermite-Bell-based Apostol-Bernoulli polynomials is given by the following theorem.

Theorem 5 *The following explicit formula*

$${}_{HB}B_{n,\lambda}(x;y,z) = \sum_{k=0}^{\infty}\sum_{l=0}^{k-1} y^k \binom{k-1}{l}(-1)^{k-l-1}\frac{H_{n+1}(l+x,y)}{n+1}$$

holds for $n \in \mathrm{N}_0$.

We give the following theorem.

Theorem 6 *The following formula including the Hermite-Bell-based Apostol-Bernoulli polynomials of higher-order and Stirling numbers of the second kind*

$$HB_n(x;y,z) = \frac{n!k!}{(n+k)!}\sum_{l=0}^{n+k}\binom{n+k}{l}\,{}_{HB}B_{l,\lambda}^{(-k)}(x;y,z)S_{2,\lambda}(n+k-l,m) \tag{3.11}$$

is valid for $n \in \mathrm{N}_0$ and $k \in \mathrm{N}$.

Here, we present the following theorem including the Hermite-Bell-based Apostol-Bernoulli polynomials and the Apostol-Stirling polynomials of the second kind.

Theorem 7 *The following correlation*

$${}_{HB}B_{n,\lambda}^{(\alpha)}(x;y,z) = \sum_{l=0}^{n}\sum_{k=0}^{\infty}\binom{n}{l}(x)_k\, S_2(l,k)\,{}_{HB}B_{n-l,\lambda}^{(\alpha)}(y) \tag{3.12}$$

holds for non-negative integers n.

A correlation including the Hermite-Bell-based Apostol-Bernoulli polynomials of order α and the Hermite-Bell-based Apostol-Stirling polynomials of the second kind is stated below.

Theorem 8 *The following summation formula*

$$HB_n(x_1+x_2,y_1+y_2,z_1+z_2) = \frac{n!k!}{(n+k)!}\sum_{l=0}^{n+k}\binom{n+k}{l}\,{}_{HB}B_{l,\lambda}^{(k)}(x_2;y_2,z_2)\,{}_{HB}S_{2,\lambda}(n+k-l,k:x_1,y_1,z_2) \tag{3.13}$$

holds for non-negative integers k and n with $n \geq k$.

We note that the following series manipulation formulas hold (*cf.* [8,9]):

$$\sum_{N=0}^{\infty} f(N)\frac{(x+y)^N}{N!} = \sum_{n,m=0}^{\infty} f(n+m)\frac{x^n}{n!}\frac{y^m}{m!} \tag{3.14}$$

and

$$\sum_{k,l=0}^{\infty} A(l,k) = \sum_{k=0}^{\infty}\sum_{l=0}^{k} A(l,k-l). \tag{3.15}$$

We give the following theorem.

Theorem 9 *The following implicit summation formula*

$${}_{HB}B_{k+l,\lambda}^{(\alpha)}(x;y,z) = \sum_{n,m=0}^{k,l}\binom{k}{n}\binom{l}{m}(x-\omega)^{n+m}\,{}_{HB}B_{k+l-n-m,\lambda}^{(\alpha)}(\omega;y,z) \tag{3.16}$$

holds.

Proof. Upon setting t by $t+u$ in (3.1), we derive

$$\left(\frac{t+u}{\lambda e^{t+u}-1}\right)^{\alpha} e^{y(t+u)^2+z\left(e^{t+u}-1\right)} = e^{-\omega(t+u)}\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(\omega;y,z)\frac{t^k}{k!}\frac{u^l}{l!}.$$

Again replacing ω by x in the last equation, and using (3.14), we get

$$e^{-x(t+u)}\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(x;y,z)\frac{t^k}{k!}\frac{u^l}{l!} = \left(\frac{t+u}{\lambda e^{t+u}-1}\right)^{\alpha} e^{y(t+u)^2+z\left(e^{t+u}-1\right)}$$

By the last two equations, we obtain

$$\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(x;y,z)\frac{t^k}{k!}\frac{u^l}{l!} = e^{(x-\omega)(t+u)}\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(\omega;y,z)\frac{t^k}{k!}\frac{u^l}{l!},$$

which yield

$$\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(x;y,z)\frac{t^k}{k!}\frac{u^l}{l!} = \sum_{n,m=0}^{\infty}(x-\omega)^{n+m}\frac{t^n}{n!}\frac{u^m}{m!}\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(\omega;y,z)\frac{t^k}{k!}\frac{u^l}{l!}.$$

Utilizing (3.15), we acquire

$$\sum_{k,l=0}^{\infty}{}_{HB}B_{k+l,\lambda}^{(\alpha)}(x;y,z)\frac{t^k}{k!}\frac{u^l}{l!} = \sum_{k,l=0}^{\infty}\sum_{n,m=0}^{k,l}\frac{(x-\omega)^{n+m}\,{}_{HB}B_{k+l-n-m,\lambda}^{(\alpha)}(\omega;y,z)}{n!m!(k-l)!(l-m)!}t^k u^l,$$

which implies the asserted result (3.16).

Corollary 1 *Letting* $k=0$ *in (3.16), the following implicit summation formula holds:*

$${}_{HB}B_{l,\lambda}^{(\alpha)}(x;y,z) = \sum_{m=0}^{l}\binom{l}{m}(x-\omega)^{m}\,{}_{HB}B_{l-m,\lambda}^{(\alpha)}(\omega;y,z).$$

Corollary 2 *Upon setting* $k=0$ *and replacing* x *by* $x+z$ *in (3.16), we attain*

$${}_{HB}B_{l,\lambda}^{(\alpha)}(x+\omega;y,z) = \sum_{m=0}^{l}\binom{l}{m}x^{m}\,{}_{HB}B_{l-m,\lambda}^{(\alpha)}(\omega;y,z).$$

Now, we give the following theorem.

Theorem 10 *The following symmetric identity*

$$\sum_{k=0}^{n}\binom{n}{k}\,{}_{HB}B_{n-k,\lambda}^{(\alpha)}(bx;y,z)\,{}_{HB}B_{k,\lambda}^{(\alpha)}(ax;y,z)a^{n-k}b^{k}=\sum_{k=0}^{n}\binom{n}{k}\,{}_{HB}B_{k,\lambda}^{(\alpha)}(bx;y,z)\,{}_{HB}B_{n-k,\lambda}^{(\alpha)}(ax;y,z)a^{k}b^{n-k} \tag{3.17}$$

holds for $a,b\in\mathrm{R}$ and $n\geq 0$.

Proof. Let

$$\Upsilon=\left(\frac{t^{2}}{\left(\lambda e^{at}-1\right)\left(\lambda e^{bt}-1\right)}\right)^{\alpha}e^{2abxt+y(at)^{2}+y(bt)^{2}+z\left(e^{at}-1\right)+z\left(e^{bt}-1\right)}.$$

Then, the expression for Υ is symmetric in a and b, and we derive the following two expansions of Υ:

$$\Upsilon=\sum_{n=0}^{\infty}{}_{HB}B_{n,\lambda}^{(\alpha)}(bx;y,z)\frac{(at)^{n}}{n!}\sum_{n=0}^{\infty}{}_{HB}B_{n,\lambda}^{(\alpha)}(ax;y,z)\frac{(bt)^{n}}{n!}$$

$$=\sum_{n=0}^{\infty}\sum_{k=0}^{n}\binom{n}{k}\,{}_{HB}B_{n-k,\lambda}^{(\alpha)}(bx;y,z)\,{}_{HB}B_{k,\lambda}^{(\alpha)}(ax;y,z)a^{n-k}b^{k}\frac{t^{n}}{n!}$$

and similarly

$$\Upsilon=\sum_{n=0}^{\infty}\sum_{k=0}^{n}\binom{n}{k}\,{}_{HB}B_{k,\lambda}^{(\alpha)}(bx;y,z)\,{}_{HB}B_{n-k,\lambda}^{(\alpha)}(ax;y,z)a^{k}b^{n-k}\frac{t^{n}}{n!},$$

which gives the desired result (3.17).

Conclusions

In the present paper, we have considered Hermite-Bell based Apostol-Stirling polynomials of the second kind and derived some useful relations and properties including some summation formulas related to the Hermite polynomials, the Bell polynomials and Stirling number of the second kind. Then, we have introduced Hermite-Bell based Apostol-Bernoulli polynomials of order α and investigated multifarious correlations and formulas including some summation formulas and derivative properties. Also, we have acquired diverse implicit summation formulas and symmetric identities for Hermite-Bell based Apostol-Bernoulli polynomials of order α. Moreover, we have analyzed some special cases of the results. The results obtained in this paper are generalizations of the many earlier results, some of which are involved related references in [1-14]. For future directions, we will consider that the polynomials introduced in this paper can be examined within the context of monomiality principle and umbral calculus to

have alternative ways of deriving our results.

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2-DEĞİŞKENLİ KESİLMİŞ DEJENERE ÜSSEL POLİNOMLAR α Mertebesi

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Özet
Kesik üstel polinomlar, olağan üstel fonksiyon için Mac Laurin serisinin ilk (n + 1) terimidir. Özel polinom ailesinde son yıllarda polinomların kesik formları çeşitli matematikçiler tarafından üzerinde çalışılmış ve incelenmiştir. Özel fonksiyonların çarpımlarını içeren integrallerin değerlendirilmesinde hayati önem taşıyan üst düzey kesik polinomlar tanıtılmış ve bu polinomlar Appell ailesi ve Laguerre ailesi daha genel bağlamında tartışılmıştır. İki değişkenli kesik Fubini polinomları ve sayıları tanımlanır ve ardından toplama formülleri, yineleme ilişkileri, türev özelliği ve ikinci türden kesik Stirling sayılarıyla, ikinci türden Apostol tipi Stirling sayılarıyla korelasyonlar dahil olmak üzere çok çeşitli ilişkiler ve formüller, Kesik Bernoulli polinomları ve kesik Euler polinomları araştırıldı. Kesilmiş Bernoulli polinomları dikkate alındı ve çeşitli özellikler verildi. Kesikli Euler polinomları tanımlandı ve kesik Bernoulli polinomlarının bazı özellikleri ve ilişkileri sağlandı. Kesik üstel tabanlı Apostolik tip polinomlar analiz edilmiş ve bunların bazı örtülü toplama formüllerini ve simetrik özdeşlikleri kapsayan çeşitli özellikleri keşfedilmiştir.
Bu çalışmada dejenere kesik üstel polinomların tanımı ve ardından bazı özellikleri ve ilişkileri verilmiştir.
Anahtar Kelimeler: kesikli üstel polinomlar, özel polinomlar, üreteç fonksiyonlar

THE 2-VARIABLE TRUNCATED DEGENERATE EXPONENTIAL POLYNOMIALS OF ORDER α

Abstract
The truncated exponential polynomials are the first $(n + 1)$ terms of the Mac Laurin series for the usual exponential function. In the family of special polynomials, in recent years, the truncated forms for polynomials have been worked on and investigated by various mathematicians. The higher-order truncated polynomials which play a role of crucial importance in the evaluation of integrals involving products of special functions were introduced and these polynomials were discussed within the more general context of the Appell family and the Laguerre family. The two-variable truncated Fubini polynomials and numbers are defined and then multifarious relations and formulas including summation formulas, recurrence relations, derivative property, and correlations with the truncated Stirling numbers of the second kind, Apostol-type Stirling numbers of the second kind, the truncated Bernoulli polynomials, and truncated Euler polynomials were investigated. The truncated Bernoulli polynomials were considered, and several properties were given. The truncated Euler polynomials were defined and some properties and relations with the truncated Bernoulli polynomials were provided. The truncated-exponential-based Apostol-type polynomials were analyzed and their various properties covering some implicit summation formulas and symmetric identities were discovered.In this study, the definition of the 2-variable truncated degenerate exponential polynomials of order α and then provide some of their properties and relations.
Keywords: truncated exponential polynomials, special polynomials, generating functions

Introduction

Throughout this paper, the familiar symbols C, R, Z, N and N_0 are referred to the set of all complex numbers, the set of all real numbers, the set of all integers, the set of all natural numbers and the set of all non-negative integers, respectively.

The truncated exponential polynomials $e_n(x)$ are the first $(n+1)$ terms of the Mac Laurin series for the function e^x (*cf.* [2-4,6,12]), that is

$$e_n(x) = \sum_{k=0}^{n} \frac{x^k}{k!}. \tag{1.1}$$

This polynomial has the following integral representation:

$$e_n(x) = \sum_{k=0}^{n} \frac{x^k}{k!} \frac{(n-k)!}{(n-k)!} = \frac{1}{n!} \int_0^{\infty} e^{\beta} (x+\beta)^n \, d\beta. \tag{1.2}$$

The classical generating function of the truncated exponential polynomials is as follows (*cf.* [2-4,6,12])

$$\sum_{n=0}^{\infty} e_n(x) t^n = \frac{e^{tx}}{1-t}. \tag{1.3}$$

Using the aforesaid generating function, one can easily get the following derivative relations:

$$e_{n+1} = \left[1 + \frac{x}{n+1}\left(1 - \frac{d}{dx}\right)\right] e_n(x) \tag{1.4}$$

and

$$e_{n-1}(x) = \frac{d}{dx} e_n(x). \tag{1.5}$$

For more detailed information about the truncated exponential polynomials, see [2-4,6,7,12-14] and also the references cited therein.

The traditional Pochhammer symbol $(x)_n$ (sometimes called the descending factorial, falling sequential product, falling factorial, or lower factorial) is defined by (see [1,5,8-11])

$$(x)_{n,1} := (x)_n = \begin{cases} x(x-1)(x-2)\cdots(x-(n-1)), & n \in \mathrm{N} \\ 1 & n = 0. \end{cases} \tag{1.6}$$

The λ-extension of the usual Pochhammer symbol $(x)_{n,\lambda}$ is given by (see [1,5,8-11])

$$(x)_{n,\lambda} = \begin{cases} x(x-\lambda)(x-2\lambda)\cdots(x-(n-1)\lambda), & n \in \mathrm{N} \\ 1 & n = 0. \end{cases} \tag{1.7}$$

Note that $(x)_{n,1} := (x)_n$.

The Δ_λ difference operator of a function is defined by (see [1,5,8-11])

$$\Delta_\lambda f(x) := \Delta_{\lambda;x} f(x) = \frac{1}{\lambda}(f(x+\lambda) - f(x)), \quad \alpha \neq 0. \tag{1.8}$$

The following difference rule holds (*cf.* [1,5,8-11]):

$$\Delta_\lambda^k (x)_{n,\lambda} = \frac{n!}{(n-k)!}(x)_{n-k,\lambda}, \quad 0 \leq k \leq n, \tag{1.9}$$

where the notation Δ_λ^k denotes the k times applying the Δ_λ difference operators.

Let $\lambda \in \mathrm{R} / \{0\}$. The degenerate exponential function $e_\lambda^x(t)$ is defined by (*cf.* [1,5,8-11])

$$e_\lambda^x(t) = (1+\lambda t)^{\frac{x}{\lambda}} \text{ and } e_\lambda^1(t) = e_\lambda(t). \tag{1.10}$$

It is readily seen that $\lim_{\lambda \to 0} e_\lambda^x(t) = e^{xt}$. From (1.10), we obtain the following relation

$$e_\lambda^x(t) = \sum_{n=0}^{\infty} (x)_{n,\lambda} \frac{t^n}{n!}, \tag{1.11}$$

which satisfies the following difference rule

$$\Delta_\lambda e_\lambda^x(t) = t e_\lambda^x(t). \tag{1.12}$$

By (1.11), we can write

$$e_\lambda(t) = \sum_{n=0}^{\infty} (1)_{n,\lambda} \frac{t^n}{n!} = 1 + (1)_{1,\lambda} \frac{t}{1!} + (1)_{2,\lambda} \frac{t^2}{2!} + (1)_{3,\lambda} \frac{t^3}{3!} + \cdots.$$

In the family of special polynomials, in recent years, the truncated forms for polynomials have been worked on and investigated by various mathematicians *cf.* [2-9,11-14], and see also the references cited therein. Dattoli et al. [2] introduced the higher-order truncated polynomials which play a role of crucial importance in the evaluation of integrals involving products of special functions and discussed them within the more general context of the Appell family and the Laguerre family. Duran et al. [4] considered the two-variable truncated Fubini polynomials and numbers and then investigated multifarious relations and formulas including summation formulas, recurrence relations, derivative property, and correlations with the truncated Stirling numbers of the second kind, Apostol type Stirling numbers of the second kind, the truncated Bernoulli polynomials and truncated Euler polynomials. Hassen et al. [6] defined the truncated Bernoulli polynomials and derived several properties. Komatsu et al. [12] considered the truncated Euler polynomials and presented their properties and relations with the truncated Bernoulli polynomials. Srivastava et al. [13] examined the truncated-exponential-based Apostol-type polynomials and derived their various properties covering some implicit

summation formulas and symmetric identities.

While the truncated exponential polynomials $e_n(x)$ (1.1) are the first $(n+1)$ terms of the Mac Laurin series for usual exponential function e^x, the truncated degenerate exponential polynomials are introduced as the first $(n+1)$ terms of the Mac Laurin series expansion of the degenerate exponential function $e_\lambda(t)$ in (1.11) as follows:

Definition 1 *The truncated degenerate exponential polynomials (the Detr -exponential polynomials) are introduced as the first* $(n+1)$ *terms of the Taylor series expansion of* $e_\lambda(t)$ *in (1.11) at* $t=0$*:*

$$e_{n,\lambda}(t)=\sum_{k=0}^{n}(1)_{k,\lambda}\frac{t^k}{k!}. \tag{1.13}$$

Remark 1 *When* $\lambda\to 0$*, the Detr -exponential polynomials* $e_{n,\lambda}(t)$ *(1.13) reduce to the truncated exponential polynomials* $e_n(t)$ *in (1.1).*

Proposition 1 *For* $|z|<1$*, we have*

$$\sum_{n=0}^{\infty}e_{n,\lambda}(t)z^n=\frac{e_\lambda(zt)}{1-z}. \tag{1.14}$$

Proposition 2 *The following difference operator rule holds:*

$$\Delta_{\lambda,}e_{n,\lambda}(t)=te_{n-1,\lambda}(t). \tag{1.15}$$

Proposition 3 *The following recurrence relation*

$$e_{n+1,\lambda}(t)=(n+1)\sum_{k=0}^{n}\left((1)_{k+1,\lambda}\frac{t^{k+1}}{k!}+e_{k,\lambda}(t)\right) \tag{1.16}$$

is valid for $n\in \mathrm{N}_0$.

Main Results

In this chapter, we define the 2-variable truncated degenerate exponential polynomials of order α and then investigate some of their properties.

We now consider the 2-variable truncated degenerate exponential polynomials of order α, therefore we give the following definition.

Definition 2 *The 2-variable truncated degenerate exponential polynomials of order* α *are*

introduced by the following explicit expression:

$$e_{n,\lambda}^{(\alpha)}(x,y)=\sum_{k=0}^{\left\lfloor \frac{n}{\alpha} \right\rfloor}\frac{(x)_{n-k\alpha,\lambda}\,y^{k}}{(n-k\alpha)!}, \tag{2.1}$$

where $\lfloor\cdot\rfloor$ means the greatest integer function.

We choose to call the $2VTD$-exponential polynomials as well as the 2-variable truncated degenerate exponential polynomials of order α.

We now examine a special case of the aforementioned polynomials as follows.

Remark 2 *When $\alpha=1$, the $2VTD$-exponential polynomials $e_{n,\lambda}^{(\alpha)}(x,y)$ (2.1) reduce to the 2-variable truncated degenerate exponential polynomials $e_{n,\lambda}(x,y)$, which are the new extension of the exponential polynomials in (1.1), given by*

$$e_{n,\lambda}(x,y)=\sum_{k=0}^{n}(x)_{n-k,\lambda}\frac{y^{k}}{(n-k)!}. \tag{2.2}$$

Remark 3 *When $y=1$, the $2VTD$-exponential polynomials $e_{n,\lambda}^{(\alpha)}(x,y)$ (2.1) reduce to the truncated degenerate exponential polynomials $e_{n,\lambda}^{(\alpha)}(x)$ of order α, which are the new extension of the exponential polynomials in (1.1), given by*

$$e_{n,\lambda}^{(\alpha)}(x)=\sum_{k=0}^{\left\lfloor \frac{n}{\alpha} \right\rfloor}(x)_{n-k\alpha,\lambda}\frac{1}{(n-k\alpha)!}. \tag{2.3}$$

Remark 4 *When $x=1$, the $2VTD$-exponential polynomials $e_{n,\lambda}^{(\alpha)}(x,y)$ (2.1) reduce to the truncated degenerate exponential polynomials $e_{n,\lambda}^{(\alpha)}(1,y)$ of order α, which are the new extension of the exponential polynomials in (1.1), given by*

$$e_{n,\lambda}^{(\alpha)}(1,y)=\sum_{k=0}^{\left\lfloor \frac{n}{\alpha} \right\rfloor}\frac{(1)_{n-k\alpha,\lambda}\,y^{k}}{(n-k\alpha)!}. \tag{2.4}$$

Remark 5 *When $y=1=\alpha$, the $2VTD$-exponential polynomials $e_{n,\lambda}^{(\alpha)}(x,y)$ (2.1) reduce to the truncated degenerate exponential polynomials $e_{n,\lambda}(x)$, which are the new extension of the exponential polynomials in (1.1), given by*

$$e_{n,\lambda}(x)=\sum_{k=0}^{n}(x)_{n-k,\lambda}\frac{1}{(n-k)!}. \tag{2.5}$$

Remark 6 *When* $\lambda \to 0$, *the* $2VTD$*-exponential polynomials* $e_{n,\lambda}^{(\alpha)}(x,y)$ *(2.1) reduce to the 2-variable truncated exponential polynomials* $e_n^{(\alpha)}(x,y)$ *of order* α, *given by*

$$e_n^{(\alpha)}(x,y) = \sum_{k=0}^{\left\lfloor \frac{n}{\alpha} \right\rfloor} \frac{x^{n-k\alpha} y^k}{(n-k\alpha)!}.$$

Remark 7 *When* $y = \alpha = x = 1$, *the* $2VTD$*-exponential polynomials* $e_{n,\lambda}^{(\alpha)}(x,y)$ *(2.1) reduce to the degenerate truncated exponential polynomials* $e_{n,\lambda}(t)$ *in (1.13).*

Remark 8 *When* $y = \alpha = x = 1$ *and* $\lambda \to 0$, *the* $2VTD$*-exponential polynomials* $e_{n,\lambda}^{(\alpha)}(x,y)$ *(2.1) reduce to the truncated exponential polynomials* $e_n(t)$ *in (1.1).*

The classical generating function of the $2VTD$-exponential polynomials is given by the following theorem.

Theorem 1 *For* $|t| < \sqrt[\alpha]{\frac{1}{|y|}}$, *we have*

$$\sum_{n=0}^{\infty} e_{n,\lambda}^{(\alpha)}(x,y) t^n = \frac{e_\lambda^x(t)}{1-yt^\alpha}. \tag{2.6}$$

Proof. Using (2.1) and

$$\sum_{n=0}^{\infty}\sum_{k=0}^{\infty} A(k,n) = \sum_{n=0}^{\infty}\sum_{k=0}^{\left\lfloor \frac{n}{\alpha} \right\rfloor} A(k,n-\alpha k) \quad \text{(see [5])}$$

for $|t| < \sqrt[\alpha]{\frac{1}{|y|}}$, we consider

$$\sum_{n=0}^{\infty} e_{n,\lambda}^{(\alpha)}(x,y) t^n = \sum_{n=0}^{\infty}\sum_{k=0}^{\left\lfloor \frac{n}{\alpha} \right\rfloor} \frac{(x)_{n-k\alpha,\lambda}\, y^k}{(n-k\alpha)!} t^n$$

$$= \sum_{n=0}^{\infty} (x)_{n,\lambda} \frac{t^n}{n!} \sum_{k=0}^{\infty} y^k t^{k\alpha}$$

$$= \frac{e_\lambda^x(t)}{1-yt^\alpha},$$

which implies the assertion (2.6).

We remark that using (2.6), the classical generating function of the polynomials in (2.2), (2.3), (2.4) and (2.5), respectively, can be given as follows:

$$\sum_{n=0}^{\infty} e_{n,\lambda}(x,y)t^n = \frac{e_\lambda^x(t)}{1-yt},$$

$$\sum_{n=0}^{\infty} e_{n,\lambda}^{(\alpha)}(x)t^n = \frac{e_\lambda^x(t)}{1-t^\alpha},$$

$$\sum_{n=0}^{\infty} e_{n,\lambda}^{(\alpha)}(1,y)t^n = \frac{e_\lambda(t)}{1-yt^\alpha},$$

$$\sum_{n=0}^{\infty} e_{n,\lambda}(x)t^n = \frac{e_\lambda^x(t)}{1-t}.$$

Theorem 2 *The following difference operator rule holds:*

$$\Delta_{\lambda;x} e_{n,\lambda}^{(\alpha)}(x,y) = e_{n-1,\lambda}^{(\alpha)}(x,y). \tag{2.7}$$

Proof. Using (2.1), we observe

$$\sum_{n=0}^{\infty} \Delta_\lambda e_{n,\lambda}^{(\alpha)}(x,y)t^n = \frac{\Delta_\lambda e_\lambda^x(t)}{1-yt^\alpha}$$

$$= \frac{te_\lambda^x(t)}{1-yt^\alpha}$$

$$= \sum_{n=0}^{\infty} e_{n,\lambda}^{(\alpha)}(x,y)t^{n+1},$$

which gives the claimed result (2.7) by comparing the coefficients of the first and the last series with respect to t.

We provide the following recurrence formula.

Theorem 3 *The following recurrence relation*

$$e_{n+1,\lambda}^{(\alpha)}(x,y) = e_{n-u,\lambda}^{(\alpha)}(x,y)\sum_{u=1}^{\infty}\frac{(-1)^{u+1}}{u}\lambda^{u-1} + \sum_{k=0}^{\left\lfloor \frac{n+1}{\alpha}-1 \right\rfloor} e_{n-(k+1)\alpha+1,\lambda}^{(\alpha)}(x,y)\frac{y^{k+1}}{(n-(k+1)\alpha+1)!} \tag{2.8}$$

is valid for $n \in \mathrm{N}_0$.

Proof. By (2.1), we observe that

$$\sum_{n=0}^{\infty} e_{n,\lambda}^{(\alpha)}(x,y)\frac{d}{dt}t^n = \frac{d}{dt}\left(\frac{e_\lambda^x(t)}{1-yt^\alpha}\right)$$

$$= \frac{\left(1-yt^{\alpha}\right)\frac{d}{dt}e_{\lambda}^{x}(t)-e_{\lambda}^{x}(t)\frac{d}{dt}\left(1-yt^{\alpha}\right)}{\left(1-yt^{\alpha}\right)^{2}}$$

$$= \frac{1}{\left(1-yt^{\alpha}\right)^{2}}\left(\left(1-yt^{\alpha}\right)e_{\lambda}^{x}(t)\frac{\log(1+\lambda t)}{\lambda}+e_{\lambda}^{x}(t)yt^{\alpha-1}\right)$$

$$= \left(\frac{e_{\lambda}^{x}(t)}{1-yt^{\alpha}}\sum_{u=1}^{\infty}\frac{(-1)^{u+1}}{u}\lambda^{u-1}t^{u}+\left(1-yt^{\alpha}\right)\frac{e_{\lambda}^{x}(t)}{1-yt^{\alpha}}yt^{\alpha-1}\right)$$

$$= \left(\sum_{n=0}^{\infty}e_{n,\lambda}^{(\alpha)}(x,y)t^{n}\sum_{u=1}^{\infty}\frac{(-1)^{u+1}}{u}\lambda^{u-1}t^{u}+\sum_{n=0}^{\infty}y^{n+1}t^{n\alpha}\sum_{n=0}^{\infty}e_{n,\lambda}^{(\alpha)}(x,y)t^{n}t^{\alpha-1}\right)$$

$$= \left(\sum_{n=0}^{\infty}\sum_{u=1}^{\infty}e_{n,\lambda}^{(\alpha)}(x,y)\frac{(-1)^{u+1}}{u}\lambda^{u-1}t^{u+n}+\sum_{n=0}^{\infty}\sum_{k=0}^{\left\lfloor\frac{n}{\alpha}\right\rfloor}\frac{e_{n-k\alpha,\lambda}^{(\alpha)}(x,y)y^{k+1}}{(n-k\alpha)!}t^{n+\alpha-1}\right)$$

which gives

$$e_{n+1,\lambda}^{(\alpha)}(x,y) = e_{n-u,\lambda}^{(\alpha)}(x,y)\sum_{u=1}^{\infty}\frac{(-1)^{u+1}}{u}\lambda^{u-1}$$

$$+\sum_{k=0}^{\left\lfloor\frac{n-\alpha+1}{\alpha}\right\rfloor}e_{n-(k+1)\alpha+1,\lambda}^{(\alpha)}(x,y)\frac{y^{k+1}}{(n-(k+1)\alpha+1)!},$$

which means the asserted result (2.8).

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SEMANTIC AND FUNCTIONAL CHANGE OF SHOPPING AND FASHION IN THE AGE OF CONSUMER CULTURE

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Abstract
The general course of consumption behaviour and shopping behaviour has undergone a significant change following the Industrial Revolution. Towards the end of the 19th century, when production was prioritised, consumption became the main paradigm, and practices that encourage consumption and create new needs became widespread. The culture industry, which has become dominant thanks to mass media, has prioritised the creation of new needs, and this has led to the formation of a sector called fashion. Fashion, which was previously only in a narrow framework and for those with high socio-economic opportunities, has become a phenomenon that shapes and directs the consumption behaviour of the masses through mass media. The most characteristic feature of fashion, which determines the creation of new needs and the way these needs are met, is change. Change is a value glorified by today's dominant mentality. Clothes, automobiles, houses, mobile phones, white goods, furniture, physical appearance and even people, friendships, values, emotions, beliefs, which are indicators of an individual's tastes and material power, are the objects of change. Therefore, fashion is about everything. In the context of all these, fashion, in the shortest terms, is what is temporary. Something becomes fashionable only for a certain/limited period of time and then quickly becomes obsolete. Essentially, the process of becoming obsolete begins with something becoming fashionable. The idea of obsolescence is what enables something to be fashionable and unfashionable, that is, the rapid change that takes place in this process, in other words, the fashion trend to start the next trend. With this research, the semantic change, formation and functioning of the concept of fashion will be discussed.
Keywords: Fashion, Obsolescence, Obsolescence, Consumption.

Introduction

Capitalism, culture industry, consumer culture, fashion, advertising... all these are situations and phenomena that have a direct and strong relationship with each other. They have enveloped individual and collective mentalities and all areas of individual and social life. Capitalism represents the most dominant phenomenon among them all. The others fulfil their functions under the influence and control of capitalism in a cause-and-effect relationship or in support of each other. To make a statement on fashion, the subject of this chapter, *fashion* cannot exist in its present meaning and function without *capitalist* mentality and practices. The *culture industry*, which is a sub-element of capitalism, makes use of *advertising* while creating and popularising fashion. The ultimate goal of all these is *the culture of consumption. Consumption culture* motivates *capitalist* mentality and practices.

Fashion And Consumption

Now we can ask our main question: *What is fashion?* There is no standard definition of fashion that is accepted by everyone. Because it can have different definitions according to its scope and function. For this reason, many definitions have been made. New definitions continue to be made. The meaning and function of fashion may differ in different social structures according to the dominant mentality and lifestyles there. For example, socioeconomic status and situations can significantly change the meaning and function attributed to fashion. Similarly, changes in the acceptance and understanding of "consumption" can lead to changes in the meaning and function of fashion. Nevertheless, by taking into account the common features and commonly accepted meanings of the definitions, some determinations can be made about what fashion is, even in a general sense. Fashion, in the most general sense, refers to what is accepted and/or used by a certain group of people at a certain time and in a certain place. For this reason, the definition of *style and form in force* in dictionaries is meaningful. The determination of the *rule that temporarily regulates the use and shapes of ornaments, clothing, furniture, etc.* expressed by another definition expresses one of the common views on the scope of fashion. Many more definitions can be expressed based on different dictionaries and encyclopaedias. The origin of the word fashion can be seen as the right starting point to determine the meaning of fashion in order to reach the result in a short way without wandering between definitions. According to the common opinion, the origin of fashion is *mod*, which is a statistical term. *Mode refers to the most* repeated number among the numbers in a certain sequence. Therefore, fashion refers to the *most repeated thing, the common thing.* It is important

that fashion expresses the state of "prevalence". While a work, behaviour or appearance that is done by a person or a few people in a society and is out of the ordinary may be considered strange, the fact that that thing *becomes widespread and* is done/adopted by many people can lead to the normalisation of that thing. This situation points to fashion. Of course, there are some important criteria that shape the transformation of something from being considered strange to being liked and widely adopted. Personalities who are respected by the society/mass and therefore are models are the most important tools of this transformation. For this reason, *the culture industry,* since it is the shortest and easiest way to include a product in the consumption process, first of all produces model personalities or "star" individuals with popular nomenclature, and through these, it puts its products on the consumption market. The product is easily accepted through "stars". There are significant differences between being a person respected by society in the traditional sense and being a "star", which is a phenomenon of modern times. In traditional society, reputation is a requirement of being an exceptional personality that is appreciated and admired by the members of the society in line with the value judgements of the society. For example, a person can be a respected artist of the society with his/her long-standing and outstanding achievements. In the traditional mentality and society, being an artist is a characteristic that is a combination of special talent, great labour and outstanding achievement. Today, however, being a "star" does not require special talent, labour and success. When mass media advertise a person as a "star", it is possible to become a "star". In fact, most of the time, a person with no special talent, labour and achievement can suddenly be remembered as a "musician", "singer", "voice artist", "model", "mannequin" .... However, this in no way means that the "artist" or other titles of that person will have a long-lasting continuity. A person can shine in one moment and fade away in the next. For example, a person chosen by the culture industry can become a "star" with a song and then disappear after fulfilling the functions expected of him/her by the culture industry. As no one knew before, no one remembers him/her after he/she fades out. This "star's" being remembered and continuing his/her "stardom" is related to and limited to what the culture industry expects from him/her.

There is a linear relationship between the role of the culture industry in producing "stars" and fashion, which is the most important motivational tool of consumption that capitalism wants to make uninterrupted. Because there is a strong relationship between *fashion* and *being widespread.* However, although the fact that something is preferred by many people is important for it to be fashionable, this feature may not be enough to ensure that what is desired

to be widely consumed is fashionable. An example of this is the torn/worn jeans that are in fashion today. When the blouse was first invented in the USA, it was used by mine workers. The blousins used by the workers and worn out during long periods of hard labour were not considered fashionable in any way. Moreover, despite the fact that they were worn by a large mass of workers. However, as relatively high status groups, especially young people, began to dress more widely, the torn jeans became fashionable. This was done through "star" personalities who were modelled. Through them, young people and even non-young people started to wear torn/worn jeans and this became a widespread consumption behaviour. People could be directed to the desire of owning torn/worn jeans by paying more for them than for the good ones. A similar situation can be said for "old" clothes. In the old times, the torn, worn, partially dismantled clothes that the poor had to wear were not fashionable although they were worn by the poor on a mass level. This condition of those items was a result of unfavourable economic conditions. Today, however, torn, frayed and partially dismantled clothes have become fashionable through role models and individuals with high socio-economic conditions have been made to wear torn and dismantled clothes. Perhaps patched clothes will soon face a similar situation. Of course, if the people or businesses who decide what is fashionable decide to do so.If one of the important references in determining the meaning of fashion is "mod", the other is *modus*, which means "unformed border" in Latin. *Modus* contributes to understanding the meaning of fashion as well as its function. As it is known, fashion is something that changes easily and does not remain fixed/the same in any way. In the shortest terms, fashion is something that is temporary. Something becomes fashionab/e only for a certain/limited period of time and then quickly becomes *obso/ete.* In fact, when something becomes fashionable, the process of becoming obsolete also begins. The idea of *obso/escence is* what enables a thing to become fashionable and unfashionable, that is, the rapid change that takes place in this process, in other words, the fashion trend to start the next trend. For example, objects physically wear out over time depending on their qualities and usage. This is an expected and familiar situation. However, the traditional mentality and the modern mentality's understanding of *obso/escence* do not refer to the same meaning. From the point of view of the traditional mentality, the obsolescence of an object is due to the fact that it is physically unable to fulfil its basic function and deteriorates. However, from the point of view of this mentality, the obsolescence of an item does not require that the item be immediately thrown away or considered as "rubbish". The *old* item can be repaired and used again and again. Understandings that control consumption, such as *waste* and *saving* with the limited means available, can contribute to transforming the *worn-*

out item and maintaining its functionality, even if it has completed its actual useful life. In this respect, some familiar examples are clothes that are patched and worn, furniture that is repaired and sweaters that are dismantled and put back into use by mopping. It is understandable for elderly individuals with a traditional mentality to continue to keep any item that has lost its function with the understanding that "it will be needed one day". Because from the point of view of this mentality, throwing away items that can be repaired or throwing away objects that have economic value is considered as "rubbish" and is considered as *waste*. Waste is a behaviour that should be avoided. Therefore, according to this view, every item, even if *it is old,* has a use value. This is the requirement of the mentality in which *consumption* is not a value, instead *saving is recognised* as a value.On the other hand, the meaning attributed to "obsolescence" by the modern mentality, which represents the transition from the *old* to *the new* and makes *change* a fundamental value in this context, is completely different from the meaning attributed by the traditional mentality. In the modern mentality, it is not the case that things lose their physical function, wear out and become unusable. The meaning attributed to *obsolescence* by the modern mentality is directly related to the course of development of the capitalist mentality. In the early 20th century, as a result of the replacement of the principle of *production* with the principle of *consumption,* "spending" rather than "saving" or "preserving" was encouraged, while values such as "frugality" began to be perceived as *stinginess.* The thrifty, wasteful individuals of the past have been replaced by individuals with the mentality of *"I consume, therefore Iexist"* and the masses formed by these individuals. Instead of *stability, permanence* and *order,* transience and *change* have become the basic principle. The idea of *impermanence* and *disposability* has been developed and reinforced through adverts that manifest themselves at every corner of daily life with calls to *bring the old and take the new.* Being "disposable" and "discontinuous", which comes with the idea of *obsolescence,* has become a feature that reveals itself in its full form not only in clothes, household appliances, cars, accessories, furniture and houses, but also in human relations and preferences. The minds are now dominated by a distinction between what is appropriate and inappropriate for the times and conditions. When this idea is engraved in the consciousness with the concepts of "new" and "change", individuals who are motivated by the discourses of infinite *freedom of choice can,* for a small reason, remove friends, people or relationships that they do not like or that are no longer useful from their agenda and minds, and continue their lives as if they had never happened by opening a new page. As in the Greek philosopher Heraclitus' statement that the

only thing that does not change is change itself, change/abandonment is at the centre of the mentality of today's individuals and life in today's societies.

Fashion And Change

Change is a value glorified by today's dominant mentality. Clothes, automobiles, houses, mobile phones, white goods, furniture, physical appearance and even people, friendships, values, emotions, beliefs, which are indicators of the individual's tastes and material power, are objects of change. For today's individual, none of these have the importance and meaning to deserve to stay for a long time. Fashion is an important motivational tool that manages the process. Fashion keeps the desire for change alive through the understanding of *obsolescence* in a way that can be called continuous. Sociologist Roland Robertson (1938-2022) considered the adoption and spread of fashion as a five-stage process supported by social motivations. These stages consist of the following:

1) The adoption of what will become fashionable by agents, i.e. change leaders,

2) Social visibility and communicability,

3) Harmony within and between social systems,

4) Social cohesion and the market,

5) Becoming obsolete with the emergence of new fashion alternatives.

In addition, fashion represents the logic of planned obsolescence. Fashion is not only a necessity for the survival of the capitalist market, but also an important tool for the expansion of capital. Werner Sombart (1863-1941), who analysed the economic dimension of fashion within the capitalist system, defined fashion as the *favourite child of capitalism in* his work *Economy and Fashion* (Wirthschaft und Mode) published in 1902. According to him, fashion is a necessity to offer new fields and products to the capitalist market. It is a highly functional mechanism for making profit by making things, ideas, values, lifestyles, attitudes and behaviours, personalities, identities... constantly "obsolete". Within the scope of all these, the main characteristics of the fashion sector can be expressed under five headings:

Being short-lived: Fashion products are generally short-lived. The life of a fashion product is expressed in weeks or months. Fashion is recognised as a temporary and cyclical phenomenon. For this reason, it is known that the life curve of fashion clothing products is shorter than other

industries.*High variability:* The demand trend for fashion products is rarely constant or linear. Fashion products can be affected by seasons, famous people, trends.*Lowpredictability:* Due to the variability of demand, it is difficult to make sales and demand projections.*Highly motivated buying tendency:* Most of the purchasing decisions of consumers are made at the point of purchase. When the consumer encounters the product, he/she is encouraged to buy it.*Being similarising:* Today, although the fashion industry is multidimensional, multicultural, multicoloured and multivocal, as a result of globalisation, clothing and fashion culture has evolved into a similar structure among countries. In this respect, brands such as Zara, Berschka, Pull&Bear, H&M, Stradivarius, Mango, Vero Moda, TopShop, Koton and Batik function as actors of similarity of appearance.Attitudes and behaviours, preferences and tendencies that can be considered within the scope of fashion have been one of the unchanging features of social life. In all societies, senior executives and the people around them, especially family members, members of the socio- economically high class, and especially women have had different and variable preferences from the majority of the society. Fashion is a sociological phenomenon related to power holders and rich people before the 19th century. In the first quarter of the 20th century, it gained a mass character with a form and scope unprecedented in history. Class fashion has been replaced by consumer fashion. Instead of a single type of fashion determined by the upper classes, a fashion understanding that tends to include all layers of society has emerged. In the 20th century, developments in mass communication technologies led fashion to become widespread and prestigious in a way never seen in any period of history. In the 20th century, the phenomenon of dressing has covered the whole social life in a way that goes beyond culture and has become a part of the material and spiritual dimension of consumer culture. Through mass media, it has become an element that mobilises social change as well as a mirror of social life. However, in addition to fashion shows, fashion blogs and fashion magazines, other channels that are as effective as them have emerged in the dissemination of fashion. One of these channels is fashion magazines. In addition, the internet and social media platforms have assumed important functions in terms of the opportunity to spread fashion trends rapidly and to deliver visual images to wider audiences. Fashion influencers and celebrities who are effective on platforms such as Instagram, YouTube and TikTok popularise a certain body type, clothing style and beauty standards in a short time and have a strong influence on their followers to adopt these idealised images.

Scope of Fashion

The most basic expression of fashion is recognised as *clothing, dress* and *ornamentation.* Clothes are the most classic and basic product of fashion. Being a manifestation of people's personality and character, clothes are an observable form of behaviour. However, although clothes are the most visible form of fashion, fashion is a broader phenomenon. It is related to many different material and non-material contexts. The most important tool and even lever of fashion is advertising. Every day people are bombarded by visual advertisements that encourage them to buy certain products or services, which in turn creates and popularises fashion. However, these images also function as factors that influence attitudes, values, beliefs and behaviour. Fashion is inherently related to material contexts (furniture, architecture and automobiles, etc.) as well as non-material contexts (child-rearing techniques, art appreciation, etc.). In essence, fashion is not only concerned with the appearance of a person's body, but also with their behaviour, thoughts, feelings, emotions, knowledge, speech, agenda, interests... in short, the way they present themselves. For example, making personality analyses based on horoscopes, using slang words or gesticulating while speaking under the influence of some TV series and films can be things that are encountered as fashion elements. In this respect, the words of the famous fashion designer Coco Chanel (1883-1971) are important in terms of expressing the scope of fashion: *Fashion is not something that exists only in clothes, fashion is something in the air we breathe. It is a wind, you feel it coming, you smell it. Fashion is about ideas, lifestyles, what is happening.* The basis of fashion culture is capitalism, which is driven by an unlimited and irresponsible drive for material profit. The rulers of the capitalist mentality, who deliberately declare the contents of existing wardrobes *obsolete* and *outdated*, have succeeded in turning people into slaves dependent on themselves through fashion; they have first and foremost influenced young people and women. Nowadays, even young people who do not have enough money for a bagel to fill their bellies consider following fashion as an indispensable condition and try to follow fashion as much as possible. Young people with no economic means walk around hungry, they feel cold because they have no clothes to protect themselves from the cold, but they try to have something fashionable; sometimes it is perfume, sometimes it is a branded clothing, and lately most of the time it is a mobile phone. Because it is through these that the young person feels his/her existence and makes his/her peers feel it.

The modern mentality and lifestyle has placed the human being as the "subject" at the centre of the "God-centred" existence and lifestyle of the previous, traditional period. This subject, on

the other hand, manifests the things constructed and characterised by the culture industry in all the units of the system at the centre of which it sits. For this reason, the mass society and its individuals value fragmentation instead of unity and harmony, pleasure and desire instead of reason. In addition, modernity prefers not the sacred but the profane embodied in itself. In this respect, while entering into a conflict with the sacred, it also presents itself as a taboo. This presentation manifests itself most clearly in fashion rituals. For example, the fact that fashion shows are presented in a ritual/ritual atmosphere, that fashion provides its followers with a belonging with transcendental references, that the members of this belonging display the appearance of a "faith community", that they think, dress and live in the same style... points to fashion's effort to create a *sacred* space around itself. Through fashion, the profane is given a sacred spirit and appearance. For this reason, Barnard's definition that *fashionable clothing and clothing items are the most fetishproductsproducedandconsumedin capitalist society* is very meaningful. According to Andrew Greeley, an American clergyman, it is enough to visit any car fair today to watch a religious ritual. When one goes to the place where automobiles are exhibited, it will be seen that fashion presenters are treated as people with immunity like clergymen, and the products are treated as aesthetically and ethically indisputable taboos.

Conclusion

In addition to all these, the following should also be stated: The planned rapid *obsolescence of* consumer goods through fashion provides capitalist capital with billions of dollars every year. This makes capitalism always strong and effective. It is possible to clearly see how this process works in the individuals of the consumer society who see consumption as the only way of expressing themselves and use the brands they use instead of their identity. It would be misleading to see this as merely a situation that enables consumers to prefer the products they need. This operates through an idea/value that is embedded in the consciousness of consumers in their human relations and perspectives on life, and is reflected in their behaviour. The philosophy of *carpe diem*, which invites individuals to cut their ties with the past, not to take the future into account and to turn towards the present moment, and to enjoy the moment, drags consumers to further stages and contributes to the establishment of the *disposable* logic from products to human relations, from nature to working life.

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TRANSFORMATION PROCESS OF SHOPPING SPACES AND SHOPPING CENTRES

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Abstract

Among the places where people's shopping activities were shaped before the Industrial Revolution, the agora of Ancient Greece, the market area or city squares of the Middle Ages are important in terms of the functions they fulfil. In addition to being places where commercial activities were carried out and shopping was carried out to meet needs, they were also places where political or cultural activities were carried out and where individuals socialised extensively. They were the heart of social life. In fact, this situation has never completely ended, and especially city squares, with their increasingly narrower and shallower functions, have maintained the features they inherited from history until today, albeit in a diminishing form. However, with the Industrial Revolution, the first signs of change began to be seen in the primary space of production-consumption relations. In the first stage, department stores, which can be considered as the pioneers of shopping centres, started to be seen. These stores fulfilled important functions for a while as places where comfortable shopping could be done, where the products offered for sale were offered to the consumer under favourable conditions and exhibited to encourage consumption. As of today, shopping malls, which have become a centre of attraction with their many elements, are living centres that host many of the activities that individuals and masses feel the need for or feel the need for. These places have become places where the heart of urban life beats with their multifaceted functionality such as shopping, entertainment, eating and drinking, worshipping, doing sports, leisure time, watching movies in the cinema, spending time with friends, spending the weekend with the family, window shopping, socialising, following fashion with their units such as shops, cinema, bank, restaurant, patisserie, cafeteria, hairdresser, pharmacy, place of worship, entertainment or sports venue, playground. With these multifaceted functions, they appeal to all segments of the society from the highest income level to the lowest income level and attract everyone's attention. In this respect, they are micro spaces of daily life. With this research, the meaning and functions of shopping centres, which represent the last stage of the change process of shopping spaces, in the context of consumption culture will be discussed and evaluations will be made regarding the process.

Keywords: Shopping, Consumption, Shopping places, Shopping centres.

Introduction

The Industrial Revolution has an important place in the formation of the modern mentality and lifestyle, to put it in terms of shaping the process, disregarding the philosophical and scientific heritage of several centuries. The Industrial Revolution, which led to many changes in people's mentality and in their individual and social lives, and the urban life that accelerated and intensified thanks to it, significantly changed the production-consumption relations and caused these relations to be reflected in other areas of individual and social life, rather than being limited to the economic field as before. Changes in working life, the emergence of the traffic problem, new meanings attributed to consumption, the emergence of the concept of "leisure time" and proposals and initiatives regarding its content, the search for alternative spaces for the needs shaped by the new mentality and lifestyle... have been the determinants of radical changes and innovations in the course of humanity.

Emergence of Shopping Centres

Before the Industrial Revolution, among the places where people's shopping activities were shaped, the agora of Ancient Greece, the market area of the Middle Ages or the city squares are important in terms of the functions they fulfil. In addition to being places where commercial activities were carried out and shopping was carried out to meet needs, they were also places where political or cultural activities were carried out and where individuals socialised extensively. They were the heart of social life. In fact, this situation has never completely ended, and especially city squares, with their increasingly narrower and shallower functions, have maintained their features inherited from history until today, albeit in a diminishing form. However, with the Industrial Revolution, the first signs of change began to be seen in the primary space of production-consumption relations. In the first stage, *department stores*, which can be considered as the pioneers of shopping centres, started to be seen. These stores fulfilled important functions for a while as places where comfortable shopping could be done, where the products offered for sale were offered to the consumer under favourable conditions and exhibited to encourage consumption. The growth of cities, the increase and intensification of the population, the emergence of the traffic problem, the emergence of the concept of leisure time in general and holidays in particular due to the regulations in working life, the emergence of the need to engage in as many activities as possible in limited free time... all these have led to the inadequacy of city centres and the search for alternative spaces has emerged. Although the spaces that were the product of these searches responded to the needs, albeit with difficulty,

until the 1950s, this was not found sufficient. Victor Gruen (1903-1980) was the planner of the first shopping centre with its present form and function in the United States based on the existing problems and demands. According to him, there was a need for a place of escape for people who were overwhelmed by the traffic problem and the boredom of daily life. Due to the fact that the city centres had lost their functions to a great extent with the division of life and spatial construction into different activity areas in cities, he thought that there was a need for places where new social activities were concentrated and designed the first shopping mall. In 1954, he designed the first suburban open-air shopping facility called Northland Mall. In addition to shops, it was designed as a complex of apartment blocks, schools and health facilities, with its own large park and lake. This complex was never completed, but the idea of this complex space design was original. Victor Gruen continued to design new spaces with some additions and subtractions. The second mall Gruen designed was the Southdale Shopping Centre in Minnesota. He designed it as an enclosed space for both vendors and consumers, where social activities were carried out together, going beyond mere shopping activities. Others followed. By the mid-1970s he had designed more than fifty shopping centres in the USA. Each space was planned in more detail than the previous ones. Thus, he reached the shopping centre design that brings together the functions that the busy and complex lifestyle of today's modern city makes individuals feel the need or desired to feel in their daily lives under a single homogeneous roof.

Structural Features of Shopping Centres

As of today, shopping malls, which have become centres of attraction with their many elements, are living centres that host many of the activities that individuals and masses need or feel the need for. These places have become places where the heart of urban life beats with their multifaceted functionality such as shopping, entertainment, eating and drinking, worshipping, doing sports, leisure time, watching movies in the cinema, spending time with friends, spending the weekend with the family, window shopping, socialising, following fashion with their units such as shops, cinema, bank, restaurant, patisserie, cafeteria, hairdresser, pharmacy, place of worship, entertainment or sports venue, playground. With these multifaceted functions, they appeal to all segments of the society from the highest income level to the lowest income level and attract everyone's attention. In this respect, they are micro spaces of daily life.

The main factor that is often unrecognised in the functioning of shopping malls is the phenomenon of *leisure time*, which is a product of the Industrial Revolution. While*production*

and *work* were at the forefront in the early days of the Industrial Revolution, *leisure time* based on consumption was built as an important living space in the following period. Following the Industrial Revolution, *working time* and *rest time* were completely separated from each other as two separate living spaces. However, in traditional life, working life and rest time were intertwined; there was no such separation. With this separation, the social structure based on production and work was replaced by a new social structure based on consumption and leisure time. Capitalism, which is the subject of the process, while reshaping production and consumption through its own paradigm, has designed that individuals who use their time for production should also have private time for consumption. Non-working time, which is created through regulations on working life, is designed as a field of activity based on consumption. For this reason, leisure time activities have been commodified and functioned as a tool of hegemonic planning rather than being seen as a time to spend leisure time resting. Consumption became the main activity of the process. In this respect, thanks to *the institution of leisure time* built under the conditions of the Industrial Revolution, *consumption* has ceased to be a means of sustaining life and has become an end in itself. This has functioned as an important means of dominating the understanding that people should *live to consume rather than consume to live.*

Today, the act of shopping and consumption has social and symbolic contents such as having fun, leisure time, acquiring status, achieving an idealised lifestyle and obtaining prestige. In terms of the modern mentality, consumption has emphasised the meanings attributed to products rather than their properties and functions, and in some cases even completely. The "mass society", which is constructed with the help of mass media and is open to all kinds of manipulation, and whose sociality is questionable in every respect, has been transformed *into a society of consumption.* The *consumer society,* which is constructed with the desires of large companies engaged in mass production and through the advertising-fashion tools of mass media, gains meaning as the name of an extremely shallow and largely formal structure compared to the natural/real social structure. This structure is a structure whose main function is to consume, where not only consumption commodities but also identities, spaces, lifestyles, cultural elements, images, meanings, values, time and almost everything else are perceived as objects of consumption. Consumption has ceased to be the result of an act of shopping to satisfy mostly physiological needs and has become a phenomenon that is supported and directed through fashion and advertisements in line with the aims of the capitalist economy, and in which

consumed objects are used as identity and status indicators. Both the constructor and the supporter of this phenomenon is the capitalist mentality. Just as every society has a culture, a culture has been invented for *the consumption society,* and unlimited consumption tendencies to obtain the symbols dressed in consumption objects, and the lifestyle shaped around consumption behaviours that diversify every day have formed the basis of this culture. The modern urban individual has become the ideal type of *consumption society* and *consumption culture.* This individual consumes in order to have the sense of identity offered to him/her and to live according to who he/she wants to be perceived as.

Consumption culture is a necessity of not seeing consumption activity only as the consumption of commodities. Consumption culture refers to a mentality and lifestyle related to the purpose and manner of obtaining the commodities consumed, the way they are used and the norms and value system emerging in this process. The use of an object because of its ability to satisfy a need and being found valuable in this respect is a very normal and routine feature in terms of human behaviour. Here, the subject is the human and the object is the product consumed. However, consumer culture gains meaning as the name of a situation that disrupts this hierarchy. In this case, people become objectified and things become subjectified. Karl Marx's (1818-1883) conceptualisations of alienation and fetishism are important as one of the first to recognise this situation. Another social scientist György Lukacs (1885-1971) made a similar evaluation while reaching the concept of *reification* through what Marx expressed with alienation and fetishism. Whatever the conceptualisations expressing the subversion of the hierarchy in question, what is expressed expresses the differentiation of the connection that should be in the relationship between man and things. In other words, while the thing produced for use becomes the basic reference of a system of values, the human being, who should be the subject, becomes objectified and ordinary. However, the thing that becomes subjective in consumer culture is essentially the thing produced by human beings for human beings. To give an example of how this happens; when a person sees a state-of-the-art technological product, if he starts to see that technological product as a value in itself, as a basic reference that will increase his own value if he owns it, rather than the feature related to the function of that product, this is a problematic relationship and corresponds *to the culture of consumption.* In Marx's conceptualisation, the person in this situation becomes "alienated" from his/her own essence/humanity, and the object that enables this alienation gains the quality of a fetish. In the same way, the fact that money, which is an intermediary in the purchase of commodities,

becomes a measure of value is shaped according to the functioning of the process envisaged by the consumption culture. At this stage, it is meaningful that Ivan Illich (1926-2002) defines *consumer society as a* type of society in which life is organised around commodities and social progress is measured by the power of access to these commodities, or Zygmunt Bauman considers *consumer culture as a* type of society in which the exchange value of commodities disappears and the function of commodities as indicators comes to the fore instead of their utility function.

Consumption Culture and Shopping Centres

For the modern and therefore urban individual, being different from everyone else, and demonstrating this difference with his appearance, especially in terms of clothing and attire, eating and drinking places, the tools and equipment he uses, and the social environment he is in contact with, constitutes one of the targeted goals of the idealised lifestyle. He strives to be different from those around him with the visible brand name of his clothing, the neighbourhood of his residence, the brand and model of his car, the country and region he goes on holiday, the popularity of the food he eats, the subjects he is interested in, his circle of "friends", the way he speaks... This situation leads to an endless struggle to *be recognisable*, and all their efforts are shaped on the axis of being different and staying different. As a result of the increased accessibility of consumption commodities and the tendency to spread to all segments of the society, the current situation of the socioeconomically upper segments has become questionable, which has necessitated the continuous reconstruction of *differentiation* tendencies through fashion, which triggers and accelerates *being different.* The widespread access to all kinds of clothes as a stage of this situation has pushed *the privileged segments* who tend to be different to expose themselves with a nudity in which only the genitals are covered, or to exhibit behaviours that reveal their differences through appearing in such art activities. The paradox of *differentiation* and *sameness leads to* an endless consumption motivation. In this respect, shopping malls function as spaces of the capitalist commodity system cycle *that* both *segregates* and *replicates.*As places where an *ostentatious* lifestyle is embodied in all its dimensions in accordance with *the* requirements *of the consumption culture,* shopping malls make life easier for the members of the consumption culture by offering all the products required by *ostentatious symbolic consumption as well as* products that will meet all the needs that can be considered as *compulsory* such as food and clothing. Offering a wide variety of products in different stores that meet all kinds of needs together allows people to shop in accordance with their lifestyles,

identities and status. Special security personnel, devices and inspections create a safe environment and provide protection from external factors that may harm individuals. People have the understanding and confidence that they breathe in a highly controlled and disciplined life during their stay there. In shopping centres, it is clear where to enter and exit and what to do. These are dictated to individuals in the form of unwritten rules. In these places where individuals stay as long as they can, showcases create a visual space that they cannot break away from. The perception that the individual can spend his whole life if he wants is successfully dictated. There is something for everyone. People's interests, feelings of pleasure and desires are constantly provoked. In addition to these, the fact that shopping malls offer colourful brands and different lives causes people to be psychologically affected; shopping malls function as a means to get away from external problems. Individuals numb their problems or take a break by visiting the colourful showcases in the shopping malls. In shopping centres, there is virtually "nothing to find", all stores and "needs" are waiting for their customers in magical boxes.

Shopping Centres and Religious Rituals

The fact that shopping malls have become a centre of attraction of consumption that constantly renews itself and does not lose anything from its attractiveness in this respect has been possible thanks to planning carried out in a highly rational manner. Among the objective, emotional and functional elements that make shopping malls the centres of attraction of consumption culture, the fact that they are gigantic and easily accessible places, their eye- catching showcases that stimulate feelings of need, the fact that they are offered with opportunities to meet many different needs at the same time, and the use of credit card shopping facilities that facilitate spending and transfer payments to the future are important attraction features. In a sense, the roads in shopping centres, which have the appearance and function of a micro city, constantly direct people to the stores depending on the architectural tricks that highlight the showcases of the stores and present them to the attention of the consumer. The arrangement of the space is realised in such a way that the individual will increase the time he/she will spend in the shopping mall and thus, he/she will feel the need by seeing what he/she does not need. The internal flow in the space is realised through labyrinth-like circulation areas, enabling consumers to encounter the maximum number of products and shopping opportunities. The escalators, which are located in the same direction but not end-to-end and used for vertical connection, are planned to allow people to walk around and thus see more stores. What is more important and

interesting is that consumption is not directly presented in these spaces. Entertaining activities and shows are attached before and next to the consumption activity, and campaigns presented as special opportunities successfully fulfil the functions of directing consumption. Shopping in shopping centres is no longer just an act of purchasing. Entertainment, aesthetics, image and belonging have become effective elements of purchasing. With the addition of entertainment to the meaning of shopping, the distinction between shopping and entertainment has almost disappeared. Thus, consumption is transformed into an act of pleasure, a recreational activity. With the establishment of shopping centres, shopping has become an effective element of purchases such as entertainment, aesthetics, image and belonging. With the addition of entertainment to the meaning of shopping, the distinction between shopping and entertainment has almost disappeared.*A lifestyle* is offered to individuals in shopping centres. This is a lifestyle envisaged by capitalism and designed by the culture industry. The masses are directed towards the modern mentality and lifestyle through these places, the relations and transactions in these places. These spaces of production-consumption relations, which seem to put the human being at the centre, but where the intellectuals and representatives of the consumer culture are the subjects and the masses are the objects, are places where rationalism, hedonism, change, individualism, materialism, secularism... appear in accordance with the requirements of modernity. With these characteristics, they are concrete and functional examples of modernity's function of being an "anti-religion religion". Modernity, which is built on anti-religion (Catholicism/Church) and presents itself as a religion in many respects by taking its "enemy" as a model, transforms itself into a "religion of science" in educational institutions, a "religion of pleasure/entertainment" in daily life, or a belief/religion system of "sexuality", "violence", "physical power" ... in different places and environments. In this respect, Ivan Illich was one of the first and important figures to draw attention to the functions of shopping centres outside the production-consumption relationship. While defining the consumer society as a type of society in which life is organised around commodities and social progress is measured by the ability to access these commodities, he emphasised the "slavery of consumption", although the implication of "religion" is also quite strong in this determination. The American sociologist George Ritzer, on the other hand, used the term "religion" directly. As Ritzer expressed in his book *Enchanting the Disenchanted World,* shopping centres are the "cathedrals" of the "religion of consumption". He had no difficulty in finding traces of the forms and worship of the Abrahamic religions (Judaism- Christianity-Islam) in shopping centres. He likened shopping centres to places of pilgrimage. To extend his metaphor a bit; shopping malls function as the

place of worship of the modern/secular individual. In the standardised rituals here, it is possible to find traces of the weekly prayers and pilgrimages of the three Abrahamic religions. Individuals who are believers *of the religion of consumption have* a feeling of spiritual emptiness if they do not visit the shopping centre one day a week, similar to the worship of Jews on Saturday, Christians on Sunday and Muslims on Friday. Due to the conditions of working life, this is usually at the weekend. This situation is important in terms of giving the shopping centre "visit" the form of weekly worship. However, the similarity in question is by no means due to the fact that the visit in question is made once a week, but due to the meaning and function attributed to that "visit". The modern/secular individual, who is restless when he/she does not perform his/her "weekly worship[M], returns home after his/her "worship" in a state of "peace of mind". The relationship of the modern individual with shopping centres is also reminiscent of the pilgrimage rituals of the three Abrahamic religions. In the pilgrimage worship of all three religions, there are rituals such as walking around (tawaf) the object/place of pilgrimage (e.g. the Kaaba), venerating a certain building or object in the centre of the pilgrimage site with respect and love (contemplation/zikr), anointing the building or object in the centre of the pilgrimage site (Hajar al-Aswad) .... The modern individual also walks around the shops in shopping centres, which are the "cathedrals" of the "religion of consumption", admires the shop windows/items (reverence), anoints the objects (touching them, trying them on...) and leaves the place in a "purified" way.

Conclusion

Shopping centres are the *magical* places of today. It represents an association in which "magic", which is thrown out of life due to rationality and secularism, the basic principle of modernism, is also activated where necessary. Those who look into its "eyes" fall under its influence and follow it unconsciously. For this reason, George Ritzer (b.1940) likened being in places of consumption such as shopping malls to the situation of a child who imagines himself in a place where everything is made of sugar and can easily reach those candies, and emphasised the *fascinating* aspect of shopping malls. However, there is also a negative side to this; just like the spooky things, ghosts and witches in the child's imaginary space, there are things in this space that have the potential to turn beautiful dreams into nightmares. These are personal impossibilities that exceed the means and power of purchase and therefore can only be watched, which in turn leads to the destruction of the integrity of the psyche. This castle of dreams, where

almost every product and service of the world of consumption can be accessed, represents the realm of nightmares with its unaffordability as well as its accessibility.

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YÜKSEK PERFORMANSLI SİGORTA ACENTELERİNİN ORTAK BAŞARI FAKTÖRLERİNİN BELİRLENMESİ ÜZERİNE BİR DEĞERLENDİRME

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Özet
Bu çalışmanın temel amacı yüksek performanslı sigorta acentelerinin ortak kritik başarı özelliklerinin neler olabileceği konusunda bir değerlendirme yapmaktır. Dünyanın birçok ülkesinde sigortacılık sektörü devletin yasal olarak belirlemiş olduğu sınırlar çerçevesinde uygulanmaktadır. Sigorta şirketlerinin kuruluşundan, tasfiyesine kadar, sigorta ürünlerinin dağıtımından hasar işlemlerine kadar tüm süreçler kanun, yönetmelik, tarife ve talimatlar, genelgeler ve uygulama tebliğleri ile belirlenmektedir. Sigorta acentelerinin de kuruluşundan, tasfiyesine kadar tüm iş ve işlemlerin her biri yasal olarak tanımlanmış ve tüm sigorta acenteleri için eşit koşulları kapsamasına rağmen nasıl oluyor da sigorta acentelerinin bazıları çok başarılı olabilirken, bazıları ise iflasın eşiğine gelebilmektedir? Aradaki fark/farklar nerelerden kaynaklanmaktadır? Bu kapsamda temel araştırma sorusu "yüksek performanslı sigorta acentelerinin ortak kritik başarı faktörleri nelerdir ve gelecekte nasıl olacaktır?" şeklinde belirlenmiştir. Çalışmada, nitel araştırma yöntemi kullanılarak, literatürde yer alan ampirik ve teorik ikincil verilerden yararlanılmıştır. İlgili literatürde dünyada ve Türkiye'de yapılmış konuyla ilgili seçilmiş araştırma sonuçlarına göre başarılı sigorta acentelerinin ortak özellikleri incelenmiştir. Çalışmanın sonuçlarına göre, sigortacılık sektöründe başarılı sigorta acentelerini diğerlerinden ayırt eden ortak faktörler tespit edilmiştir. Bu ortak faktörler arasında sigorta acentelerinin insan kaynakları yönetim uygulamalarında AMO (Yetenek, Motivasyon ve Fırsat) teorisi olarak da bilinen faktörlerin önemli bir rol oynadığı tespit edilmiştir. Bir başka ifadeyle, sigorta acentesi çalışanlarının gerekli becerilere sahip olduklarında, yeterince motive olduklarında ve iş atmosferlerine katılma fırsatlarına sahip olduklarında, iyi performans gösterdiklerinde, sigorta acentesinin başarısında kritik bir rol oynadığı tespit edilmiştir.
Anahtar Kelimeler: Sigorta, Sigortacılık, Sigorta Acenteleri, AMO Teorisi

AN EVALUATION ON DETERMINING COMMON SUCCESS FACTORS OF HIGH-PERFORMANCE INSURANCE AGENCIES

Abstract
The main purpose of this study is to make an assessment of what the common critical success characteristics of high-performance insurance agencies might be. In many countries of the world, the insurance sector is implemented within the limits legally determined by the state. All processes, from the establishment of insurance companies to their liquidation, from the distribution of insurance products to damage transactions, are determined by laws, regulations, tariffs and instructions, circulars and implementation communiqués. Although all business and transactions of insurance agencies, from their establishment to their liquidation, are legally defined and cover equal conditions for all insurance agencies, how come some of the insurance agencies can be very successful, while others can be on the verge of bankruptcy? Where do the difference(s) arise? In this context, the main research question is "What are the common critical success factors of high-performance insurance agencies and how will they be in the future?" It was determined as. In the study, empirical and theoretical secondary data in the literature were used by using qualitative research method. The common characteristics of successful insurance agencies were examined according to the results of selected research on the subject in the relevant literature, conducted in the world and in Turkey. According to the results of the study, common factors that distinguish successful insurance agencies from others in the insurance industry have been identified. Among these common factors, it has been determined that factors also known as AMO (Ability, Motivation and Opportunity) theory play an important role in the human resources management practices of insurance agencies. In other words, it has been found that insurance agency employees play a critical role in the success of the insurance agency when they have the necessary skills, are sufficiently motivated and have the opportunity to participate in their work atmosphere, and perform well.
Keywords: Insurance, Insurance, Insurance Agencies, Amo Theory

Giriş

Bu çalışma yüksek performanslı sigorta acentelerinin ortak kritik başarı faktörlerinin neler olabileceğine odaklanmıştır. Diğer bütün şirketlerde olduğu gibi sigorta şirketlerinin de başarısının temelini oluşturan faktörler her şirket için farklılık arz etmektedir. Bir başka ifadeyle her şirketin tüm alanlarında ve faaliyetlerinde başarısını garantileyen ortak bir başarı kriterleri seti mevcut değildir. Her şirketin faaliyet göstermiş olduğu alanlarda geçerli olabilecek performans göstergeleri farklı olabilir. Şirketler önceden belirlenmiş olan bu performans kriterlerine göre faaliyetlerini sürdürürken ortaya koyacakları çaba onların başarı veya başarısızlıklarını belirleyecektir. Bu sebeplerden dolayı ortak kritik başarı faktörleri hakkında genelleme yapmak çok zordur. Şimdiye kadar yapılan araştırma ve çalışmalarda kritik başarı faktörlerini analiz etme ve tanımlama girişimlerinde, her bir alanın spesifik özellikleri, örneğin, üretim ve hizmetler, faaliyette bulunulan sektör, pazar ve bu pazardaki rekabet ilişkileri son kullanıcıların gereksinimleri ve tercihleri, teknolojik başarı ve başarısızlıklar gibi bir çok etken ve unsurun belirleyici rol oynadığı tespit edilmiştir (Selimović, 2020). Diğer yandan her ne kadar günümüze değin yapılan araştırmalarda ortak başarı faktörleri belirlenmiş olsa da covid 19 pandemisi ve sonrasında yaşanan gelişmeler daha önceden tespit edilmiş ortak kritik başarı faktörlerinin değişmiş olabileceği varsayımını da gündeme getirmektedir. Çünkü pandemi ile birlikte tüm sektörler de olduğu gibi sigortacılıkta da iş yapma biçimleri değişmekle birlikte acentelerin o dönemde (covid-19) ayakta kalma stratejileri henüz tam olarak akademik çalışmalara yeterince yansımamıştır. Bu sebeplerden ötürü günümüzde yüksek performanslı sigorta acentelerinin ortak kritik başarı faktörlerinin neler olabileceğinin belirlenmesi ayrı bir önem kazanmaktadır. Zira, böyle bir çalışma hali hazırda sigorta acenteleri için bir kılavuz görevi görmesinin yanında onların daha uzun süre hayatta kalmalarına zemin hazırlayabilecektir. Bilindiği üzere, günümüzde sigorta sektöründe faaliyette bulunan tüm aktör ve paydaşların her türlü süreç ve faaliyetleri devletin kontrolü ve müdahalesi altındadır. Bir başka ifadeyle sigorta şirketleri ve sigorta acentelerinin kuruluşundan, tasfiyesine kadar, sigorta ürünlerinin üretilip dağıtımından risk gerçekleşmesi sonucu hasar işlemlerine kadar tüm süreçler kanun, yönetmelik, tarife ve talimatlar, genel şartlar, genelgeler ve uygulama tebliğleri ile belirlenmektedir. Hal böyle olunca, söz konusu mevzuat ve düzenlemeler tüm sigorta acenteleri için eşit koşulları kapsamasına rağmen nasıl oluyor da sigorta acentelerinin bazıları çok başarılı olabilirken, bazıları ise iflasın eşiğine gelebilmektedir? Aradaki fark/farklar nerelerden kaynaklanmaktadır? Bu belirlenmiş olan araştırma sorusu çerçevesinde şimdiye kadar yapılan çalışmalara göre, yüksek performanslı sigorta acentelerinin ortak kritik başarı

faktörleri ve günümüzde ve gelecekte de geçerli olabilecek nitelikteki faktörlerin değerlendirilmesi, çalışmanın temel içeriğini oluşturmaktadır. Çalışmada, nitel araştırma yöntemi ile kavramsal ve teorik incelemeler yapılmıştır. Sistematik ve kapsamlı bir literatür araştırması ile ampirik ve teorik ikincil verilerden yararlanılmıştır. İlgili literatürde dünyada ve Türkiye'de yapılmış konuyla ilgili seçilmiş araştırma sonuçlarına göre başarılı sigorta acentelerinin ortak özellikleri incelenmiştir. Ayrıca yönetim ve danışmanlık firmalarının, sektörlerin geleceğine yönelik hazırlamış oldukları raporlardan yararlanılarak bugün ve gelecekte sözkonusu ortak başarı faktörlerine hangilerinin eklenebileceği konusundan çıkarımlar yapılmaya çalışılmıştır. Çalışmada elde edilen sonuçlara göre, yüksek performanslı sigorta acentelerinin ortak olabilecek özelliklerine yönelik bir değerlendirme yapılmıştır. Buna göre, acentelerin mevcut insan kaynakları yapısı, yetenekleri, bilgi düzeyleri, faaliyet bölgelerindeki fırsatları görme ve değerlendirme kabiliyetleri ön plana çıkmıştır. Yapılan tespitlerde günümüzde insan kaynakları yönetim uygulamalarında AMO (Ability-Motivation-Opportunity/Yetenek, Motivasyon ve Fırsat) teorisi olarak da bilinen faktörlerin sigorta acentelerinin yüksek performanslı olmalarında en önemli unsurlardan biri olduğu tespit edilmiştir.

2.Çalışma Alanı

2.1.Sigorta, Sigorta Şirketleri ve Sigorta Acenteleri

Bilindiği üzere, sigorta sektöründe faaliyette bulunan şirketler, olası risklerin gerçekleşmesi sonucu meydana gelebilecek ekonomik kayıpların telafi edilmesinde önemli rol oynayan kurumlardır. Sigorta şirketleri gerek kendileri gerekse sigorta aracıları üzerinden müşterilerine sigorta sözleşmesi (Poliçe) düzenleyip satarak prim geliri elde ederler. Toplanan bu primlerle büyük fonlar oluşturulmakta ve riskler gerçekleştiğinde meydana gelen ekonomik kayıplar poliçe şartları gereğince hak sahiplerine ödenmektedir. Risk yönetim tekniklerinden biri olan sigortacılık dünyanın birçok ülkesinde devletin yasal olarak belirlemiş olduğu sınırlar çerçevesinde uygulanmaktadır. Sigorta hizmetleri, sigorta endüstrisi için ayırt edici olan diğer bazı hizmetlerin yanı sıra, herhangi bir hizmetin tipik özelliklerine sahiptir. Aslında sigorta hizmeti, sigortalı kişinin potansiyelin sigorta şirketine duyduğu güvene dayanmaktadır (Selimović, 2020). Sigorta, birey veya kurumların ileride meydana gelebilecek (sözleşme süresi içinde) muhtemel çeşitli risklerin neden olabileceği ekonomik kayıpların karşılanmasını sağlayan bir sistemdir (Dalkılıç, 2010; Gupta, 2011; Rejda, 2005). Bu sistemde, riski bir prim karşılığında üzerine alan tarafa "sigortacı", belli bir prim karşılığında riski sigortacıya devreden tarafa "sigortalı veya sigorta ettiren", sigortacı ile sigortalı/sigorta ettiren arasında yapılan

anlaşmanın yazılı haline ise "sigorta poliçesi" denilmektedir (Cesur, 2023). Bu sistemde sigorta şirketleri poliçeleri isterlerse kendileri direkt olarak müşterilere satabilecekleri gibi çeşitli sigorta aracıları vasıtasıyla da satabilmektedirler. Bu aracılardan biri de sigorta acenteleridir. Sigorta şirketlerinin nam ve hesabına sigorta poliçelerinin hazırlanması ve satışına aracılık eden "Sigorta acenteleri" sigorta sözleşmelerinin hazırlanması ve satışını belli bir komisyon karşılığında yapan gerçek veya tüzel kişilerdir (Cesur, 2023).Günümüzde tüm sektörlerde oyunun kurallarının değiştiği söylenebilir. Özellikle covid-19 pandemisi ve sonrasındaki yaşanan değişimler diğer alanlarda olduğu gibi, sigortacılık sektöründe de önemli değişimlerin yaşanmasına neden olmakta ve bu değişim halen tüm hızıyla devam etmektedir. Pandemi öncesi ve sonrası olarak bakıldığında başta müşteriler olmak üzere, pazarlardaki tüm paydaşların istek ve beklentileri, iş yapma yöntem ve usülleri gibi şirketlerin başarı performanslarını etkileyecek gelişmeler yaşanmaktadır. "*Artık hiçbir şey eskisi gibi olmayacak"* şeklinde klişeleşmiş bir deyim olan bu ifade neredeyse tam da bu durumu özetlemektedir.

2.2.Kritik Başarı Faktörleri Kavramı

Kritik başarı faktörleri kavramı ilk olarak 20. yüzyılın ikinci yarısında yazılan makalelerde tanımlanmış ve *"birey, departman veya organizasyon için tatmin edici sonuçların başarılı rekabet performansını garanti edeceği sınırlı sayıda alan" olarak* tanımlanmıştır (Selimović, 2020). Kritik başarı faktörleri, işin gelişmesi ve yöneticinin hedeflerine ulaşması için işlerin yolunda gitmesi gereken birkaç temel alandan biridir. Boynton ve Zmud (1984) kritik başarı faktörlerinin "önemli/yüksek performansın elde edilmesini sağlayacak şekilde özel ve sürekli ilgiyi hak eden yönetsel veya organizasyonel faktörler" olduğunu belirtmektedir. Bunlar, mevcut faaliyetlerin başarısının yanı sıra gelecekte de başarıya ulaşmanın önemli temelidir. Diğer bir ifadeyle bu faktörler bir kuruluşun başarılı olabilmesi için odaklanması gereken faktörlerdir. Sanvido ve ark. (1992) kritik başarı faktörlerini "başarıyı gösteren hedeflere ulaşmak ve yönetmek için işin kritik/kaçınılmaz olarak tanımlanan yönleri" olarak tanımlamaktadır. Selimoviç (2020) bu faktörlerin genellikle üretim süreçleri, çalışanların organizasyonel ve kişisel becerileri gibi alanlarda bulunduğunu ileri sürmektedir.

2.3.AMO Yaklaşımı

AMO yaklaşımı (Ability-Motivation-Opportunity/Yetenek, Motivasyon ve Fırsat), yüksek performanslı insan kaynakları yönetimi için "bir firmanın sürdürülebilir rekabet avantajı elde etmesini sağlamak için çalışanların becerilerini, motivasyonunu ve katılımını teşvik etmek için tasarlanmış bir İKY uygulamaları paketi" olarak açıklanmaktadır (Kremmydas ve Austen, 2020). Bu yaklaşım modeli çalışan performansını belirleyen değişkenleri temel almaktadır.

Konuyla ilgili çalışma yapan araştırmacılar, yetenek, motivasyon ve fırsatın birbiriyle ilişkili olduğu ileri sürülmektedirler (Blumberg ve Pringle, 1982). AMO modelinin kökenleri, endüstriyel psikoloji perspektifinden gelmektedir (Beltrán-Martín ve Bou-Llusar, 2018; Kremmydas ve Austen, 2020; Lawshe, 1945). Bu modele göre, yetenek (A-Ability) ve performansın aynı zamanda çalışan motivasyonuna (M-Motivation) bağlı olduğu ve fırsatların (O-Opportunity) bu yüksek performansın ortaya çıkarılmasında önemli olduğu vurgulanmaktadır (Beltrán-Martín ve Bou-Llusar, 2018; Kremmydas ve Austen, 2020). AMO yaklaşımının, "A" boyutu, çalışanların işlerini yürütme yeteneklerini ifade ettiği, yani, bireysel çalışanların sahip olduğu bilgi, beceri ve yetenekler olarak tanımlandığını ve çalışanların değerlendirmesi olarak ifade edilen mesleki öz-yeterlik yapısıyla yakından bağlantılı olduğu vurgulanmaktadır. "M" boyutunun ise çalışanların işyerinde çaba harcama istekliliğini yansıtan bir dizi çalışan tutumunu ve etkisini yani motivasyonunu içerdiğini bir başka ifadeyle "davranışı yönlendiren, harekete geçiren ve sürdüren gözlemlenemeyen bir güç" olduğu ifade edilmektedir. AMO yaklaşımının, "O" boyutunun ise "çalışanların yeteneklerinin ve çabalarının sonuçlara dönüştürülebileceği araçları yansıttığını" belirtilmektedir (Beltrán-Martín ve diğ., 2017; Kremmydas ve Austen, 2020). Sonuç olarak AMO yaklaşımı, "A" bileşeninin çalışanların katkıda bulunma yeteneklerini, "M" bileşeninin bu yetenekleri ne ölçüde kullanmaya istekli olduklarını ve "O" bileşenin de bireysel düzeydeki fırsat boyutu, genel anlamda becerilerini işlerinde kullanma ve firmanın başarısına katkıda bulunma şanslarını yansıtan özerkliği, görevin önemini ve çalışanların işte algıladıkları etkiyi içerdiğini ifade etmektedir (Beltrán-Martín ve Bou-Llusar, 2018; Kremmydas ve Austen, 2020).

2.4.Sigortacılıkta Kritik Başarı Faktörleri

Farokhain ve Sadeghi, (2011) de çalışmalarında günümüze kadar sigortacının başarısının kritik faktörleri arasında sunulan hizmetin kalitesi, müşterilerin memnuniyet derecesi ve müşterilerin sadakatinin yer aldığını, ancak, günümüzde pazardaki tüm değişiklikler dikkate alındığında yakın gelecekte sadakatin yerini, sunulan hizmetin müşteriye uygun olup olmadığına ilişkin değerlendirmelerin yer alacağını iddia etmektedir. Zealley ve diğ., (2018) da sigorta şirketlerinin önemli kritik başarı faktörleri olarak, motive edilmiş nitelikli insan gücü, beceriler, bilgi ve kaynaklar olduğunu belirtmiştir. Kulkarni, (2015) çalışmasında "her pazarlama faaliyetinin müşteriyle başlayıp ve müşteriyle bittiğini" belirterek, müşterilerin bir pazarlamacı için nihai hedef olduğunu vurgulamıştır. Bir şirketin pazarlama çabalarının başarısının, dağıtım ağına hakimiyetine bağlı olduğunu belirten yazar, pazarlama kanallarının, bir ürün veya hizmetin kullanıma veya tüketime hazır hale getirilmesi sürecine katılan birbirine bağlı

kuruluşlar kümesi olduğunu ileri sürmüştür. Yazar çalışmasında telekomünikasyon ve bilgisayar teknolojisindeki gelişmelerin, hizmet sunumunda birçok yeni yaklaşımı teşvik etttiğini sigorta sektörünün de bundan yakından etkilendiğini, sigorta şirketlerinden müşterilere uzanan dağıtım kanalındaki sigorta acentelerinin kendilerini yenileyerek yeni başarı ölçütlerine sahip olmaları gerektiğini savunmuştur.Akpınar (2018) çalışmasında sigorta sektöründe MİY'in önemli konuma gelmesiyle birlikte şirketlerin müşterileri hakkında daha fazla bilgiye ihtiyaçları olduğunu ve müşterilerini iyi tanıyan ve müşterilerini iyi analiz eden şirketlerin MİY uygulamalarında da oldukça başarılı olacakları ifade etmiştir. Bunun yeni ekonomide işletmelerin rekabet avantajı sağlayacağı ideal bir yönetim yaklaşımı olduğunu açıklayan yazar, günümüz koşullarında müşterilerini tanıyan, onlara özel kişiselleştirilmiş ürün veya hizmet sunabilen, onları bir değer olarak işletmenin merkezine koyan ve süreçlerini bu doğrultuda oluşturan sigorta şirketleri müşterileri için daha fazla değer sunarak sadakat yaratmakta ve uzun dönemli karlılık elde edecekleri vurgulamaktadır. KPMG'nin raporuna (2019) göre, Insurtech'in sigorta sektöründe yenilikleri tetikleyerek, çevrimiçi sigortanın hızlı gelişimini sağladığı vurgulanmaktdır. Diğer yandan yaşanan bu değişimlerle fiyatlandırma ve sigortalamadan dağıtım ve hak taleplerine kadar çeşitli iş süreçlerinde yeni uygulamalar gelişmekte ve sektörün yenilikçi yeteneklerinin yeni boyutlara ulaşmakta olduğu ifade edilmektedir. Bu durumda sigorta acentelerinin de yeni teknikleri benimseyerek, kendi performanslarını arttırmaları için yeni kapıların açıldığı ifade edilmektedir.Kaesler ve diğ., (2020) çalışmalarında, covid-19 pandemisinin, birçok sektörlerde ve coğrafyalarda insanların birbirleriyle etkileşimini derinden etkilediğini belirterek, sigortacılıkta birçok işlemin dijital ve uzaktan kanallara kaydığını ifade etmişlerdir. Yazarlar çalışmalarında günümüzde sigorta acentelerin, eskisinden farklı yeni yol ve yöntemler bulmasının zorunluluğuna dikkat çekmiştir. Yazarlar çalışmalarında Nisan 2020'de Alman sigorta acenteleri arasında yapılan (tecritten dört hafta sonra gerçekleştirilen) bir anket sonuçlarına göre, sigorta acentelerinin yaklaşık yarısının yeni işlerde yüzde 40'tan fazla düşüş yaşadığını, Mayıs 2020'de ABD bir grup sigorta acenteleri arasında yapılan bir ankete göre de benzer bir etkilerin çıktığını ifade etmişlerdir. Yapılan araştırmaya göre, acentelerin neredeyse yüzde 50'si, uzaktan yeni müşteri ilişkileri kurmanın covid-19 sırasındaki en büyük zorluk olduğunu belirtmişlerdir. Yazarlar çalışmalarında önceden yüksek performans gösteren sigorta acentelerinin pandemi sonrasında işlerinin azalmasına işaret ederek, yeni normalde farklı başarı kriterlerinin ortaya çıktığını belirtmişlerdir.Selimović, (2020) çalışmasında, sigorta şirketinin performansını etkileyen unsurları araştırmıştır. Yazar çalışmasında, sigorta şirketinin büyüklüğü, geleneği ve imajı, yani

itibarı, pazardaki konumu ve başarısı, yönetimin kalitesi ve yeteneği, modern yönetim yöntemlerinin kullanımı, değişim yönetimi, bilgi yönetimi ve risk yönetimini tanıtma ihtiyacının şirketin performansını yakından etkilediğini belirtmiştir. Yazar ayrıca, çalışmasında, satış gücünün özellikleri, yani motivasyonları özelleştirme ve müşteri odaklı süreçlere yani süreç kişiselleştirme ve iyi iletişim odaklı olarak sunulan hizmetlerin kalitesi, sayısı ve farklılığı gibi özelliklerin de şirket performansı için önemli olduğunu açıklamıştır. Bu bağlamda sigorta şirketlerinin kritik başarı faktörleri olarak, müşterilerin ihtiyaç duyduğu hizmetin sağlanması için gerekli olan tüm faktörlerin, yani şirketin finansal performansıyla ölçülebilen başarısını etkileyebilecek tüm değişkenler olduğunu tespit etmiştir. Śmietanka ve diğ., (2021) çalışmalarında, günümüzde yaşanmakta olan dijital değişimlerin, sigortacılıkta yapay zeka tabanlı analizlerin, sigorta şirketlerinin sigorta ürünlerini kişiselleştirmelerine ve mevcut müşterilerin ihtiyaçlarına daha iyi yanıt vermelerine olanak tanıdığını belirtmişlerdir. Yazarlar çalışmalarında sigorta şirketlerinin yeni işler yapmalarına yardımcı olacağını ileri sürerek, sigorta sektöründe makine öğrenimi tekniklerinden yararlanmanın fırsatlarını açıklamışlardır. Yazarlar çalışmalarında yaşanacak bu teknolijik yenilikler ile sigorta acentelerinin de müşteri çekme ve elde tutma konusunda etkili stratejiler geliştirmelerinin önemine değinmişlerdir. Bunun için de yeni dönemde yeni normal için yeni performans yeteneklerinin kazanılması gerektiğini savunmuşlardır.Svoboda (2021) çalışmasında, pandemi ve sonrasında gündeme gelen dijitalleşme ile birlikte, özellikle de hizmet sektöründe büyük değişiklikler ve geçişlerle birlikte çevrimiçi satın alma ve işlemlerin, dijital platformlar aracılığıyla yapılamaya başlandığını vurgulamıştır. Yazar çalışmasında temel bulgu olarak, sigorta acenteleri için böyle bir duruma kendilerini dijital süreçlere adapte etmelerinin rakiplerine göre farklar oluşturacağını ileri sürmektedir. Ayrıca yazar çalışmasında araştırmasının sonuçlarına göre, pandemi sonrasında oluşan yeni normalde sigorta acentelerinin farklı ekosistemlerde faaliyet göstermek zorunda olacaklarından dolayı diğer acenteler ile ortaklıklar kurmaya odaklanmalarını, acentelerin ekip olarak çalışmaya teşvik edilmelerinin ve hibrit veya çok kanallı bir dağıtım modeli oluşturmaları durumunda yüksek performanslı konuma geçebileceklerini ifade etmektedir.HBW Leads ekibinden kıdemli bir satış temsilcisi olan Bondaug-Win (2021), başarılı sigorta acentelerinin sahip olduğu on alışkanlığı, nasıl çalıştıklarını ve bunları profesyonel yaşamda nasıl uygulanabileği konusunda şunları belirtmektedir:

Günlük Rutin Oluşturulması: Günlük bir rutine sahip olmak, başarılı sigorta acentelerinin zamanlarını yönetmelerine ve fırsatlar ortaya çıktığında esnek olmalarına olanak tanıyan bir yapı sağlar.

İyi Bir Satış Temsilcisi: Birçok sigorta acentesi her şeyi kendi başına halletme alışkanlığını edinir. Oysa başarılı sigorta acenteleri görevlerinin çoğunu asistanlara ve meslektaşlarına devretmektedir.

Stres Yönetimi: Sağlıklı stres yönetimi başarılı sigorta acenteleri için önemli bir alışkanlıktır. İhtiyaçlarına uygun bir iş-yaşam dengesi geliştirmeye çalışmak, "Çalışma" saatleri ile "ev" saatlerinin ayrılması gibi.

Hedefleri Belirleyin ve Takip Edin: Kişisel, profesyonel ve ekip hedeflerini belirlemek, büyümeye yardımcı olacak değerlendirme araçları oluşturmak, acente performansını önemli oranda artırabilecektir.

Başarılı İnsanlarla İletişim İçinde Olmak: Başarılı acenteler ister kişisel olarak ister sosyal medyadan takip ettiğiniz kişiler olsun, hep çevrsindeki başarılı kişileri takip ederler. Başarılı acenteler başarılı meslektaşlarıyla güçlü ilişkiler kurarlar.

Tavsiye ve Rehberlik: Bazı acenteler için rehberlik istemek yenilgiyi kabul etmek anlamına gelmektedir. Esasen bu yanlış bir düşüncedir.

Her Yerde İlişkiler Kurmaya Özen Göstermek: Bir sigorta acentesi olarak ağ kurmak yalnızca konferanslara ve çalıştaylara gitmek ve diğer sigorta acenteleriyle konuşmaktan ibaret değildir.

Öğrenmeye Devam Etmek: Neredeyse her kaynağın parmaklarınızın ucunda olduğu bir zamanda, kendi eğitiminize yatırım yapmaya devam etmek önemlidir.

Sosyal Becerilere İnce Ayar Yapılması: İletişim, problem çözme, organizasyon ve eleştirel düşünme gibi sosyal becerilerinizi yeniden gözden geçirin. Bir takımda çalışıyorsanız iletişim ve problem çözme egzersizleri yapma fırsatı olabilir.

Teknolojiyi Kucaklamak: Başarılı sigorta acentelerini ve diğer uzmanları takip ederek rutinlerine hangi araç ve yazılımları uyguladıklarını öğrenin. Sizin için anlamlı olanları benimseyin. Kalıpların dışında düşünün ve diğer sektörleri ve kullandıkları yazılımları inceleyin.

Cesur (2023) çalışmasında, sigorta acenteleri üzerinde yapmış olduğu saha araştırmalarından elde edilen verileri tematik analiz yöntemiyle değerlendirerek, sigorta acentelerinin hayatta kalma becerilerini belirlemeye çalışmıştır. Yazar, çalışmasında yüksek performanslı en başarılı sigorta acentelerinin ortak özelliklerinin, *acente-şirket arası ilişkiler, adaptasyon, bilgi düzeyi*

ve paylaşımı, sorun çözme kabiliyeti, müşteri memnuniyeti ve kanıksanmışlık olarak açıklamıştır. Cesur, çalışmasında başarılı ve uzun ömürlü sigorta acentelerinin ortak özelliklerinden en göze çarpanlarının ise sorun çözme kabiliyetine sahip, değişimlere hızlı cevap verebilen, sürekli kendilerini geliştiren nitelikli kadroların işin başında olduğu acenteleri işaret etmiştir. Uluslararası Sigorta Denetçileri Birliği tarafından yayınlanan direktiflere göre (Insurance Authority, 2024). Sigorta acenlerinin yasalara uygun bir şekilde faaliyet gösterebilmeleri için aşağıda belirlenmiş olan kriterlere dikkat etmelerini önermişlerdir. Bir anlamda yetkili bir sigorta acentelerinin ortak başarı kriterleri olarak tanımlanabilecek bu faktörler şunlardır:

- Yetkili bir sigorta acentesi, dürüst, etik ve doğrulukla hareket etmelidir.
- Müşterilerine her zaman adil davranmalı ve onların çıkarlarına en uygun şekilde hareket etmelidir.
- Özen, beceri ve titizlikle hareket etmelidir.
- Uygun düzeyde mesleki bilgi ve deneyime sahip olmalı ve yalnızca acentenin gerekli yetkinliğe sahip olduğu düzenlenmiş faaliyetleri yürütmelidir.
- Müşterilere bilinçli kararlar verebilmeleri için doğru ve yeterli bilgi sağlamalıdır.
- Düzenlenmiş tavsiyesi, müşterinin koşulları dikkate alınarak müşteriye uygun olmalıdır.
- Çıkar çatışmalarını önlemek için en iyi çabayı göstermeli ve bu tür çatışmalar önlenemediğinde, acente, müşterilere her zaman adil davranılmasını sağlamak için bunları uygun açıklamalarla yönetmelidir.
- Acente tarafından alınan veya acentenin mülkiyetinde olan müşteri varlıklarını korumak için yeterli güvenlik önlemlerine sahip olmalıdır.

Accenture tarafından hazırlanan rapora (2024) göre, yüksek performanslı sigorta acentelerinin yapması gereken iş ve eylemler şu şekilde sıralanmıştır:

- Yeni nesil sigorta müşterilerinin değişen davranış ve beklentilerine uyum sağlamak.
- Zorlu pazar ortamında müşterileri elde tutmaya odaklanmak.
- Çapraz satış ve üst satış yaparak müşterilerin “Gümüş” ten “Platin” e yükseltmek.
- Temsilcileri yeni müşteri türüne uygun hale getirmeye odaklanmak.
- Temsilcilerin uygun pazar segmentine odaklanmasını sağlamak.
- Yaşlanan müşteri popülasyonu için bir geçiş stratejisi geliştirmek.
- Hedef pazarlara ilişkin bilgi edinmek.

- Müşterileri doğru kanallara yönlendirmek.
- Müşterileri doğru ürünlere yönlendirmek.
- Temsilcileri doğru ürün için, doğru pazardaki doğru müşteriye yönlendirmek.

Slayton Search Partners'in (2024) hazırlamış olduğu rapora göre, sigorta sektöründe dijital dönüşüm, sigortacı ve müşteri çıkarlarının birleşmesi için yeni fırsatlar sunmaktadır. Sigorta şirketleri, araç telematik cihazları, kondisyon takip cihazları, elektrokardiyogram (EKG) monitörleri gibi yeni veri toplama araçlarından da yararlanarak poliçelerini hazırlayıp uygulamaya koyabilmektedirler.

3.Materyal ve Yöntem

Çalışmada, nitel araştırma yöntemi ile kavramsal ve teorik incelemeler yapılmıştır. Nitel veri analizi, dilsel (veya görsel) materyalin araştırmanın amacı doğrultusunda yorumlanması ve sınıflandırılmasıdır (Flick, 2022; Kara, 2015). Yazar araştırmasında sistematik ve kapsamlı bir literatür araştırması ile ampirik ve teorik ikincil verilerden yararlanılmıştır. Bilindiği üzere, literatür taraması belirli amaçları gerçekleştirmek veya konunun doğası ve nasıl ele alınması gerektiği hakkında belirli görüşleri ifade etmek için belirli bir bakış açısıyla yazılmış bilgi, fikir, veri ve kanıt içeren, konuyla ilgili mevcut belgelerin seçimi, incelenmesi ve bu belgelerin önerilen araştırmayla ilişkili olarak etkin bir şekilde değerlendirilmesi sürecidir (Bowen 2009; Kara, 2015). Araştırmacı çalışmanın amacı doğrultusunda ilgili literatürde dünyada ve Türkiye'de yapılmış konuyla ilgili seçilmiş araştırma sonuçlarına göre başarılı sigorta acentelerinin ortak özellikleri incelemiştir. Ayrıca yönetim ve danışmanlık firmalarının sektörlerin geleceğine yönelik hazırlamış oldukları raporlardan yararlanılarak bugün ve gelecekte sözkonusu ortak başarı faktörlerine hangilerinin eklenebileceği konusudan çıkarımlar yapmaya çalışılmıştır. Bilindiği üzere ikincil verilerin analizi, birincil verilerin analizi kadar yaratıcı olabilir ve araştırmacının analitik hayal gücünün akıllıca kullanılmasını destekleyerek sonuçlara ulaşmasını sağlayabilir (James 2012; Kara, 2015).

4.Bulgular ve Tartışma

Çalışmanın kavramsal çerçevesinde de belirtildiği üzere, sigorta acentelerinin esas yaptıkları iş, faaliyet bölgelerinde sigorta şirketlerinin nam ve hesabına sigorta poliçelerin tanıtımı, pazarlanması ve satışı ile ilgili çalışmalar yapmaktır. Yani bir tür hizmet pazarlamasına ait iş ve işlemleri yürütmektedir. Bu acentelerin bir kısmı faaliyet bölgelerinde başarılı olup yüksek cirolar ve satış komisyon gelirleri elde ederken, diğerleri ise benzer başarıyı göstermekten

yoksun kalmaktadırlar. Bu aradaki farkların hangi faktörlerden kaynaklandığının araştırıldığı bu çalışmada cevabını aradığımız temel araştırma sorularından biri "yüksek performanslı sigorta acentelerinin ortak kritik başarı faktörleri nelerdir?" şeklinde belirlenmiştir. Bir diğer araştırma sorusu ise bugün ve geleceğe yönelik, yani "bundan sonra yüksek performanslı sigorta acentelerinin ortak kritik başarı faktörleri neler olacaktır?" şeklinde belirlenmiştir. Yapılan inceleme ve araştırmalardan elde edilen tespitler Tablo 1'de yer almaktadır. Yine çalışmanın kavramsal çervesinde belirtildiği üzere belirlenmiş olan bu sözkonusu kritik başarı faktörlerinin tüm sigorta acenteleri için mutlak geçerli olacağını ileri sürmek mümkün değildir. Zira her acentenin içinde bulunduğu faaliyet bölgesi, kendi iç yapısı, çalışanlarının ve müşterilerinin demografik, ekonomik ve sosyolojik özellikleri gibi birçok farklılıklar söz konusudur. Elde edilen bulguların bu çerçevede değerlendirilmesi önem arz etmektedir.

Tablo 1: Sigorta Acentelerinin Kritik Başarı Faktörleri

Yazarlar/Yıl	*Kritik Başarı Faktörleri*
Farokhain ve Sadeghi, (2011)	*Sunulan hizmetin kalitesi, müşterilerin memnuniyet derecesi ve müşterilerin sadakati, hizmetin müşteriye uygun olup olmadığı, çalışanların sahip olduğu beceriler, bilgi ve kaynaklar.*
Kulkarni, (2015)	*Dağıtım ağına, telekomünikasyon ve bilgisayar teknolojisindeki gelişmelere hakim olmak.*
Zealley ve diğ., (2018)	*Beceriler, bilgi ve kaynaklar, nitelikli ve motive edilmiş insan gücü.*
Akpınar (2018)	*MİY uygulamalarına özen göstermek, müşterilerini iyi analiz etmek, müşterilerine kişiselleştirilmiş ürün veya hizmet sunabilmek, sadık müşteri oluşturmak.*
KPMG'nin raporu (2019)	*Insurtech, yapay zeka ve yeni teknikleri benimsemek, personelin dijital becerilerle donatılması, yenilikçi yeteneklerin şirkete kazandırılması.*
Kaesler ve diğ., (2020)	*Dijital ve uzaktan çalışma kanallara adapte olmak, eskisinden farklı yeni yol ve yöntemler bulmak, dijital becerilere sahip personele sahip olmak.*
Selimović, (2020)	*Şirketinin büyüklüğü, geleneği ve imajı, itibarı, pazardaki konumu ve başarısı, yönetimin kalitesi ve yeteneği, modern yönetim yöntemlerinin kullanımı, değişim yönetimi, bilgi yönetimi ve risk yönetimini tanıtma, satış gücünün özellikleri, yani motivasyonları özelleştirme ve müşteri odaklı süreçlere yani süreç kişiselleştirme ve iyi iletişim odaklı olarak sunulan hizmetlerin kalitesi, sayısı ve farklılığı.*
Śmietanka ve diğ., (2021)	*Yapay zeka ve makine öğrenimi tekniklerinden yararlanmak, müşteri çekme ve elde tutma konusunda etkili stratejiler geliştirmek, çalışanlara yeni normal için yeni performans yetenekleri kazandırmak.*
Svoboda (2021)	*Dijital süreçlere adapte olmak, diğer acenteler ile ortaklıklar kurmaya odaklanmak, acentelerin ekip olarak çalışmaya teşvik edilmesi ve hibrit veya çok kanallı bir dağıtım modeli oluşturmalarını sağlamak.*
Bondaug-Win (2021)	*Acentelerde günlük rutinlerin oluşturulması, iyi bir satış temsilcisi/temsilcilerine sahip olması, stres yönetimi ve uygulamalarına hakim olması, hedeflerin belirlenmesi ve takip edilmesi, acente sahibini ve çalışanlarının başarılı insanlarla iletişim içinde olması, müşteriye tavsiye ve rehberlik konusunda destek ve kılavuz olmak, acente sahibi ve çalışanlarının her yerde sosyal ve iş ilişkileri kurmaya özen göstermesi, acentede görevli herkesin öğrenmeye ve kendini geliştirmesine devam etmesi, sosyal becerilere sahip olmak, acentedeki tüm çalışanların Insurtech gibi teknolojilere hakim olması.*
Cesur (2023)	*Acente-şirket arası ilişkilere özen göstermek, adaptasyon konusunda acente sahibi ve çalışanlarının her türlü yasal, teknolojik, ekonomik ve sosyal değişimlere hızlı ve etkili uyum sağlaması, bilgi düzeyi ve paylaşımı konusunda duyarlı olmak, karşılaşılan sorunlar karşısında hızlı ve etkili sorun çözme kabiliyetine sahip olmak, müşteri memnuniyetine azami ve sürekli olarak özen göstermek ve müşteriler nezdinde işini iyi yapan bir acente olarak kanıksanmış olmak.*
Uluslararası Sigorta Denetçileri Birliği (Insurance Authority, 2024).	*Yetkili bir sigorta acentesi, dürüst, etik ve doğrulukla hareket etmelidir. Müşterilerine her zaman adil davranmalı ve onların çıkarlarına en uygun şekilde hareket etmelidir. Özen, beceri ve titizlikle hareket etmelidir. Uygun düzeyde mesleki bilgi ve deneyime sahip olmalı ve yalnızca acentenin gerekli yetkinliğe sahip olduğu düzenlenmiş faaliyetleri yürütmelidir. Müşterilere bilinçli kararlar verebilmeleri için doğru ve yeterli bilgi sağlamalıdır. Düzenlenmiş tavsiyesi, müşterinin koşulları dikkate alınarak müşteriye uygun olmalıdır. Çıkar çatışmalarını önlemek için en iyi çabayı göstermeli ve bu tür çatışmalar önlenemediğinde, acente, müşterilere her zaman adil davranılmasını sağlamak için bunları uygun açıklamalarla yönetmelidir. Acente tarafından alınan veya acentenin mülkiyetinde olan müşteri varlıklarını korumak için yeterli güvenlik önlemlerine sahip olmalıdır.*
Accenture (2024)	*Yeni nesil sigorta müşterilerinin değişen davranış ve beklentilerine uyum sağlamak. Zorlu pazar ortamında müşterileri elde tutmaya odaklanmak. Çapraz satış ve üst satış yaparak müşterilerin "Gümüş"ten "Platin"e yükseltmek. Temsilcileri yeni müşteri türüne uygun hale getirmeye odaklanmak. Temsilcilerin uygun pazar segmentine odaklanmasını sağlamak. Yaşlanan müşteri popülasyonu için bir geçiş stratejisi geliştirmek.* *Hedef pazarlara ilişkin bilgi edinmek. Müşterileri doğru kanallara yönlendirmek. Müşterileri doğru ürünlere yönlendirmek. Temsilcileri doğru ürün için, doğru pazardaki doğru müşteriye yönlendirmek.*
Slayton Search Partners (2024)	*Sigorta şirketlerinin, araçlar, telematik cihazları, kondisyon takip cihazları, elektrokardiyogram (EKG) monitörleri gibi yeni veri toplama araçlarından yararlanarak poliçelerini hazırlama tekniklerini öğrenmek ve uygulamak, nitelikli insan gücü ihtiyacını karşılamak.*

Kaynak: Yazar tarafından oluşturulmuştur.

5.Sonuçlar

Araştırmadan elde edilen bulgulara göre, yüksek performanslı sigorta acentelerinin müşterileri anlamak konusunda hünerli olduklarını söylemek pek yanlış olmayacaktır. Başarılı sigorta acentelerinin müşterilerden hangilerinden en büyük karı elde edeceğini, hangilerinin üst ve çapraz satışa uygun olduğunu, bu müşterilerin hangilerinin en sadık ve hangilerinin en büyük kaçış riskiyle karşı karşıya olduğunu anlamakta yetenekli oldukları ön plana çıkmıştır. Bir başka ifadeyle, sigortacı, bir müşterinin elde tutulup tutulmayacağına, buna değer olup olmadığını ve en değerli müşterileri kazanmak ve elde tutmak için nasıl bir yol izleyeceğini konusunda bilgi ve yetenek sahibidir.Elde edilen bir diğer bulgu ise, yüksek performanslı sigorta acentelerinin doğru pazarları hedefleyerek kendi performansları üzerinde pozitif bir etki yapacak şekilde çalışmalarıdır. Bir başka ifade ile bu sigorta acenteleri bu tür belirli müşterilere ve segmentlere göre uyarlanmış büyüme stratejileri ile belirli bir bölgenin potansiyeline göre iş yapmaktadırlar. Bir anlamda bu sigorta acenteleri, bir bölgedeki hangi müşteri segmentlerine hangi ürünlerin sunulması gerektiğinin yanı sıra pazarlama kaynaklarının en iyi şekilde nasıl tahsis edilebileceğini belirlemekte yeteneklidirler. Şüphesiz bu durum acentenin satışlarında yüksek performansa ulaşmalarını kolaylaştırmaktadır.Araştırma sonucuna göre, elde edilen bir diğer bulgu ise, sigorta acentelerinin doğru sigorta satış temsilcilerini işe alma ve onları doğru bir şekilde görevlendirmelerdir. Acente performansını artırabilecek yüksek performanslı satış gücüne sahip olan sigorta acenteleri diğerlerine karşı önemli bir avantaj yakalamaktadır. Özellikle de acentenin istikrarlı, deneyimli yetenek havuzuna erişmesi ve en son teknoloji ve araçlarından yararlanmayı bilen işgücü onu diğer acentelerin önünde yer almasında önemli rol oynamaktadır. Elde edilen bulgular bir bütün olarak değerlendirildiğinde tespit edilen hususların en ortak özelliği ise, AMO yaklaşımı olarak da bilinen İK uygulamalarının yüksek performanslı sigorta acentelerinde çok önemli olduğu tespit edilmiştir. Çalışmanın kavramsal çerçevesinde de açıklandığı üzere, söz konusu bu yaklaşımında, çalışanların işlerini yürütme yeteneklerinin, yani, bireysel çalışanların sahip olduğu bilgi, beceri ve yetenekleri şirket performansını yakından etkilemektedir. Diğer yandan çalışanların işyerinde çaba harcama istekliliği, motivasyonu ve en önemlisi, bütün bunları değerlendirebileceği fırsatların acente performansını diğer unsurlardan daha fazla etkilediği tespit edilmiştir.Araştırma kapsamında cevabı aranan bir diğer soru ise, “bundan sonra yüksek performanslı sigorta acentelerinin ortak kritik başarı faktörleri neler olacaktır?” şeklinde belirlenmişti. Yapılan incelemeler sonucunda bugün ve gelecekte sigorta acentelerinin her şeyden önce sağlam bir kurumsal yapıya sahip olup, dijital çağın gerektirdiği tüm aksiyonları hızlı bir şekilde bünyesine adapte etme

kabiliyetine haiz olması gerekmektedir. Şüphesiz Cesur'un (2023) da belirttiği gibi, acente-şirket arsındaki ilişkiler acentenin yüksek performans göstermesinde ilk sırada yer almaktadır. Acente sahibi ve çalışanlarının değişimlere hızlı uyumu ve bu değişimlere etkili cevap verebilme yetenekleri ikinci derecede önem arz etmektedir. Üçüncü sırada da acente personelinin AMO yaklaşımı çerçevesinde çalışanların bilgi, beceri ve yeteneklerinin sürekli geliştirilmesinin yanında, motivasyonlarının yüksek tutulması ve son olarak da ortaya çıkacak fırsatları değerlendirme kapasiteleri yer almaktadır.Sigorta acentelerinin başarılı olanları hakkında yapılan çalışmaların çoğu pandemi öncesine dayanmaktadır. Günümüzde (pandemi sonrası) başarılı sigorta acentelerinin ortak özelliklerini açıklayan bir çalışmaya yapılan literatür çalışmalarında rastlanmamıştır. O yüzden konu hakkında yeni araştırmalara ihtiyaç olduğu söylenebilir. Bu çalışma böyle bir ihtiyacın giderilmesine katkı sağlayabilir. Bir başka ifade ile bu çalışma diğer araştırmacılar için bir davet anlamı taşımaktadır.

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BORSA İSTANBUL GAYRİMENKUL FAALİYETLERİ SEKTÖRÜNÜN NAKİT, BORÇLANMA VE KÂRLILIK DURUMUNUN İNCELENMESİ

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Özet
Bu çalışmanın amacı; gayrimenkul sektörünün Türkiye'deki mali durumunu incelemektir. Bu incelemeyi gerçekleştirmek için BİST Gayrimenkul Faaliyetleri Sektörü'ne kayıtlı 3 firmanın nakit, borçlanma ve kârlılık rasyoları hesaplanmıştır. Çalışmanın örneklem yılı, 2018-2022 yılları arasını kapsayan 5 yıllık zaman dilimidir. Çalışmada BİST Gayrimenkul Faaliyetleri Sektörü'nde 3 işletme bulunmaktadır. Bunlar; Adese Gayrimenkul, İhlas Gayrimenkul ve Sönmez Filament işletmeleridir. Çalışmada ayrıca bu işletmelerin piyasa değerleri de incelenmiştir. Sonuç olarak; işletmelerin hangi yıllarda nakit düzeylerinin daha düşük veya yüksek olduğu, borçlanma durumları ve kârlılıkları tespit edilmiştir. Bu tespite göre firmalara politika önerileri sunulmuştur.
Anahtar Kelimeler: Gayrimenkul Sektörü, Nakit, Borçlanma ve Kârlılık Oranları

REVIEW OF CASH, DEBT AND PROFITABILITY SITUATION IN ISTANBUL STOCK EXCHANGE REAL ESTATE ACTIVITIES SECTOR

Abstract
The aim of this study is to examine the financial situation of the real estate sector in Turkey. Cash, debt and profitability ratios of 3 companies registered in the BIST Real Estate Activities Sector were calculated to carry out this analysis. The sample year of the study is a 5-year period between 2018 and 2022. In the study, there are 3 firms in the BIST Real Estate Activities Sector. These are Adese Gayrimenkul, İhlas Gayrimenkul and Sönmez Filament firms. The study also examined the market values of these firms. As a result, the years in which the cash levels of the enterprises were lower or higher, their debt status and profitability were determined. According to this determination, policy recommendations were presented to companies.
Keywords: Real Estate Sector, Cash, Debt and Profitability Rates

GİRİŞ

Gayrimenkul sektörü, ülkelerin ekonomik koşullarından oldukça etkilenen ve ekonomiye duyarlılığı yüksek olan bir sektördür. Dolayısıyla bu sektörün durumu ülke ekonomisini istihdam, işsizlik vb. göstergeler açısından ilgilendirmektedir. Türkiye için ise bu ilgi daha çok gayrimenkul faaliyetleriyle doğrudan ilişkili olan inşaat sektörünün durumuna bağlıdır. Gayrimenkul, hukuki açıdan bir sermeye niteliğine sahiptir. Çünkü gayrimenkul tanımında da ifade edildiği üzere; bireylerin veya kurumların barınabilmek veya yatırım yapmak amacıyla sahip oldukları taşınmaz maldır (Parasız, 2015). Gayrimenkuller literatürde farklı şekillerde sınıflandırılsa da genellikle arazi ve arsalar, binalar ve projeler olarak üç ana başlık altında toplanmaktadır (Akbulut, 2023). Gayrimenkulleri finanse etmek için kullanılan yöntemler farklılık göstermekte ve ülkelerin ekonomik ve sosyal yapılarına göre şekillenmektedir (Yalçıner, 2006). Bu yöntemler; doğrudan finansman, mevduat finansmanı, mortgage kredileri, menkul kıymetleştirme ve yapı tasarruf sandığı olarak gruplara ayrılmaktadır (Akbulut, 2023).Türkiye'de faaliyet gösteren firmaları oluşturan gayrimenkul sektörü ise nüfus, kentleşme ve göç, kentsel dönüşüm, yabancı ülke vatandaşlarına satış ve ekonomiden etkilenmektedir (Akbulut, 2023).Nüfusa bakıldığında; Türkiye'nin genç ve dinamik bir nüfusuyla birlikte hayat standardındaki yükselmenin getirdiği yaşam kalitesi artışı gayrimenkule olan talebi doğrudan etkilemektedir. Yaş ortalamasındaki artış, çalışan nüfusun orta ve uzun vadede gayrimenkul ihtiyacının artacağını göstermektedir (Özdemir, 2018). Türkiye'de kentleşme ve göç birbirinden bağımsız olarak düşünülemez. Bu iki kavram iç içedir. Kentleşme, göçün etkisiyle hızlanmıştır. Türkiye'de 2011 yılına kadar iç göç yoğunluğu olsa da ilerleyen yıllarda dış göç de hızlanmıştır. Orta Doğu'daki gelişmelerle birlikte 2022 yılı itibariyle yaklaşık 4 milyon yabancı uyruklu vatandaş Türkiye'de ikamet etmektedir. Bu değişimle beraber konut talebi ve üretimi hızla artış göstermiştir (Akbulut, 2023).Yabancı ülke vatandaşlarına satışta; mütekabiliyet ilkesinin kaldırılması ve yabancı ülke vatandaşlarına vatandaşlık verilmesiyle beraber gayrimenkul satışları hızlanmış ve gayrimenkul sektörüne pozitif etki yapmıştır (Akbulut, 2023).Kentsel dönüşüm; çarpık yapıların, eski, altyapısı yetersiz, yapılaşmanın yoğun fakat afet riskine duyarlı mülklerin yeni imar planı verilerine göre düzenlemesidir (Ülger & Ülger, 2015). Kentsel dönüşüm Türkiye için özellikle deprem riskleriyle beraber sürekli gündemde yer almakta ve konut piyasasını etkilemektedir.

Ekonomi kavramı ise birçok göstergeyi içinde barındırmaktadır. Bu göstergeler içerisinde yer alan kişi başı milli gelir, satın alma gücü, enflasyon, faiz oranı ve istihdam gibi faktörler

gayrimenkul sektörünü direkt olarak etkilemektedir (Akbulut, 2023).Gayrimenkul sektörüyle ilgili literatürdeki çalışmaların bazıları incelenmiş ve kronolojik olarak özetlenmiştir.Şeker (2023) çalışmasında; Türkiye Gayrimenkul Piyasaları Bileşik Endeksi hazırlamıştır. 2010 yılını baz alarak veri seti yapılmıştır. Sonuç olarak; endeksteki en güçlü 3 değişken saptanmıştır. İlk sırada konut kredisi faizleri, ikinci sırada ihraç edilen gayrimenkule dayalı finansal araçların ihraç tutarları, üçüncü olarak ise gayrimenkul değerleme uzmanı sayısı değişkenlerinin ön planda oldukları ortaya konmuştur.Çubukcu vd. (2023) tarafından yapılan araştırmada; Türkiye genelinde 2023 depremlerinden sonra gayrimenkul sektöründeki yatırımcı davranışlarını ölçmektir. Deprem öncesi ve sonrası yatırımcı davranışlarının oldukça farklılaştığı görülmüştür. Depremden sonra yapılan yatırımlarda deprem yönetmeliğine uygun olup olmamasının tasarım, fiyat vb. özelliklerin önüne geçtiğini göstermektedir. İlave olarak müstakil veya az katlı yapılan tercih edildikleri ortaya çıkarılmıştır.Zoghayyer (2022) yapmış olduğu yayınında; Covid-19'un Türkiye Emlak Piyasası üzerindeki makroekonomik etkilerini incelemiştir. Kullanılan değişkenler; konut faiz oranı ve gayrimenkul konut satışlarındaki toplam ihracattır. Veri seti Ocak 2018 – Eylül 2021 arasındaki aylık verilerden oluşmaktadır. Covid-19 öncesi ve sonrası iki regresyon modeli kurulmuştur. Ampirik bulgulara göre; ihracat hem Covid-19 öncesi hem de sonrasında konut satışlarını olumlu etkilemektedir. Faiz, konut satışlarını negatif etkilemektedir. Covid-19 döneminde ihracatın konut satışlarındaki olumlu etkisi azalırken, reel faiz oranlarının olumsuz etkisinin arttığı tespit edilmiştir.

2. MATERYAL VE YÖNTEM

Araştırma 2018-2022 yılları arasını kapsayan 5 yıllık veri setinden oluşmaktadır. Araştırmaya ait verilere Kamuyu Aydınlatma Platformu (KAP) internet sitesinden erişim sağlanmıştır. Dolayısıyla ikincil verilerden oluşmaktadır. Araştırmada kullanılan örneklem Borsa İstanbul Gayrimenkul Faaliyetleri Sektörü'ne kayıtlı 3 işletmeden oluşmaktadır. Bu işletmeler; Adese Gayrimenkul, İhlas Gayrimenkul ve Sönmez Filament firmalarıdır. İşletmelere ait nakit, borçlanma ve kârlılık durumları finansal rasyolar aracılığıyla ölçülmüştür. Nakit durumunu ölçmek için likidite rasyoları kullanılmıştır. Kullanılan likidite rasyoları; cari oran, asit-test oranı ve nakit orandır. Borçlanma durumunu ölçerken finansal yapı oranlarından faydalanılmıştır. Kullanılan finansal yapı oranları; finansal kaldıraç oranı, genel ödeme gücü oranı, özkaynaklar / aktif toplamı, kısa vadeli borç / özkaynak toplamı, borçlanma katsayısıdır. Kârlılık durumu için ise kârlılık rasyoları kullanılmış ve bunlar; brüt kâr marjı, net kâr marjı, özsermaye kârlılığı ve aktif kârlılığıdır.

3. BULGULAR

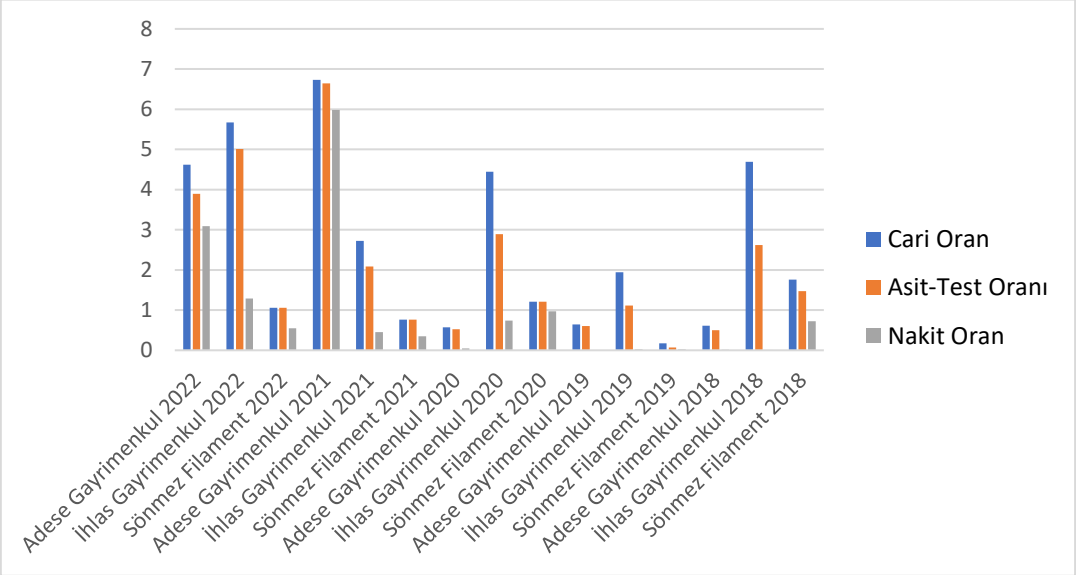
Borsa İstanbul Gayrimenkul Faaliyetleri Sektörü'ndeki 3 işletmenin 2018-2022 yılları arasındaki 5 yıllık likidite oranları hesaplanmış ve Tablo 1'de verilmiştir.

Tablo 1: Likidite Oranları

2022 yılı			
İşletmeler / Oranlar	**Cari Oran**	**Asit-Test Oranı**	**Nakit Oran**
Adese Gayrimenkul	4,622343	3,89885072	3,0894746
İhlas Gayrimenkul	5,66972	5,00773751	1,2882832
Sönmez Filament	1,059684	1,059684102	0,5461471
2021 yılı			
İşletmeler / Oranlar	**Cari Oran**	**Asit-Test Oranı**	**Nakit Oran**
Adese Gayrimenkul	6,729453	6,646149181	5,9790942
İhlas Gayrimenkul	2,720932	2,089466038	0,4534886
Sönmez Filament	0,763954	0,76395375	0,3480463
2020 yılı			
İşletmeler / Oranlar	**Cari Oran**	**Asit-Test Oranı**	**Nakit Oran**
Adese Gayrimenkul	0,568987	0,52777429	0,048482
İhlas Gayrimenkul	4,441025	2,891927285	0,7414709
Sönmez Filament	1,207602	1,207601508	0,9729962
2019 yılı			
İşletmeler / Oranlar	**Cari Oran**	**Asit-Test Oranı**	**Nakit Oran**
Adese Gayrimenkul	0,644805	0,600294344	0,0085138
İhlas Gayrimenkul	1,945331	1,110928358	0,0193664
Sönmez Filament	0,170759	0,067303938	0,0195453
2018 yılı			
İşletmeler / Oranlar	**Cari Oran**	**Asit-Test Oranı**	**Nakit Oran**
Adese Gayrimenkul	0,613775	0,50257766	0,0149617
İhlas Gayrimenkul	4,695462	2,621925633	0,0064096
Sönmez Filament	1,760979	1,471860691	0,7213558

Tablo 1'de hesaplanan likidite oranlarını daha ayrıntılı biçimde yorumlayabilmek için sonuçlar grafiğe dökülerek Şekil 1'de verilmiştir.

Şekil 1: Likidite Oranları



Şekil 1'de verilen likidite oranlarına göre;

- 2022 yılında Adese ve İhlas Gayrimenkul işletmelerinin Sönmez Filament işletmesine göre daha likit durumda olduğu tespit edilmiştir.
- 2021 yılında Adese Gayrimenkul işletmesinin tüm likidite oranlarının diğer işletmelere göre daha iyi olduğu ve dolayısıyla nakit sıkıntısı yaşamadığı görülmüştür.
- 2020 yılında ise tüm işletmelerin likidite oranları düşerken, İhlas Gayrimenkul işletmesinin diğerlerine kıyasla daha iyi durumda olduğu saptanmıştır.
- 2019 yılında Covid-19 pandemisinin de etkisiyle işletmelerin likidite düzeyleri düşmüştür.
- 2018 yılında İhlas Gayrimenkul işletmesinin diğer işletmelere kıyasla likidite düzeyinin daha iyi olduğu ortaya konmuştur.

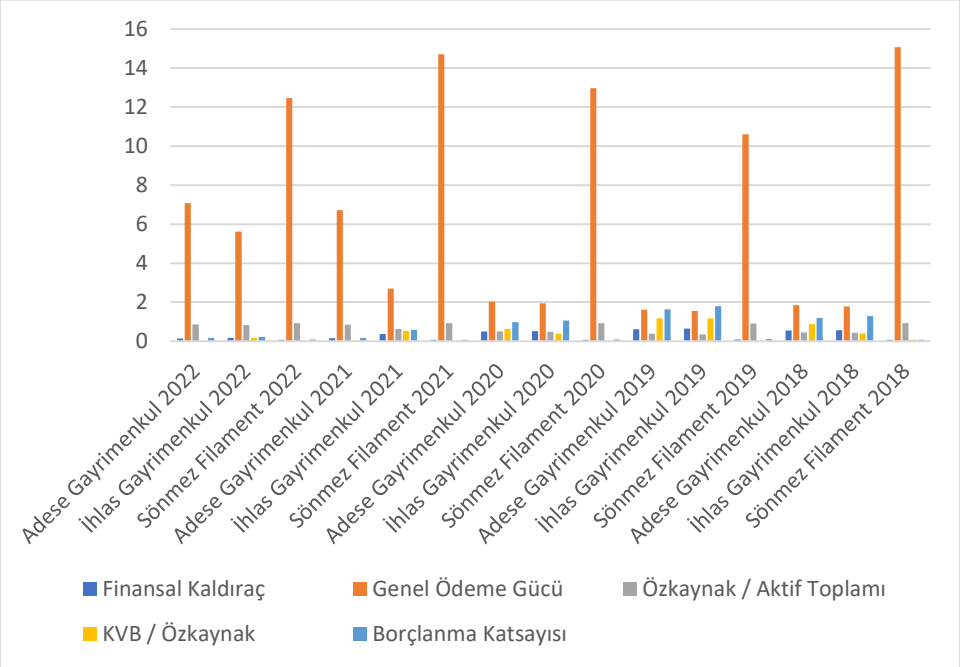
Likidite oranlarının ardından firmaların borç durumunu inceleyebilmek için borçlanma rasyoları hesaplanmış ve Tablo 2'de sunulmuştur.

Tablo 2: Borçlanma Oranları

2022 yılı					
İşletmeler / Oranlar	**Finansal Kaldıraç**	**Genel Ödeme Gücü**	**Özkaynak / Aktif Toplamı**	**KVB / Özkaynak**	**Borçlanma Katsayısı**
Adese Gayrimenkul	0,141425454	7,070862908	0,858574546	0,02740913	0,164721229
İhlas Gayrimenkul	0,178127202	5,613965693	0,821872798	0,16830268	0,216733298
Sönmez Filament	0,080295491	12,45399949	0,919704509	0,02376946	0,087305749
2021 yılı					
İşletmeler / Oranlar	**Finansal Kaldıraç**	**Genel Ödeme Gücü**	**Özkaynak / Aktif Toplamı**	**KVB / Özkaynak**	**Borçlanma Katsayısı**
Adese Gayrimenkul	0,14878504	6,721105849	0,85121496	0,03256295	0,174791382
İhlas Gayrimenkul	0,370828542	2,696664056	0,629171458	0,53180291	0,58939187
Sönmez Filament	0,06801769	14,70205757	0,93198231	0,00574749	0,07298174
2020 yılı					
İşletmeler / Oranlar	**Finansal Kaldıraç**	**Genel Ödeme Gücü**	**Özkaynak / Aktif Toplamı**	**KVB / Özkaynak**	**Borçlanma Katsayısı**
Adese Gayrimenkul	0,495115189	2,019732018	0,504884811	0,62949028	0,980649801
İhlas Gayrimenkul	0,514764841	1,942634616	0,485235159	0,38345841	1,060856436
Sönmez Filament	0,077119748	12,96684732	0,922880252	0,00779495	0,083564198
2019 yılı					
İşletmeler / Oranlar	**Finansal Kaldıraç**	**Genel Ödeme Gücü**	**Özkaynak / Aktif Toplamı**	**KVB / Özkaynak**	**Borçlanma Katsayısı**
Adese Gayrimenkul	0,618823215	1,615970402	0,381176785	1,17119736	1,623454628
İhlas Gayrimenkul	0,642368603	1,5567386	0,357631397	1,16538295	1,796175081
Sönmez Filament	0,094254416	10,60958253	0,905745584	0,02221447	0,104062793
2018 yılı					
İşletmeler / Oranlar	**Finansal Kaldıraç**	**Genel Ödeme Gücü**	**Özkaynak / Aktif Toplamı**	**KVB / Özkaynak**	**Borçlanma Katsayısı**
Adese Gayrimenkul	0,543971141	1,838332816	0,456028859	0,88103535	1,192843678
İhlas Gayrimenkul	0,561584175	1,780676958	0,438415825	0,40590802	1,280939562
Sönmez Filament	0,066423098	15,05500393	0,933576902	0,06863442	0,071149037

Tablo 2'de sunulan borçlanma rasyolarını ayrıntılı biçimde inceleyebilmek için grafiğe dönüştürülüp Şekil 2 oluşturulmuştur.

Şekil 2: Borçlanma Oranları



Şekil 2'de verilen borçlanma oranları incelendiğinde; tüm yıllarda genel ödeme gücü oranının diğer oranlara göre yüksek olduğu dolayısıyla işletmelerin borçlanma potansiyelinin iyi olduğu görülmüştür. Ayrıntılı biçimde değerlendirildiğinde;

- 2022 yılında Sönmez Filament işletmesinin borçlanma potansiyelinin daha yüksek olduğu görülmüştür. Çünkü genel ödeme gücü en yüksek firma olarak tespit edilmiştir.
- 2021 yılında da benzer biçimde Sönmez Filament işletmesinin borçlanma potansiyelinin en yüksek olduğu saptanmıştır.
- 2020 yılında ise Sönmez Filament hariç diğer işletmelerin pandeminin de etkisiyle genel ödeme güçleri azalmıştır.
- 2019 yılında da aynı şekilde genel ödeme güçleri düşerken, Sönmez Filament işletmesi en iyi durumdadır.
- 2018 yılında diğer işletmelere göre yine Sönmez Filament borçlanma potansiyeli en iyi işletme olarak tespit edilmiştir.

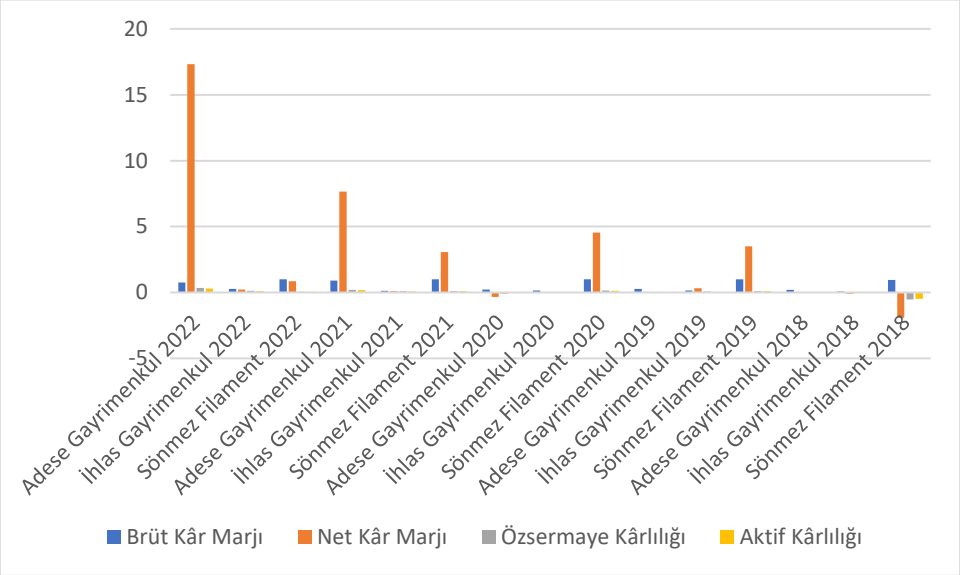
Borçlanma oranlarının ardından firmaların kârlılık durumunu inceleyebilmek için kârlılık rasyoları hesaplanmış ve Tablo 3'de sunulmuştur.

Tablo 3: Kârlılık Oranları

2022 yılı				
İşletmeler / Oranlar	**Brüt Kâr Marjı**	**Net Kâr Marjı**	**Özsermaye Kârlılığı**	**Aktif Kârlılığı**
Adese Gayrimenkul	0,762106316	17,3361773	0,338316871	0,290470254
İhlas Gayrimenkul	0,25936394	0,233896091	0,122216418	0,100446349
Sönmez Filament	1	0,857750978	0,045811986	0,04213349
2021 yılı				
İşletmeler / Oranlar	**Brüt Kâr Marjı**	**Net Kâr Marjı**	**Özsermaye Kârlılığı**	**Aktif Kârlılığı**
Adese Gayrimenkul	0,914144534	7,667417163	0,19997568	0,17022229
İhlas Gayrimenkul	0,130719408	0,112897034	0,11154583	0,070181453
Sönmez Filament	1	3,053843825	0,108781172	0,101382128
2020 yılı				
İşletmeler / Oranlar	**Brüt Kâr Marjı**	**Net Kâr Marjı**	**Özsermaye Kârlılığı**	**Aktif Kârlılığı**
Adese Gayrimenkul	0,231588279	-0,34623088	-0,094110537	-0,047514981
İhlas Gayrimenkul	0,154619438	0,010986051	0,004331307	0,002101702
Sönmez Filament	1	4,555763154	0,141690549	0,13076341
2019 yılı				
İşletmeler / Oranlar	**Brüt Kâr Marjı**	**Net Kâr Marjı**	**Özsermaye Kârlılığı**	**Aktif Kârlılığı**
Adese Gayrimenkul	0,279578863	-0,002507727	-0,000852442	-0,000324931
İhlas Gayrimenkul	0,158997089	0,30891066	0,082030523	0,029336691
Sönmez Filament	1	3,498250598	0,108337356	0,098126081
2018 yılı				
İşletmeler / Oranlar	**Brüt Kâr Marjı**	**Net Kâr Marjı**	**Özsermaye Kârlılığı**	**Aktif Kârlılığı**
Adese Gayrimenkul	0,209836617	-0,02869637	-0,028404809	-0,012953413
İhlas Gayrimenkul	0,084945764	-0,09927609	-0,016014282	-0,007020914
Sönmez Filament	0,959487049	-1,917523314	-0,524791621	-0,489933335

Tablo 3'deki kârlılık oranları grafiğe dönüştürülüp Şekil 3 oluşturulmuştur.

Şekil 3: Kârlılık Oranları



Şekil 3'de görülen kârlılık oranlarına göre; diğer oranlara kıyasla net kâr marjının en yüksek olduğu görülmüştür. Firma bazlı incelendiğinde;

- 2022 yılında Adese Gayrimenkul işletmesi en kârlı işletme olarak tespit edilmiştir.
- 2021 yılında Adese Gayrimenkul en kârlı iken, Sönmez Filament işletmesinin de kârlılık düzeyi artış göstermiştir.
- 2020 yılında ise Sönmez Filament hariç diğer işletmelerin pandeminin de etkisiyle kârlılık oranları düşüş eğilimindedir.
- 2019 yılında Sönmez Filament işletmesi en kârlı durumdadır.
- 2018 yılında ise bu kez Sönmez Filament işletmesi zarar açıklamış ve net kâr marjı negatif olarak tespit edilmiştir.

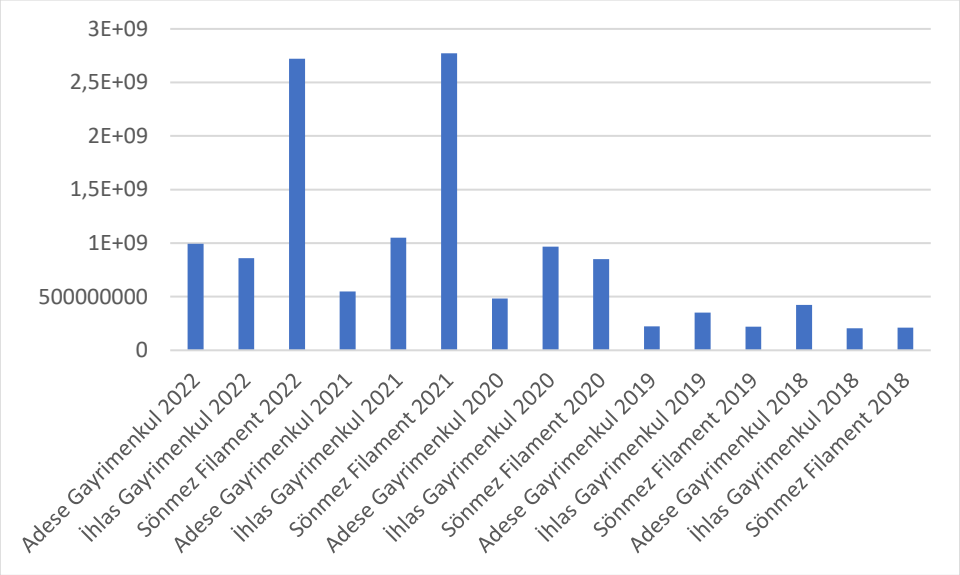
Nakit, borçlanma ve kârlılık durumları tespit edildikten sonra gayrimenkul firmalarının piyasa değerleri bulunmuş ve Tablo 4'te sunulmuştur.

Tablo 4: Piyasa Değerleri

2022 yılı	
İşletmeler	**Piyasa Değeri**
Adese Gayrimenkul	992976190,5
İhlas Gayrimenkul	859325396,8
Sönmez Filament	2720662698
2021 yılı	
Adese Gayrimenkul	548714859,4
İhlas Gayrimenkul	1050883534
Sönmez Filament	2771799197
2020 yılı	
Adese Gayrimenkul	482210317,5
İhlas Gayrimenkul	966412698,4
Sönmez Filament	850944444,4
2019 yılı	
Adese Gayrimenkul	224000000
İhlas Gayrimenkul	352931726,9
Sönmez Filament	219566265,1
2018 yılı	
Adese Gayrimenkul	422824701,2
İhlas Gayrimenkul	204418326,7
Sönmez Filament	210661354,6

Tablo 4'te verilen piyasa değerlerini ayrıntılı yorumlayabilmek için veriler grafiğe aktarılarak Şekil 4 oluşturulmuştur.

Şekil 4: Piyasa Değeri



Şekil 4'te görülen piyasa değerleri genellikle analizin gerçekleştiği son iki yıl olan 2021 ve 2022'de yükselişe geçmiştir. Ayrıntılı incelendiğinde;

- 2022 yılında piyasa değeri en yüksek işletme olarak Sönmez Filament tespit edilmiştir.
- 2021 yılında da benzer şekilde Sönmez Filament işletmesinin piyasa değeri en iyidir.
- 2020 yılında ise piyasa değerleri birbirine daha yakın seyretmekte ve İhlas Gayrimenkul işletmesinin piyasa değeri en yüksektir.
- 2019 yılında pandemi etkisiyle tüm işletmelerin piyasa değerleri düşük seyretse de içlerinde en yüksek piyasa değeri İhlas Gayrimenkul'e aittir.
- 2018 yılında yine düşük piyasa değerleri içerisinden en yüksek piyasa değeri Adese Gayrimenkul işletmesinindir.

4. SONUÇ ve ÖNERİLER

İnşaat sektörünün önderliğinde faaliyetlerini sürdüren gayrimenkul sektörü yaşanılan olaylara ve koşullara göre şekillenmektedir. Dünyada yaşanan pandemi döneminde gayrimenkul sektöründeki talep daha çok sessiz, sakin ve doğayla iç içe alanlara yapılan konutlar iken, Türkiye'de yaşanan deprem sonrası, bu kez konutların depreme dayanıklılığı birinci öncelik hâline gelmiştir. Hatta Covid-19 dönemindeki gibi az katlı binalara talep artış göstermeye başlamıştır. Gayrimenkul sektöründe başarıyı sürdürebilir kılmak için hedef kitleyi doğru tespit ederek hedef kitlenin istek ve ihtiyaçlarına hitap edebilmek son derece önem arz etmektedir.

Bu çalışmada Borsa İstanbul Gayrimenkul Faaliyetleri Sektörü'ne kayıtlı 3 işletmenin nakit, borçlanma ve kârlılık oranları hesaplanmıştır. Ayrıca bu işletmelerin piyasa değerleri de

bulunmuştur. Hesaplamalar 2018-2022 yılları arası 5 yılı kapsamaktadır.Elde edilen bulgular ışığında; nakit, borçlanma ve kârlılık oranları ile piyasa değerleri yorumlanmıştır. Likidite oranlarına bakıldığında; 5 yılda nakit durumu en iyi olan işletmeler farklılaşsa da genellikle 3 işletmenin de likidite oranları pozitif ve nakit durumlarının yeterli düzeyde olduğu görülmüştür. Borçlanma oranlarına göre; 3 işletmenin de yıl bazlı farklılık gösterse de ödeme güçlerinin iyi ve yeterli olduğu tespit edilmiştir. Kârlılık oranları incelendiğinde ise; net kâr marjının en çok önem verilen kârlılık oranı olduğu fakat bazı yıllarda işletmelerin zarar etmesinden dolayı net kâr marjının negatif olduğu tespit edilmiştir. Piyasa değerlerine göre genellikle 5 yıl içerisinde Sönmez Filament işletmesinin piyasa değerinin en yüksek olduğu saptanmıştır.Bu yorumlar doğrultusunda; Türkiye'de gayrimenkul sektöründe faaliyet gösteren işletmelerin pandemi gibi istisnai dönemler dışında mali durumlarının yeterli düzeyde olduğu görülmüştür. İşletmelerin mali açıdan sürdürülebilirliğini sağlamak için hedef kitlenin arz ve talebine cevap vermeleri ve sürekli yenilenmeye açık olmaları gereklidir. Gayrimenkul yatırımlarının uzun vadeli ve finansal açıdan yüksek değerli oldukları için müşteri istek ve ihtiyaçlarına cevap verebilecek şekilde kendilerini iyileştirmeleri hem firmaların geleceği hem ülke ekonomilerine katkıları için oldukça önemlidir.

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THE IMPORTANCE OF SAFE PUBLIC TRANSPORT: A SYSTEMATIC LITERATURE REVIEW

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ABSTRACT
Public transport plays a vital role in people's day-to-day migrations in all modern countries around the world. High quality public transport systems are the right tool for satisfying transportation demand in most global cities. Demand for bus, rail, underground and tram transport systems is varied, and safety is the key factor of its effectiveness. Adequate operation of the public transport system has economic effects, where many urban areas focus on tackling three main problems: safety, congestion and pollution. Alongside the demand for public transport, the need for higher-level safety regulations in the public transport system is growing as well. With continuous development of technology and innovations, the human factor remains the most common cause of traffic accidents. Those commuters who trust the accountable institutions for transportation safety are prone to use the services more often. In addition, vice versa, those who have issues regarding the public transport are more inclined to use private vehicles. The behaviour of the commuters is guided by their safety transportation awareness and is also influenced by individual factors and the environment. In this paper, based on extend literature review, it will be emphasized the most important characteristics for the establishment of safe public transport. This research was motivated by the need to better understand, address, and optimize safety, behaviour, and economic aspects related to public transportation, while emphasizing the role of technology and considering socioeconomic factors. The scientific contribution of this paper lies in the recognition of the multifaceted relationship between public transport, safety, and individual behaviour, and the intention to provide insights based on a literature review to enhance the safety and efficiency of public transportation systems in urban areas.
Keywords: expenses for transport, safety, safety awareness, public transport.

INTRODUCTION

In most of the world's metropolises, transport demand is met precisely through high-quality public transport systems (Schmöcker, Bell & Lam, 2010). The lack of transportation is an obstacle to accessibility and social inclusion in modern society. Thus, in rural and sparsely populated areas, access to public transport, compared to urban areas, is often poor, which leads to fewer opportunities for rural residents to participate in various activities (Berg & Ihlström, 2019). The development of transport services is a very important factor for the quality of life, and the availability of public transport plays a key role in the evaluation and design of transport systems in terms of mobility and sustainability (Saif, Zefreh & Torok, 2019). Considering that the public transport system enables the transportation of passengers to school, public health institutions and to work, it is extremely important to take care of examining the competitiveness of it (Poliak et al., 2017). Taking into account the undoubted importance of this system, there is a lot of research that focused on the functioning of the same. Thus, the findings of earlier research, among others, confirmed that the key factor for the efficient functioning of the public transport system is safety (Marusin, Marusin & Danilov, 2018; Schmöcker, Bell & Lam, 2010). Passengers show a greater preference for using public transport systems when they believe in the safety of the same (Jain et al., 2014). As the demand for the use of public transport grows, so does the need to establish a higher level of security in the public transport system (Wang et al., 2020). Public transport represents a greater risk for safety because, as a rule, the means of transport in this system in most cases contain a large number of passengers. The problem of establishing a safe public transport system is even more pronounced in developing countries due to the lack of appropriate and integrated approaches (Joewono & Kubota, 2006). Taking into account the crisis caused by the COVID-19 pandemic, it can be seen that now is the right time to rebuild trust in public transport and to give it the attention that deserves through politics and investment decisions (United Nations Habitat, 2021).According to the above, the purpose of this paper is to conduct a systematic literature review of the studies that have analysed the public transportation with special emphasis on those which have put focus on the establishment of the safe public transportation. The expected results of the research are likely to include a comprehensive overview of the state of public transportation safety, identification of key challenges and best practices, and potential recommendations for policymakers and urban planners to improve safety and accessibility in public transportation systems. After the introduction section, in the second chapter it will be analysed the significance and specifics of public transportation. In the third chapter, the focus is on crucial aspects for the establishment

of safe public transport. Discussion is provided in the fourth chapter, while conclusion remarks are presented in the fourth chapter.

2. SIGNIFANCE AND SPECIFICS OF PUBLIC TRANSPORTATION

Public transport plays a key role in the daily migration of people in all modern countries of the world (Tirachini & Cats, 2020). Transport systems are complex and dynamic systems that include people, vehicles, infrastructure and the environment; and eventual deficiencies of this system can very easily cause a traffic accident (Feng et al., 2021). Requirements for bus, railway, subway and tram systems are diverse, and the key factor for their efficient functioning is safety (Marusin, Marusin & Danilov, 2018). Most of the developed countries are making efforts to increase the share of public transportation, and in the period from 2017 to 2021, city authorities around the world implemented numerous projects to improve the operation of the public transportation system (McKinsey & Company, July 2021). Adequate functioning of the public transport system has economic effects, whereby many urban areas solve three main problems: safety, congestion and pollution (Schmöcker, Bell and Lam, 2010). Traditional public transport, operated by heavily subsidized public bodies using separate modes, was fragmented in terms of timetables, ticketing, and customer service alignment. This approach, while asset-focused, often hindered citizens; journey options across transit systems, with agencies adopting a monopoly mindset. But today, new market players are improving last-mile transportation with enhanced services and convenience. Emerging disruptive transport technologies and the seamless service interactions in other sectors have raised customer expectations for public transport. The future of mature transport systems lies in integrated services, effortless payments, and enhanced customer experiences (KPMG, November 2022)Not only is public transport important when it comes to providing the workforce with the means to travel to work and generally across a given region; it allows for a better distribution of congestion levels across different modes of transport, which usually contribute to reduced carbon dioxide emissions, for example if individuals opt for public transport instead of driving a car (Burgueño Salas, 28.11.2022). Along with the growing demand for public transport, the need for establishment a higher level of security in the public transport system also grows stronger (Wang et al., 2020). There is continuous development of technology and innovative solutions, and the human factor remains the most common cause of traffic accidents (Feng et al., 2021).The specificity of social dialogue in public transport in many countries of Central and Eastern Europe is characterized by a high degree of decentralization with a lack of sectoral or

national organizations. Thus, social dialogue in the countries of Central and Eastern Europe is organized mainly within the framework of national social and economic councils that make decisions on various topics at the state or company level (Bordogna, 2018). An important contribution to the social dialogue in the public transport segment in Europe is made by the European social partners for public transport: The International Association of Public Transport (UITP) and The European Transport Workers' Federation Federation (ETF)) (Europäische Akademie für umweltorientierten Verkehr gGmbH, May 2019). Rundmo et al. (2011) emphasize that there is a significant relationship between trust in accountable institutions and the use of public transport. People who trust the institutions in charge of transport safety use public transport more often. Consequently, people with less trust in accountable institutions will be more inclined to use privately owned means of transport (Rundmo et al., 2011).For many regional journeys, walking and cycling are not viable options, meaning that public transport is often the only alternative to the car for such journeys. People in rural areas are at risk of being excluded from participating in normal relationships and activities if they do not have a driver's license or access to a car (Lucas, 2012). The quality of regional public transport services affects the independent movement of this group, especially children and adolescents (Berg & Ihlstrom, 2019). The availability of public transport has a significant impact on life satisfaction in the form of perceived accessibility (Saif, Zefreh & Torok, 2019). Although public transport represents a financial burden for public budgets, it must not be forgotten that it ensures the mobility of passengers that usual dispose with less financial means (pensioners, students, etc.) (Poliak et al, 2017). An efficient public transport system, including its management, plays a significant role in economic development (Madejski, Amushila & Kulatau, 2014).

The concluding remarks serve to encapsulate the significance and multifaceted impact of public transport, underlining its role in enhancing safety, environmental sustainability, social inclusion, and economic development.

3. CRUCIAL ASPECTS FOR THE ESTABLISHMENT OF SAFE PUBLIC TRANSPORT

Passengers in public transport have high demands from service providers expecting safety, comfort, regularity, frequency, speed and economics (Hussain, Zefreh & Torok, 2018). The most important requirement of passengers in public transport is safety (Vuletić, Horak & Jurčević, 2021: 63; Jain et al., 2014). The behaviour of road users is driven by their transportation safety awareness (Feng et al., 2021), which is influenced by individual factors and the environment (Feng et al., 2021; Tao, Zhang & Qu, 2017). When a person thinks about safety, he is motivated

to find countermeasures to avoid accidents or at least reduce their consequences. Fear of crime is an important issue affecting passengers' perception of public transport safety. Especially when it comes to younger people who often avoid using public transport services due to prejudice (Currie, Delbosc & Mahmoud, 2013). Potential security threats in the public transport system relate to injuries caused by infrastructure (eg escalators), violent crime (eg sexual offences, stabbings, terrorism), non-violent crime (eg vandalism, drug use, trespassing, drunkenness), or viruses (Friman, Lättman & Olsson, 2020).The level of transportation safety awareness determines the participation of individuals in the traffic activities of public and private transport (Liu, 2007) and affects the level of expenditure of individuals for transport needs. Expenditures for transportation represent an important part of an individual's budget, and at the same time there are large variations in consumption due to belonging to a particular socio-economic group. On average, individuals with the highest income spend 1.8 times more on transportation than individuals from the lowest income group (Kauppila, 2015). The share of transport expenses in personal consumption increases with income, and most often as a result of buying a personal car (European Environment Agency, 2012). Transport policies aimed at sustainability, i.e. those that promote public transport and the reduction of cars, reduce the impact of the crisis on the amount of personal expenditure on transport (Cascajo et al., 2018). For people with higher incomes, public transportation represents an inferior good, and their transportation expenditures are relatively higher for public and private transportation (Burguillo, Romero-Jordan & Sanz-Sanz, 2017). Due to the growing awareness of public transport safety among people with higher incomes, the demand for public transport services is increasing (Gandelman, Serebrisky & Suárez-Alemán, 2019).The behaviour of traffic users is guided by their transportation safety (Feng et al., 2021). Transportation safety awareness implies continuous adjustment of the individual's activities and behaviour (Liu, 2007). An individual's transportation safety awareness is associated with a safe way of participating in transportation (Liu, 2007). Factors affecting transportation safety awareness are divided into individual factors and environmental factors. Gender, age, level of education, occupation, income and mode of travel have a significant impact on the way public transport services are used (Zhu et al., 2014). Men are more prone to less safe behaviour in transport, so for example a larger proportion of them do not use a seat belt (Ghadban et al., 2017). Personality traits imply a recognizable pattern of feelings, thoughts and behaviour of individuals (McCrae & Costa, 2021), and are significantly related to the risky behaviour of road users. Personality traits contribute to indirect effects on crash risk driven by road users' unsafe behaviour (Tao, Zhang & Qu, 2017). In addition to

individual factors, environmental factors have an important influence on safety awareness (education about traffic safety, records of traffic violations, approval of violations of traffic regulations and traffic culture (Feng et al., 2021). Education about transportation safety, especially for children, significantly improves their safety knowledge, but also their transportation safety awareness (Rosenbloom et al., 2008). Safety awareness in the context of public transport refers to the safety knowledge of passengers that enables the protection of persons (individuals and others), as well as influencing others to behave safely in public transport (Wang et al., 2020). Individuals are more likely to develop safety awareness if they perceive the behaviour of people around them and if their friends and family follow certain safety regulations (Chang & Liao, 2010; Chan et al., 2005). Also, normative encouragement from important people has a positive effect on the development of an individual's consciousness (Asif et al., 2018). The role of the interpersonal environment is emphasized when studying an individual's transportation safety awareness. Family and friends can be the basis of emotional support in developing safety awareness. If a larger share of close people does not approve the violation of regulations on transportation safety, the individual's awareness of it is higher (Feng et al., 2021). Transport safety culture includes all factors related to drivers, vehicles and infrastructure (Leviäkangs, 1998) and therefore has a strong influence on an individual's safety awareness. Gehlert et al. (2014) emphasize how it unites the thoughts and feelings of the participants about transportation in the environment as well as the possible intentions of the participants regarding behaviour. Chen et al (2023) research the impact of the neighborhood and working environment on green commuting from a health perspective. Authors conclude that good working environment and relationships will significantly encourage the sub-healthy group to choose active commuting.Individuals with a positive attitude toward safe passenger behaviour seek important safety information and become more aware of the importance of safe transportation behaviour (Wang et al., 2020). The safe behaviour of passengers in public transport implies the actions shown by passengers to reduce the probability of occurrence of unwanted events when traveling by public transport (Wang et al., 2020). The state of traffic safety in an area is inseparable from the transportation safety awareness of the local public. Therefore, in order to improve the transport safety, that is, public transport, it is crucial to improve the transportation safety awareness (Rong, 2008). Safe behaviour in transport refers to all behaviours that the public shows when participating in public transport, which enable them to comply with regulations and protect themselves and other people in case of danger (Feng et al., 2021).Safety awareness implies the passenger's safety knowledge that enables him to

consciously protect himself and others, as well as influence others for the purpose of safe behaviour in public transport (Wang et al., 2020). The level of transportation safety awareness determines the participation of individuals in transportation activities, whether public or private (Liu, 2007) and affects the level of personal expenditures for transportation needs. Among people with a higher income, due to the increase in safety awareness of the public transport, the share of public transport use increases (Gandelman, Serebrisky & Suárez-Alemán, 2019). Expenditures for transportation represent an important part of an individual's budget, and there are large variations in consumption depending on belonging to a particular socio-economic group (Kauppila, 2015). Personal expenses for transportation refer to the cost of buying a private car, the cost of fuel and the cost of usage of public transportation (Köhler, Luhmann & Wadeskog, 2004). A person's position along the rural-urban continuum significantly affects transportation expenditures as well as the perceived severity of problems related to a particular type of transportation. People with disabilities and the elderly have similar spending patterns for transportation, as well as the interdependence of the same with safety awareness of a particular type of transportation (Venter, 2011).The establishment of an adequate and safe public transport system is an urban necessity. In order to establish a more sustainable transport system, it is necessary to provide all citizens access to the public transport system and, if necessary, to work on its expansion (United Nations Habitat, 2021). A safe public transport system is of primary importance for any economic system. Therefore, one of the roles of the European Commission is to respond to these expectations by ensuring satisfactory standards throughout the Union for safety in all modes of transport, especially the public transport system (European Commission, 2022). Through provisions such as the EU Road Safety Policy Framework 2021-2030 (European Commission, 2019) and White Paper 2011 Mobility and Transport (European Commission, 2011)), the European Commission strives to standardize and improve the level of safety of the public transport system at the level of the Union. It was the recent crisis periods (coronavirus pandemic and Russia's invasion of Ukraine) that confirmed that public transport is an important backbone for the functioning of highly urbanized areas.In essence, the concluding remarks reinforce the importance of public transport safe-ty, its influence on behaviour and expenditures, and its role in urban and economic con-texts. As well it is also emphasize the efforts made by organizations like the European Commission to ensure and enhance safety standards in public transport.

4. DISCUSSION

Based on the analyzed research that have observed or highlighted the signifance and specifics of public transportation, it is evident that public transport is recognized as playing a crucial role in the daily lives of people in modern countries, facilitating their mobility and daily activities (Pichardo-Muñiz, 2011; Mononen & Leviäkangas, 2016). Safety is identified as a fundamental factor in the efficient functioning of public transport systems. The text underscores that deficiencies in these systems can lead to traffic accidents, emphasizing the need for safety measures. Public transport systems are noted to have economic effects, addressing issues like safety, congestion, and pollution in urban areas (Singh, 2012; Pojani & Stead, 2017; Allbalate & Fageda, 2019; Almatar, 2024). They contribute to a better distribution of congestion levels and reduced carbon dioxide emissions (Kramberger, Dragan & Prah, 2014; Newman & Kenworthy, 2015; Liu, Yu & He, 2022; Al-Jabir & Isaifan, 2024) highlighting their positive environmental impact.The ongoing development of technology and the persistent role of human behaviour in traffic accidents are acknowledged, reinforcing the need for evolving safety measures and technology in public transport. The role of social dialogue and trust in accountable institutions is discussed, pointing out that trust in these institutions is linked to increased use of public transport. Lack of trust may lead to a preference for private means of transportation (Maroun et al., 2024; Nasrin & Bunker, 2024). Public transport is considered essential, particularly in rural areas (Šťastná & Vaishar, 2017; Porru et al, 2020) to prevent the exclusion of individuals from participating in normal activities due to a lack of personal transportation options. It is essential for independent movement, especially for children and adolescents. The availability of public transport is connected to life satisfaction, particularly regarding perceived accessibility. Public transport is highlighted as a critical option for individuals with limited financial means. Passengers in public transport have high expectations, with safety being the most critical requirement. Safety is paramount for passenger satisfaction (Mouwen, 2015). The behaviour of road users is strongly influenced by their transportation safety awareness, which is shaped by both individual and environmental factors. Fear of crime, particularly among younger individuals, affects passengers' perception of public transport safety and can deter them from using these services.Transportation expenses represent a significant portion of an individual's budget (Kapatsila, Collins & Grise, 2024). The level of transportation safety awareness affects personal transportation choices and expenditures. There are notable variations in transportation expenditures based on socio-economic status. People with higher incomes tend to spend more on transportation, and safety awareness in public transport can lead to increased usage among this group. Transport safety culture, which

encompasses drivers, vehicles, and infrastructure, plays a crucial role in influencing individuals' safety awareness.A positive attitude toward safe passenger behaviour leads individuals to seek safety information and become more aware of the importance of safe transportation behaviour. Transportation safety awareness enables passengers to consciously protect themselves and others while influencing safe behaviour in public transport. Establishing an adequate and safe public transport system is a necessity for urban areas. A safe public transport system is essential for economic stability. The European Commission is mentioned as an entity working to ensure satisfactory safety standards in all modes of transport, including public transport, at the European Union level. In the previous chapter it is also under-scored the resilience of public transport during recent crisis periods, such as the corona-virus pandemic and geopolitical events, highlighting its importance in urbanized areas.For better understanding the relationship between safety awareness and public transport usage, future research could delve into behavioural studies. These studies might explore how individuals' perceptions of safety influence their choices and behaviours in public transport systems. As well it could be conducted comparative analysis which can be valuable to understand how different cities or regions have successfully improved safety in their public transport systems. Research can identify best practices, policies, and strategies for enhancing safety.

5. CONCLUSION

Safety in public transport is extremely important considering that public transport is closely connected with human lives, and because of fact that in most situation a large number of people participate in it at the same time. It is not disputed that public transport plays an important role in the functioning of economic systems, given that it enables people to be transported to schools, faculties and work. But in order to ensure an even greater role of public transport in the functioning of individual cities, as well as a role in the establishment of a more sustainable transport system, it is necessary to continuously work on the establishment of a higher level of safety. It should not be overlooked that the establishment of an adequate and safe public transport system is an urban necessity.An important factor influencing people's attitudes towards the use of the public transport system is precisely their transportation safety awareness, which is influenced by individual and environmental factors. Thus, the level of transportation safety awareness actually determines whether individuals can participate in the public transport system in a safe manner and in compliance with regulations, and it also affects the level of personal consumption for transport needs. When people perceive the public transport system as

safer, then they are more willing to use its services more often. Accountable institutions should allocate more financial resources to safety education, because through it both the knowledge of individuals and the transportation safety awareness can be significantly improved.In order to establish a safe public transport system, in addition to the adoption of an adequate development transport policy, it is necessary to influence the growth of transportation safety awareness by taking appropriate measures. A public transport system that does not use its capacity represents only financial damage to society, and therefore it is extremely important not only to take care of the technical aspects of establishing more safety, but above all to restore or create people's trust in the safety of the public transport system.

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THERAPY FOR TUBERCULOSIS AND MEDICATION SCHEDULES: A COMPREHENSIVE REVIEW

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ABSTRACT
Multimodal therapy regimens are used to treat tuberculosis, an infectious disease spread through the air. Maintaining an appropriate blood medication level during long-term antituberculosis therapy requires strict adherence. Inadequate patient care is a major factor in the emergence and dissemination of strains that are resistant to Mycobacterium TB. Because there are costly, ineffective, and hazardous substitutes for first-line medications, treating tuberculosis that has developed drug resistance is a laborious process. In recent years, health government officials have approved two new antituberculosis medications: bedaquiline and delamanid. However, these drugs cannot serve as the only treatment for tuberculosis that has developed drug-resistant forms; this is especially true in settings with intermediate economies, like China, India, and the collapsed Soviet republics, where resistance to medications is common. There is an urgent need for new research and development initiatives. It is necessary for public health policies to protect both novel and traditional therapy alternatives. Combination treatment is used in the treatment of tuberculosis. Although there are new medications currently being researched and licenced (such as bedaquiline), the leadership of tuberculosis has become more difficult due to the rise in drug-resistant forms of the illness. A key element in the leadership and oversight of tuberculosis is the use of medical treatment in conjunction with accurate diagnosis. From a clinical and public health standpoint, it matters because tuberculosis is a dangerously contagious illness that may spread through the air.
Keywords: Anti tuberculosis, Bedaquiline, Combination treatment .

INTRODUCTION

One of the most serious infectious illnesses in the world, tuberculosis, has a major effect on public health. Mycobacterium tuberculosis, a bacteria that causes tuberculosis, mostly affects the lungs, though it can also damage the kidneys, spine, and brain. It is extremely contagious because it spreads via the air when an infected person coughs, sneezes, or talks. Clinical manifestations of tuberculosis vary, encompassing latent infection, in which individuals harbour the bacteria without exhibiting symptoms or disseminating the disease, and active tuberculosis disease, which is marked by symptoms like fever, cough, weight loss, and exhaustion. Tuberculosis can be lethal or extremely debilitating if left untreated. Poverty, overcrowding, malnutrition, and weaker immune systems particularly in those with HIV/AIDS are factors that contribute to the persistence of tuberculosis[1]. Additionally, a major obstacle to international tuberculosis control efforts is the growth of drug-resistant forms of the disease. A multimodal strategy is used to fight tuberculosis, involving early detection, suitable treatment, infection control practices, and public health initiatives. A combination of clinical assessment, imaging techniques (like chest X-rays), and laboratory testing (like sputum microscopy and culture) are usually used to make the diagnosis[2]. To properly eradicate the germs and stop the emergence of drug resistance, treatment for tuberculosis usually entails a combination of antibiotics administered over a period of many months. A popular tactic to guarantee treatment adherence and enhance results is Directly Observed Therapy, in which a medical professional watches patients take their medications. Even with improvements in tuberculosis diagnosis and treatment, societal stigma surrounding the illness, a lacklustre healthcare system, and restricted access to treatments all continue to impede the fight against tuberculosis. To reach the aim of eliminating tuberculosis as a worldwide health issue, governments, healthcare providers, researchers, and communities must work together in harmony[3].

PHARMACOLOGICAL TREATMENT FOR TUBERCULOSIS :

Anti-tuberculosis medications are a class of antibiotics used in combination to treat tuberculosis. The purpose of these medications is to eradicate the tuberculosis causing germs and stop antibiotic resistance from growing. The most widely used anti tubercular medications are as follows:

Isoniazid (INH): An important first-line medication for tuberculosis treatment, isoniazid acts by preventing the bacterial cell wall's ability to synthesise mycolic acids, which eventually results in the death of the bacteria.

Rifampicin (RIF): Rifampicin is another first-line medication that kills bacteria by preventing them from synthesising RNA. It is frequently taken in addition to other medications to treat tuberculosis.

Pyrazinamide (PZA): In acidic settings, like those present inside macrophages, pyrazinamide is effective against bacteria that are actively multiplying. It is essential for reducing the length of time that tuberculosis lasts[4].

Ethambutol (EMB): Ethambutol helps to kill off mycobacteria by preventing the synthesis of certain cell wall components. When treating tuberculosis, it is frequently used in conjunction with other medications, especially to stop the emergence of drug resistance.

Streptomycin: This injectable antibiotic is mostly used for drug-resistant tuberculosis cases or in situations where other first-line medications are intolerable.

Drug-resistant strains of tuberculosis may also be treated with second-line medications in addition to these first-line medications. These medications include injectable antibiotics like kanamycin and amikacin, as well as fluoroquinolones like levofloxacin and moxifloxacin. Drug susceptibility test findings, the existence of comorbidities, and the patient's clinical presentation all play a role in the selection of medications and treatment plans[5].

MULTI DRUG THERAPY

The mainstay of treatment for tuberculosis (TB) is multi-drug therapy (MDT), particularly in cases where the tuberculosis bacteria is caused by drug-sensitive strains. To minimise the possibility of drug resistance and target distinct stages of the bacterial life cycle, multiple antibiotics are used simultaneously in a method known as multidrug resistance. Eliminating the tuberculosis germs from the body and avoiding relapse is the main goal of MDT[6]. It usually entails a mix of first-line anti-tubercular medications, which are quite successful in treating the majority of TB strains. For drug-sensitive tuberculosis, the most often prescribed combination regimen consists of isoniazid (INH), rifampicin (RIF), pyrazinamide (PZA), and ethambutol (EMB) [7]. Together, these medications suppress the manufacture of proteins, RNA, and cell walls, among other methods that the bacteria use to survive. MDT lessens the possibility of

drug-resistant strains emerging by focusing on several facets of bacterial growth and replication, assisting in the effective destruction of all germs[8]. Depending on variables like the patient's reaction to treatment and the extent of the illness, the multi drug therapy usually lasts six to nine months. Patients must closely follow the recommended treatment plan throughout this time in order to get positive results. Multi drug therapy is frequently given as part of directly observed therapy (DOT), in which a medical professional or other qualified observer makes sure patients take their prescriptions as directed. This strategy lowers the chance of treatment failure and relapse while also enhancing treatment adherence[9]. Second-line therapies, which are effective against TB strains resistant to first-line medications, may be added to the multidisciplinary treatment plan (MDT) in cases of drug-resistant tuberculosis. Drug-resistant tuberculosis, on the other hand, is more difficult to treat and may need longer periods of therapy with a variety of antibiotics, including injectable ones. In general, MDT is essential to the treatment of tuberculosis (TB) since it aids in the infection's cure, stops its spread, and lessens the burden of medication resistance. On the other hand, prompt diagnosis, wise treatment choices, and rigorous commitment to the recommended course of action are necessary for good results[10].

DRUG RESISTANT TUBERCULOSIS AND TREATMENT CHALLENGES

Global attempts to eliminate tuberculosis (TB) are severely hampered by drug-resistant TB. It happens when the tuberculosis-causing germs become resistant to one or more of the medications prescribed to treat the illness. Two primary forms of drug-resistant tuberculosis exist:

Multidrug-resistant TB (MDR-TB): This type of TB is resistant to isoniazid and rifampicin, two of the most effective first-line anti-TB medications.

Extensively drug-resistant tuberculosis (XDR-TB): This is a more severe type of tuberculosis that is resistant to intravenous second-line treatments such as amikacin, kanamycin, or capreomycin, as well as to at least one fluoroquinolone, isoniazid, and rifampicin[11].

Because there are fewer treatment options, longer treatment periods, more potent second-line medications, and greater treatment costs for drug-resistant TB, treating this type of TB is far more complicated and difficult than treating drug-sensitive TB. The following are some of the main obstacles to treating drug-resistant tuberculosis:

Restricted Treatment Options: Compared to drug-sensitive TB, drug-resistant TB is treated with fewer potent medications. Second-line medications are frequently more costly, more hazardous, and less successful for treating drug-resistant tuberculosis.

Extended Treatment Period: Compared to drug-sensitive TB, which usually only needs 6 to 9 months of medication, treatment for drug-resistant TB usually takes a longer period of time, ranging from 9 to 24 months or more. The chance of side effects, relapse, and treatment failure rises with extended ttreatment[12].

Increased Toxicity: When second-line medications are used to treat drug-resistant tuberculosis, there is a greater chance of side effects, such as peripheral neuropathy, renal damage, hearing loss, and mental health issues. Handling these side effects calls for careful observation and can call for modifying the prescribed course of action.

High Cost: Treating drug-resistant TB is far more expensive than treating drug-sensitive TB because it requires longer treatment periods, more costly medications, and specialised monitoring and care.

Treatment Adherence: For drug-resistant tuberculosis treatment to be effective, patients must adhere to the recommended treatment plan. Adherence, however, may be more difficult for patients due to the extended length of therapy, the higher pill burden, and the intensity of unpleasant effects[13].

MANAGEMENT OF SIDE EFFECTS

Effective control of side effects during tuberculosis (TB) treatment is essential to good treatment outcomes, patient adherence, and reduced treatment interruptions. Medication for tuberculosis (TB), especially second-line treatments for drug-resistant TB, can have a number of adverse effects, such as:

Gastrointestinal Symptoms: Many TB drugs can cause nausea, vomiting, and abdominal pain as adverse effects, particularly if taken empty. To lessen stomach discomfort, patients may be encouraged to take their prescriptions with meals.

Hepatic toxicity: Isoniazid and rifampicin are two examples of TB medications that can harm the liver and result in hepatitis, increased liver enzymes, or even cirrhosis of the liver. Clients should be advised to report any symptoms of jaundice, stomach pain, or dark urine at least once. Liver function test monitoring is crucial[14].

Peripheral Neuropathy: Some TB medications, such as isoniazid and ethambutol, can harm peripheral nerves, leading to symptoms including tingling, numbness, or weakness in the hands and feet. Peripheral neuropathy may be prevented or treated using vitamin B6 (pyridoxine) supplements.

Ototoxicity: Injectable TB medications, including capreomycin, kanamycin, and amikacin, might result in balance issues or hearing loss. Patients should receive counselling with the warning signals of ototoxicity, and audiometric monitoring is required to detect any changes in hearing[15].

Nephropathy Toxicity: Aminoglycosides (kanamycin, amikacin, etc.) and capreomycin are examples of aminoglycosides that can harm the kidneys. Moisturising may be advised to reduce the risk of kidney toxicity, and monitoring renal function tests is crucial.

Visual Disability: An optic neuritis that results from ethambutol, a regularly used TB medicine, can cause visual abnormalities or possibly irreversible vision loss. Patients should report any changes in vision as soon as they occur, and regular vision testing is essential[16].

Adjusting dosages, temporarily stopping problematic medications, or switching to other medications are some methods of managing adverse effects. Supportive treatments such as topical medications for skin responses, analgesics for stomach discomfort, and antiemetics for nausea may occasionally be recommended to treat symptoms. Throughout the duration of TB therapy, healthcare providers are essential in keeping an eye out for side effects, informing patients about possible adverse responses, and offering support and guidance. To maximise treatment success and reduce the risk of side effects, close communication between patients and healthcare providers is necessary[17].

CONCLUSION

Tuberculosis (TB) remains a significant global health challenge, with drug-resistant strains posing an increasingly formidable threat. The management of TB requires a comprehensive approach that encompasses early diagnosis, appropriate treatment, infection control measures, and patient support. Pharmacological treatments, including multi-drug therapy (MDT), are essential for effectively treating TB and preventing the development of drug resistance. However, the emergence of drug-resistant TB presents unique challenges, including limited treatment options, prolonged treatment durations, increased toxicity, and higher costs.

Managing side effects is crucial for ensuring patient adherence and treatment success. Healthcare providers play a vital role in monitoring for side effects, educating patients about potential adverse reactions, and providing support throughout the treatment process. At the local, national, and international levels, coordinated efforts are required to solve the problems caused by tuberculosis. This entails bolstering medical systems, boosting financing for tuberculosis research and control initiatives, enhancing infection control practices, and increasing access to diagnoses and treatment. Ultimately, governments, medical professionals, researchers, civil society organisations, and impacted communities must work together to coordinate and persistently eradicate tuberculosis as a global health issue. Together, we can accomplish the aim of eliminating tuberculosis from the world.

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OPINIONS OF EDUCATION ADMINISTRATORS ON EFFECTIVE SCHOOL DEVELOPMENT: A CASE STUDY

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ABSTRACT

In this study, it was aimed to reveal the opinions of the education administrators working in Antalya city Muratpaşa district official public schools in the context of their opinions about effective school and to determine their views on effective school development. In the study, one of the qualitative research designs, the holistic multi-case design based on the case study was used. The data collection technique of the research is individual interview. The interviews were made using the semi-structured interview form developed by the researcher, and the descriptive analysis technique was used in the data analysis. As a result of the research, it was determined that most of the education administrators had knowledge about the concept of effectiveness, but it was determined that they perceive the concept as a social activity in terms of the concept of activity. According to the views of the administrators, the ideas that the characteristics of effective schools should primarily provide the school's education-training service in the best way, the school should attach importance to the relationship between the school and the environment, and the school climate and culture are noteworthy.It was emphasized that education administrators think that each school has its own mission and vision, that being effective and efficient can only be achieved with a vision and mission determined according to needs, and that physical needs, maintenance of classes and materials should be completed in cooperation with all stakeholders in order for schools to be effective. Participants emphasized that discipline, punishment and reward should be intertwined with a flexible educational environment in an effective school, and emphasized the importance of the concepts of school climate and corporate culture, and mentioned a need-oriented planning.Finally, in this study, the importance of breaking out of routine behaviors of effective schools, providing students with different educational environments, and doing extra studies was mentioned, and it was concluded that students' change in the desired direction and their self-actualization depend on these differences. It was emphasized that motivation is important while meeting the different expectations and needs of the stakeholders of an effective school, but positive reinforcement can be achieved with positive communication and cooperation. It was mentioned that random goals are not achieved in effective schools, and that clear and clear criteria are required according to the structure and mission-vision of the schools. It has been concluded that effective schools must focus on the necessity and indispensability of change and adapt to changes in order to be effective. According to the educational administrators, the lack of control in educational organizations has once again emerged, and the fact that the greatest deficiency in becoming an effective school originates from this gap has been emphasized with precision.

INTRODUCTION

The biggest task of schools is to help students achieve the set goals. Schools that provide students with targeted behaviors in the desired direction are effective and successful schools. The aim is that all schools should be effective, and the studies and recommendations made in order for schools to be effective schools will make it easier for schools to move along this path. The aim of this study is to define an effective school based on the opinions of school administrators working in Muratpaşa district of Antalya province and to reveal what needs to be done in developing an effective school. For this purpose, the answers to the following questions were sought in the research.

1- What do the concepts of effectiveness and effectiveness mean for managers?

2- What does effective school mean according to administrators? Why?

3- How should the structuring process of effective schools be? Why?

4- According to the administrators, what is seen and applied in effective schools?

5- According to managers, what are the duties of stakeholders in effective schools?

RESEARCH AND FINDINGS

In this study, the qualitative research design was used. The focus of qualitative research is to understand, explain, examine, explore and clarify the situations, feelings, perceptions, attitudes, values, beliefs and experiences of a group of individuals (Çokluk & Şekercioğlu, 2014). Since the research was conducted with education administrators who voluntarily participated in the research working in different official public schools in Muratpasa district of Antalya Province, a holistic multi-situation design related to case study, one of the qualitative research patterns, was used in this study.

The data collection technique of the research is individual interview. The data were recorded and notes were taken during the interview. First of all, the records were handled and written down. The written data were recorded after the individual interviews were completed. In the data analysis, inductive descriptive analysis method was used. The themes created after analyzing the literature and data tools were categorized in the form expressed in the research method and these themes were listed as: effectiveness and effectiveness, effective school,

effective school configuration, effective school practices, stakeholder tasks, models designed to improve effective school.

CONCLUSION

The participants think that each school has its own unique mission and vision, that being effective and efficient can only be achieved with a vision and mission determined according to needs, and that involving parents and other stakeholders in this process will increase the impact, overlap in this respect and sufficiently demonstrate the necessity of the vision and mission.

One of the results of this research is student-centered activities. The prerequisite for these activities is that the trust and physical conditions are made suitable for students. For an effective education system, it is necessary to provide a certain level of minimum resources and facilities. Schools with effective education systems should provide facilities and equipment that meet the basic health and safety needs of all students (Kemal & Karip, 1996).

From this point of view, the participants support this idea by expressing that physical needs, classroom maintenance and materials should be completed with TAF, stakeholders and cooperation in order for schools to be effective, emphasizing the importance of meeting basic needs by talking about corporate culture and school climate.

If the school administrator can create an effective culture and an effective school climate, he can contribute to the development of a healthy school personality by increasing the motivation of teachers (Çelik, 2002). In this context, it has been emphasized in this research that motivation is important when meeting the different expectations and needs of stakeholders of an effective school, but positive reinforcement can be achieved through positive communication and cooperation. Also, the lack of supervision in organizations in Turkey has once again emerged in this study, and the fact that the biggest deficiency in becoming an effective school is born from this gap has been emphasized by school administrators.

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DECOLONISATION AND ITS AFTERMATH: PESSIMISM AND OPTIMISM'S DESCRIPTION OF NIGERIAN SPACE, 1980S-2015

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Abstract
The thoughts of being pessimistic and optimistic about the remote and contemporary issues of Nigeria after independence have birth political thoughts in the dimensions of hope and ruin in the building of Nigerian nationhood. It is evidently true that, the large proportion of decolonisation activities were of the 20th-century in Africa. This does not position the critical thinking about it to be limited to the above mentioned century, but did flow into the 21st-century experiences of Africa. Hence, Africa as a continent recognised 1950s and 1975 as the landmark periodisation of the phenomenon of decolonisation in history. In light of this fact, the political thoughts of pessimism and optimism have become a strong instrument in the definition of Nigeria as a state of hope or ruin after breaking lose from the grip of the colonial masters in 1960. These thoughts will guide this discourse with reference to Nigeria because it created unprecedented platforms to host critical thinking about her existence since independence. More so, agitations of Nigerians who were brought together in 1914 with Nigerian Council Constitution cannot be under emphasised in this discourse. Thereafter, the agitators found errors in the constitution formation and started with constitutional reforms and better life for her people till independence in 1960. Consequently, the constitutional reforms and agitations led into two political thoughts of pessimism and optimism in the Nigerian space from 1980s to 2015.
Keywords: Pessimism, Optimism, Decolonisation, Nigeria and Constitution

Introduction

This study explores 35 years' experience of Nigerian State existence after independence between 1980 and 2015. Nigerian State has been searching for her nationhood since 1980s and this explains the trajectory of the thoughts of pessimism and optimism in its growth and development in the period under review. This search for nationhood has generated the national question phenomenon in the building of Nigerian State. As a result of these agitations, Nigeria has been confronted with series of agitations such as Movement for the Actualisation of the Sovereign State of Biafra (MASSOB), Niger Delta People's Volunteer Force (NDPVF), Oodua's People's Congress (OPC) and Boko Haram insurgence and banditry, among others questioning the hope or ruin notion for Nigerian State.[1] From the perspective of constitution making in the country since the earliest experience in 1914 up to the most recent in 1999, questions bordering on Nigeria's existence or otherwise have continued to generate controversial strands of thoughts. With this understanding, Babatunde and Morakinyo opine that the constitutional trajectory in Nigeria can be broadly examined under three different historical epochs, viz: the period of colonial autocracy and absolutism; the era of constitutional democracy and the period of Presidentialism.[2]

Hence, this study explores a historical route into the discourse on the attitudinal framework of Nigerians' political thoughts in the postcolonial Nigeria. This is with regards to its developmental stages and progresses in the last 35 years between 1980 and 2015. This study captures the activities of the military and democratic rules as the major leadership in the period under study with emphasis on the second and fourth Republican system of government in Nigeria under the watch of these political parties viz: National Party of Nigeria (NPN), Shehu Shagari (1979-1983) and Peoples' Democratic Party (PDP), Olusegun Obasanjo (1999-2007), Umar Musa Yar'Adua (2007-2010) and Goodluck Jonathan (2007-2015).[3]

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[1] Akin Alao and Adetunji Ojo Ogunyemi, 'Introduction', Akin Alao and Adetunji Ojo Ogunyemi (eds.), *Contemporary Issues on Nigeria's Development Trajectory Since 1914* (Ile-Ife: Obafemi Awolowo University Press, 2020), xiii- xv; B. Olatunji Oloruntimehin, *Culture and Democracy* (Lagos: Centre for Black and African Arts and Civilisation, 2007), 25-26, 35; Matlotleng P. Matlou, *Advancing and Integrating African Values, Ethics and Norms in the Interest of Africans and the African Diaspora* (Lagos: Centre for Black and African Arts and Civilisation, 2007), 9, 36.

[2] Ekundayo O. Babatunde and Olabisi O. Morakinyo, 'A Survey of Nigeria's Constitutional Development since 1914', Akin Alao and Adetunji Ojo Ogunyemi (eds.), Contemporary Issues on Nigeria's Development Trajectory Since 1914 (Ile-Ife: Obafemi Awolowo University Press, 2020), 42-44.

[3] Oloruntimehin, *Culture and Democracy*, 35.

This research examines the pessimists and the optimists' political thoughts in Nigeria between 1980 and 2015 exploring significant individuals within their scope of thought in the areas of the divide and how these thoughts have initiated a divided mindset and attitude in Nigerians in the describing doom and hope. What kept the thoughts afloat or alive in Nigerian space is analysed within the philosophy of these divides in the postcolonial Nigeria as aftermath of decolonisation process. The study employed secondary source of data. The secondary source included books, journal articles and the Internet. The collected data were analysed from a historical perspective. The results showed in the study that there were historical awareness and indications in the Nigerian's space of the thoughts of pessimism and optimism in describing the entity called Nigeria between 1980 and 2015. The study concluded that the postcolonial Nigeria is a description of pessimism and optimism and that this argument will continue to engage each other until an ideal Nigerian's space is achieved in the postcolonial epoch.

Conceptual Clarifications

Nigerian's Space

Nigerian's space dates antiquity as far back as 3 million years ago when human evidence was found in Africa with the fact of its evidence at Iwo Eleru in present Ondo State which dated the 9th millennium BC. Nigeria is a formation with more than 200 ethnic societies which came under the British colonial hegemony as an amalgamated entity in 1914.[4] Hence, she is a republican state situated in the West Africa and it is bordered to the West by Republics of Ghana and Benin, to the East by Republics of Cameroon and Chad, to the North by Republic of Niger and to the South Gulf of Guinea. She lies between the latitudes 4^0 North and 14^0 North and

[4] Alao and Ogunyemi, 'Introduction', xiii; Adetunji Ojo Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', Akin Alao and Adetunji Ojo Ogunyemi (eds.), Contemporary Issues on Nigeria's Development Trajectory Since 1914 (Ile-Ife: Obafemi Awolowo University Press, 2020), 4

longitude 3^0 and 16^0 East of the meridian. This implies that Nigeria approximately is 923,000 square kilometers or about 356,000 square miles. The population of Nigeria is about 206 million with a Federal Capital Territory at Abuja, 36 State and 774 sub-components parts.[5]

Decolonisation

Decolonisation is the dimension of political economy activities embarked upon by the colonial powers after the World War II to free her colonies and reabsorbed them into her political hegemony in order to save herself from the severe economic crisis and to acquire economic recovery and development in the postwar era. It is also the process of making efforts for the survival of the colonial masters. It explains the competition for economic space between Africa and the metropolises. Decolonisation represents negotiation about control of the postcolonial political economy. It is a phenomenon in salvaging the primary interest of colonialism of the colonial powers. It is an expensive programme but not with major restructuring or initiative for the colonies.[6]

Pessimism

It is a thought pattern that see worst aspect of a thing and believe that the worst will happen, in this context that Nigeria will collapse and will not hold. In other words, it is an attitude that Nigerian state is not a working entity, it is a dead system on arrival. It is a thought of evil will prevail over good. It is negativity, hopelessness and gloom mindset.

[5] *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 3-4,17; Bosun Banjoko, 'Environmental and Ecological Question in the Nigerian Project', Akin Alao and Adetunji Ojo Ogunyemi (eds.), Contemporary Issues on Nigeria's Development Trajectory Since 1914 (Ile-Ife: Obafemi Awolowo University Press, 2020), 641.

[6] G. Ugo Nwokeji, 'African Economics in the Years of Decolonisation', Toyin Falola (ed.), *Africa, The End of Colonial Rule: Nationalism and Decolonisation, Volume 4* (Durham, North Carolina: Carolina Academic Press, 2002), 131-132, 134,;150

Optimism

It is an attitude of confidence that all will be well about the future of a system like Nigeria even in the face of threats to her existence when things seems not working. In addition, it is positivism of thought that Nigeria is the best of all best states in the world.

The aftermath of Decolonisation in the Description of Nigerian Space: Pessimism and Optimism, 1980s-2015

Taking a leave from 1979 the opening date into the second Republic in postcolonial Nigeria between 1979 and 1983 which gave hope to Nigerian's space after the decades of military rule between 1966 and 1979. Olusegun Obasanjo in 1979 ignited the fire of optimism which ran into the 80s of the last century. Obasanjo was endorsed as the first African military head of State to hand over power to a democratically elected government under the watch of Shehu Shagari. While by 1983 the hope began to dim and the pessimists' ideology came with the return to the military rule in successions of Muhammad Buhari (1983-1985) and Ibrahim Babangida (1985-1993) and Chinua Achebe's thesis on the ruin description of Nigerian's space surfaced with his work titled, *The Trouble with Nigeria*. Thereafter, the discourse of ruin and hope kept engaging each other for 35 years as observed in this study. The appearance of Olusegun Obasanjo in 1999 in the journey of the fourth Republic further contested the position of the pessimists' description of Nigerian State. This actions, reactions and counteractions of attitude of Nigerians formed the background to the positive and negative sides to the description of Nigeria in the postcolonial era in this study.[7]

[7] Alao and Ogunyemi, 'Introduction', xiii; Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 4; Tunde Babawale, *Good Governance, Democracy and Democratic "Best Practices": Prescription for Nigeria* (Lagos: Centre for Black and African Arts and Civilisation, 2007), 11, 14, 19.

Pessimism's Description of Nigerian Space

The remote factor into the contemporary idea of pessimism in Nigeria is dated to 1967. This was during the regime of General Yakubu Gowon when the Eastern Region was established as an administrative convenience system and later turned to be an opened wall in the building of the nationhood of Nigeria through the machinery of Colonel Odumegwu Ojukwu. This was in an effort to react to some maladies in the institutional framework of Nigerian State system in the period then. To resolve the problem, the creation of Biafra State was seen as a remedy to the poor leadership and negative stereotypes of Nigeria to her major stakeholders. This agitation by the east was as a result of the political economy situation of Nigeria which gave no hope to the whole but, few individuals who exploited the masses for their own capitalist gains.[8] This opinion of pessimism was further reinstated with Chinua Achebe in 1983 in his work titled, *The Trouble with Nigeria* barely 13 years after the first movement in the dimension of no hope for Nigerian State because most of the leaders are like old wine in new bottles. He drew the attention of the masses to the pessimistic atmosphere of Nigerian state as a result of maladministration and mismanagement of economic resources of the State by Shehu Shagari's government. This notion was further reechoed in 2012 by Chinua Achebe in another work titled, *There was a Country: A Personal History of Biafra,* when Goodluck Jonathan was the President. By 1986, Chu S. P Okongwu observed that Nigeria has huge external debt and he alerted the people of Nigeria as a pessimist in his article, *The Nigerian Economy: Being an Anatomy of a Traumatised Economy with some Proposal for Stabilisation*, he made a way forward for Nigerian State if the instruction would be followed. This call came during the reign of Ibrahim Babangida. Thus, Obafemi Awolowo's opinion serves as a bridge to the above opinions, he emphasised political and legal crisis of governance as a catalyst to misrule and

[8] *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 23

lack of accountability. This opinion is found in his work title, *The Travails of Democracy and the Rule of Law* in 1987. This still falls under the regime of Ibrahim Babangida.[9] The Federal Office of Statistics explains further the pessimism of the socio-economy structure of Nigerian state from 1987 to the middle 1990s by expressing a disturbing picture of Nigerian federation criticising the government's economy reform programme called the Structural Adjustment Programme (SAP), creation of States and Local Governments Areas to manage the fiscal crisis in Nigeria.[10] By 2014, John A. A. Ayoade, Adeoye Akinsanya and Olatunde Ojo opine that Nigeria has no hope in their work titled, *Nigerian: Descent into Anarchy and Collapse*?[11] The above pessimists' thought in the political arena of Nigeria revealed selfishness through party deflections with no agenda for the masses except for themselves. The leadership in Nigeria has not gotten it right and cannot lead Nigeria anywhere. In substantiating their notion of pessimism these factors below were used as argument in favour and to further enriched the hopelessness of the Nigerian state because of its relationship and understanding of the political economy consciousness in the contemporary times. The arguments include:Constitutional power has always been from the centre rather than from the components between 1980 and 2015. This has not given an inclusive consciousness to Nigerians as major stakeholder in their state affairs. These components made decisions which ought to be recognised but such recommendations were just for sighting not for the real business of doing the needful among the citizens of Nigeria. Therefore, individuals with opinion that no hope for Nigeria used this as a base for argument which replicates itself in different movements such as MASSOB, NDPVF, OPC, Boko Haram and deadly politics through vote buying and coercion among others.[12] In addition,

[9] Alao and Ogunyemi, 'Introduction', xv, xvii
[10] *Ibid.* Alao and Ogunyemi, 'Introduction', xvi-xvii
[11] *Ibid.* Alao and Ogunyemi, 'Introduction', xvii
[12] Babawale, *Good Governance, Democracy and Democratic "Best Practices":* 9; *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 16.

the economic factor has been one of the propelling factors in decisions making as regards amalgamation of Nigerian space since 1861 for the exploitation of the people colonised and for the balanced budget which has shown injustice in the administration of the protectorates and division to the level of regions and State creations. The driving force has been economy, with the understanding of robbing the south to feed the north, and there was no efforts to plow back such contributions' profit into the south, the people felt it is better Nigeria seize to exist and the south is at peace.[13]Administrative convenience as a unitary and centralised state was in operation from 1914 to 1939. This structure made the northern protectorate to be an entity with 12 provinces and the southern protectorate was divided into two; western and eastern with 11 provinces. By 1943, it was further divided into administrative divisions 39 and 44 respectively and by 1946 there exist 23 provinces and 83 divisions. By 1953 the provinces were grouped into Northern, Western and Eastern regions with an addition of Mid-west region in 1963. This structure ran with little modification till 1967. This administrative convenience revealed the inequality in the Nigerian State and encouraged the attitude of pessimism in the period under review.[14] Dissolution of regional system structure by Gowon in 1967 and the creation of 12 State was a check against ruin of Nigerian space. Northern region was fragmented into 10 states of 41 divisions while eastern, western and mid-west regions were split into three states with 55 divisions. This is an unequal arrangement which strengthened the hopelessness in Nigerian State.[15] General Murtala Muhammed in 1976 created an additional 7 states and collapsed the 96 division into 301 Local Government Areas structure and the north benefited more from this decisions while the south were at the receiving end.[16] The regime of General Ibrahim Babangida

[13] Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 16-17, 21, 26
[14] *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 18-19, 22-23
[15] *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 23.
[16] *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 24.

between 1985 and 1991 had the highest creation of States and Local Government Areas in Nigerian space in the period under review from 1980s and 2015: 1987-1990 3 States, 1991 9 States. By 1996, General Sanni Abacha created additional 5 states making total of 36 States and 769 Local Government Areas with 774 sub-component part including 5 area councils at Abuja. All these administrative convenience were like adding salt to injury, as the problem of injustice in the distribution of the state resources were not solved the national questions were not treated clinically by the political actors.[17] Nigeria has not stopped practicing colonial legacies consciously or unconsciously. Nigeria has not been able to look inward and find solution to her own problem in all spheres of life ranging from politics to social life.[18] Most of the promulgated laws were not working in sustaining the Nigerian State as it affects waste management, pollution, oil spills and oil pipeline vandalisation, deforestation, erosion and flood, among others. For instance, the supervising agency for environmental protection, Nigerian Environmental Standard Regulation Agency (NESRES) has not done the needful in knitting Nigerian's space as an entity of hope in the period under review.[19] Olanisebe and Lateju opine that Ariri-Chidomere describes Nigeria as an artificial creation, by implication, it is not meant to last. It will soon disintegrate and the marriage will fall and members of the union will divorce one another. According to the duo, marriage by convenience is not providing hope for Nigerian State. Corroborating the above Isiramen avers that Nigerian State is a volatile mix which some day must fail.[20]The religious factor has put Nigerian state on a divide rather than unity, the pessimists see this as a signal for Nigerian ruin. Ariri-Chidomere observes that the marriage of

[17] *Ibid.* Ogunyemi, 'Nigeria: A Review of its History since the Precolonial Times', 25.
[18] Alao and Ogunyemi, 'Introduction', xviii
[19] Bosun Banjoko, 'Environmental and Ecological Question in the Nigerian Project', Akin Alao and Adetunji Ojo Ogunyemi (eds.), *Contemporary Issues on Nigeria's Development Trajectory Since 1914* (Ile-Ife: Obafemi Awolowo University Press, 2020), 641; Babawale, *Good Governance, Democracy and Democratic "Best Practices":*, 11.
[20] Samson O. Olanisebe and Fola T. Lateju, 'The Role of Religion in the Making of Nigerian State', Akin Alao and Adetunji Ojo Ogunyemi (eds.), *Contemporary Issues on Nigeria's Development Trajectory Since 1914* (Ile-Ife: Obafemi Awolowo University Press, 2020), 647.

Christianity and Islam is not a good match for Nigerian State. For example when the Sharia law was agitated for between 1976 and 1978 which finally had a headway in 1979 with the inclusion of Sharia Court in the fourth Republic's constitution. This gave an explanation that the postcolonial Nigeria situation encouraged loyalty of individuals first to religion and ethnic divides at the expense of the whole State. Hence, religion has been used to further polarised Nigerian people. The inclusion of Nigeria into the Organisation of Islamic Countries (OIC) has also tolled the route of ruin for Nigerian State which was perfected by Ibrahim Babangida regime although initiated by Yakkubu Gowon's regime.[21] This action has continued to generate heat and violence between 1980 and 2015 viz: Kano (1980), Maiduguri and Kaduna (1982), Yola (1984), Gombe (1985), Funtua (1993), Kafanchan-Kaduna (1987), Zaria (1988), Bauchi (1991), Kano (1991), Zagonkataf-Kaduna (1992), Kastina (2000), Jos (2001 and 2004), Onitsha (2006), Jos (2008), Bauchi (2009) and Boko Haram insurgencies (2009-2015).[22] It is pretty clear that at independent with the application of 1960 constitution and first Republic constitution no mention of the word God not until 1979 and 1999 constitutions that birth the second and fourth Republic respectively, these constitutions made provisions for the mention of the word God. This has also been replicated in the National Anthem and Pledge. This religio-politics phenomenon has since 1914 being there. This religious factor made Wole Soyinka to observe that Religion is the enemy of Nation building because it drives exclusion and not inclusion.[23]

Optimism's Description of Nigerian Space

At the inauguration on the 29th May, 2007, President, Umar Musa Yar'Adua encourages Nigerian to march with him into the age of restoration by working together to restore the lost

[21] *Ibid.* Olanisebe and Lateju, 'The Role of Religion in the Making of Nigerian State', 652-653.
[22] *Ibid.* Olanisebe and Lateju, 'The Role of Religion in the Making of Nigerian State', 654-655.
[23] *Ibid.* Olanisebe and Lateju, 'The Role of Religion in the Making of Nigerian State', 657-658.

honoured values of honesty, decency, generosity, modesty, selflessness, transparency and accountability which are foundation to a society with hope and a future because Nigerians choose to succeed.[24] The optimists were of the opinion that despite all the challenges faced by Nigerian State that someday Nigerian would overcome it and hit the ground running as great nation-state. The admonition of the optimist is that Nigerians should have positive mindset and they should work for the benefit of the State by moving amass to taking her on the path of greatness through revolutionary change activities. Nigerian efforts in the larger world revealed an atmosphere of optimism because of Nigerians' contributions to creativity and innovations in the global economy which is top notch, if applied in Nigeria with the right attitude then she would be bettered for it. Olusegun Obasanjo is one of the optimists who sees hope in Nigerian State way back in 1989 when others saw ruin, he suggested integration of Nigerian people for political inclusion and economic development. He understood the effect of the political economy on the attitude of Nigerians which at all times stares at the existence of Nigerian State as a political entity in the communities of nation as an existence. Hence, the likes of Hyacinth Ajaeghu, B.J. St. Mathew-Daniels, Okon Edet Uya, A.B. Mamman and Oluwole Oyebamiji put up a piece in 2014 titled, *Nigeria: A people United, A Future Assured (Vol. I)* and by 2002, Olusegun Obasanjo encourages Nigerian youth in an engaging entrepreneur exercise in his work title, *I See Hope* as a reflection that Nigerian can still be stronger again through patriotism and perseverance.[25] Adetunji Ogunyemi and Richard Adeyemi corroborate the thought of hope in Nigerian system if Nigerians can be properly integrated into a true State system by restructuring and free her from the attachment to the West.[26] Having looked at some of the optimists and how it began in the period under review, they provide way forward to Nigerian

[24] Oloruntimehin, *Culture and Democracy*, 35.

[25] Alao and Ogunyemi, 'Introduction', xvii

[26] *Ibid.* Alao and Ogunyemi, 'Introduction', xviii

State which include:The safety of Nigeria as opined by the optimist is the safety of Africa. This has been the approach of the integrative element in Nigerian State. This thought informed the foreign policy of Nigeria which is African centre in the period under review. This sect believes that Nigeria has life and hope. This factor has helped strengthened the optimists thought in the description of Nigerian State between 1980 and 2015.[27] Education is another factor recommended by the optimist that seeking knowledge always is power and by this the mental capacity of Nigerians are equipped and strengthened for the kind of change Nigerians want by critically analysing issues and situations as it appear.[28]Participatory democracy is used here to argue further the hope for Nigeria, Nigerian should come out and do the needful, enough of putting the ball in the court of bad leaders only. Nigerian should stop complaining and being lackadaisical, Nigerians should keep a watch on the politics and stop seeing politics as a dirty game which has been used to deprive Nigerians of their benefits between 1980s and 2015. This participation is to be rooted in the family system not by queuing behind the politicians and individuals who want to use and drop them but mobilise for a better Nigeria.[29] Resilience and Consistence is the power to giving Nigeria hope even when Nigerians leaders failed in their efforts in changing thing because the system is saturated with bad people. Nigerian should keep at it and forge ahead with the attitude of Nigeria must be rescued from the bad leadership by contributing to its maintenance as structural functional system.[30]Doing it right is another instrument in making Nigeria to live as a sovereign state in the committee of nations.

[27] Kehinde Olayode, 'Rethinking Nigeria's Afro-Cemtre Foreign Policy Amidst New Realities in Globalised World', Akin Alao and Adetunji Ojo Ogunyemi (eds.), *Contemporary Issues on Nigeria's Development Trajectory Since 1914* (Ile-Ife: Obafemi Awolowo University Press, 2020), 560-561.

[28] Babawale, *Good Governance, Democracy and Democratic "Best Practices":*, 12; Olakunle A. Ogunbameru, *Sociological Theory* (Revised and Enlarged Edition) (Ibadan: Penhouse Publications, 2010), 24839.

[29] Tunde Babawale, *Culture, Politics and Sustainable Development: Lessons for Nigeria* (Lagos: Centre for Black and African Arts and Civilisation, 2007) 18-19; Ogunbameru, *Sociological Theory*, 38-39.

[30] Babawale, *Culture, Politics and Sustainable Development: Lessons for Nigeria*, 18-19; Ogunbameru, *Sociological Theory*, 39.

Government is all about people, when a Nigerian is in a leadership position he/she should strive to do it right. Learn the art of good leadership and lead right and through this there would be positive outcomes for the overall benefits of Nigerians. Adding to the above the optimists believe that it is a prepared leader that can do it and a transformational leadership is what Nigeria needs, this has been the thought since 1980 to 2015. The optimists are of the opinion that Nigerian are creative and are self-made because of their level of creativity and innovations. With this creativity Nigerians can achieve more in order for Nigeria to exist and perform maximally. Therefore, Nigerian should keep at being creative always as she forges ahead with rays of hope.[31]

Conclusion

This paper has revealed two major sects of Nigerians based on the political thoughts of pessimism and optimism. In other words, those who are negative and disintegrative and those who are positive and integrative as a balanced description of Nigerian State in the period under review. The discourse on the pessimists and optimists thinking in Nigerian's space has revealed the two sides of a coin which cannot be separated from each other. These two perspectives serve as a correctional and checkmating mechanism to putting Nigeria on the right footing as a corporate existence. The thoughts are good for Nigerian system to survive. Those with the thought that Nigeria is done for and those who see Nigeria coming strong are both striving directly or indirectly for a better and strong Nigeria. The study has observed that when the maladies are well taken care of the pessimists will become optimist automatically because the system will be inclusive and everyone will be integrated pragmatically into a Nigeria with nationhood although diversified with cultures and orientations.

[31] Babawale, *Good Governance, Democracy and Democratic "Best Practices"*, 12.

A HISTORY OF THE PHENOMENA OF THE 'FIRST' IN THE BAPTIST MEDICAL CENTRE OGBOMOSO, 1907-1997

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Abstract
This paper attempts to interrogate the spectacle of the *'First'* grand breaking individuals and the routes engaged by them in the Baptist Medical Mission's activities in Ogbomoso in the period under review. It explores the relationship between the institution (Baptist Medical Centre, Ogbomoso (BMCO)) as the first and selected individuals who were *'First'* in their delivery of services in BMCO. This interrogation adopts both primary and secondary sources of data which is contextualised within the framework of medical evangelism in Yorubaland. This research embraces a case study approach to achieving its purposes in one of the Baptist Mission's medical facilities in the southwestern state of Nigeria. This facility under study was established on 18th March, 1907 as the first Baptist Medical Mission facility in Yorubaland through the instrumentality of the Southern Baptist Convention's medical missionaries. Other medical facilities of the Baptist Mission in Yorubaland are located in Oyo, Ibadan, Iwo, Saki, Okeho, Okaka, Gbaabe, Ilero, Okuta, Iree, Ile-Oluji, Ejigbo and Igede-Ekiti, among others. This study gives prominence to BMCO and selected individuals in the period under review.
Keywords: First, Ogbomoso, Phenomena, Medical Mission and Baptist Medical Centre.

Introduction

This study attempts to explore the trajectory of human condition and knowledge in the Baptist Medical Centre Ogbomoso by reviewing selected individuals with the incident of the idea *'first'* in their existence in the Baptist Mission's medical evangelism in Ogbomoso between 1907 and 1997.[32] Hence, four selected individuals who possessed both material and spiritual human condition and knowledge are examined in this paper using *phenomena:* appearance as they were and *noumena*; things in themselves (self-consciousness). The human situation and information about them is not devoid of God (religion) consequently, man and religion walk together in existence.[33] In addition, human experience is the ultimate source and justification of all forms knowledge. This implies that, every man is different from another due to the way he thinks and behaves in his environment based on time and space factors.[34] Therefore, these selected individuals are cultures on their own though of different backgrounds and orientations but with a common being, human condition and knowledge of *'first'* in their distinct cultures in the activities of the Baptist Medical Centre Ogbomoso (BMCO) between 1907and 1997.[35] Human existence is germane to historical reconstruction of any kind be it political, social, economic and medical, among others. In the light of human existence in a space which is time bound with historical evidences, this research attempt considering the existence of selected individuals who have showcased themselves as *'first'* in the history of Baptist Medical Centre Ogbomoso (BMCO) between 1907 and 1997.[36]

[32] Daniel Adedosu Gbadero, 'Ogbomoso: The Citadel of Baptist Medical Mission in Nigeria' in Daniel Folorunso Oroniran (ed.) *Ogbomoso: The Jerusalem of the Baptist in Nigeria* (Ibadan: Titles Publishers, 2014), 140,

[33] Abstract, Iram Azhar, 'A Critical Study of Existentialistic view of Education and Its Relevance to Human Existence and Progress' (Ph.D. Thesis, Education Department, Faculty of Education, Augarh Muslim University Aligarh (India), 2013), 1; Valentine Ethichioya Obinyan, Nature of Human Existence in Kierkegaard's Ethical Philosophy: A step towards Self-Valuation and Transformation in Our Contemporary World. *International Journal of philosophy.* Vol. 2. No. 1, 2014: 3-4. Doi: 10.11648/j.ijp.20140201.11; B.N. Tripathi, *Meaning of Life in Existentialism.* (Aradhana Prakashan, 1987), 1, 5, 9, 12, 410; R.N. Kali, Immediacy, Reason and Existence. (Udayana Publications, 1965), 222; D. Shukla, Subjectivity in Kierkegaard's Philosophy (Mansi Prakashan, 1987), 17.

[34]Y. Kashima, E.S. Kashima, U. Kim, & M. Gelfand, Describing the Social World: How is a Person, a Group, and a Relationship described in the East and the West? *Journal of Experimental Social Psychology* (2006), 42, 388–396; Scott O'leary, Sin, Despair, and the Other: The works of Soren Kierkegaard, 39.

[35] H. Mead, *Types and Problems of Philosophy: An Introduction* (H. Holt, 1946), 426.

[36] D.R. Bali, *Introduction to Philosophy* (Sterling Publication Private Ltd., 1984), 224-226; *Ibid.*, Tripathi, *Meaning of Life in Existentialism*, 410, *Ibid.*, Kalu, *Immediacy, Reason and Existence*, 222

This study explores these significant individuals within the medical mission of the Baptists exposing their biographical experiences and contributions to humanity as a form of knowledge which is buried in human memories. The study employed both primary and secondary sources of data. The primary source included oral interviews with purposively selected informants and archival materials like Baptist papers, memoirs and diaries, annual reports, magazines and other relevant records collected from Baptist repositories in Ogbomoso. The four selected individuals in Baptist Medical Centre Ogbomoso in this study are: George Green, Ruth May Kersey, Adeoye Adeniyi and Peter Olusola Elemile. This selection is based on the fact that these individuals were Baptist Mission's medical missionaries who were first in their respective culture and played significant roles in the growth and development of the Baptist medical facilities in Ogbomoso between 1907 and 1997. The secondary source included books, journal articles and the Internet. The collected data were analysed from a historical perspective. The results showed in the study that there were historical consciousness and suggestions in the Baptist Medical Centre Ogbomoso between 1907 and 1997. The study concluded that the colonial and postcolonial experiences and memories of these selected individuals cannot be underemphasised in the routes to human condition and knowledge in the Baptist Mission's enterprise in Ogbomoso.

Conceptual Clarifications

First

The concept the *'First'* in this article is a form of human condition and knowledge which is termed *phenomena*; things as they appeared in human space. In other words, it is a common set of circumstantial appearance of man as a historical existence in space-time.[37] Hence, the appearance of the idea *'First'* at different times in the history of man most especially in the history of the Baptist Medical Centre Ogbomoso (BMCO) was a systematic reality in existence as it explains these dimensions viz.: Horizontal Auto-Transcendence[38] and Vertical Auto-Transcendence.[39] This human condition and knowledge is applied in this research as a result of the appearance of significant individuals in history with distinct and unique impact on humanity in the medical space. Therefore, *first* as a condition and knowledge is the coming before all

[37] J.V.L. Casserly, 'Some Contemporary Beliefs' I. Levine (ed.), *Philosophy: Man's Search for Reality* (London: Odhams Press, 1955), 181, 217; Bali, *Introduction to Philosophy*, 224-226; T.Z. Lavine, *From Socrates to Sartre: The Philosophic Quest* (Bantam Books, 1984), 330-333.
[38]Egocentric and Philanthropic Auto-Transcendence
[39] Theocentric Auto-Transcendence

others in time or order; earliest.[40] It also means preceding all others in time, order, importance or series; before any other.[41] The *'first'*[42] in this research draws readers' attention to a unique circumstantial knowledge in history as an occurrence that is a thrust to many succeeding events in the perspective of the unique individuals as *phenomena* and *noumena* in space.[43] The concept '*first'* in this research is also looked at based on the postulation of Aristotle as statements of understanding, accepted saying, definition and assumption of significant individuals. On this justification of the '*first'* as human condition and knowledge; statement of understanding, accepted saying, definition and assumption is the Baptist Medical Centre Ogbomoso (BMCO) examined. By implication, the '*first'* have carved a niche which was '*formally accepted human condition and assumption'* about the being of appearance and consciousness in the activities of the Baptist Medical facility in Ogbomoso in the period under review.[44]

Baptist Medical Centre Ogbomoso (BMCO)

Baptist Medical Centre Ogbomoso is an idea explaining the contributions of the nationals to growth and development of medical mission in Ogbomoso. It is also an expansion in services delivery and the amalgamation of three (3) initial independent medical institutions in Ogbomoso viz.: Baptist Hospital Ogbomoso (1907), Kersey Children Home (1926) and Leprosy Camp (Health Service) (1930s) which were coordinated differently until the introduction BMCO as a coordinating entity of the Baptist Mission's medical facilities in Ogbomoso in 1980s.[45] However, the idea of the Baptist Medical Centre Ogbomoso has since expanded by incorporating other facilities viz.: School of Nursing, Educational services and financial institution, among others.[46]

[40] Definition of First by Dictionary.com
[41] Definition of First by Merriam Webster
[42] It denotes foremost, pioneer, highest, introductory, primary, beginning, opening and principal.
[43] *Ibid.* Casserly, 'Some Contemporary Beliefs', 181, 217; *Ibid.* Bali, *Introduction to Philosophy*, 224-226; *Ibid.* Lavine, *From Socrates to Sartre: The Philosophic Quest*, 330-333.
[44] Aristotle *Metaphysics*. 1-3. Translated W.D. Ross. (Oxford Clarendon Press, 1924); Sophia Project (2005). The First Principles of Knowledge, Aristotle, Book I., 1-5 Philosophy Archives. www.sophia.omni.org
[45] Annual Report Baptist Medical Centre Ogbomoso, Western Nigeria (Baptist Manuscript available at J. C. Pool Library of the Nigerian Baptist Theological Seminary, Ogbomoso File No. V.F. 1805, 31st December, 1971), 5; S. Ademola Ajayi, *Peter Olusola Elemile: Biography of a Nigerian Baptist Missionary Physician* (Ibadan: Book Wright Publishers, 2019), 343.
[46] *Ibid.* Ajayi, *Peter Olusola Elemile, Biography of a Nigerian Baptist Missionary Physician*, 54-57, 343; Olufemi Timothy Ogunbode, 'A History of the Baptist Mission and Healthcare Delivery System in Ogbomosoland, 1907-1997' (M.Phil. Dissertation, History Department, Faculty of Arts, Obafemi Awolowo University, Ile-Ife, 2019), 103.

Phenomena of the 'First' in the Baptist Medical Centre Ogbomoso, 1907-1997

The selected four individuals in this study possess human condition and knowledge of appearances, memories and experiences which birth arts and reasoning in the Baptist Mission's enterprise in Ogbomoso between 1907 and 1997. Hence, appearances, memories and experiences are the universal judgment for human relational activities to space, time and action as it was engaged and interrogated in the Baptist Medical Centre Ogbomoso in the 20th-century.[47]

George Green: The First Baptist Medical Missionary and Medical Superintendent, 1907-1944

It is worthy to note that George Green was born in London on the 26th July, 1872 by George Green and Charlotte Steadman Green. He encounter Christ at the age of 12 at a revival meeting held on the 4th November, 1884 when he became born again. This corroborates the statement of Socrates that one must aspire to know oneself. According to Socrates he who knows himself knows his Lord. This attitude led George Green to be baptised into full membership of the Upton Baptist Chapel in 1885 at age 13. In addition, he was inflicted with influenza in 1895 which made him to be admitted in the Montreal General Hospital. He was cared and treated by the Reeds, member of Upton Baptist Chapel and got recuperated in the home of another church family member. This compassionate care he received from these kind people planted the seed of medical mission which got germinated when he was enrolled into the world of medical missions as a Medical Doctor. This medical mission assignment made him in 1906 to complete his 18 months non-remunerative internship training at St. Vincent de Paul's Hospital, Norfolk.[48] He was ordained into the gospel ministry of Christ on the 26th November, 1906. He and his wife, Lydia were married at Park Avenue Baptist Church, Norfolk, on the 9th January, 1907. This newly wedded couple went directly from the church to the wharf to board the steamer from Norfolk to Richmond. They left Richmond for New York on the 17th January, 1907. Finally departed for Lagos on the steamship Carmania via Liverpool, England, on the 19th January,

[47] Aristotle *Metaphysics*. 1-3. Translated W.D. Ross.; Sophia Project. The First Principles of Knowledge, Aristotle, Book I., 1-5; Marc Gasser-Wingate, *Aristotle on Induction and First Principles*, Volume 16, No. 4 (Philosophers' Imprint, 2016), 7-13 www.philosophersimprint.org/016004

[48] Lavine, *From Socrates to Sartre: The Philosophic Quest*, 330-333; Daniel Adedosu Gbadero, 'A Eulogy to Dr. George Green, M.D., 1872-1962', at The Centenary Thanksgiving Service at Ori-Oke Baptist Church on Sunday The 18th of March 2007; Daniel Folorunso Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 196-199, Interview, Daniel Adedosu Gbadero, Dean, Faculty of Clinical Sciences, College of Health Sciences, Bowen University Teaching Hospital, Ogbomoso, 18th October, 2017.

1907. They arrived in Lagos on the 4th March, 1907 and finally in Ogbomoso on 18th March, 1907.[49]

Consequently, his rebirth and spiritual encounter and the medical training further led to unprecedented action of his movement to Africa, West Africa, Nigeria and Ogbomoso respectively. The Foreign Mission Board (FMB) of the Southern Baptist Convention (SBC) appointed him, the first medical missionary and superintendent to Africa and by extension Ogbomoso. His arrival in Ogbomoso made him to encounter his first patient, a little girl (Aina) who spurred the chain reactions that led to creation and establishment of the Baptist Hospital Ogbomoso 1907 and Baptist Medical Centre Ogbomoso years after. Aina was about four years old, when the Greens arrived in Ogbomoso. She had severe burns and burns contractures that had caused significant deformity to one of her legs. The fame of George Green and his new hospital in Ogbomoso soon spread far and wide in the existence of Baptist Medical Centre Ogbomoso (BMCO) in the 20th century. The Baptist Hospital Ogbomoso grew in leaps and bounds and George Green, the first Southern Baptist Convention (SBC) medical missionary to Nigeria, reported to the Foreign Mission Board (FMB) that, 'Our work in Ogbomoso has been three-fold in character; Evangelistic, Educational, and Medical.' In other words, it included the work of the Churches, Schools and Dispensaries.[50] The people he worked with as the first medical missionary and superintendent in the Baptist Mission's medical facility in Ogbomoso included Lydia William Green, Basil Lee Lockett, Mary Ellen Caver, Mary Reeks McCormick,[51] Ruth Mary McCormick, S.G. Pinnock, John Ajao Dare[52], Peter Ogunranti

[49] *Ibid.* Gbadero, 'A Eulogy to Dr. George Green, M.D., 1872-1962'; Louis M. Duval, *Baptist Missions in Nigeria, Educational Department, Foreign Mission Board, Southern Baptist Convention,* (Richmond, Virginia, 1928):150-151; *Ibid.* Oroniran, *The Baptist Heritage: A Nigerian Perspective,* 196-199; Deji Ayegboyin and Michael A. Ogunewu, 'Ogbomoso and the Baptist Enterprise: Lesson for Today' in Daniel Folorunso Oroniran (ed.) *Ogbomoso: The Jerusalem of the Baptist in Nigeria* (Ibadan: Titles Publishers, 2014), 21; Ezekiel Akanni Bamigboye, *150 Years of Baptist Work in Ogbomoso* (Ibadan: Flourish Books Limited, 2005), 114; Daniel Adedosu Gbadero, 'Ogbomoso: The Citadel of Baptist Medical Mission in Nigeria' in Daniel Folorunso Oroniran (ed.) *Ogbomoso: The Jerusalem of the Baptist in Nigeria* (Ibadan: Titles Publishers, 2014),131; *Ibid.* Interview, Gbadero, 18th October, 2017.

[50] Samuel Chukwudoruem Agubosim, 'The Development of Modern Medical and Health Services in the Warri/Delta Province, Nigeria 1906-1960' (Ph.D. Thesis, History Department, Faculty of Arts, University of Ibadan, January, 1997), 66.

[51] Annual Report of the Southern Baptist Convention, Nineteen Hundred and Twenty-Six Seventy-First Session, Eighty-First Year, Houston, Texas, May 12-16, 161.

[52] He joined service of Baptist healthcare in 1911 as dispenser.

Ogunniyi, Clara Keith,[53] Ruth May Kersey, E.G. Maclean,[54] Okanla[55], John Lafihan,[56] William Page Meredith,[57] Mary Hester Powell, Joseph Oke,[58] James Clarence Anders, Leonard Long, Valda Long, Frances Carter-Jones, Lucille Reagan, Horace Glenn Walker, Howard Douglas McCamey,[59] V.I. Seat, L. Blair, Knight, Nothrip[60], J.C. Anders, N.B., Robertson and Harold Canning among others.[61]

Ruth May Kersey: First Missionary Nurse and Pediatric Nurse, 1920-1955

Ruth May Kersey experiences started in 1889 with Mr. Phillip W. Kersey and Mrs. Emma Cornelia Kersey in Virginia, who warmly received her on the said date above. The existence of Ruth May Kersey in 1889 made her to acquire education from these institutions namely Public school in Hanover County, 1896-1907; Richmond High School, 1907-1908 and Hanover College Richmond where she studied English and History, 1913-1914. Hence, at the age of 25, she enrolled into the Southern Baptist Women Missionary's Union Training School in Louisville, Kentucky in 1914 and graduated in 1916 with a Bachelor in Missionary Training Degree. Kersey enrolled for nurse training at Retreat for the Sick in Richmond near her home in 1917 and graduated in 1920 with a Nursing degree.[62] She read several books to prepare her for mission work such as *The Romance of Nigeria, The Light of the World, An African Trail,* and *The Cure of Africa.* In addition to the above facts about her she studied Comparative Religion and Missions under Dr Carver.[63] The chain of educational reactions was a reflection of her appearance, memory and experience as she searched for the real Kersey in existence in the 20th-century. Ruth May Kersey was appointed a missionary on the 10th June, 1920. At the

[53] First Missionary Nurse in Ogbomoso in 1915.
[54] *Ibid.* Interview, Gbadero, 2017.
[55] Okanla was employed as the Chaplain of the Baptist Hospital, Ogbomoso by George Green
[56] Rasheed Oyewole Olaniyi, Memory and Politics of Colonial Medical Services in Ogbomoso, 1907-1970, Dreaming of Health and Science in Africa: Aesthetics, Affects, Poetics and Politics (Wellcome Trust Conference Centre, Hinxton Hall, Cambridgeshire, UK, June 13-15, 2015), 15, 23
[57] Interview, Ruth Tinuola Oke, Retired Theatre Practitioner in the Operation Room (OR) of Baptist Medical Centre, Ogbomoso, 28th August, 2018.
[58] *Ibid.* Interview, Oke, 2018.
[59] Eyitope O. Ogunbodede, History of Dentistry in Nigeria (Ile-Ife: The Foundation for Dental Education Museum and Archives, 2015), 33.
[60] *Ibid,* Olaniyi, Memory and Politics of Colonial Medical Services in Ogbomoso, 1907-1970, 23
[61] *Ibid,* Interview, Gbadero, 2017.
[62] See Ruth Kersey, Application for Missionary 1920, 1; Alison Marie Salevan, 'Altruism in Action: The Southern Baptist Nurse Missionary in Nigeria, Mid-Twentieth Century', 2018), 19, 21, 30.
[63] Salevan, 'Altruism in Action: The Southern Baptist Nurse Missionary in Nigeria, Mid-Twentieth Century', 19, 21-22.

age of 31, as a single woman, she sailed for Africa on the 28th December, 1920. When she arrived Nigeria, she was sent to work with Dr George Green at the Baptist Hospital, Ogbomoso. She worked with him for 6 years at Ogbomoso. Before she had the encounter that further shaped her life's work in Ogbomoso in 1926. Mrs Green was quoted in an article published by the Women's Missionary Union (WMU):

'Ruth had lived in our home when she first came to Nigeria and I could almost tell what she was thinking as she looked at the little black baby whose mother had died and at the father with such pleading in his eyes. Somehow he had managed to keep the baby alive for nearly two weeks and the loving heart of the missionary was touched. She told the father to leave the baby and she would do what she could. The Africans knew nothing about artificial feeding and she knew the baby would die and she reached out her arms for the child….'[64] The statement above from Mrs Green summarised the contribution and the creation of a single lady in search for authentic life as a being there in the Baptist Medical Centre Ogbomoso. It was her appearance, memory and experience in the above statement that shaped and turned her history around for good in Ogbomoso. The experience birth Kersey's Home where children who needed help were helped and supported. Emma was the product of Kersey's appearance, memory and experience in her search for knowledge's creation in history. Kersey's existence in the Baptist Medical Centre Ogbomoso (BMCO) started in 1920 by working with George Green as the principal officer at that time until she came up with her dream child Kersey Home in 1926. She served in Nigeria for 35 years before retiring at age 66. She worked in the Baptist Hospital, Ogbomoso before establishing the Kersey Home for the motherless children in 1926.[65] She served as paediatric advisor to the Baptist Hospital, Ogbomoso and held clinics on proper feeding for mothers in the community from 1920-1958.[66]The people she worked with as the first missionary nurse in the Baptist Medical Centre Ogbomoso were Lydia William Green, Basil Lee Lockett, Mary Ellen Caver, Mary Reeks McCormick,[67] Ruth Mary McCormick, S.G. Pinnock, John

[64] See Southern Baptist's First Missionary Nurse to Nigeria 1920-1955, written by Rees Watkins, published by the Women's Missionary Union on December 11, 1958 in Alison Marie Salevan, 'Altruism in Action: The Southern Baptist Nurse Missionary in Nigeria, Mid-Twentieth Century', 31.

[65] *Ibid.* Salevan, 'Altruism in Action: The Southern Baptist Nurse Missionary in Nigeria, Mid-Twentieth Century', 29-31.

[66] Interview, Grace Atinuke Odebode, 2018.

[67] Annual of the Southern Baptist Convention, Nineteen Hundred and Twenty-Six Seventy-First Session, Eighty-First Year, Houston, Texas, May 12-16, 161.

Ajao Dare, Peter Ogunranti Ogunniyi, E.G. Maclean,[68] William Page Meredithm,[69] Joseph Oke,[70] James Clarence Anders, Leonard Long, Valda Long, Frances Carter-Jones, Lucille Reagan, Horace Glenn Walker, Howard Douglas McCamey,[71] Loy Connell Smith, Georgia Alice Miller, William Dean Bender,[72] Harold Canning, Leslie William and Clara Keith among others.[73] Miss Ruth May Kersey died on 8th November, 1958

Adeoye Adeniyi, First Indigenous Medical Doctor, 1963-1966

Adeoye Adeniyi Nigerian National Postgraduate Medical College Prof. Emeritus) was born on 26th January, 1924 into the family of Pastor David Osayingbemi. Adeniyi and Mary Stefanu Fayomi at Ogga in West Yagba Local Government of Kwara State. His birth led him into marrying Florence Adedayo nee Adegbite in 1955. The marriage was blessed with four (4) children namely Dr Adedapo Adeniyi, Mrs Aderonke A. Ajibola nee Adeniyi, Mr Oyedotun O. Adeniyi and Dr Mrs Adebola O. Adetunmbi nee Adeniyi.[74] Hence, Adeniyi went through appearance, memory and experience by acquiring education from these institutions: Sudan Interior Mission (SIM) School, Egbe and Holy Trinity Church School, Lokoja for his Primary Education, 1934-1940. For his Secondary Education, he went to Baptist Boys' High School (BBHS), Abeokuta, 1943-1947 with certificate in Cambridge School. He had his University study at the University College Ibadan, for his Pre-Clinical training, 1952-1956 and for Clinical training at Guy's Hospital Medical School and West London Hospital, Hammersmith in United Kingdom, 1956-1960 with Bachelor of Medicine and Surgery (MBBS). He was a graduate member of the Royal College of Surgeons (MRCS) and Licentiate of the Royal College of Physicians (MLRCP). He did his House Job in England and returned to Nigeria in 1961. He furthered his study at the University College Hospital (UCH), Ibadan in Paediatrics, Obstetrics and Gynecology as a preparatory stage for him to be appointed into the Baptist Hospital, Ogbomoso in 1963. [75]Before his engagement with the Baptist Hospital Ogbomoso, he had

[68] Interview, Gbadero, 18th October, 2017.
[69] *Ibid.* Interview, Oke, 28th August, 2018.
[70] *Ibid.* Interview, Oke, 2018.
[71] Eyitope O. Ogunbodede, *History of Dentistry in Nigeria* (Ile-Ife: The Foundation for Dental Education Museum and Archives, 2015), 33.
[72] Bamigboye, *150 Years of Baptist Work in Ogbomoso*, 52-53.
[73] *Ibid.* Interview, Daniel Adedosu Gbadero, 2017.
[74] 'The Biography Deacon Prof. Emeritus Adeoye Adeniyi, Lineage of a Pioneer', Celebration of Life Order of Funeral Service for Deacon Prof. Emeritus Adeoye Adeniyi (November, 2019), 4, 14.
[75] Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 393-394, 398; *Ibid.* 'The Biography Deacon Prof. Emeritus Adeoye Adeniyi, Lineage of a Pioneer', 12-14.

worked as Agricultural Officer at Samaru, Zaria, 1948, Laboratory Technologist, General Hospital, Lagos, 1949 and Leprosy Settlement/Services at Uzuakoli and Umuahia, Eastern Nigeria, 1949-1951. The aforementioned were not directly related to medicine, his career as Medical Doctor started with the Baptist Hospital, Ogbomoso January, 1963 and withdrew his service for further study in September, 1966.[76] The reason for his withdrawal of service was because of the commonwealth award he got in 1966 to study Paediatrics at the Post-Graduate level in the United Kingdom. This opportunity drew him into the Post-Graduate research studies at Sheffield University and the Institute of Child Health, Great Ormond Street, London. He received the Doctor of Medicine (MD) of University of London, 1972. He became research fellow, University of London and University of Ibadan, 1967-1972. By 1976, he rose to the rank of an Associate Professor at University of Ibadan and was appointed Professor of Paediatrics and Child Health in December, 1977 at the University of Ilorin and assumed the post in January, 1978.[77]

The people he worked with as the first indigenous medical doctor in the Baptist Mission's healthcare services included Loy Connell Smith, T. Keith Edward, Martha Gilliland, Karl Myers, Daisy Jester, Georgia Alice Miller,[78] Grace Atinuke Odebode, Ruth Tinuola Oke and Hazel Moor among others.[79]

Peter O. Elemile, First Indigenous Medical Superintendent, 1974-1997

Peter O. Elemile was born on 20th July, 1949 into the Iworoko of family in Owo, Ondo State. His parents who warmly received him when he was born were Peter Olasegbe and Janet Amope Elemile of blessed memory. He belonged to the family of five (5). He got born again in 1970. This rebirth of his in the consciousness of knowing himself and his Lord as found in the Socrates' statement formed his passion for medical mission which became reality in 1974 at first appearance and 1983 at the second appearance.[80] He got married to Olubunmi Ololade[81]

[76] Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 394-395; 'The Biography Deacon Prof. Emeritus Adeoye Adeniyi, Lineage of a Pioneer', 4, 14.
[77] *Ibid.* Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 395-396; *Ibid.* 'The Biography Deacon Prof. Emeritus Adeoye Adeniyi, Lineage of a Pioneer', 12-14.
[78] *Ibid*. Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 395.
[79] *Ibid.* Interview, Oke, 28th August, 2018.
[80] Interview, Peter O. Elemile, Proprietor/Chief Medical Director, Cornerstone Medical Centre and First Indigenous Medical Superintendent of Baptist Medical Centre, Osogbo, 17th August, 2018; Ajayi, *Peter Olusola Elemile: Biography of a Nigerian Baptist Missionary Physician*, 54-57; Lavine, *From Socrates to Sartre: The Philosophic Quest*, 330-333.
[81] A Nurse who also worked in the Baptist Hospital, Ogbomoso, 1975-1997.

in 1976.[82] Peter Elemile was privileged to benefit from the free education programme of the Old Western Region in the early days of his life's existence at the Elekuro Baptist Primary School, Ibadan, 1956-1960. For his Secondary School programme he went to Methodist High School, Igbogila in the Yewa Region of the Old Western Region in present Ogun State between 1961 and 1964. He further his education by attending Anglican Mission school named Christ's School, Ado-Ekiti for his HSC between 1965 and 1967. He proceeded for his University education at the Premier University of Ibadan, 1968-1973. Between 1978 and 1983 he did his Post-Graduate courses in the United Kingdom.[83] He started work at the Baptist Hospital, Ogbomoso as House Officer in 1974 thereafter he proceeded for his NYSC between 1975 and 1976. He worked at Ile Abiye Hospital in Ondo State between 1976 and 1978. He left for the United Kingdom in 1978 and returned in 1983 and continued his career in the Baptist Mission's medical service at the Baptist Hospital, Ogbomoso till 1997 when he retired from active service. He was the first indigenous medical superintendent in the Baptist Medical Centre between 1984 and 1997.[84]The people he worked with medical superintendent in the Baptist Medical Centre Ogbomoso included Jack Eldon Tolar, Bill Norman, Martha Jordan Gililand, William Carter Garventer, William Jackson Williams, Howard Douglas Mcamey, Margret Richardson, Daniel Adedosu Gbadero, Grace A. Odebode, J.O. Ojebode, David Asaju, Grace Koleosho, Robert Koleosho,[85] Samuel Oyedele, S.O. Olaoti, Adekola Alade and David O. Akande among others.[86]

Contributions and the Creations of selected 'First' in the Baptist Medical Centre Ogbomoso, 1907-1997

One of selected firsts by name George Green contributed and created the household name as the pioneer Baptist medical missionary to Africa and by extension Ogbomoso and the first medical superintendent. George Green was a medical doctor of the Foreign Mission Board (FMB) of the Southern Baptist Convention (SBC) to Ogbomoso. This opportunity given to him by the SBC helped him in a way to create his being, consequently historicising himself as the

[82] *Ibid.* Ajayi, *Peter Olusola Elemile: Biography of a Nigerian Baptist Missionary Physician*, 54-57; *Ibid.* Interview, Elemile, 17th August, 2018.
[83] *Ibid.* Ajayi, *Peter Olusola Elemile: Biography of a Nigerian Baptist Missionary Physician*, 54-57; Interview, Elemile, 17th August, 2018.
[84] *Ibid.* Ajayi, *Peter Olusola Elemile: Biography of a Nigerian Baptist Missionary Physician*, 54-57, 343; *Ibid.* Interview, Elemile, 2018.
[85] First Director of Nursing Services.
[86] *Ibid.* Interview, Elemile, 2018.

pioneer medical missionary and superintendent to of the Baptist Hospital Ogbomoso through the evidence of the establishment of the hospital in Ogbomso in 1907. This experience had outlived him in the whole world especially in Africa and Ogbomoso to be precise he was seen as the first embodiment of medical mission in Nigeria.[87] Another contribution and creation by George Green was that he was declared the father of the Baptist Medical Ministry in Nigeria which picked its root from the activities at Baptist Hospital Ogbomoso. This was because every other activity picked it activities from him as far Nigeria and Baptist medical evangelism was concerned in Africa.[88]In addition, Ruth May Kersey contributed and created the Kersey Children's Home (KCH) through the help of the Foreign Mission Board of the Southern Baptist Convention, USA, in 1926. Hence, the historical fact about the establishment of the kersey Home was rather dramatic. Motherless Children Home, Ogbomoso was founded 1926 by a missionary nurse Ruth May Kersey, six years after her commissioning to Ogbomoso.[89] It began in 1926 following the admission of the first motherless child, a girl (Emma), into the Baptist Hospital, Ogbomoso. The father had arrived at the facility carrying a set of twins who had been born in a distant village, the mother of the babies had died soon after delivery of the twins. The father carried the two babies to the hospital in a calabash tray. One of the twins died soon after their arrival at the hospital. With adequate healthcare and treatment given to the set of twins, one of them, a girl survived the crisis. The prominent nurse who played the role in caring for the twins was Ruth May Kersey. Thereafter, many more motherless children were brought to the hospital. The primary responsibility of caring for these children fell squarely on the shoulder of Ruth May Kersey.[90] Motherless and malnourished babies' care programmes through the use of artificial milk got from plant (Soya) have been in continuum since the founding of it in 1926.[91] KCH building was constructed next to the Baptist Hospital, Ogbomoso and it housed

[87] Interview, Solomon Ademola Ishola, former General Secretary of the Nigerian Baptist Convention and Senior Lecturer, Nigerian Baptist Theological Seminary, Ogbomoso, 19th October, 2017.
[88] Interview, S. O. Ayankeye, Professor, Nigerian Baptist Theological Seminary, Ogbomoso, 19th October, 2017.
[89] Kersey Family Papers, 1917–1959. 68 items. Mss1K4738a, Documenting Women's Lives A Users Guide to Manuscripts at the Virginia Historical Society, 102
[90] Gbadero, 'Ogbomoso: The Citadel of Baptist Medical Mission in Nigeria', 140; Bamigboye, *150 Years of Baptist Work in Ogbomoso*, 115; 'Baptist Medical Centre, Ogbomoso, Minutes of the Advisory Board held on the 27th January, 1982', 3.
[91] Gbadero, 'Ogbomoso: The Citadel of Baptist Medical Mission in Nigeria', 146; Ayegboyin and Ogunewu, 'Ogbomoso and the Baptist Enterprise: Lesson for Today', 22; 'Baptist Medical Centre, Ogbomoso, Minutes of the Advisory Board held on the 27th January, 1982', 3.

about 45 infants and small 24 children at a time between 1926 and 1950s.[92] Thereafter, Kersey Children Home, also known as *Bebi*, today in 1965 built and dedicated a facility for its use on about six acres of land on the way to Ikoyi at Kinira area, Ogbomoso.[93] Peter Olusola Elemile's contribution and creation was in the area of the marriage among the initial different entities of Baptist Hospital, Kersey Children Home and Leprosy Camp that later became Baptist Medical Centre Ogbomoso in 1980s. In other words, he merged all the components facilities of the Baptist Mission's medical services in Ogbomoso into one for easy administration in 1980s when he was the Medical Superintendent. This was further consolidated to be managed by single Board of Trustees as against three board committees as it was presented by Adeniyi Adeoye in a report to the Nigerian Baptist Convention (NBC) during Convention-in-session in the 1960s.[94]

Another contribution and creation was in the achieving of quality service these individuals applied the Principle of Non-Maleficence which implies 'Do no harm.' It also means that they will willingly refrain from doing any injury or wrong.' All these selected people refrained from doing harm to anybody who came their way for treatment or healthcare services.[95] Health challenges recorded in Ogbomoso viz: Influenza pandemic of 1918, 1957 and 1968, recurrent Yellow Fever, Cholera 1971 and 1979, Measles, Meningitis and Smallpox among others revealed the creation by selected individuals to see to it that the people prosper both in health and in mind.[96] Corroborating the above it was noted that George Green treated over 5,000 patients during his stay in Ogbomoso, record has it that, in his first year he treated over 2,000 patients in Ogbomoso[97] More so, he initiated the construction of water well system in Ogbomoso in 1907, when he discovered the town had no good water system to enhance the health of the people. This became a strong contribution towards the health of the people since

[92] Salevan, 'Altruism in Action: The Southern Baptist Nurse Missionary in Nigeria, Mid-Twentieth Century', 23-25.
[93] *Ibid.* Gbadero, 'Ogbomoso: The Citadel of Baptist Medical Mission in Nigeria', 140; *Ibid.* Bamigboye, *150 Years of Baptist Work in Ogbomoso*, 115; Interview, A.O. Adeniji, Social Worker of the Bowen University Teaching Hospital, Ogbomoso, 16th November, 2017.
[94] Interview, Emmanuel Afolabi Amao Proprietor/Chief Medical Director, Shalom Medical Centre, Ogbomoso, 2nd June, 2018,
[95] Interview, Elemile, 17th August, 2018.
[96] Gbadero, 'Ogbomoso: The Citadel of Baptist Medical Mission in Nigeria' in Daniel Folorunso Oroniran (ed.) *Ogbomoso:*, 139-145.
[97] Olaniyi, Memory and Politics of Colonial Medical Services in Ogbomoso, 1907-1970, 19, 24.

1907 to 1997.[98] Many people were healed of their diseases due to the health facility introduced by the Greens in 1907. By 1923 thousands upon thousands had benefitted from the facility and it was one of the contributions and creation of the Greens to healthcare system in Ogbomoso. Also, quality service came to light by sourcing for fund to build a big hospital that could accommodate increasing patients in the Baptist Hospital, Ogbomoso. The sum of Seven Thousand pounds was raised for that purpose in 1910, by 1917, Three Thousand five hundred dollars was raised for expansion of the health facility. By 1919, Seventy Five Thousand dollars was raised for the same purpose. By 1923, the facility was set for commissioning and the dream of the Greens came through.[99] He left indelible footprint in the three continents; Europe his place of birth continent, America his adopted continent and Africa his home continent.[100] George was part of the medical committee of the Christian Council of Nigeria (CCN) which advised the colonial government periodically on medical programmes and policies that guided the transformation of the people's health.[101] He trained nurses to help reduced the burden of the work on him at least till when Ruth May Kersey emerged in 1920s.[102] Elemile initiated and started Midwifery services at the centre and made part of the school of nursing course of study to include Midwifery for good enhancement of the beauty of the centre in 1993.[103]Also, improvement on the take home package of the staff was another contribution and creation by Elemile. Nationals who were indigenous staff were not included in the payroll by the FMB and this arrangement was not too good for sustainability of the integrity of the centre as upheld by the missionaries due to quality staff. To achieve this, Elemile had to increase the pay of the staff a little to measure up with what was obtained with other medical facilities in town.[104] To sustain this welfare package, Randa Community Bank in 1995 was initiated by Elemile, now Randalpha Microfinance Bank to generate Pension Fund. Trading company was established in 1995, it was named GORAH.[105] It was to generate income for the centre for smooth running of

[98] *Ibid.* Olaniyi, Memory and Politics of Colonial Medical Services in Ogbomoso, 1907-1970, 16.
[99] *Ibid.* Olaniyi, Memory and Politics of Colonial Medical Services in Ogbomoso, 1907-1970, , 16
[100] Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 200, Bamigboye, *150 Years of Baptist Work in Ogbomoso*, 114, Interview, Gabriel Akanmu, Account Officer, Bowen University Teaching Hospital, Ogbomoso, 27th May, 2018.
[101] Interview, Gbadero, 18th October, 2017.
[102] Interview, Oke, 28th August, 2018.
[103] *Ibid.* Interview, Amao, 2nd June, 2018.
[104] *Ibid*. Interview, Amao, 2nd June, 2018.
[105] It is an acronym for five individuals that have made contributions to the growth of healthcare system in Ogbomosoland through the cooperative bodies managed by them. These individuals

the healthcare services of the Baptist Medical Centre Ogbomoso and the management of the welfare of the medical and para-medical staff at the centre.[106] Medical Mission was one of the strategies imbibed by Baptist missionaries in reaching Nigerians for Christ most especially Ogbomoso people. This in a way was a contribution and creation that Nigerian would access salvation in Christ through the instrumentality of Baptist Medical Centre Ogbomoso (BMCO). George Green pursued this creativity vigorously and vehemently.[107] In his report to Foreign Mission Board (FMB), he stated, 'our work in Ogbomoso had been of three fold in character (Evangelistic, Educational and Medicals).' It was the medicals, he gave his life to between 1907 and 1944.[108] His proficiency in medicine and surgery created and enhanced the value of his services and multiply his usefulness as a soul winner in Africa. This explained the power of his skill as a factor for a creating being. Also, Kersey had considered foreign mission work every import ever since she was a small child and felt that it was a life work. As she wrote in one of her notes, Christ said, 'Go into the world and preach the gospel to every creature…I believe that was meant for me.' Jesus also said, 'Heal the Sick' When asked if she preferred a special field, she wrote, Africa…I have always felt that it is the least desirable from a personal viewpoint. She also noted that she would desire medical missionary service and wrote again of her three (3) years of nurse's training at the Retreat for the Sick.[109] More so, Adeoye corroborated the above statement concerning creating Christian community that, health ministry was a call to serve Jesus Christ who went about doing good and part of his good deeds was this healing of a thing and resolved to do good to humanity and most especially Ogbomoso people. This statement corroborated Adeniyi's contribution to as the first Nigerian medical doctor at the Baptist Hospital, Ogbomoso between 1963 and 1966. He served only for short time but labored 'creditably, maintaining the high standard of work, diligence and honesty which the missionary doctors have consistently maintained.'[110] Finally, they all contributed and created a historic human relationship within the medical and community space which cannot be under emphasised in this discourse. This level of human relation out lived them in the Baptist

included; G for George Green, O for Olatunde Olawoyin, R for Ruth Mary Kersey, Adeoye Adeniyi and Hezel Moor

[106] Interview, Amao 2nd June, 2018; Interview, Gabriel Akanmu, Account Officer, Bowen University Teaching Hospital, Ogbomoso, 27th May, 2018.

[107] *Ibid*. Oroniran, *The Baptist Heritage: A Nigerian Perspective*, 201-202

[108] Agubosim, 'The Development of Modern Medical and Health Services in the Warri/Delta Province, Nigeria 1906-1960', 66.

[109] Salevan, 'Altruism in Action: The Southern Baptist Nurse Missionary in Nigeria, Mid-Twentieth Century', 23.

[110] Olaniyi, Memory and Politics of Colonial Medical Services in Ogbomoso, 1907-1970, 26.

Mission's medical space in the 20th and 21st century Ogbomoso's space. It was this contribution that has sustained the longevity of the facility since 1907 and 1997 which covers the scope of this study. The contribution made it real to his that the Baptist Medical Centre and the four selected individuals appeared in space-time, had memories and initiated experiences in Baptist Medical Centre Ogbomoso between 1907 and 1997.[111]

Conclusion

This study has explored the thesis that human experience is the ultimate knowledge through engaging of the Baptist Medical Centre Ogbomoso and four (4) selected individuals who had made landmark impacts on the facility and the host community in the period under review. In achieving the goal of this study the phenomena of the 'First' and their contributions and creations were highlighted and discussed in line with the scope of this study between 1907 and 1997. This revealed the human condition and knowledge which spread across selected individuals medical missionaries with appearances, memories and experiences of a balanced study of foreign and indigenous missionaries of the Baptist Mission in Nigeria.

[111] Interview, Gbadero, 18th October, 2017; Interview, Amao, 2nd June, 2018; Interview, Oke, 28th August, 2018.

EĞİTİMDE GÖÇ POLİTİKALARI, GÖÇMEN, SIĞINMACI VE MÜLTECİ SORUNLARI: AFGAN GÖÇMENLER ÖRNEĞİ

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Özet
Son yıllarda Türkiye'de göç konusu önemli konuların biri sayılmaktadır. Çünkü Türkiye transit göçün değişmeyen coğrafyası olmayı sürdürmeye devam etmekte. Ancak 2011 yılından bu yana eksilmeyen hatta artan mülteci sayısı bize geçici göçmenlerin zamanla kalıcı göçmenler haline geldiğini gösteriyor. TUİK'in son verilerine göre gelen göçmenlerin büyük kısmını çocuk ve gençler oluşturuyor. Bu nedenle Türkiye ilk başta göçmen eğitim politikasını da ilk sırıya koymalıdır. Çünkü gelen göçmenlerin entegrasyon olabilmeleri için göçmenlere uygun hem eğitim planı şart. Bu sebeple çalışmamızda göçmen eğitim politikasına değindik ve örnek olarak Afgan göçmenleri aldık. Çünkü son on yıldır Türkiye'de Suriyeli göçmenler fazla ilgi gösterilmesiyle azınlık olarak algılanan ancak son iki yılda gelen Afgan göçmenleri sayı olarak Suriyelileri geçmiş durumda. Bu çalışmada Afganistan'ının göç sorununu ve Türkiye'de Afgan göçmenlere karşı uygulanan göçmen eğitim politikasını ele aldık.
Anahtar Kelimeler: Afganistan, Türkiye, Afgan Mülteciler, Göç, Göçmenler.

MIGRATION POLICIES IN EDUCATION, IMMIGRANT, ASYLUM SEEKER AND REFUGEE PROBLEMS: THE CASE OF AFGHAN IMMIGRANTS

Abstract
In recent years, the issue of migration has been considered one of the important issues in Turkey. Because Turkey continues to be the unchanging geography of transit migration. However, the number of refugees, which has not decreased or even increased since 2011, shows us that temporary migrants have become permanent migrants over time. According to the latest data of TUIK, most of the incoming migrants are children and young people. For this reason, Turkey should also put its migrant education policy first. Because for incoming immigrants to be integrated, an education plan suitable for immigrants is necessary. For this reason, we touched upon the immigrant education policy in our study and took Afghan immigrants as an example. Because Syrian immigrants have been perceived as a minority in Turkey for the last ten years with a lot of attention, but Afghan immigrants who have arrived in the last two years have surpassed Syrians in number. In this study, we discussed the migration problem of Afghanistan and the immigrant education policy applied against Afghan immigrants in Turkey.
Keywords: Afghanistan, Turkey, Afghan Refugees, Migration, Migrants.

Giriş

Göç Kavramı

Göç teriminin kavramına literatürde birçok tanım bulunmaktadır. Onların biri Durugönül'e (Durugönül,1997) göre yaşanan coğrafi ve sosyal-kültürel çevreden ayrılıp başka coğrafi ve sosyal-kültürel çevreye yerleşmesidir. Burada yerleşmek kalıcı süreklilik anlamını taşımaktadır. Göç, çok boyutlu bir olaydır. Yasal, eğitsel, kültürel ve psikolojik sorunları da beraberinde getirir (Tezcan, 2000). Göç, Türk Dil Kurumuna göre; "ekonomik, toplumsal, siyasi sebeplerle bireylerin veya toplulukların bir ülkeden başka bir ülkeye, bir yerleşim yerinden başka bir yerleşim yerine gitme işi, taşınma, hicret, muhaceret" olarak tanımlanmıştır. (Erişim, TDK 2020, https://sozluk.gov.tr). Göç kavramının kökeni ise 19. yüzyılına dayanmaktadır ve günümüzde literatüre geçen göç tanımları Avrupa'dan Amerika'ya doğru gerçekleşen göç sürecini tanımlama ve analiz etme sonucunda ortaya çıkmıştır (Öner vd., 2012).

Göç Türleri

Birçok çalışmada göç ile ilgili farklı sınıflandırmalar bulunmaktadır. Örneğin William Peterson, gücü 5 başlığa ayırırken, Fichter ise göç türlerini sadece ikiye ayırmıştır.

William Peterson'a göre:

Göç				
İlkel göç	Kontrollü göç	Serbest göç	Zorunlu göç	Yönetilmiş göç

Fichter'e göre:

Göç	
Zorunlu Göçler	Gönüllü Göçler

Bunların dışında iç göç, dış göç, beyin göçü, işçi göçü, kitlesel göç ve doğal afetler nedeniyle oluşan geçici göç gibi olayların çeşitliğine göre göç türleri farklılık gösterebilir.

İç Göçler

Ülke sınırlarında gerçekleşen göçlere iç göç denilmektedir (Sağlam, 2006) ve kendi içinde de farklılık göstermektedir. Onlar, kırdan kente, kentten kıra, kırdan kıra, kentten kente olarak bilinmektedir. Türkiye'de iç göç, hızla gelişen sanayileşme süreciyle birlikte daha kırdan kentte olarak seyredilmektedir. Buna Türkiye'nin birçok boşaltılmış yani nüfusu tamamen göç etmiş köyler örnek olabilir. Ancak son zamanda büyük ilgi gören organik yaşam akımı nedeniyle birçok insan büyük şehirler yerine köyleri, kırları tercih etmeyi başlaması boş kalmış köyler

için tekrardan yaşam katmaktadır. Bir diğer etken olarak da ulusal ve küresel ekonomik krizler nedeniyle son yıllarda büyük şehirlerde seyredilen barınma sorunları kentlerden kırsala ya da İstanbul, Ankara, İzmir ve Antalya gibi şehirlerden başka şehirlere iç göç gözlemlenmektedir.

Dış Göçler

Bireylerin/toplumların sürekli ikamet ettiği ülkeden siyasi, dini, ekonomik ya da savaş, iç çatışma gibi nedenler ile ayrılarak kalıcı/ geçici süreyle yeni bir ikamet oluşturmak amacıyla gerçekleştirdikleri göç, faaliyetlerine dış, göç, denmektedir (Günay vd., 2017). Bir ülkenin gelişmesinde nitelikli insan gücü önemlidir. Ülkelerin gelişme surecinde çeşitli alanlarda uzmanlaşmış, bireylere ihtiyaç, duyulmaktadır, bu alanlarının uzmanı olan nitelikli insanların göç, ülkeleri için büyük bir kayıptır (Başaran, 1972). Türkiye dış göç olarak sadece göç alan değil göç veren ülkelerden biridir ve aynı zamanda geçici olarak Türkiye'ye yerleşen ve daha sonra başka ülkeye göç eden göçmen sayısı da çoktur. Bu açıdan göçmenler için Türkiye transit ülke olarak görülmektedir.

Zorunlu Göç

Zorunlu göç kavramın karşılığını birçok araştırmacı ele almıştır ve genel olarak zorunlu göç dediğimizde nedeni ne olursa olsun insanların isteği olmadan bir yerden ikinci yere taşınmasıdır diyebiliriz. Bu nedenlerin çeşitlerine göre de zorunlu göçü sınıflandırabiliriz. Doğal afetler, beklenmedik savaşlar, terör, eğitim, sosyal entegrasyon, sağlık, iç siyaset gibi nedenler zorunlu göçün en büyük nedenidir. Bunlara itici ve zorlayıcı nedenler diyebiliriz. Türkiye'de kendi sınırlarında olsun ya da sınır dışından olsun bu tür gölere fazla maruz kalmıştır. Özellikle 2000'li yıllardan itibaren zaman zaman işsizlik, yoksulluk, terör, doğal afetler nedeniyle zorunlu iç göçler yaşanmaktadır. Örneğin 6 Şubat 2023'te Kahramanmaraş merkezli Türkiye'nin Hatay, Gaziantep, Malatya, Diyarbakır, Kilis, Şanlıurfa, Adıyaman, Osmaniye, Adana ve Elâzığ bölgesinde Türkiye Cumhuriyeti'nin en büyük depremi yaşanmıştır. Açıklanmış resmi rakamlara göre 50 783 kişi hayatını kaybederken 115 353 kişi yaralanmıştır. Belirtilen bölgelerde olağanüstü hâl ilan edilerek yaklaşık 2,8 milyon insan zorunlu göç etmiştir. Deprem bölgesinin büyüklüğü nedeniyle yaklaşık 13 milyon insan etkilendiği belirtilmekte. Zorunlu bir şekilde deprem bölgelerinden geçici ve kalıcı olarak Türkiye'nin güvenli bölgelerine göç yaşanmıştır. Türkiye'de deprem nedeniyle yaşanan zorunlu göçün bir kısmını geçici göç olarak değerlendirebiliriz. Çünkü deprem sonrası alınan kakarlar niteliğinde deprem bölgesindeki vatandaşları güvenli bölgelere, depremden etkilenmeyen bölgelere taşıma yapıldı. Depremzedeler sadece yakınların bulundukları bölgelere değil hükümetin belirlemiş oldukları illere yerleştirildi. Olağanüstü hâl ilan edilerek güvenli bölgelerdeki KYK yurtlarına

yerleştirildi. Deprem sonrası deprem bölgelerine konteynerlerin hazırlanması bittikten sonra geçici olarak KYK yurtlarında kalan vatandaşlar deprem bölgelerine geri döndü. Böylece, geçici göç yaşandı. Uluslararası boyutta ise dünya siyasi gündemler nedeniyle özellikle Suriye'de ve Irak'ta yaşanan ve yaşanmakta olan iç savaş nedeniyle zorunlu göç alan konumuna geçmiştir ve son yıllarda Afganistan'dan ve İran'dan da çok diyecek kadar göç almaya başladığını belirtebiliriz.

Afganistan'ın Yakın Tarih Göç Sorunu

Afganistan'ın iç göç sorunu en çok XX yüzyılın 70 yıllarında 2 yıl süren kuraklık nedeniyle çıkmıştır. Özellikle bu dönemde köylüler zor zamanlar geçirmişlerdir, kuraklık tarların yanmasına ve hasattın azalmasına hatta sıfıra inmesine neden olmuştur. Hasat azalınca, ülke çapında hayvan besleme ve yetiştirme yok olmaya başlamıştır. Özellikle Kuzey-Batı Afganistan (Gerat, Badgis, Maymana, Gor) ve Kuzey-Doğu Afganistan (Badaşan) gibi bölgeleri çok zarar görerek halk arasında açlık başlamıştır. Böylece yüz binlerce köylü tarlalarını ucuz satarak büyük şehirlere göç etmiş (Слинкин М.Ф., 2001).

Uluslararası boyutta ise Birleşmiş Milletler Mülteciler Yüksek Komiserliği (UNHCR) verilerine göre Afganistan dünyadaki en büyük göç veren beş ülkeden biridir. Hatta Suriye'de iç savaş çıkmadan önce mülteci sayısıyla ilk sırada yer alıyordu. Çünkü Afganistan'daki göç sorununun temeli, özellikle uluslararası boyutta XVIII yüzyılların başlarına kadar dayanıyor. Kayıtlara göre Afganlar en çok İran'a ve Pakistan'a göç etmiştir. Nedenlerin biri coğrafi yakınlık, etnik-kültürel bağlar ve dini benzerlikler olmuştur (Abbasi-Shavaz M. J vd., 2015). En büyük dış göçlerin biri 1973 yılında gerçekleşen darbe sonrasıdır. Bu darbe sonrası ülke büyük ölçüde beyin göçü vermiştir. Onlar, üst düzey askeri rütbeliler, yüksek ve orta düzey makamlı devlet memurları. İlk gidenler (1973 yılında) Avrupa ülkelerine ve ABD'ye kaçmıştır. İkinci grup gidenler (1975-1978) ağırlıklı Pakistan'a ve İran'a göç etmiştir. Böylece, ülkede daha iç savaş çıkmadan mülteci ve göçmen sayısı yükselmiştir.

1978 yılında gerçekleşen ve Afganistan'ın tüm illerini iç savaştan sonra ise iç göç ve dış göç inanılmaz derecede artarak ülkede en büyük ulusal ve sosyal-kültürel sorun haline gelmiştir. İç göç sayısının belirlemek zor olmuştur. Çünkü 1980 ve 1990 yılları arasındaki iç göçün yönü sürekli değiştiği kayıt tutmak imkânsız kalmış. Örneğin ilk başlarda insanlar güvenlik açısından orduya yakın olmak amaçlı köylerden büyük şehirlere akın etmiştir. Ancak büyük şehirlerde farklı siyasi görüşlere sahip grupların çatışmaları göç yönünü tersine şehirlerden kırsala yönlendirmiştir. Birleşmiş Milletler Örgütünün verilerine göre 1987 yılında iç göç sayısı yaklaşık 2 milyon insandı. Özellikle başkentte göçmen sayısı çok yüksekti. Resmi verilere göre

1978 yılı başkent sınırları içinde 650 000 kişi ederken, 1979 yılında 931 418 insan, 1980 yılında 992 286, 1981 yılında 1 057 124 insan, 1982 yılında 1 126 205 insan ve seksenlerin sonlarında ise 1,5 milyon insana kadar yükselmiştir. Başkent Kabil'in nüfusu 1978 yıldan seksenlerin sonlarına kadar üçe katlanmıştır (Porahov, 1978). Daha sonrasında 1985 yılında Mücahitler bir araya gelerek Afganistan'daki Demokratik Halk Partisi'nin perçem kanadından Bebrek Kemal'ı destekleyen Sovyet askerlerine karşı ittifak kurdular. Bu tarihe geldiğinde Afgan halkının yarısı göç etmiş durumdaydı (Afganistan'ın yakın tarihi, 2009) ve doksanlarda Mücahitler Kabil'i aldıklarına sadece 200 binden fazla kişi şahit olabilmiştir. Çünkü ilk başlarda köylüler ve kırsal bölgelerde yaşayanlar başkent onlara daha güvenli yaşam sağlayacak düşüncesiyle göç etmiştir. Ancak Mücahitlerin ve diğer siyasi ve dini gruplar başkenti kanlı çatışma merkezine çevirmiştir. Böylece birçok insan ve aile çaresiz ülkeyi tamamen terk ederek komşu ülkelere gitmeyi tercih etmiştir. Özellikle Afganlar o dönemler Pakistan'a akın etmiştir. Pakistan'a göç edenlerin sayısı birden yükselince Pakistan Hükümeti tarafından Afgan göçmenleri kontrol etmek amaçlı özel ulusal komite kurulmuştur. Aynı şekilde İran'da Afgan göçmenlerin akın etmesiyle özel komiteler oluşturulmuştur. Ancak Afganların en çok tercih ettikleri ülke Pakistan olmuştur. Bunu Nisan !978 yılından Kasım 1982 yılına kadar raporlanmış tabloya bakarak görebiliriz (Collins J.J., 1982).

Tablo.1

Tarih		Kayıta geçen Afgan Mülteci sayısı	Tarih		Kayıta geçen Afgan Mülteci sayısı
Yıl	Ay		Yıl	Ay	
1978	Nisan-Aralık	18 329	1981	Ocak	1 232 253
1979	Ocak-Aralık	389 072	1981	Şubat	1 310 928
1980	Ocak	427 580	1981	Mart	1 310 928
1980	Şubat	538099	1981	Nisan	1490 301
1980	Mart	599 050	1981	Mayıs	1560 912
1980	Nisan	650 076	1981	Haziran	1 688 289
1980	Mayıs	720 495	1981	Temmuz	1 812 001
1980	Haziran	779059	1981	Ağustos	1 835 894
1980	Temmuz	839 260	1981	Eylül	1 859 639
1980	Ağustos	926 216	1981	Ekim	1 887 639
1980	Eylül	996 871	1981	Kasım	1 906 826
1980	Ekim	996 872	1981	Ocak	1 913 412
1980	Kasım	1 148 470	1981	Şubat	2 800 000
1980	Aralık	1 232 253			

Tabloya bakarak Afganistan'ın iki yıl içerisindeki göç hızını ne kadar yüksek olduğunu görebiliriz. BM örgütün verilerine göre 1990 yılında Pakistan'da ve İran'da Afgan göçmenler sayısı toplam yaklaşık 6,2 milyon insana ulaşmıştır (Сикоев Р.Р.,1999).

Türkiye'de Mülteci Hakları

Uluslararası düzeyde mültecilerin hakları ilk defa 1951 yılında Birleşmiş Miletler Sözleşmesinde belirtilmiştir. Sözleşmenin 1. Maddesine göre, "1 Ocak 1951´den önce meydana gelen olaylar sonucunda ve ırkı, dini, tabiiyeti, belli bir toplumsal gruba mensubiyeti veya siyasi düşünceleri yüzünden, zulme uğrayacağından haklı sebeplerle korktuğu için vatandaşı olduğu ülkenin dışında bulunan ve bu ülkenin korumasından yararlanamayan, ya da söz konusu korku nedeniyle yararlanmak istemeyen; yahut tabiiyeti yoksa ve bu tür olaylar sonucu önceden yasadığı ikamet ülkesinin dışında bulunan, oraya dönemeyen veya söz konusu korku nedeniyle dönmek istemeyen şahıs" olarak tanımlanmıştır. Bu sözleşmenin nedeni ikinci Dünya

Savaşında dünyada sayısızca insanın mülteci konumuna düşmesi olmuştur. Türkiye'de ise ilk olarak mülteci hakları ilgili hukuki düzenlemeler, Ortadoğu'daki 1980'lerin sonlarında başlayan ve 1990'ların başlarına kadar uzanan iç savaşlar yüzünden Türkiye'ye mültecilerin akın etmeye başlaması nedeniyle başlamıştır. Böylece 1994 yılında "Türkiye'ye İltica Eden veya Başka Bir Ülkeye İltica Etmek Üzere Türkiye'den İkamet İzni Talep Eden Münferit Yabancılar ile Topluca Sığınma Amacıyla Sınırlarımıza Gelen Yabancılara ve Olabilecek Nüfus Hareketlerine Uygulanacak Usul ve Esaslar Hakkında Yönetmelik" yayınlanmıştır. Daha sonra mevcut yönetmenliğe değişikler getirilerek 2006 yılında "Türkiye'ye İltica Eden veya Başka Bir Ülkeye İltica Etmek Üzere Türkiye'den İkamet İzni Talep Eden Münferit Yabancılar ile Topluca Sığınma Amacıyla Sınırlarımıza Gelen Yabancılara ve Olabilecek Nüfus Hareketlerine Uygulanacak Usul ve Esaslar Hakkında Yönetmelikte Değişiklik Yapılmasına Dair Yönetmelik" olarak yeni yönetmenlik resmi gazetede yayınlanmıştır. Türkiye'de göçmen hakları en başta Türkiye Cumhuriyeti Anayasasında 10. Maddesinde belirtilmiştir: "Temel hak ve özgürlükler, yabancılar için milletlerarası hukuka uygun olarak kanunla sınırlanabilir". Türkiye'nin göç politikasının önemli dönüm noktalarının biri 1999 yılında Avrupa Birliğine kabul edilmiş olup önündeki en önemli engel "göç" politikası olmasıdır. Bu sebeple hükümet bu konuda kapsamlı araştırmalar yürüterek göç yönetimini nasıl yönetilebilir soruna cevap alabilmek amaçlı çalışmalar yapılmıştır ve 2001 yılında Türkiye ile Avrupa Konseyi arasında imzalanan ortaklık belgesinde göç yönetimi konusunda Türkiye hedeflerini şu şekilde belirtmiştir.

1. "Yasal olmayan göçü önlemek için, göç, (kabul, tekrar kabul, sınır dışı etme) konusundaki AB Mevzuatı ve uygulamalarının benimsenmesi ve uygulanması."
2. "Müktesebatın benimsenmesi, uygulanması ve idare edilmesi için kamu yönetiminin kapasitesinin özellikle eğitim ile yasal olmayan göç, ve yasal olmayan insan ve uyuşturucu kaçakçılığını önlemek için etkin sınır kontrollerinin geliştirilmesi dahil olmak üzere, bakanlıklar arasında uygun eşgüdüm sağlanmak suretiyle, iyileştirilmesi." Türkiye'de son on sene değişen göç akımı nedeniyle "1994 Yönetmenliği" ve diğer hukuki düzenlemeler yetersiz kaldığı için 2 Şubat 2013'te 6458 sayılı Yabancılar ve Uluslararası Koruma Kanunu (YUKK) düzenlenerek 11 Nisan 2014 yürürlüğe girmiştir. Yabancılar ve Uluslararası Koruma Kanunu'nun (YUKK) getirdiği önemli değişiklik, 1951 Mülteci Sözleşmesi ve !994 Yönetmenliğinde yer alan "sığınmacı" kavramına son vererek "mülteci, şartlı mülteci, ikincil koruma" gibi tanımlara vererek değişikler getirmiştir.

Mülteci: Avrupa ülkelerinde meydana gelen olaylar nedeniyle; ırkı, dini, tabiiyeti, belli bir toplumsal gruba mensubiyeti veya siyasi düşüncelerinden dolayı zulme uğrayacağından haklı sebeplerle korktuğu için vatandaşı olduğu ülkenin dışında bulunan ve bu ülkenin korumasından yararlanamayan ya da söz konusu korku nedeniyle yararlanmak istemeyen yabancıya veya bu tür olaylar sonucu önceden yaşadığı ikamet ülkesinin dışında bulunan, oraya dönemeyen veya söz konusu korku nedeniyle dönmek istemeyen vatansız kişiye statü belirleme işlemleri sonrasında mülteci statüsü verilir (Yabancılar ve Uluslararası Koruma Kanunu (YUKK)-Md. 61).

Şartlı Mülteci: Avrupa ülkeleri dışında meydana gelen olaylar sebebiyle; ırkı, dini, tabiiyeti, belli bir toplumsal gruba mensubiyeti veya siyasi düşüncelerinden dolayı zulme uğrayacağından haklı sebeplerle korktuğu için vatandaşı olduğu ülkenin dışında bulunan ve bu ülkenin korumasından yararlanamayan, ya da söz konusu korku nedeniyle yararlanmak istemeyen yabancıya veya bu tür olaylar sonucu önceden yaşadığı ikamet ülkesinin dışında bulunan, oraya dönemeyen veya söz konusu korku nedeniyle dönmek istemeyen vatansız kişiye statü belirleme işlemleri sonrasında şartlı mülteci statüsü verilir. Üçüncü ülkeye yerleştirilinceye kadar, şartlı mültecinin Türkiye‟de kalmasına izin verilir (YUKK-Md. 62)

İkincil Koruma: Mülteci veya şartlı mülteci olarak nitelendirilemeyen, ancak menşe ülkesine veya ikamet ülkesine geri gönderildiği takdirde;

a) Ölüm cezasına mahkûm olacak veya ölüm cezası infaz edilecek,

b) İşkenceye, insanlık dışı ya da onur kırıcı ceza veya muameleye maruz kalacak,

c) Uluslararası veya ülke genelindeki silahlı çatışma durumlarında, ayrım gözetmeyen şiddet hareketleri nedeniyle şahsına yönelik ciddi tehditle karşılaşacak, olması nedeniyle menşe ülkesinin veya ikamet ülkesinin korumasından yararlanamayan veya söz konusu tehdit nedeniyle yararlanmak istemeyen yabancı ya da vatansız kişiye, statü belirleme işlemleri sonrasında ikincil koruma statüsü verilir (YUKK-Md. 63).

Geçici Koruma: “1-Ülkesinden ayrılmaya zorlanmış, ayrıldığı ülkeye geri dönemeyen, acil ve geçici koruma bulmak amacıyla kitlesel olarak sınırlarımıza gelen veya sınırlarımızı geçen yabancılara geçici koruma sağlanabilir.” “2-Bu kişilerin Türkiye‟ye kabulü, Türkiye‟de kalışı, hak ve yükümlülükleri, Türkiye‟den çıkışlarında yapılacak işlemler, kitlesel hareketlere karşı alınacak tedbirlerle ulusal ve uluslararası kurum ve kuruluşlar arasındaki iş birliği ve koordinasyon, merkez ve taşrada görev alacak kurum ve kuruluşların görev ve yetkilerinin belirlenmesi, Bakanlar Kurulu tarafından çıkarılacak yönetmelikle düzenlenir (YUKK-Md. 62).Geçici Koruma Dair Yönetmenliğine 2016 yılında değişilik yapılarak “20 Mart 2016

tarihinden sonra ülkemiz üzerinden düzensiz yollarla Ege adalarına geçmiş olan Suriye Arap Cumhuriyeti vatandaşlarından, ülkemize geri kabul edilenlere koruma talep etmeleri halinde bu Yönetmelik kapsamında geçici koruma sağlanabilir" fıkrası eklenmiş olup, söz konusu Yönetmelik halen yürürlükte bulunmaktadır.

Türkiye'de Afgan Göçmenlerin Eğitim Sorunu

Milli Eğitim Bakanlığının 23 Eylül 2014 tarih ve 2014/21 sayılı "Yabancılara Yönelik Eğitim-Öğretim Hizmetleri" konulu genelgeyle mülteci ve sığınmacı çocuklar da dahil olmak üzere ülke sınırları içerisindeki zorunlu eğitim çağındaki tüm çocukların eğitim-öğretim hizmetlerine erişimleri ile ilgili birtakım standartlar oluşturulmuştur. Söz konusu genelgeyle ülke sınırları içerisindeki yabancı uyruklu öğrencilerin eğitim öğretim hizmetleri ile ilgili işlemlerin Bakanlık ve İl Komisyonlarınca yerine getirilmesi esasa bağlanmıştır. Aynı genelgeyle mülteci ve sığınmacıların sadece Geçici Eğitim Merkezlerinde değil, MEB'e bağlı devlet okullarında da eğitimlerine devam etmeleri sağlanırken, öncesinde kayıtta istenen "ikamet izni" yerine artık "yabancı tanıtma belgesi" ile en yakın bir devlet okuluna kaydolabilmelerinin önü açılmıştır.

TUİK'in verilerine göre Afganlar Türkiye'de son 3 yılda fazla göçmen sayısıyla üçüncü sırada gelmektedir ve sayı olarak Suriyeli göçmenlerden önde gelmektedir. UNHCR'in verilerine göre Afgan göçmenlerin yaklaşık %60 gençler ve çocuklar oluşturmakta. Kayıtsız ikamet edenlerin sayısı da çok fazladır. Afganların en çok bulunduğu iller Adana, Konya, Erzurum, Van, İzmir ve İstanbul.

Maddi Sorunlar: Afgan çocukların ve gençlerin Türkiye'de eğitim almalarında en büyük sorun sosyal-ekonomik sorunlardır. Ailelerin büyük kısmı daimî gelire sahip değil. Devlet tarafından da belirli yardım ya da program belirlenmemektedir. Bu konuda İl Milli Eğitim Müdürlükler, Belediyeler ve sivil Toplum Örgütler iş birliği içerisinde birçok program düzenleyerek yardımcı gelişme sağlamaya çalışsa da uygulamada sorunlar hala devam etmektedir.

Dil Sorunu: Son yapılan araştırmalara göre Afgan çocukların önemli sorunların biri dil olmaktadır. Bu nedenle çoğu göçmen çocukları Türkiye Cumhuriyeti tarafından onlara tanınan tüm devlet okullarında eğitim alma haklarını kullanamıyorlar. Türkçe bilmedikleri için devlet okullarında diğer çocuklarla entegre olmaları nerdeyse imkânsız oluyor ve aynı zamanda akademik başarılarını etkilemektedir

Sürekli Yer Değiştirme: Afgan çocukların diğer sorunlarının biri ailelerin sürekli yer değiştirmeleridir. Türkiye'ye gelen Afgan ailelerin en büyük sorunların biri de sabit iş bulamama. Gelen göçmenlerin büyük kısmı günlük işlerde çalışıyorlar. Bu nedenle yurt dışına kadar yol alan istihdam arayışı Türkiye'de de son bulmuyor ve Türkiye sınırları içerisinde de

göç haraketlilikleri devam ediyor. Bu nedenle Afgan çocukların kaydoldukları okullardaki eğitimleri yarım kalıyor ve sürekli okul değiştirme sonucunda çocuğun hem akademik başarısı olumsuz etkilenerek ve okuldaki diğer öğrencilerle uyum sorunu yaşanıyor.

Düzensiz Göçmenler*:* Afgan çocukların eğitimden uzak kalmalarının bir başka sorunu Afgan ailelerin Türkiye'ye kaçak yollarla gelmeleridir. Son yılların verilerine göre Türkiye sınırını kanun dışı yollarla geçenler listesinde Afganlar ilk sırada gelmektedir. UNESCO Uluslararası Göç Kürsüsü Yürütücüsü Doç. Dr. Ayselin Yıldız, Türkiye'de yakalanan göçmenlerin %40 Afgan göçmenler olduğunu belirtti ve son yıllarda ilk sırada Suriyeliler değil Afganlar olması her sene Afganistan'dan gelen göçmenlerin arttığını göstergesidir. Düzensiz gelen Afgan göçmenlerin kaçak çalışarak ilgili kurumlara kayıt yaptırmıyorlar. Çocukları ise haliyle okula kaydolamıyorlar.

Sonuç ve Öneriler

Göç ve göçmenler geçmişten günümüzde kadar tüm ülkelerde önemli yere sahip olmuştur. Birçok ülkede göçmenler ülkenin siyasi ve ekonomik gelişmelerini etkileyen en büyük faktörlerin biridir. Örneğin yakın tarihe bakacak olursak, en güzel örnek olarak Sovyet Sosyalist Cumhuriyetler Birliğini (SSCB) gösterebiliriz. Çünkü 1922'de kurulan ve on beş ülkeden oluşan Sovyet Birliği, bu ülkelerin birleşmesiyle ülkeler arası göçün sayısı artacağın farkına varmıştır. Özellikle gelişmeyen ve ekonomik olarak daha zayıf kalan ülkelerden merkeze (Moskova) ve başka büyük kentlere göç akını olabileceğini öngörmüşlerdir. Olası büyük göçler sonucu farklı kültürlerin büyük çatışması da kaçınılmaz olabilirdi. Bu nedenle hükümet bu konuda kapsamlı göç politikası ve entegrasyon programı düzenlemiştir. Bu programın en büyük önem gösterilen nokta eğitim olmuştur. Yapılan düzenlemeler sonucunda on beş ülkeyi Kiril alfabesine geçirerek aynı eğitim sistemi uygulanmaya başlanmıştır. Orta Asya ülkelerinde yaşayanlar göçebe hayat sürdükleri için ve belirli sabit yaşam alanları olmadıkları için çocuklarına düzenli eğitim vermek çok zor olmasına rağmen hükümet çocukları kelimenin tam anlamıyla dağdan taştan toplayarak yatılı okullarda eğitim vermeye çalışmıştır. Aynı zamanda kadın erkek eşitliğini getirerek cinsiyet ayırmaksızın tüm çocuklar eğitim almaya hak kazanmıştır. Çocuğunu okula yollamak istemeyene hükümet caydırıcı hatta hapis cezası bile uygulamıştır. Böylece, 1940'lara gelince halkın nerdeyse tamamının okuma yazma sorununu çözülmüştür. Bununla birlikte entegrasyondan ekonomiğe kadar en büyük sorunlar ortadan kalkarak bu topraklarda göze görülür derecede ciddi sosyal-ekonomik gelişmeler başlamıştır. Bu nedenle göç kontrolünde eğitim politikası en başta gelen ve en önemli adım.

Türkiye'de son zamanlarda görülen göçmen sayısı, acil yeni göçmen eğitim politikasına ihtiyacımız olduğunu gösteriyor. Çünkü yukarıdaki verdiğimiz SSCB örneğinden eğitimin ne kadar önemli yere sahip olduğunu görebiliriz. Çünkü Türkiye'ye gelen göçmenlerin büyük kısmı mülteci statüsündeki göçmenler ve gelen göçmen çocukların çoğu kendi ülkelerinde de eğitime ulaşamayanlardandır. Bu nedenle öncellikle kapsamlı bir eğitim politikasının düzenlenmesi şart.

Yukarıda belirtiğimiz gibi Afgan göçmenlerin %40 illegal yollarla Türkiye'ye gelmekteler. Bazıları kilometrelerce, günlerce yürüyerek ve birçok zorlukları atlatarak geliyor. Büyüklerle birlikte çocuklar da büyük psikolojik travma ile sınırları geçmekte. Göçmen eğitim politikasında en çok bu konuda çalışmalar yürütmemiz gerekir ve oluşturacağımız göçmen eğitim sistemi adım adım ilerlemeli:

1. Gelen göçmen çocuklara psikolojik destek sağlamak ve bunu zorunlu hale getirmek.
2. Zorunlu Türkçe dil hazırlığıyla birlikte, Türk kültürü dersi (Göçmen çocuklara özel Türkiye'yi tanıtan, Türk kültürünü anlatan ders içeriği oluşturmak).
3. Çocuklarını okutamayan bunun için maddi ve fiziki durumu müsaade etmeyen göçmen aile çocukları için yatılı okulları açılabilir (bunun için projeler geliştirerek uluslararası yardım kurumlardan maddi destek alınabilir).
4. Devlet okullarına yerleştirmek.

Böylece, göçmen çocukları daha kolay bir şekilde entegre edebiliriz. Onların eğitim alması, yerli sosyal-kültürel değerlere sahip olması Türkiye'nin yarınları için büyük bir katkı olacaktır. Çünkü göçmenler arasındaki yoksulluk, eğitimsizlik, entegrasyon sorunu ilerde Türkiye'nin iç güvenliği ve refahı için tehdit oluşturabilir.

Araştırmamızda belki de son yılların en çok konuşulan konuyu ele aldık ama güncel duruma baktığımızda somut adımlar atılmayan bir konu olduğunu vurgulamak istedik. Çünkü gittikçe artan Afgan göçmen sayısı ve diğer göçmenler ileride ülkemizin nülüsünün bir parçası olabilir. Bu nedenle durum daha karmaşık hale gelmeden eğitim konusunda belirli bir politika izlememiz şart. Unutmayalım ki "Ağaç yaş iken eğilir", bugün bizim değil dediğim ağaç yarın bize belki meyve verir, gölge olur korur…

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İKLİM VERİLERİNDEN FAYDALANARAK SİİRT ZİVZİK NARININ BİTKİ SU TÜKETİMİNİN BELİRLENMESİ

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ÖZET
Bu çalışmanın amacı iklim parametrelerinden yararlanarak bitki su tüketimini tahmin etmeye yarayan Penman Monteith eşitliği (ET_o miktarına bağlı olarak çeşitli bitkilerin ET miktarlarının tahmin edilmesinde kullanılan yöntem) FAO 56 modifikasyonu yöntemini kullanarak Siirt zivzik narının Siirt iklim koşullarında bitki su tüketimini belirlemektir. Araştırmada bitki materyali olarak Siirt zivzik narı kullanılmıştır. Çalışma 2017 yılı narın yetişme sezonu boyunca yürütülmüştür. Erken vejetatif dönemde Penman Monteith eşitliği ile saptanan referans bitki su tüketimi günlük ETa değeri 5,5 mm gün^{-1} arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 10-10,5 mm gün^{-1} olarak belirlenmiştir. Aylık (Temmuz) olarak ise, Penman Monteith eşitliğine göre 288.50 mm ay^{-1} olarak hesaplanmıştır. Penman Monteith FAO 56 modifikasyonu eşitliğine göre ise sezonluk ET_o miktarı 808.0 mm/yıl olarak tespit edilmiştir. Sonuç olarak çalışmada gerçek su tüketimi ile hesaplanan (kıyas) su tüketimi arasındaki farkın önemsiz olduğu ve daha fazla meteorolojik veri kullanarak bitki su tüketim tahminlerinde daha gerçekçi sonuçlara ulaşan bir yöntem olan Penman-Monteith eşitliği kullanılarak zivzik narının yarı kurak iklim koşullarında sulama programının hazırlanmasında kullanılabileceği söylenebilir.
Anahtar Kelimeler: Plant water consumption, Climate data, Zivzik pomegranate

BENEFITTING FROM CLIMATE DATA, SİİRT ZİVZİK PARI DETERMINATION OF PLANT WATER CONSUMPTION

ABSTRACT
The aim of this study is to determine the plant water consumption of Siirt zivzik pomegranate in Siirt climatic conditions by using the FAO 56 modification method of the Penman Monteith equation (the method used to estimate the ET amounts of various plants depending on the amount of ETo), which is used to estimate plant water consumption by using climate parameters. Siirt zivzik pomegranate was used as plant material in the research. The study was conducted during the 2017 pomegranate growing season. While the reference plant water consumption daily ETa value determined by the Penman Monteith equation in the early vegetative period varied between 5.5 mm day-1, it was determined as 10-10.5 mm day-1 before flowering and during the flowering period. In monthly (July) terms, it was calculated as 288.50 mm month-1 according to the Penman Monteith equation. According to the Penman Monteith FAO 56 modification equation, the seasonal ETo amount was determined as 808.0 mm/year. As a result, it can be said that the difference between the actual water consumption and the calculated (comparison) water consumption in the study is insignificant and that it can be used in the preparation of the irrigation program of zivzik pomegranate in semi-arid climate conditions by using the Penman-Monteith equation, which is a method that reaches more realistic results in plant water consumption estimates by using more meteorological data.
Keywords: Crop water consumption, Water balance equation, Climate data

Giriş

Zivzik Narı, Siirt yöresinin önemli tarımsal ürünleri arasında yer almaktadır. Botan Çayı Vadisi etekleri boyunca yerleşim gösteren, Şirvan ilçesine bağlı Kapılı, Sarıdana, Pirinçli ve Zivzik (Dişlinar) köylerinde kapama bahçelerde yaygın olarak yetiştiriciliği yapılan bir meyve türüdür. Tad, aroma ve lezzet bakımından son derece iyi bir çeşit olan Zivzik, adından da anlaşılacağı gibi orta-sert yapıda bir çekirdeğe sahip olması nedeniyle sofralık tüketimden çok meyve suyu elde edilmesine uygundur. Mayhoş bir tada sahiptir. Bu çeşidin en önemli bir diğer özelliği de kontrollü atmosferli koşullarda altı aya kadar depolanabilme özelliğine sahip olmasıdır. 2008 yılında Gaziantep Fıstık Araştırma Enstitüsü tarafından tescil ettirilmiş bir çeşit olan Zivzik Narı üzerinde şimdiye kadar çeşitli konularda farklı araştırmalar yapılmıştır (Pakyürek ve ark., 2020; Al-Jabbari ve ark., 2020; Pakyürek ve ark., 2019; Aydın ve ark., 2017). Damla sulama yöntemi, tarımsal üretimde hem suyun ekonomik kullanımı sağlamakta hem de yabancı otları baskılayarak su kaybını azaltabilmektedir (Hill ve Keller, 1980). Nar yetiştiriciliğinde uygulanan sulama suyu miktarı ile verim ve meyve kalitesi arasında önemli ilişki olduğu bildirilmektedir. Uygulanan sulama suyu arttıkça meyve veriminin de buna paralel olarak arttığı ancak meyve kabuğunda oluşacak çatlaklar olmak üzere bazı kalite özelliklerinde azalmalar olabildiği bildirilmektedir (Khattab ve ark., 2011). Galindo ve ark. (2014), tarafından yapılan bir çalışmada kısıtlı su uygulamasının (0.33) verimde azalmaya, olgunlaşma süresinde kısalmaya, toplam fenolik madde miktarında az da olsa artışa, antosiyanin içeriğinde ise herhangi bir değişime neden olmadığı belirlenmiştir. Pena-Estevez ve ark. (2016), tarafından Mollar de Elche nar çeşidinde kontrol olarak tam sulama (1.00) ve kontrole göre %78 oranında azaltılmış sulama olmak üzere iki farklı sulama seviyesinin meyve kalitesi üzerine etkisi araştırılmıştır. Araştırma sonuçlarına göre hasat edilen taze meyvelerde toplam fenolik madde ve antosiyanin içeriğinin kontrol konusuna kıyasla daha yüksek olduğu belirlenmiştir. Mellisho ve ark. (2012) tarafından narda farklı sulama düzeylerinin meyvenin renk, mineral madde, suda çözünür kuru madde, asitlik gibi bazı kalite özellikleri üzerine olan etkisi araştırılmıştır.

Sulama programı oluşturulmasında ve bitki su tüketiminin saptanmasında alternatif metotlardan birisi de, toprak suyunun ölçülmesi (gravimetrik) yöntemdir (Pardossi et al., 2009). Bitki su tüketimi ve sulama suyu ihtiyacı bitki, toprak ve iklim özelliklerine bağlı olarak değişkenlik göstermektedir. Tarımsal sulamada su kaynaklarının optimum bir randımanla kullanımı, bitki su tüketimini esas alan sulama programları hazırlanarak, bitkinin suya ihtiyacı olduğu zamanlarda sulama yapılması ve her sulamada bitkiye ihtiyacı kadar su verilmesi ile sağlanabilmektedir (Jensen ve Allen, 2016). Bitki su tüketim yöntemleri direkt olarak veya

indirekt olarak iklim parametrelerine bağlı olarak birçok yöntemle tespit edilebilmektedir. Direkt yöntemler uzun bir zaman dilimi ve fazla miktarda iş gücü gerektirirken, indirekt yöntemler daha basit ve daha hızlı uygulanabilmektedir (Kaya 2011). ETo'ı belirleyen etmenler iklim parametreleri ve hava verileridir. Örneğin belirlenmesinde FAO56 Penman-Monteith yöntemi değerlendirildiği bölgede çayır bitkileri ETo değeriyle oldukça sıkı şekilde benzerlik gösterdiği için, fiziksel olarak, fizyolojik ve aerodinamik parametrelerin her ikisini de açıkça birleştirmiş bir yöntem olması sebebiyle tek yöntem olarak tavsiye edilmektedir. Yöntemin ilk aşamasında birçok iklim verisi formüle dâhil olduğu için zorluklar yaşanmasına karşın araştırmadaki ilerlemeler ve bitkiler kıyas ürünlerini içeren geçerli tahminleri ile büyük çapta aşılmıştır (Jensen ve Allen, 2016).

Bu çalışmanın amacı iklim parametrelerinden yararlanarak bitki su tüketimini tahmin etmeye yarayan Penman Monteith eşitliği (ETo miktarına bağlı olarak çeşitli bitkilerin ET miktarlarının tahmin edilmesinde kullanılan yöntem) FAO 56 modifikasyonu yöntemini kullanarak tatlı zivzik narının Siirt iklim koşullarında bitki su tüketimini belirlemektir.

2. Gereç ve Yöntem

2.1. Deneysel Çalışmalar

Penman-Monteith yöntemine göre referans (kıyas) bitki su tüketiminin hesaplanması aşağıda formülde verilmiştir.

Bu yöntemde kıyas bitki su tüketimi;

Bu yöntemde kıyas bitki su tüketimi;

$$ET = \frac{\delta}{\delta + \gamma^*}(R_n - G)\frac{1}{\lambda} + \frac{\gamma}{\delta + \gamma^*}\frac{900}{T + 275}u_2(e_a - e_d)$$

(1.3) eşitliği ile tahmin edilmektedir.

Bu eşitlikteki bazı terimlerin hesaplanmasında kullanılan eşitlikler ise aşağıda verilmiştir.

$\delta = \frac{4098e_a}{(T+237.3)^2}$ (1.4)

$\lambda = 2.501 - 2.361 \times 10^{-3}T$(1.5)

$\gamma = 0.0016286\frac{P}{\lambda}$(1.6)

$\gamma^* = \gamma(1 + 0.34u_2)$

$R_n = R_{n_s} - R_{nl}$ (1.8)

$$R_{n_s} = 0{,}75R_s \quad (1.9)$$

$$R_{n_l} = 2{,}451 f(T) f(e_d) f\left(\frac{n}{N}\right) \quad (1.10)$$

$$R_5 = \left(0.25 + 0.50\frac{n}{N}\right) R_a \quad (1.11)$$

$$e_d = e_a \frac{RH}{100} \quad (1.12)$$

$$u_2 = u_z \left(\frac{2}{z}\right)^{0.2} \quad (1.13)$$

Bu eşitliklerde;

$ET = Referans\ bitki\ su\ tüketimi, mm/gün,$

$\delta = Buhar\ \ basıncı\ eğrisinin\ eğimi, kPa/°C$

$\gamma^* = Modifiye\ psikrometrik\ sabite, kPa/°C$

$\gamma = Psikrometrik\ sabite, kPa/°C$

$P = Atmosfer\ basıncı, kPa$

$R_n = Bitki\ yüzeyindeki\ net\ radyasyon\ , \frac{\frac{MJ}{M2}}{gün}$

$R_a = Atmosferin\ dış\ yüzüne\ ulaşan\ radyasyon, \frac{MJ}{M2}/gün$

(Çizelge 1.2'den doğrudan alınabilir.)

$R_s = Yeryüzüne\ ulaşan\ kısa\ dalgalı\ radyasyon, \frac{MJ}{M2}/gün$

$R_{n_s} = Kısa\ dalgalı\ net\ radyasyon, \frac{MJ}{M2}/gün$

$R_{n_l} = Uzun\ dalhalı\ net\ radyasyon, \frac{MJ}{M2}/gün$

$f(T) =$ Sıcaklık fonksiyonu (Çizelge 1.3'den doğrudan alınabilir.)

$T = Sıcaklık, °C$

$f(e_d) = \ Buhar\ basıncı\ fonksiyonu\ (Çizelge\ 1.4'ten\ doğrudan\ alınabilir)$

$e_d = \ Ortalama\ hava\ sıcaklığındaki\ gerçek\ buhar\ basıncı, kPa$

$e_a = Ortalama\ hava\ sıcaklığındaki\ doygun\ buhar\ basıncı, kPa$

(Çizelge 1.5'ten doğrudan alınabilir)

$f(^n/_N)$: $Güneşlenme\ oranı\ fonksiyonu$

$(\ Çizelge\ 1.6'dandoğrudan\ alınabilir)$

n = Güneşlenme süresi, h

N = Olası maksimum güneşlenme süresi, h (Çizelge 1.7'den doğrudan alınabilir)

G = Topraktaki ısı akımı, MJ/m2/gün

(Ardışık periyotlarda toprağın ortalama sıcaklığı çok fazla değişmediğinden ihmal edilebilir.)

$\lambda = Buharlaşma\ gizli\ ısısı, \frac{MJ}{kg}\left(ortalama\ bir\ değer\ olarak\ 2.45\ \frac{MJ}{kg}\ alınabilir\right)$

$u_2 = Rüzgar\ hızının\ 2\ m\ yükseklikteki\ eşdeğeri, m/s$

$u_z =\ z\ m\ yükseklikte$ ölçülmüş $rüzgar\ hızı, \frac{m}{s}$

z = Rüzgar hızının ölçüldüğü yükseklik, m

(Türkiye'de meteoroloji bültenlerinde genellikle 10 m yükseklikte ölçülmüş rüzgar hızı değerleri verilmektedir) ve RH = Ortalama bağıl (nispi) nem, % değerlerini göstermektedir.

Çizelge 1. Siirt iline ait uzun yıllık meteorolojik veriler (1938-2019).

Parametre	Maksimum Sıcaklık (°C)	Minimum Sıcaklık (°C)	Ortalama Nispi Nem (%)	Toplam Yağış Ortalaması (mm)	Maksimum Yağış (mm)	Ortalama Buharlaşma (mm)	Ortalama Güneşlenme Süresi (Saat)
Rasat Süresi (Yıl)	79	79	78	78	79	79	57
Ocak	19.7	-19.3	71.9	34.6	53.4	12.0	3.6
Şubat	20.6	-16.5	67.1	29.4	53.2		4.4
Mart	28.5	-13.3	62.0	24.1	63.0	33.0	5.4
Nisan	32.9	-4.1	58.0	22.4	71.4	84.0	6.5
Mayıs	36.2	2.0	50.7	21.2	68.1	186	9.0
Haziran	40.2	8.2	34.6	15.5	16.7	284.8	11.7
Temmuz	44.4	13.1	27.4	13.5	22.2	368.0	12.2
Ağustos	14.4	46.0	26.4	13.3	12.2	351.8	11.4
Eylül	39.9	8.5	31.2	14.4	37.5	254.3	9.9
Ekim	36.6	0.3	46.7	49.7	70.8	137.6	7.2
Kasım	25.8	-14.1	62.4	82.5	102.9	53.0	5.2
Aralık	24.3	-14.6	70.6	94.5	71.8	13.1	3.6
Yıllık	46	-19.3	50.8	719.8	102.9	1753.6	7.5

3. Bulgular ve Tartışma

Erken vejetatif dönemde Penman Monteith eşitliği ile saptanan günlük ETa değeri 5,5 mm gün^{-1} arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 10-10,5 mm gün^{-1} olarak hesaplanmıştır. Aylık olarak ise Penman Monteith eşitliğine göre 288,5 mm ay^{-1} olarak hesaplanmıştır. Araştırmanın yürütüldüğü yıl mevsimlik bitki su tüketimi (Penman Monteith FAO 56) modifikasyonu eşitliğine göre ise ETo miktarı 808,0 mm olarak tespit edilmiştir.

4. Sonuç

Son zamanlarda küresel ısınmaya bağlı olarak ciddi bir tehdit olarak karşımıza çıkan ani iklimsel değişim, ülkemizdeki kısıtlı olan su kaynaklarının tükenmesine yol açmakta önemli bir oynamaktadır. Bunun yanında zivzik narı bitkisi yetiştiriciliği alanında daha fazla teşvik edilmesi için yapılan çalışmada gerçek su tüketimi ile hesaplanan referans su tüketimi arasında farkın önemsiz olduğu belirlenmiştir. Öte yandan su tüketiminin en yoğun olarak kullanıldığı alanların sulama amaçlı olduğu düşünüldüğünde sulama projelerinin gerçekçi olarak iklim verilerine bağlı, uzun ya da kısa dönemlere ilişkin bitkilerin kullanacakları su miktarının belirlenmesi gereklidir. Sonuç olarak bitki su tüketiminin saptanmasında daha fazla meteorolojik veri kullanarak bitki su tüketim tahminlerinde daha gerçekçi sonuçlara ulaşan bir yöntem olan Penman-Monteith eşitliği kullanılarak zivzik narı bitkisinin sulama programı hazırlanmasında önerilebilir. Araştırmadan elde edilen sonuçlar diğer araştırıcılar tarafından da test edilebilir.

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İKLİM VERİLERİNDEN FAYDALANARAK AYÇİÇEĞİ HATLARININ BİTKİ SU TÜKETİMİNİN BELİRLENMESİ

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ÖZET
Bu çalışmanın amacı doğrudan bitki su tüketimini belirlemeye yarayan su dengesi eşitliği yöntemi ve iklim parametrelerinden yararlanarak bitki su tüketimini tahmin etmeye yarayan Penman Monteith eşitliği (ET_o miktarına bağlı olarak çeşitli bitkilerin ET miktarlarının tahmin edilmesinde kullanılan yöntem) FAO 56 modifikasyonu yöntemini kullanarak ayçiçeği hatlarının Siirt iklim koşullarında bitki su tüketimini belirlemektir. Araştırmada bitki materyali olarak ayçiçeği hattı kullanılmıştır. Çalışma 2016 yılı ayçiçeği hatlarının yetişme sezonu boyunca Siirt Üniversitesi Ziraat Fakültesi deneme arazisinde yürütülmüştür. Erken vejetatif dönemde su dengesi eşitliğine göre günlük ETa değeri 4,5 mm $gün^{-1}$ arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 9,510 mm $gün^{-1}$ olarak belirlenmiştir. Penman Monteith eşitliği ile saptanan referans bitki su tüketimi ise 9.0 mm $gün^{-1}$ olarak hesaplanmıştır. Aylık (Temmuz) olarak ise su dengesi eşitliğine göre 270.0 mm ay^{-1}, Penman Monteith eşitliğine göre 262.22 mm ay^{-1} olarak hesaplanmıştır. Araştırmanın yürütüldüğü yıl ayçiçeği hatlarına uygulanan sulama suyu miktarı 637.00 mm olup su dengesi eşitliği yöntemine göre mevsimlik bitki su tüketimi (ETa) 724.0 mm, Penman Monteith FAO 56 modifikasyonu eşitliğine göre ise ET_o miktarı 738.0 mm olarak tespit edilmiştir. Sonuç olarak çalışmada gerçek su tüketimi ile hesaplanan (kıyas) su tüketimi arasındaki farkın önemsiz olduğu ve daha fazla meteorolojik veri kullanarak bitki su tüketim tahminlerinde daha gerçekçi sonuçlara ulaşan bir yöntem olan Penman-Monteith eşitliği kullanılarak ayçiçeği bitkisinin yarı kurak iklim koşullarında sulama programının hazırlanmasında kullanılabileceği söylenebilir.
Anahtar Kelimeler: Bitki su tüketimi, Su dengesi eşitliği, İklim verileri

SUNFLOWER LINES USING CLIMATE DATA DETERMINATION OF PLANT WATER CONSUMPTION

ABSTRACT
The aim of this study is to determine the water balance equation method, which is used to directly determine plant water consumption, and the Penman Monteith equation, which is used to estimate plant water consumption by using climate parameters (the method used to estimate the ET amounts of various plants depending on the amount of ETo) and the FAO 56 modification method, to determine the results of sunflower lines in Siirt climatic conditions. To determine plant water consumption. Sunflower line was used as plant material in the research. The study was carried out in the trial field of Siirt University Faculty of Agriculture during the growing season of sunflower lines in 2016. According to the water balance equation in the early vegetative period, the daily ETa value varied between 4.5 mm day-1, while it was determined as 9,510 mm day-1 before flowering and during the flowering period. The reference plant water consumption determined by the Penman Monteith equation was calculated as 9.0 mm day-1. On a monthly basis (July), it was calculated as 270.0 mm month-1 according to the water balance equation and 262.22 mm month-1 according to the Penman Monteith equation. In the year the research was conducted, the amount of irrigation water applied to sunflower lines was 637.00 mm, and according to the water balance equation method, seasonal plant water consumption (ETa) was determined as 724.0 mm, and according to the Penman Monteith FAO 56 modification equation, the amount of ETo was determined as 738.0 mm. As a result, it can be said that the difference between the actual water consumption and the calculated (comparison) water consumption in the study is insignificant and that it can be used in the preparation of the irrigation program of the corn plant in semi-arid climate conditions by using the Penman-Monteith equation, which is a method that reaches more realistic results in plant water consumption estimates by using more meteorological data.
Keywords: Crop water consumption, Water balance equation, Climate data

Giriş

Ülkemizde insan beslenmesinde çoğunlukla ayçiçeği yağının tercih edilmesi ve artan yağ açığımız nedeniyle en önemli yağ bitkilerinden birisi ayçiçeğidir. Hemen her şeyin mekanize olması, düşük işgücü kullanımı, geniş alanlarda ekim potansiyeline sahip olmasına rağmen, ayçiçeği ekim alanlarında istenen artış sağlanamamıştır. Bunun en önemli nedenlerinden birisi; ülkemizin hemen her bölgesinde ayçiçeği kuru ziraat şeklinde (yağışa bağlı olarak sulanmadan) üretildiğinden, gelişme dönemindeki kuraklıkların tane verimini olumsuz yönde etkilemesiyle üretiminin yıllar bazında değişiklik göstermesidir. Tarımsal anlamda iklim değişikliğinin en ciddi sonucu olan su stresi veya kuraklık konusunda alınabilecek önlemlerden biride ülkemizde önemli bir ekim alanına sahip olan ayçiçeğinin, su stresi koşullarında yetiştirilebilecek yeni ayçiçeği çeşitlerinin su stresine olası tepkilerinin belirlenmesi ve her yöreye uygun bitki su tüketimlerinin saptanması sürdürülebilir tarımın devamlılığı açısından büyük önem arz etmektedir (Anonim, 2022).Türkiye sahip olduğu toprak ve su kaynakları ile çok değişik iklim koşulları yönünden dünyada tarımsal potansiyeli yüksek olan sayılı ülkeler arasında bulunmaktadır. Ülkemizde işlenen arazi 28,5 milyon hektardır. Yapılan etütlere göre, mevcut su potansiyeli ile teknik ve ekonomik olarak sulanabilecek arazi miktarı 8,5 milyon hektar olarak hesaplanmıştır. Sulanan alan ise 6,7 milyon ha'dır (Anonim, 2021). Kırnak, ve Gençoğlan (2001), yaptıkları çalışmada Akdeniz ülkeleri için suyun kısıntılı bir kaynak olduğunu, kişi başına gerekli toplam su miktarının ise yaklaşık 1700 m3/kişi/yıl olduğunu bildirmişlerdir. Ancak, çoğu Batı Asya ülkelerinde bu rakam 500 m3/kişi/yıl'dan daha azdır. Bu durum gelecekte artan nüfus için çok olumsuz bir durumdur. Tarım %70 kullanım oranı ile suyu en fazla tüketen sektördür. Ülkemizin nüfusu yaklaşık olarak 82 milyona ulaşmış bulunmaktadır. Hâlbuki tarım arazilerini daha fazla arttırma olanağı bulunmamaktadır. Bu durumda artan nüfusumuzun beslenmesi, sanayimize hammadde sağlaması ve dış ödemeler dengesinde katkıda bulunması için tarımsal üretimin arttırılması gerekmektedir. Bu husus ülke çapında iyi bir üretim planlaması ve günün modern tekniklerinin uygulanmasıyla sağlanabilir. Günümüzde bitkilerin sulanmasında yüzey sulama yöntemleri yetersiz kalmakta ve uygulanan sulama suyunun yalnızca 1/3'ü bitkiler tarafından terleme (transpirasyon) yoluyla kullanılmaktadır. Bu nedenle, sulama yöntemlerinin geliştirilmesine şiddetle ihtiyaç duyulmaktadır. Bu bağlamda, Türkiye'nin de dâhil olduğu Akdeniz ülkelerinde yapılan çalışmaların sonucuna göre; damla sulamanın, ortalama %42 su tasarrufu sağladığı, fertigasyonun geleneksel gübrelemeye göre verimi %42 arttırdığı, sulama suyu kullanma etkinliği ise %79 oranında daha yüksek olduğu belirtilmiştir. Özellikle yağmurlama ve damla

sulama sistemlerine uygun sulama programları hazırlayıp, bu programları sulama otomasyonu ile birlikte uygulayarak su kullanım etkinliği daha da arttırılabilir. Plastik sanayinin hızla gelişimi, sulama sistemi ve donanımındaki gelişmeler, basınçlı sulama sistemi kullanımının artmasında itici bir güç oluşturmuştur. Bunun sonucu olarak son yıllarda birçok bitkinin sulanmasında yağmurlama ve damla sulama uygulamaları başlamıştır. Ülkemizde de bu konudaki araştırma çalışmaları yakın geçmişten (son 20-25 yıl) beri yapılmaktadır. Ayrıca, yüzey sulamadan damla sulama sistemlerine geçişte %30-60 arasında değişen oranda bir su tasarrufu sağlanabilmektedir (Anonim, 2003). Bitkilerin sulanması amacıyla, sulama programlarının oluşturulmasında son zamanlarda sulama otomasyonu kullanılmaya başlanmıştır. Sulama otomasyonu sulama programı ile birlikte kullanıldığında, daha hassas olmakta, su ve gübre kullanım etkinliğini arttırmakta, işçilik ve enerji giderlerini azaltmakta, verimi ve kaliteyi arttırmakta, insan hatasını en aza indirmekte, sık ve düşük hacimli sulama yapma imkânı sağlamaktadır. Günümüzde bitkilerin sulanmasında yüzey sulama yöntemleri yetersiz kalmakta ve uygulanan sulama suyunun yalnızca 1/3'ü bitkiler tarafından terleme (transpirasyon) yoluyla kullanılmaktadır. Bu nedenle, bitkilerin her yöre ve her bitki için bitki su tüketimlerinin geliştirilmesine yönelik çalışmaların yapılmasına gereksinim duyulmaktadır. Ulusal ve uluslararası kaynaklarda 'Evapotranspirasyon' olarak adlandırılan ve ETa simgesiyle gösterilen terimin Türkçe' deki karşılığı 'Bitki Su Tüketimi' olarak tanımlanmaktadır (Bayramoğlu, 2013; Uçak ve ark., 20216). Bitki su tüketiminin (Evapotranspirasyon, ETa) saptanması; su kaynaklarının işletilmesi, sulama sistemlerinin planlanması ve sulama programlarının yapılabilmesi için temel bir ihtiyaçtır. Bitkisel üretimde bitki su tüketiminin dikkate alınması ve suyun ölçülü kullanılması, hem verim hem de toprak-su kaynaklarının korunması açısından büyük önem taşımaktadır (Abtew ve Obeysekera, 1995; Güngör et al., 2004; Demir ve Meral, 2016). Günümüzde sulama programlarının oluşturulmasında dikkate alınan en önemli parametrelerden biriside bitki su tüketimidir. Bitki su tüketimi lizimetre sistemleri, tarla deneme parselleri ve bitki kök bölgesindeki nem azalmasının denetimi gibi metotlardan faydalanarak doğrudan hesaplanabilmektedir (Şarlak ve Bağçacı, 2020; Kırnak ve Gençoğlan, 2001). Sulama uygulamalarında bitki su tüketimin dikkate alınmadığı ve homojen bir su dağılımının yapılamadığı, salma sulama yönteminin kullanılması durumunda, bitki gelişiminde büyük bir öneme sahip olan demir mineralinin topraktan yıkanarak etkili kök bölgesi altında sızmasına sebep olmaktadır (Fulton, 2013; Jarvis Shean et al., 2018). Uygulamada sulama programı, genellikle yetiştirici deneyimlerine veya toprak su dengesi (iklim temelli yöntem) belirlenmesine dayanmaktadır. Sulama programı oluşturulmasında ve

bitki su tüketiminin saptanmasında alternatif metotlardan birisi de, toprak suyunun ölçülmesi (gravimetrik) yöntemdir (Pardossi et al., 2009). Bitki su tüketimi ve sulama suyu ihtiyacı bitki, toprak ve iklim özelliklerine bağlı olarak değişkenlik göstermektedir. Tarımsal sulamada su kaynaklarının optimum bir randımanla kullanımı, bitki su tüketimini esas alan sulama programları hazırlanarak, bitkinin suya ihtiyacı olduğu zamanlarda sulama yapılması ve her sulamada bitkiye ihtiyacı kadar su verilmesi ile sağlanabilmektedir (Jensen ve Allen, 2016). Bitki su tüketim yöntemleri direkt olarak veya indirekt olarak iklim parametrelerine bağlı olarak birçok yöntemle tespit edilebilmektedir. Direkt yöntemler uzun bir zaman dilimi ve fazla miktarda iş gücü gerektirirken, indirekt yöntemler daha basit ve daha hızlı uygulanabilmektedir (Kaya 2011). ETo'ı belirleyen etmenler iklim parametreleri ve hava verileridir. Örneğin belirlenmesinde FAO56 Penman-Monteith yöntemi değerlendirildiği bölgede çayır bitkileri ETo değeriyle oldukça sıkı şekilde benzerlik gösterdiği için, fiziksel olarak, fizyolojik ve aerodinamik parametrelerin her ikisini de açıkça birleştirmiş bir yöntem olması sebebiyle tek yöntem olarak tavsiye edilmektedir. Yöntemin ilk aşamasında birçok iklim verisi formüle dâhil olduğu için zorluklar yaşanmasına karşın araştırmadaki ilerlemeler ve bitkiler kıyas ürünlerini içeren geçerli tahminleri ile büyük çapta aşılmıştır (Allen et al., 1998). Bu çalışmanın amacı doğrudan bitki su tüketimini belirlemeye yarayan su dengesi eşitliği ve iklim parametrelerinden yararlanarak bitki su tüketimini tahmin etmeye yarayan Penman Monteith eşitliği (ETo miktarına bağlı olarak çeşitli bitkilerin ET miktarlarının tahmin edilmesinde kullanılan yöntem) FAO 56 modifikasyonu yöntemini kullanarak ayçiçeği hatlarının Siirt iklim koşullarında bitki su tüketimini belirlemektir.

2. Gereç ve Yöntem

2.1. Deneysel Çalışmalar

Damlama sulama yönteminin kullanıldığı deneme parsellerinde su dağıtımı, 4 atm çalışma basıncı ve 16 mm dış çapa sahip yumuşak PE lateral boru hatları kullanılarak sağlanmıştır. Araştırma alanının toprakları ağırdır ve 7 mm h^{-1} infiltrasyon oranına sahiptir. Her lateralde, sıralı tip basınç düzenleyicisi ve 1 atm çalışma basıncında 4 L h-1 akış hızına sahip damlatıcılar kullanıldı ve aralarında 0.33 m boşluk kaldı. Bu nedenle, bitki damla sulama yöntemi ile sulama suyu sadece doğru miktarda uygulanmıştır. Herhangi bir sızma veya yüzey akışı meydana gelmesine izin verilmemiştir. Sırta ekilecek tohum yatağı hazırlanmıştır. Her parsel, sıra arasında 70 cm boşluk, sıra üzeri 20 cm boşluk, parsellerin boyutları 6 m uzunluğunda ve 2,8 m genişliğinde (parsel yüzeyi = 16,8 m2) olmak üzere 4 çizgiye sahip olacak şekilde tasarlanmıştır. Tohumun 4-5 cm derinlikte ekildiğinden emin olmak için 4 hatlı pnömatik

tohum makinası kullanılmıştır. Sulama konuları ve tekrarlar arasındaki etkileşimleri önlemek için 2 m tampon bölge oluşturulmuştur. Çalışmada, etkili kök derinliğinin (90 cm) nem içeriği her sulamadan önce gravimetrik yöntem kullanılarak tespit edilmiştir. Her tür için tam sulama (I100)ile kontrol parselinde 90 cm toprak derinliğinde eksik nem getirmek için sulama suyu miktarı, her bir konu için uygulanacak sulama suyu miktarını belirlemek için kullanılmıştır. Bu amaçla, sulama öncesi her sulama derinliği için 90 cm'lik toprak profilinin 0-30, 30-60 ve 60-90 cm'lik tabakalarından alınan toprak numuneleri toplanmış ve kuru toprak ağırlık yüzdesi (%Pw) olarak belirlenmiştir. Her katman için belirlenen nem içeriği, denklem 1 kullanılarak derinlemesine nem içeriğine dönüştürülmüştür.

d=(Pw-PwAW)*As*D/100..... (1)

Burada; d derinliğinde toprak nem içeriğidir (mm), Pw tarla kapasitesi (%), PwAW;her katmanın nem içeriği (%), As ,Toprak birim ağırlığı (g/cm^3)

D katman derinliği (mm) olduğu gibi uygulanacak suyun hacmi aşağıdaki denklem kullanılarak hesaplanmıştır (Eq. (2));

Her tabaka için hesaplanan su içeriği nin eklenmesiyle, etkili kök derinliği için toplam su miktarı (dT) bulunmuştur (Eq. (2)).

dT=d(0-30)+ d(30-60) + d(60-90) ..... (2)

Her sulama konusunun aylık ve mevsimsel evapotranspirasyon değerleri, büyüme mevsiminde hasadın başlangıcında ve sonunda ölçülen toprağın nem oranı (90 cm) su bütçe yöntemi ve nem içeriği değerleri kullanılarak hesaplanmıştır (Zeleke ve Wade 2012).

Bitkinin su tüketiminin hesaplanmasında aşağıdaki su dengesi denklemi kullanılmıştır (Eq. (4)) (Zeleke ve Wade 2012).

ETa= P + I – Rf – Dp ± ΔS .....(Eq. (5).

ETa: Evapotranspirasyon (mm),

P: yağış (mm),

I: sulama suyu miktarı (mm),

Rf: yüzey akışı (mm),

Dp: Derin infiltrasyon (mm) ve

ΔS (mm) kökündeki toprak nem değişimidir. Çalışmada tercih edilen damla akış hızı toprağın sızma hızından daha düşük olduğundan, yüzey akışı oluşmamıştır. Sulama suyu miktarı mevcut nemi saha kapasitesine getirmek için yeterli olduğu için derin bir sızma meydana gelmediği varsayılmıştır. Penman-Monteith yöntemine göre referans (kıyas) bitki su tüketiminin hesaplanması aşağıda formülde verilmiştir.

Bu yöntemde kıyas bitki su tüketimi;

Bu yöntemde kıyas bitki su tüketimi;

$$ET = \frac{\delta}{\delta + \gamma^*}(R_n - G)\frac{1}{\lambda} + \frac{\gamma}{\delta + \gamma^*}\frac{900}{T + 275}u_2(e_a - e_d)$$

(1.3) eşitliği ile tahmin edilmektedir.

Bu eşitlikteki bazı terimlerin hesaplanmasında kullanılan eşitlikler ise aşağıda verilmiştir.

$\delta = \frac{4098e_a}{(T+237.3)^2}$ (1.4)

$\lambda = 2.501 - 2.361 \times 10^{-3}T$(1.5)

$\gamma = 0.0016286\frac{P}{\lambda}$(1.6)

$\gamma^* = \gamma(1 + 0.34u_2)$ (1.7)

$R_n = R_{n_s} - R_{nl}$ (1.8)

$R_{n_s} = 0{,}75R_s$ (1.9)

$R_{n_l} = 2{,}451f(T)f(e_d)f\left(\frac{n}{N}\right)$ (1.10)

$R_5 = \left(0.25 + 0.50\frac{n}{N}\right)R_a$ (1.11)

$e_d = e_a\frac{RH}{100}$ (1.12)

$u_2 = u_z\left(\frac{2}{z}\right)^{0.2}$ (1.13)

Bu eşitliklerde;

$ET = Referans\ bitki\ su\ tüketimi, mm/gün,$

$\delta = Buhar\ \ basıncı\ eğrisinin\ eğimi, kPa/°C$

$\gamma^* = Modifiye\ psikrometrik\ sabite, kPa/°C$

$\gamma = Psikrometrik\ sabite, kPa/°C$

$P = Atmosfer\ basıncı, kPa$

$R_n = Bitki\ yüzeyindeki\ net\ radyasyon\ , \frac{\frac{MJ}{M2}}{gün}$

$R_a = Atmosferin\ dış\ yüzüne\ ulaşan\ radyasyon, \frac{MJ}{M2}/gün$

(Çizelge 1.2'den doğrudan alınabilir.)

$R_s = Yeryüzüne\ ulaşan\ kısa\ dalgalı\ radyasyon, \frac{MJ}{M2}/gün$

$R_{n_s} = Kısa\ dalgalı\ net\ radyasyon, \frac{MJ}{M2}/gün$

$R_{n_l} = Uzun\ dalhalı\ net\ radyasyon, \frac{MJ}{M2}/gün$

$f(T) =$ Sıcaklık fonksiyonu (Çizelge 1.3'den doğrudan alınabilir.)

$T = Sıcaklık, °C$

$f(e_d) =\ Buhar\ basıncı\ fonksiyonu\ (Çizelge\ 1.4'ten\ doğrudan\ alınabilir)$

$e_d =\ Ortalama\ hava\ sıcaklığındaki\ gerçek\ buhar\ basıncı, kPa$

$e_a = Ortalama\ hava\ sıcaklığındaki\ doygun\ buhar\ basıncı, kPa$

(Çizelge 1.5'ten doğrudan alınabilir)

$f\left(\frac{n}{N}\right)$: $Güneşlenme\ oranı\ fonksiyonu$

$(\ Çizelge\ 1.6'dandoğrudan\ alınabilir)$

n = Güneşlenme süresi, h

N = Olası maksimum güneşlenme süresi, h (Çizelge 1.7'den doğrudan alınabilir)

G = Topraktaki ısı akımı, MJ/m2/gün

(Ardışık periyotlarda toprağın ortalama sıcaklığı çok fazla değişmediğinden ihmal edilebilir.)

$\lambda = Buharlaşma\ gizli\ ısısı, \frac{MJ}{kg}\left(ortalama\ bir\ değer\ olarak\ 2.45\frac{MJ}{kg}\ alınabilir\right)$

$u_2 = Rüzgar\ hızının\ 2\ m\ yükseklikteki\ eşdeğeri, m/s$

$u_z =\ z\ m\ yükseklikte$ ölçülmüş $rüzgar\ hızı, \frac{m}{s}$

z = Rüzgar hızının ölçüldüğü yükseklik, m

(Türkiye'de meteoroloji bültenlerinde genellikle 10 m yükseklikte ölçülmüş rüzgar hızı değerleri verilmektedir) ve RH = Ortalama bağıl (nispi) nem, % değerlerini göstermektedir.

Çizelge 1. Siirt iline ait uzun yıllık meteorolojik veriler (1938-2019).

Parametre	Maksimum Sıcaklık (°C)	Minimum Sıcaklık (°C)	Ortalama Nispi Nem (%)	Toplam Yağış Ortalaması (mm)	Maksimum Yağış (mm)	Ortalama Buharlaşma (mm)	Ortalama Güneşlenme Süresi (Saat)
Rasat Süresi (Yıl)	79	79	78	78	79	79	57
Ocak	19.7	-19.3	71.9	34.6	53.4	12.0	3.6
Şubat	20.6	-16.5	67.1	29.4	53.2		4.4
Mart	28.5	-13.3	62.0	24.1	63.0	33.0	5.4
Nisan	32.9	-4.1	58.0	22.4	71.4	84.0	6.5
Mayıs	36.2	2.0	50.7	21.2	68.1	186	9.0
Haziran	40.2	8.2	34.6	15.5	16.7	284.8	11.7
Temmuz	44.4	13.1	27.4	13.5	22.2	368.0	12.2
Ağustos	14.4	46.0	26.4	13.3	12.2	351.8	11.4
Eylül	39.9	8.5	31.2	14.4	37.5	254.3	9.9
Ekim	36.6	0.3	46.7	49.7	70.8	137.6	7.2
Kasım	25.8	-14.1	62.4	82.5	102.9	53.0	5.2
Aralık	24.3	-14.6	70.6	94.5	71.8	13.1	3.6
Yıllık	46	-19.3	50.8	719.8	102.9	1753.6	7.5

3. Bulgular ve Tartışma

Erken vejetatif dönemde su dengesi eşitliğine göre günlük ETa değeri 4,5 mm gün^{-1} arasında değişirken, çiçeklenme öncesinde ve çiçeklenme döneminde 9,5-10 mm gün^{-1} olarak belirlenmiş olup, Penman Monteith eşitliği ile saptanan referans bitki su tüketimi ise 9.0 mm gün^{-1} olarak hesaplanmıştır. Aylık olarak ise su dengesi eşitliğine göre 270 mm ay^{-1}, Penman Monteith eşitliğine göre 262,3 mm ay^{-1} olarak hesaplanmıştır. Araştırmanın yürütüldüğü yıl ayçiçeği hattına uygulanan sulama suyu miktarı 637.00 mm olup su dengesi eşitliği yöntemine göre mevsimlik bitki su tüketimi (ETa) 724 mm, Penman Monteith FAO 56 modifikasyonu eşitliğine göre ise ETo miktarı 738.40 mm olarak tespit edilmiştir.

4. Sonuç

Son zamanlarda küresel ısınmaya bağlı olarak ciddi bir tehdit olarak karşımıza çıkan ani iklimsel değişim, ülkemizdeki kısıtlı olan su kaynaklarının tükenmesine yol açmakta önemli bir oynamaktadır. Bunun yanında ayçiçeği bitkisi yetiştiriciliği alanında daha fazla teşvik edilmesi için yapılan çalışmada gerçek su tüketimi ile hesaplanan referans su tüketimi arasında farkın önemsiz olduğu belirlenmiştir. Öte yandan su tüketiminin en yoğun olarak kullanıldığı alanların

sulama amaçlı olduğu düşünüldüğünde sulama projelerinin gerçekçi olarak iklim verilerine bağlı, uzun ya da kısa dönemlere ilişkin bitkilerin kullanacakları su miktarının belirlenmesi gereklidir. Sonuç olarak bitki su tüketiminin saptanmasında daha fazla meteorolojik veri kullanarak bitki su tüketim tahminlerinde daha gerçekçi sonuçlara ulaşan bir yöntem olan Penman-Monteith eşitliği kullanılarak ayçiçeği hatlarının bitkisinin sulama programı hazırlanmasında önerilebilir. Araştırmadan elde edilen sonuçlar diğer araştırıcılar tarafından da test edilebilir.

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A REVIEW TO SPACE SYNTAX WITH THE SCOPE OF URBAN PLANNING AND ARCHITECTURE

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Abstract
The spatial arrangement and connectivity of urban environments play a significant role in shaping human behavior, social interactions, and the overall functioning of cities. This study explores the application of the Space Syntax method as a powerful tool in understanding and designing urban spaces that promote efficient movement, social integration, and improved quality of life.The Space Syntax method, rooted in architecture and urban planning, focuses on mapping and analyzing the spatial layout and connectivity of cities, districts, or individual buildings. By utilizing graph theory and mathematical models, this approach allows researchers and practitioners to unveil patterns of movement, accessibility, and social interaction within built environments.This study provides an overview of the theoretical framework and the various techniques employed in Space Syntax analysis. It discusses the significance of axial and visibility analysis, which capture the movement potential and visibility relationships of different spatial configurations. Furthermore, it delves into tools such as integration analysis, which quantifies the interconnectedness of spaces, and configurational analysis, which measures the complexity and intelligibility of spatial layouts.The study further highlights the invaluable insights provided by Space Syntax analysis in the planning and design of cities and buildings. By understanding how spatial layouts influence human behavior, decision-makers can optimize urban environments to foster social cohesion, pedestrian movement, and accessibility. This method has the potential to inform crucial decisions related to urban regeneration, transportation planning, and the design of public spaces.
Keywords: Space Syntax in Urban Planning, Space Syntax in Architecture, Human Behavior

Introduction

In the intricate weave of urban landscapes and architectural design lies a profound understanding of space and its influence on human behavior. At the heart of this understanding is the concept of space syntax—a powerful analytical tool that unveils the underlying patterns and relationships within built environments. As cities grow denser and design becomes more complex, the application of space syntax offers a compelling lens through which architects and urban planners can decipher the dynamics of space.Urban planning is a complex and multifaceted process that requires careful consideration of numerous factors to create functional and livable cities. One approach gaining traction in recent years is the use of space syntax. Space syntax is a method that analyzes spatial configurations and their relationships to human behavior. By mapping the accessibility and connectivity of urban spaces, planners can better understand how people navigate and interact with the built environment. This information can inform decisions on transportation, land use, and urban design to create more efficient, inclusive, and sustainable cities. As urban populations continue to grow, the need for strategic planning becomes increasingly crucial. Through the use of space syntax, planners can gain valuable insights into the spatial dynamics of cities, ultimately leading to more effective and responsive urban planning strategies.This study delves into the fundamental principles and practical applications of space syntax, exploring its transformative impact on architectural theory and urban planning strategies. From its theoretical origins to its contemporary use in shaping vibrant, functional spaces, we embark on a journey to uncover how space syntax enriches our comprehension of spatial organization and human interaction.

Understanding Space Syntax

Understanding space syntax is crucial for effective urban planning as it offers a comprehensive framework that integrates physical structures with social, economic, and cultural considerations. Building on the principles of space syntax theory, urban designers can gain deeper insights into the spatial configurations of urban environments and their impact on human interactions and activities. The use of advanced methodologies, such as drone oblique photography and clustering algorithms, as demonstrated in (Ran Zhang et al., 2023), allows for a nuanced analysis of spatial patterns, emergence of informal spaces, and their determinants within communities. By leveraging space syntax tools like Depthmap, designers can decipher the intrinsic relationships between architectural layouts, traffic patterns, and the formation of various spatial typologies, as exemplified in the case study of Jilin City (Kayvan Karimi, 2023). This in-depth understanding of urban morphology enables planners to develop evidence-based

designs and predictive models that address the evolving needs of urban populations while fostering sustainable and balanced urban environments. Ultimately, the integration of space syntax in urban planning practices holds the potential to reshape future urban settings by harmonizing physical structures with human existence.Space syntax emerged in the 1970s, pioneered by a group of researchers at the Bartlett School of Architecture and Planning under the leadership of Bill Hillier and Julienne Hanson. This group developed a theoretical and practical methodology aimed at providing a mathematical definition of space and testing its spatial potentials with foresight. This methodology, developed to predict human behaviors at both building and urban scales, came to be known as space syntax. Space syntax studies are not limited to urban scales but also encompass architectural scales. Over time, the most important concept encapsulated within space syntax is the notion of spatial configuration (Hillier, 2007). Hillier and Hanson (1984) assert that the spaces within buildings reflect the relationships within society. As expressed by Penn (2003), space syntax enables the comparative reading of spaces with different functional organizations and configurations.

Space Syntax With the Scope of Urban Planning

Historical Development of Space Syntax in Urban Planning

The historical development of Space Syntax in urban planning has been a subject of significant evolution and application, as evidenced by the studies on urban agglomeration patterns and topological analyses of cities like Colombo and Irkutsk. Research (Nilantha Randeniya et al., 2023) highlights the interconnectedness of cities within urban agglomerations, emphasizing the spatial formations and population integration crucial in urban design. This perspective underscores the importance of understanding historical urbanization patterns, such as Colombo's nuclear style urbanization prior to 1970 and subsequent suburban expansion post-1990, shaping the city over time. Additionally, the study on Irkutsk (Timur A. Dashiev, 2021) showcases the practical implications of Space Syntax through the analysis of axial maps and city integration dynamics. Drawing insights from these studies, the historical development of Space Syntax reveals its relevance in enhancing urban functional zoning, improving social efficiency, and guiding spatial development strategies for sustainable urban planning practices.

Principles of Space Syntax Analysis

In understanding the principles of Space Syntax Analysis within the realm of urban planning, it is essential to delve into the intricate dynamics of public spaces and their impact on social interactions, particularly among the elderly population. Research has shown that close social interactions, such as those facilitated through blind-dating activities in urban areas, play a vital

role in enhancing the well-being and social connections of the elderly. This emphasis on social behavior highlights the importance of designing urban spaces that not only cater to physical needs but also foster opportunities for meaningful social engagement. Additionally, the recognition of spatial hierarchy within architectural structures, as observed in mosques, sheds light on the significance of spatial organization in creating inclusive and accessible environments for community interaction. By integrating the principles of Space Syntax Analysis with a focus on encouraging social interactions and hierarchies within public spaces, urban planners can enhance the quality of city living, promote community cohesion, and contribute to the overall well-being of residents.

Applications of Space Syntax in Urban Planning

The application of Space Syntax in urban planning offers significant benefits in enhancing the design and functionality of urban spaces. By incorporating principles of Space Syntax, urban planners can analyze the spatial configurations of cities to optimize connectivity, integration, and choice within the urban fabric. Utilizing a combination of Space Syntax analysis and clustering techniques, as proposed in the study by (C. Pezzica et al., 2021), can further facilitate the evaluation of temporary housing sites post-disaster, aiding in the formulation of effective urban design strategies for resilient recovery. Additionally, the theoretical foundations of Space Syntax, as expounded in (A. Refaat, 2019), provide a framework for understanding the tangible aspects of urban design, translating intangible urban values such as legibility and accessibility into quantifiable measures. This comprehensive approach empowers urban planners to create more inclusive, navigable, and user-friendly urban environments through informed spatial design decisions.

Case Studies Utilizing Space Syntax

In exploring the utilization of space syntax in urban planning through case studies, it becomes evident that the integration of digital technologies and data analysis plays a crucial role in understanding spatial patterns and their implications on social behavior and economic growth. As evidenced by the research presented in (Tara Azad Rauof, 2023), there exists a mathematical relationship between connectivity values and urban spatial layouts, highlighting the importance of analyzing such relationships to enhance urban design efficiency. Moreover, the findings from (Yunfeng Huang et al., 2023) shed light on the spatial advantages of commercial layouts in traditional villages, emphasizing the significance of strategic placement for optimal commercial success. By critically analyzing these case studies, planners and architects can glean valuable insights into how space syntax principles can be effectively applied to enhance urban

configurations, promote economic development, and improve overall urban planning strategies for sustainable and efficient city design.

Criticisms and Limitations of Space Syntax

The use of space syntax in urban planning has garnered significant attention for its ability to analyze spatial configurations and their impact on human behavior and movement patterns. However, criticisms and limitations of space syntax must be acknowledged to ensure its effective application in urban design. One major criticism relates to the challenge of state-space explosion, which can hinder the scalability and complexity of space syntax models. Symmetry reduction techniques, as discussed in (Shamim Ripon et al., 2011), offer a potential solution to alleviate this issue by addressing the effects of identical components within systems. Moreover, the notion of generalizing mechanical translation procedures based on thesaurus principles, as explored in (M. Masterman et al., 2011), could inspire a broader perspective on addressing the complexities of spatial analysis in urban planning through innovative methodologies. By recognizing and addressing these criticisms and limitations, urban planners can enhance the applicability and robustness of space syntax in shaping sustainable and efficient urban environments.

Integration of Space Syntax with Other Urban Planning Approaches

The integration of space syntax with other urban planning approaches presents a valuable opportunity to enhance the sustainable development and functionality of urban areas. This synergy allows for a comprehensive analysis of urban morphology, connectivity, and mixed land use, as seen in studies focusing on neighborhoods in Erbil and Latin American cities. By incorporating space syntax analysis alongside qualitative and quantitative methods, urban planners can gain deeper insights into the relationships between street networks, neighborhood connectivity, and residents' satisfaction. The research on neighborhood planning in Erbil demonstrates that non-gated neighborhoods tend to exhibit higher levels of connectivity and mixed land use, emphasizing the need for interventions in gated communities to align with sustainable urban design principles. Similarly, the study on the expansion areas in Latin American cities underscores the importance of integrating new development with already established urban areas to promote urban inclusion and functionality. Integrating space syntax with other planning approaches can guide decision-making processes in urban development to create more integrated, sustainable, and functional urban environments.

Future Directions in Space Syntax Research

In contemplating the future directions of space syntax research within the realm of urban planning, it is crucial to acknowledge the evolving trends and challenges that shape the field. As highlighted by bibliometric analysis (Abdelbaseer A. Mohamed et al., 2023), there exists a gap in understanding the main characteristics and tendencies of space syntax studies, emphasizing the need to delve deeper into publication trends, collaboration networks, and research frontiers to chart a course for future exploration. Furthermore, the comparative analysis of medical research facilities (Z. Zamani, 2023) sheds light on the importance of optimizing spatial allocations and design to foster collaboration, productivity, and efficiency—a lesson that can be extended to the urban planning domain. Moving forward, future research endeavors should capitalize on empirical data and longitudinal studies to address current limitations and ensure that space syntax methodologies continue to enrich urban planning practices by enhancing connectivity, flexibility, and safety within built environments.

Impacts of Space Syntax on Urban Design and Policy

The integration of space syntax in urban design and policy has had a significant impact on the way cities are planned and developed. By analyzing the relationship between spatial configuration and human behavior, space syntax enables planners to create more efficient and pedestrian-friendly urban environments. This approach considers how the layout of streets and buildings influences movement patterns, social interactions, and accessibility within a city. Through the use of space syntax analysis, planners can identify areas that may be underutilized or congested, leading to targeted interventions that improve the overall functionality of a city. Additionally, space syntax has been used to inform policy decisions related to transportation, land use, and public space design, promoting sustainability and equity in urban development (Akkelies van Nes et al., 2021-07-31). Overall, the application of space syntax in urban planning has proven to be a valuable tool in creating more livable and vibrant cities for residents and visitors alike.

Challenges and Opportunities in Implementing Space Syntax

The integration of space syntax into urban planning presents both challenges and opportunities that warrant careful consideration. Focusing on the implementation of space syntax in this context reveals complexities related to data collection, analysis, and interpretation, as well as the need for interdisciplinary collaboration between urban planners, architects, and data scientists. Leveraging modern data science practices, such as artificial intelligence and machine learning, as suggested by (Travis A. Meyer et al., 2022), offers the potential to enhance the

efficiency and effectiveness of space syntax analysis in urban planning. Moreover, the incorporation of computational visual programming, as discussed in (R. Schroeder et al., 2019), can facilitate interactive design tools and real-time collaboration, critically influencing design methodologies in the architectural and urban planning realms. Embracing these technological advancements may revolutionize the way urban planners approach spatial analysis, leading to more informed decision-making processes and innovative urban design solutions that prioritize functionality and aesthetic appeal while effectively addressing societal needs.

Space Syntax With the Scope of Architecture

Historical Development of Space Syntax in Architecture

1. Early Influences (1960s-1970s):

In the 1960s and 1970s, seminal works by urban theorists such as Kevin Lynch and historical geographers like M. R. G. Conzen laid the groundwork for understanding the significance of spatial configuration in urban environments. Lynch's book “The Image of the City” (1960) explored how people perceive and navigate urban spaces, while Conzen's research on town-plan analysis, such as “Alnwick, Northumberland: A Study in Town-Plan Analysis” (1960), highlighted the importance of historical spatial arrangements in shaping urban form.

2. Formation of Space Syntax Theory (1980s):

Space syntax theory emerged in the 1980s through the pioneering work of architects Bill Hillier and Julienne Hanson. Their influential book “The Social Logic of Space” (1984) laid the foundation for understanding how spatial configurations influence human behavior and social interactions within built environments. This work introduced concepts such as visibility, accessibility, and integration, which became central to space syntax analysis.

3. Theoretical Refinement (1990s):

Throughout the 1990s, Hillier, Hanson, and their colleagues further refined space syntax theory and developed analytical techniques to quantify spatial configurations. The book “Space is the Machine: A Configurational Theory of Architecture” (1996) provided a comprehensive overview of space syntax theory and its applications. Additionally, scholars like Alan Penn contributed to the theoretical advancement of space syntax, exploring topics such as spatial cognition and the relationship between space syntax and architectural design.

4. Widespread Adoption (2000s):

In the early 2000s, space syntax gained popularity among architects, urban designers, and researchers worldwide. Researchers such as Michael Marshall and A. Turner explored the application of space syntax in architectural design and urban planning. Space syntax analysis

became increasingly integrated into architectural and urban design practices, influencing projects ranging from individual buildings to entire cities.

5. Continued Research and Applications (2010s-present):

In recent years, space syntax research has expanded to encompass a wide range of topics, including sustainability, accessibility, and pedestrian movement. Scholars like Bin Jiang and Jie Yin have applied space syntax analysis to study urban street networks and pedestrian flow patterns. The continued research and application of space syntax continue to contribute to our understanding of how spatial configuration shapes human behavior and the built environment. These references provide a comprehensive overview of the historical development of space syntax theory in architecture, from its theoretical foundations to its widespread adoption and ongoing research applications.

Applications of Space Syntax in Architecture

Designing in the field of architecture is a learning process acquired through doing and experiencing. Architects, while engaged in design, generate multiple problems and ask questions within the fieldwork. These questions aid in defining the field and executing the design, contributing to a comprehensive understanding of architectural knowledge. Architectural knowledge is a synthesis of practice and theory (Vitruvius, 1990). During the design process, architects must reconcile abstract-concrete, mystery-certainty, intuition-science, and practice-research concepts. Thus, focusing on the configurational theory (space syntax) of space and incorporating this process into design becomes an integral part of the design.

The Usage Areas of Syntax in Architecture

Space syntax analysis is often used in architectural design to understand how spatial layouts influence movement patterns, visibility, and social interactions within buildings. Architects use space syntax techniques to evaluate different design options and optimize spatial configurations for functionality and user experience (Turner, A., Penn, A., 2003).Space syntax analysis helps architects and urban designers create more navigable environments by understanding how spatial configurations affect wayfinding. By analyzing the spatial connectivity and accessibility of different paths and spaces, designers can improve navigation efficiency and user experience (Dalton, R.C., 2008).Space syntax analysis is used to assess and improve the accessibility of buildings and urban environments for people with disabilities. By identifying barriers to movement and circulation, designers can implement solutions to enhance accessibility and inclusivity (Kim, Y. H., & Steinfeld, E. 2012).

Conclusion

In conclusion, the use of space syntax in urban planning has proven to be a valuable tool for analyzing and understanding the spatial configurations of cities. By applying this methodology, planners can identify patterns of movement, connectivity, and accessibility within urban environments, allowing for more informed decision-making in the design and development of urban spaces. The integration of space syntax into planning processes has the potential to optimize the functionality and efficiency of cities, creating more pedestrian-friendly environments, improving traffic flow, and enhancing overall urban livability. Additionally, space syntax analysis can help identify potential barriers to social inclusion and accessibility, guiding efforts to create more equitable and inclusive urban spaces. As cities continue to grow and evolve, the application of space syntax in urban planning will play a crucial role in shaping the future of sustainable and people-centered urban development.Commonalities and differences have been observed between the disciplines of architecture and urban regional planning in the concept of spatial sequence. In both architecture and urban planning, spatial sequence provides an analytical analysis of spatial structures. This analytical approach helps to understand spatial relationships and interactions and to support design decisions. In addition, in both fields, spatial sequencing focuses on improving design by taking into account human behaviour and interactions. By analysing the way users perceive, move and interact with spaces, spatial sequencing contributes to more user-oriented and functional designs.While spatial organization in architecture analyses the functional arrangements within buildings, spatial organization in urban planning generally examines the spatial structures of urban areas at a large scale. Therefore, in urban planning, the spatial sequence is analysed at a macro scale to understand urban morphology and social interactions, whereas in architecture, this scale remains at a micro level. On the other hand, while spatial organisation in architecture is used in the design process of individual projects, spatial organisation in urban planning is used in the development of broader urban strategies such as urban development policies, infrastructure planning and the elimination of social inequalities.In conclusion, the use of the Space Syntax method in architecture and urban planning presents a paradigm shift in understanding and designing built environments. By analyzing the spatial configuration and connectivity of cities and buildings, this approach offers valuable insights into the relationship between space, movement, and social interactions. Ultimately, this knowledge allows for the creation of urban environments that are not only aesthetically pleasing but also efficient, inclusive, and sustainable.

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2,4-DIHYDRO-1H-CYCLOPENTA[B]INDOL-3-ONE: FRONTIER MOLECULAR ORBBITAL ANALYSIS

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Özet
Moleküler orbital teorisinde, sınır moleküler orbitaller (FMO) fikri, organik kimyada moleküllerin reaktivitesini anlamak için çok önemlidir. En Yüksek İşgalli Moleküler Orbital (HOMO) ve En Düşük İşgalsiz Moleküler Orbital (LUMO) iki temel sınır moleküler orbitaldir. Kimyasal bir süreçte, HOMO orbitalinden bir elektron çıkarılır. Bir reaksiyonda, bu orbital donör orbital anlamına gelir. Öte yandan, bir kimyasal reaksiyon sırasında bir elektron alan orbital ise LUMO olarak bilinir. Bir reaksiyonda, kabul eden yani alan orbital anlamına gelir. Bu çalışmada, 2,4-dihidro-1H-siklopenta[b]indol-3-one molekülünün sınır orbital analizi Gaussian 09W yazılım paketi kullanılarak DFT/B3LYP teorisi/fonksiyoneli ve 6-311++G(d,p) temel seti ile gerçekleştirilmiştir. Elde edilen sonuçlardan, üzerinde çalıştığımız molekülün yeni bir organik korozyon inhibitörü olup olamayacağı araştırılmıştır.
Anahtar Kelimeler: Korozyon İnhibitörleri, Sınır Orbitalleri, DFT

2,4-DIHYDRO-1H-CYCLOPENTA[B]INDOL-3-ONE: FRONTIER MOLECULAR ORBBITAL ANALYSIS

Abstract
In molecular orbital theory, the idea of frontier molecular orbitals (FMO) is crucial for comprehending the reactivity of molecules in organic chemistry. The Highest Occupied Molecular Orbital (HOMO) and the Lowest Unoccupied Molecular Orbital (LUMO) are the two fundamental frontier molecular orbitals. In a chemical process, one electron is extracted from the HOMO orbital. In a reaction, it stands for the orbital that is donating. On the other hand, the orbital that acquires an electron during a chemical reaction is known as the LUMO. In a reaction, it stands for the accepting orbital. In this study, the frontier orbital analysis of molecule 2,4-dihydro-1H-cyclopenta[b]indol-3-one was performed with DFT/B3LYP theory/functional and 6-311++G(d,p) basis set using Gaussian 09W software package. From the results obtained, it was investigated whether the molecule we worked on could be a new organic corrosion inhibitor.
Keywords: Corrosion Inhibitors, Frontier Orbitals, DFT

Introduction

Inhibitors of organic corrosion are essential for preventing corrosion in metal materials. Because of their advantageous qualities, which include good metal adsorption, low oxidation resistance, thermal stability, and environmental friendliness, these compounds are frequently employed for surface anti-corrosion (Zhao et al., 2023). The ability to comprehend the molecular behavior of organic corrosion inhibitors by quantum theoretical modeling is an intriguing feature of these compounds (Brycki, Kowalczyk, Szulc, Kaczerewska, & Pakiet, 2018; Popoola, 2019). Computational techniques are used in quantum theoretical modeling to forecast the electronic structure and characteristics of molecules. Density functional theory (DFT) computations are used by researchers to investigate different factors in the context of organic corrosion inhibitors. In other words, we can put it as follows: We can investigate the atomic-level electrical structure and reactivity of molecules using quantum chemistry techniques. We can forecast the efficacy of organic compounds employed as corrosion inhibitors by using these methodologies, eliminating the need for expensive and time-consuming trials. Within the fields of materials research and corrosion prevention, this prediction capacity is extremely significant. Quantum chemical simulations shed light on the interactions between corrosion inhibitors and metal surfaces in terms of mechanism. The energy bandgap, the energy of the lowest occupied molecular orbital (E_{LUMO}), and the energy of the highest occupied molecular orbital (E_{HOMO}) are among the factors that we can examine. These characteristics aid in our comprehension of how inhibitors attach themselves to metal surfaces and impede the corrosion process.

In this study, the frontier orbital analysis of 2,4-dihydro-1H-cyclopenta[b]indole-3-one molecule (Fig. 1) was calculated for the first time with DFT/B3LYP theory/functional and 6-311++G(d,p) basis set using Gaussian 09W package (Frisch et al., 2009) and Gauss View 5. 0 (Dennington, Keith, & Millam, 2009) interface softwares. Based on the results obtained, it was investigated whether the molecule we studied could be a potential new organic corrosion inhibitor.

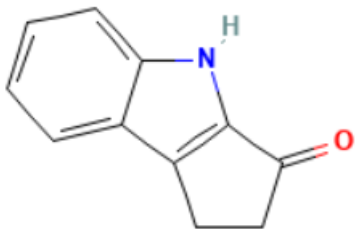


Figure 1. Unoptimized version of the molecule (https://pubchem.ncbi.nlm.nih.gov/).

Materials and Methods

Our molecule was quantum chemically optimized using the Gaussian 09W software (Frisch et al., 2009) and Gauss View 5.0 (Dennington et al., 2009) interface tools. Gaussian 09W software (Frisch et al., 2009) is used in many different fields by researchers, such as organic chemistry, materials science, and biochemistry. It is essential to comprehending molecular characteristics and making behavioral predictions. In addition, this program includes molecular mechanics, semi-empirical and ab initio methods. The program allows for extensive customization, offering multiple theory and basis set options for each method. GaussView 5.0 (Dennington et al., 2009) is a powerful graphical interface designed to work seamlessly with Gaussian computational chemistry software. In summary, GaussView 5.0 also simplifies the workflow for computational chemists and physicists, allowing them to work efficiently with large molecular systems. With the use of the 6-311++G(d,p) basis set and DFT/B3LYP theory/functional, the molecule was optimized.

Findings and Discussion

Utilizing the DFT/B3LYP theory/functional and 6-311++G(d,p) basis set, 2,4-dihidro-1H-siklopenta[b]indol-3-one molecule was optimized and the symmetry state of the molecule was determined as Cs (mirror symmetry). The optimized structure and the horizontal position of the molecule were shown in Fig. 2.

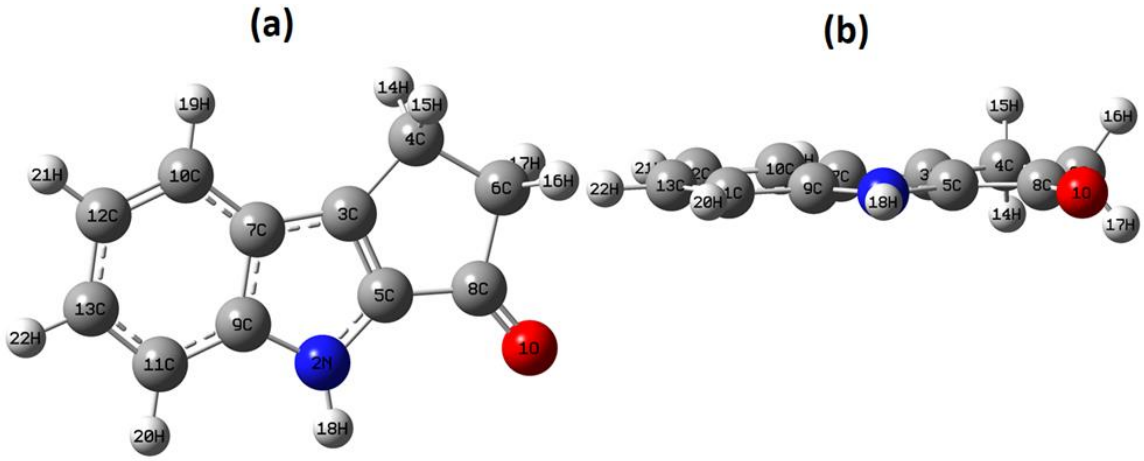


Figure 2. Optimized (a) and horizontal position (b) version of the molecule.

In the previous section, we have explained the importance of quantum chemical calculations before testing organic corrosion inhibitors in the experimental environment, both in terms of time and financially. Although there are many methods to quantum chemically predict whether a molecule can be an organic corrosion inhibitor (Albo Hay Allah, Balakit, Salman, Abdulridha, & Sert, 2023; Obot, Macdonald, & Gasem, 2015; Özlem, Gümüş, Yusuf, İrfan, & Atıf, 2022;

Saha, Hens, Murmu, & Banerjee, 2016), the most common of these is to determine the proton affinity points on the molecule, to calculate the proton affinity points on the molecule, to analyze the frontier orbital of the molecule and to decide by looking at the symmetry state. At this stage, it should be emphasized that in order for a molecule to be a corrosion inhibitor, it should generally have the following properties, which directly require frontier molecular orbital analysis for the molecule. a) Cs must be close to symmetry, b) Excess in the ring, c) E_{HOMO} value must be large, d) E_{LUMO} value must be small, e) ΔE value must be small, f) Chemical softness value must be large, g) Chemical hardness value must be small, h) Electronegativity value must be small. In the first two stages, the symmetry of the molecule being mirror symmetry, i.e. Cs, is very good in terms of adhesion to the surface to be applied and the number of rings in the molecule is a positive start. The calculations required for the other parameters mentioned above were carried out with DFT/B3LYP theory/functional and 6-311++G(d,p) basis set using chk* file over the optimized structure. Table 1 presented the results that were obtained.

Table 1. Some global reactivity descriptors the computed for the title compound.

Parameters (eV)	Values
E_{LUMO}	-1.821
E_{HOMO}	-6.218
Energy bandgap $\lvert E_{HOMO} - E_{LUMO} \rvert$	4.397
Ionization potential ($I = -E_{HOMO}$)	6.218
Electron affinity ($A = -E_{LUMO}$)	1.821
Chemical hardness ($\eta = (I-A)/2$)	2.199
Chemical softness ($\sigma = 1/2\eta$)	0.227
Electronegativity ($\chi = (I+A)/2$)	4.020
Chemical potential ($\mu = -(I+A)/2$)	-4.020
Electrophilicity index $\omega = \mu^2/2\eta$	3.674
Maximum charge transfer index ($\Delta N_{max.} = -\mu/\eta$)	1.828

Fig. 3 also provided the molecule's HOMO and LOMO distributions. As can be seen from Fig. 3, the HOMO and LUMO clouds are concentrated on indole and cyclopenta rings, i.e. there is almost no electron flow from HOMO to LUMO.

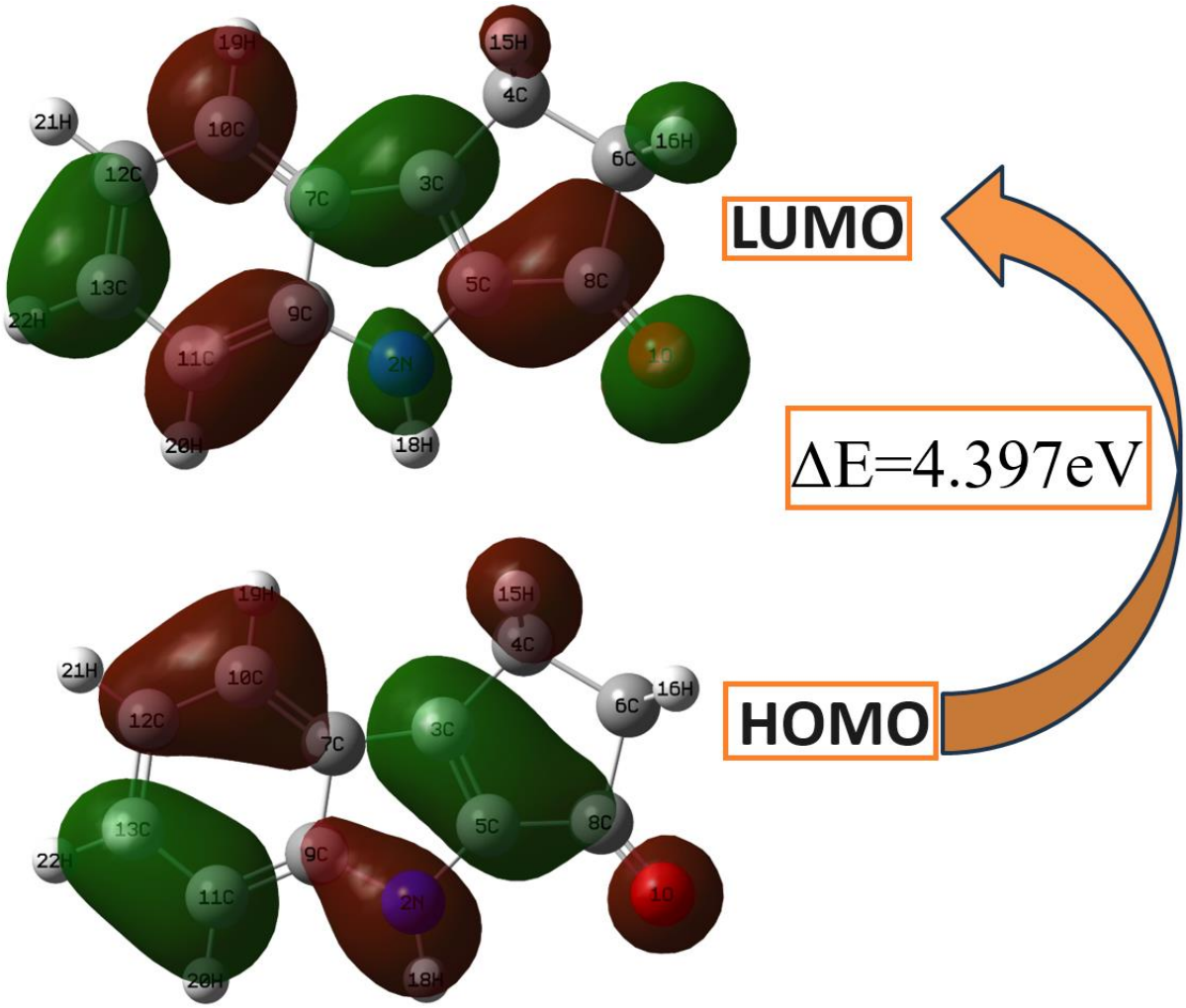


Figure 3. HOMO and LUMO distributions of the molecule.

Band gap, ionization potential, electron affinity, chemical hardness, chemical softness, electronegativity, chemical potential, electrophilic index and maximum charge transfer values obtained by looking at the HOMO and LUMO values of the molecule. The band gap, ionization potential, electron affinity, chemical hardness, chemical softness, electronegativity, chemical potential, electrophilic index and maximum charge transfer values obtained by looking at the HOMO and LUMO values of the molecule support that the studied molecule can potentially be an organic corrosion inhibitor.

Conclusion and Recommendations

We can emphasize the outcomes with the following remarks in the section on Conclusion and recommendations:

- Computational modeling helps evaluate the effectiveness of organic compounds as corrosion inhibitors. Therefore, the optimization and symmetry state of the 2,4-dihydro-

1H-cyclopenta[b]indole-3-one molecule, which is considered to be a potential corrosion inhibitor, was modelled quantum chemically with Gaussian 09W program.

- The frontier orbitals of the molecule and the global indicators calculated based on these values were calculated using the optimized structure. Based on the results obtained, it was predicted that the molecule could be an alternative corrosion inhibitor.
- When ΔN is less than 3.6eV, the inhibitor's ability to donate electrons to the surface of the material increases, leading to an increase in inhibition efficiency.
- Although the theoretical results obtained are promising, the proton affinity points will be determined by using advanced computational techniques under the conditions considered for a real experimental environment and the values will be repeated more precisely. The calculations performed in this study were carried out in the gas phase.

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2-(2,6-DIOXOPIPERIDIN-3-YL)-5-FLUOROISOINDOLINE-1,3-DIONE: MOLECULAR DOCKING AND MEP ANALYSIS

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Özet
Literatürde belirtildiği üzere, cüzzamla bağlantılı ağrılı bir cilt rahatsızlığı olan eritema nodozum leprosum talidomid ile tedavi edilmekte ve önlenmektedir. Ayrıca, bir kan hastalığı olan multipl miyelomdan muzdarip bireylerde deksametazon ile birlikte kullanılır. Talidomid bağışıklık sistemini etkileyerek iltihaplanmayı azaltır. Aynı zamanda multipl miyelom hücrelerinin çoğalmasını önler, bu da sonuçta vücutlarının yok olmasına yol açar. Talidomid bir leprostatik ajan ve bir antineoplastiktir (kanser ilacı). Bu çalışma, 2-(2,6-Dioxopiperidin-3-yl)-5-fluoroisoindoline-1,3-dione'un PDB-4TZ4 proteini ile moleküler kenetlenmesinin kapsamlı bir araştırmasını ve ayrıntılı analizini içermektedir. Ayrıca çalıştığımız molekülün elektronca zengin ve elektronca eksikliği olan bölgeleri MEP analizi ile araştırılmıştır. Moleküler kenetlenme çalışmaları Autodock Vina ile MEP (Moleküler Elektrostatik Potansiyel) analizi ise Gaussian 09W paket programı ile gerçekleştirilmiştir.
Anahtar Kelimeler: Talidomid, Moleküler Kenetlenme, MEP

2-(2,6-DIOXOPIPERIDIN-3-YL)-5-FLUOROISOINDOLINE-1,3-DIONE: MOLECULAR DOCKING AND MEP ANALYSIS

Abstract
As stated in the literature, erythema nodosum leprosum, a painful skin condition linked to leprosy, is treated and prevented with thalidomide. Additionally, it is used in conjunction with dexamethasone to individuals suffering from multiple myeloma, a blood malignancy. Thalidomide reduces inflammation by influencing the immune system. It also prevents multiple myeloma cells from proliferating, which ultimately leads to their body's destruction. Thalidomide is a leprostatic agent and an antineoplastic (drug for cancer). This work involved a thorough investigation and detailed analysis of the molecular docking of 2-(2,6-dioxopiperidin-3-yl)-5-fluoroisoindoline-1,3-dione with PDB-4TZ4 protein. In addition, electron-rich and electron-deficient regions of the molecule we studied were investigated by MEP analysis. Molecular docking studies were performed with Autodock Vina and MEP (Molecular Electrostatic Potential) analysis was performed with Gaussian 09W package program.
Keywords: Thalidomide, Molecular Docking, MEP

Introduction

The antiangiogenic and anti-immunoinflammatory properties of thalidomide and its analogs have increased its clinical usage in the treatment of multiple myeloma, various malignancies, and Hansen's disease despite its teratogenic hazard (Aragon-Ching, Li, Gardner, & Figg, 2007; Millrine & Kishimoto, 2017; Sherbet, 2015). Consequently, great efforts are being made to increase thalidomide's efficacy while lowering its toxicity. Due to its wide range of biological effects, including reduced TNF-α production, destabilized or decreased COX-2 expression, downregulated VEGF and FGF, NF-κB inhibition (possibly via suppression of IκB kinase), inhibition of prostaglandin E2 secretion, and α1-acid glycoprotein binding, thalidomide was initially thought to be a multitarget drug (Lepper, Smith, Cox, Scripture, & Figg, 2006; Paravar & Lee, 2008). But in 2010, a thalidomide-linked magnetic nanoparticle test for affinity purification revealed cereblon to be the exclusive target of thalidomide binding (Ito et al., 2010). The component of a DDB1-CUL4-RBX1 E3 ubiquitin ligase complex that recognizes substrates is called cereblon. The current theory explaining the bioactivity of thalidomide and analogues is that binding to the cereblon itself causes all downstream effects by inducing the degradation of substrates for the E3 complex by ubiquitin-dependent proteasomal enzymes (Ito & Handa, 2016; Krönke et al., 2015; Matyskiela et al., 2018). One of the products of glutamic acid is thalidomide. With the structural formula $C_{13}H_{10}N_2O_4$, it is a crystalline solid that dissolves readily in water. The general chemical behaviour of the structure is as follows (Fig. 1):

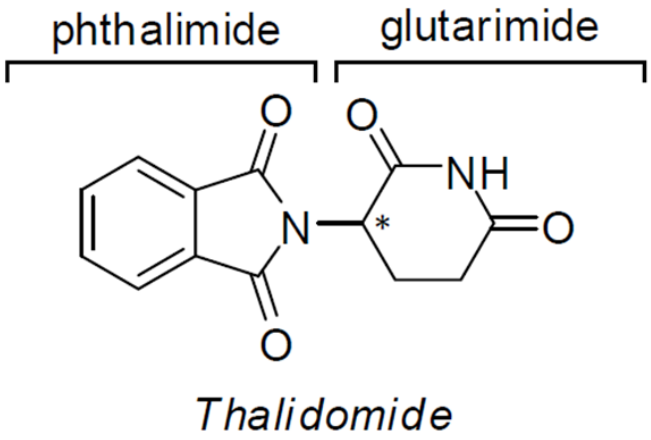


Figure 1. The chemical structure of thalidomide molecule (Peach et al., 2020).Another name of the molecule which we are working on is thalidomide 5-fluoride. So it's a thalidomide-based molecule.

This study provides a comprehensive investigation of the molecular docking of the 2-(2,6-Dioxopiperidin-3-yl)-5-fluoroisoindoline-1,3-dione molecule with the PDB-4TZ4 protein and the molecular electrostatic potential (MEP) analysis of the molecule was analysed for the first time.

Materials and Methods

Quantum chemical calculations of our ligand molecule were performed with Gaussian 09W package (Frisch et al., 2009) and Gauss View 5.0 (Dennington, Keith, & Millam, 2009) interface programs and docking calculations of the molecule to the related protein were performed with Autodock Vina (Trott & Olson, 2010). A popular software for determining the geometries and energy levels of molecular structures is Gaussian 09W (Frisch et al., 2009). An interface tool for modifying and viewing molecular structures is called Gauss View 5.0 (Dennington et al., 2009). This tool allows you to study the molecule's shape and assess its many characteristics. The optimization of the used ligand was performed with the help of DFT/B3LYP theory/functional and 6-311++G(d,p) basis set. Docking calculations of the ligand molecule to the related protein were performed using Autodock Vina (Trott & Olson, 2010). Autodock Vina is a molecular modeling tool used to predict protein-ligand interactions.

Findings and Discussion

The results obtained at this stage of the study can be analysed in two ways: molecular docking and MEP analysis results. When evaluated in terms of molecular docking, the following results were obtained. The molecule 2-(2,6-Dioxopiperidin-3-yl)-5-fluoroisoindoline-1,3-dione was optimized as mentioned above (Fig. 2) and subjected to molecular docking calculations with the PDB-4TZ4 protein. Calculations were performed with the Autodock Vina program. Although the protein we are working on has two chains, A and C, only the A chain was considered in the calculations. For more efficient results, the active residues of the C chain were determined as follows: PHE402, TRP400, CYS394, CYS391, TRP386, TRP380, SER379, HIS378, PRO352, ASN351, CYS326 and CYS323. Therefore, the selected grid parameters were also chosen to keep these active residues within and the obtained calculation results were presented in Table 1 (molecular docking energy scores, rmsd l.b. and rmsd u.b. values). Table 1 shows that the optimal binding energy in the first mode was determined to be -7.2 (kcal/mol). Furthermore, employing the exp(ΔG/RT) equation "(G: binding energy, R: gas constant= 1.987203610^{-3} kcal/mol, and T: room temperature= 298.15K)", the inhibition constant was discovered to be 5.27669 μM.

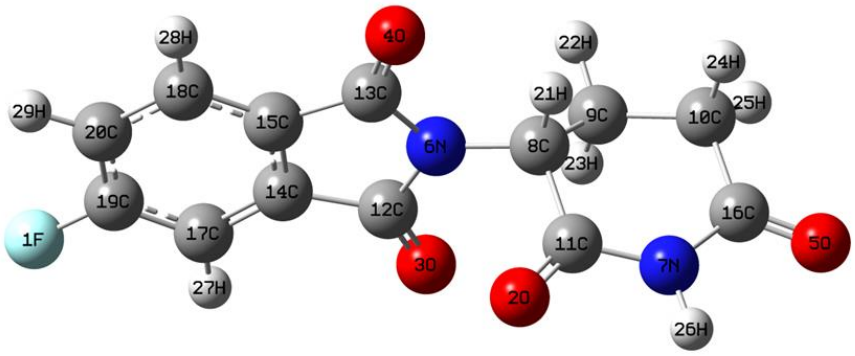


Figure 2. The optimized structure of the title molecule.

Table 1. AutoDockVina results of the binding affinity and RMSD values of different poses in 4TZ4 inhibitor (C chain) of the title compound.

Mode	Affinity (kcal/mol)	rmsdl.b.	rmsdu.b.
1	-7.2	0.000	0.000
2	-6.9	13.965	15.269
3	-6.9	8.924	11.422
4	-6.3	13.659	14.813
5	-6.1	8.347	10.429
6	-5.9	1.977	3.076
7	-5.8	21.766	23.043
8	-5.8	39.091	39.822
9	-5.8	24.228	26.101
10	-5.5	45.258	46.344

The docking results obtained as a result of the interaction are given in 3D (a) and 2D (b) in Fig. 3.

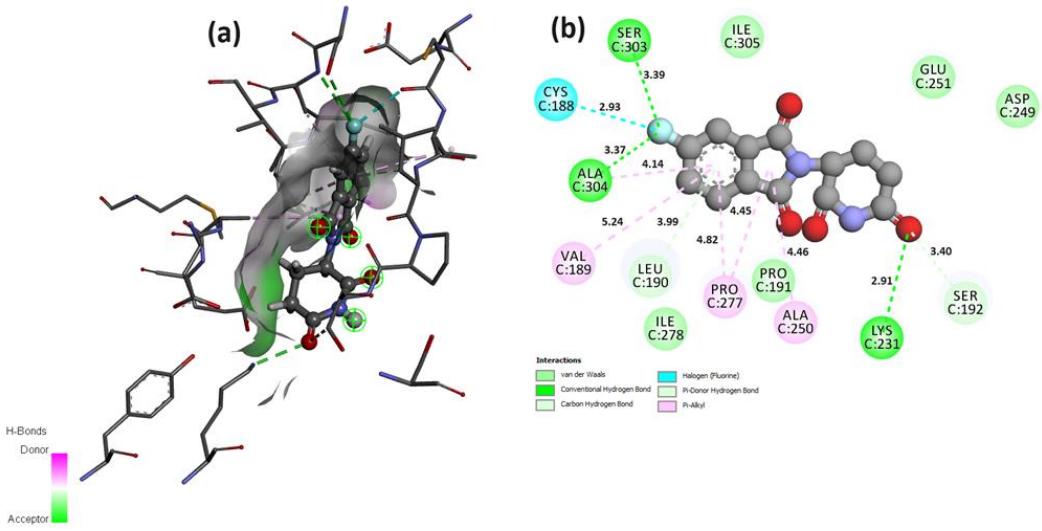


Figure 3. (a) 3D and (b) 2D molecular docking results of the ligand+PDB:4TZ4 (C chain).

In addition, we can easily see which point of the protein the ligand is attached to as a result of the interaction in Fig. 4.

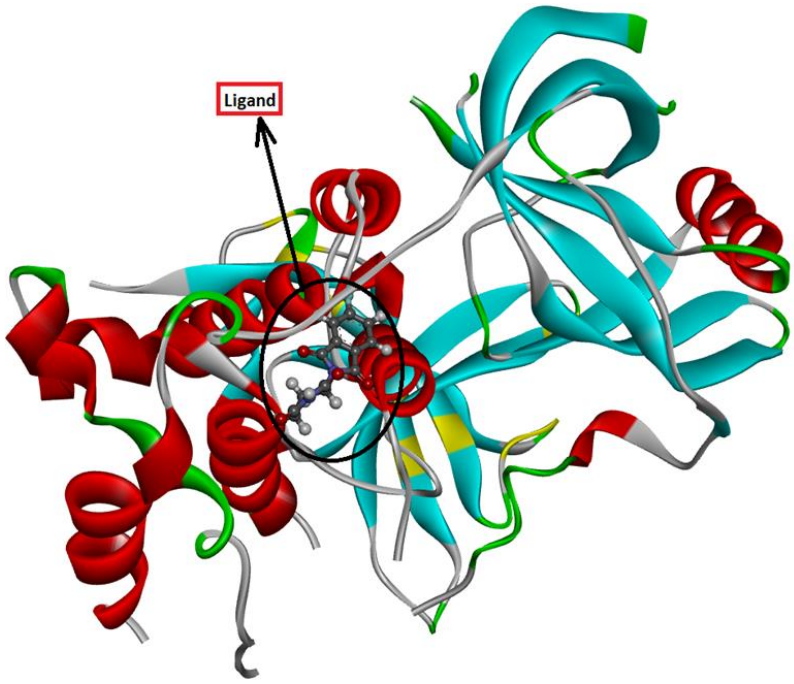
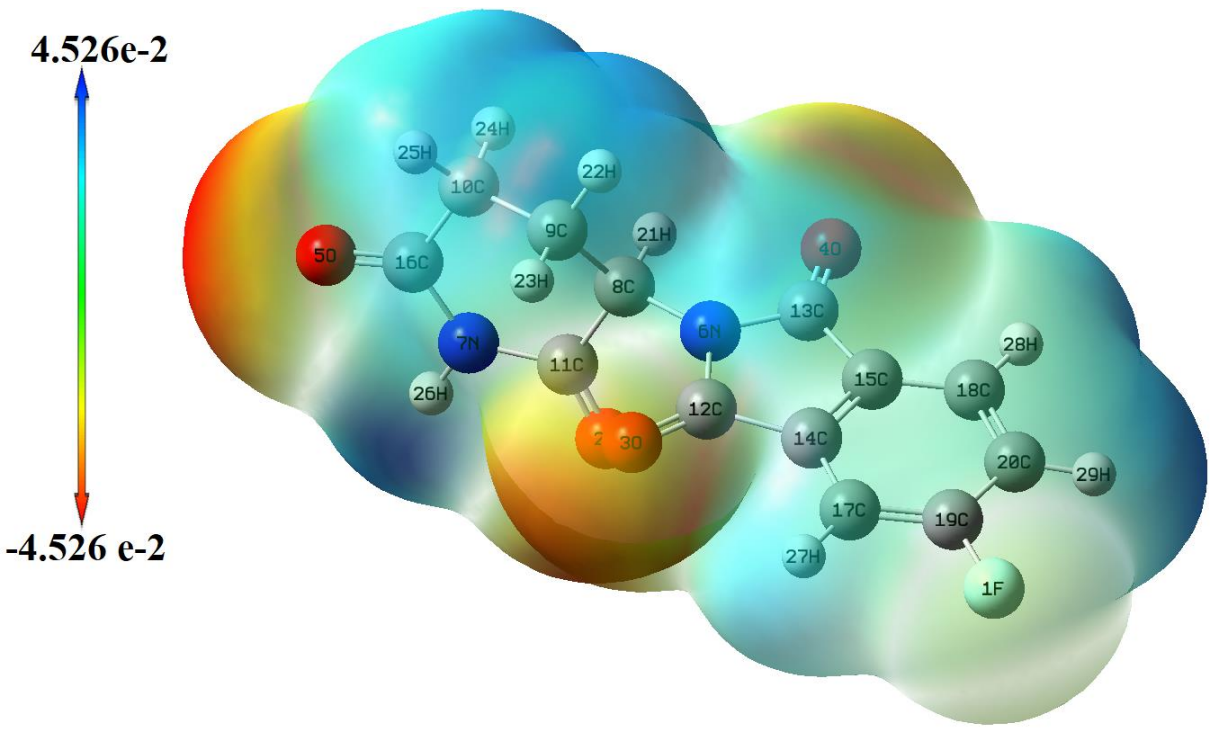


Figure 4. The placement of the title molecule in active site of PDB: 4TZ4 (C chain) protein.

In the second stage of the findings, the MEP analysis of the molecule was analysed. For MEP analysis of the molecule, the chk* file generated from the optimized structure was used. Again, as mentioned above, the calculation was performed on the same theory, functional and basis set. The MEP surface of the molecule and the scale obtained as a result of the calculation were presented in Fig. 5. Finding out a compound's reactivity and potential sites of interaction can be aided by MEP analysis, therefore it is very important (Palafox et al., 2015; Ramalingam, Periandy, Karabacak, & Karthikeyan, 2013).



The positive moiety on the MEP diagram represents the nucleophilic sites (blue dots), whereas the negative region represents the electrophilic sites (red points). Ultimately, the title chemical's MEP scale covered a range of -4.526e-2 to 4.526e-2.

Conclusion and Recommendations

In the Conclusion and Recommendations section, we can highlight the results obtained with the following points:

- Molecular docking analysis between ligand and 4TZ4 (C chain) protein was performed with Autodock Vina. According to the scores obtained, 2-(2,6-dioxopiperidin-3-yl)-5-fluoroisoindoline-1,3-dione molecule can be considered as a good potential inhibitor for related target.
- Using MEP analysis, the molecule's nucleophilic (on hydrogen atoms) and electrophilic (over oxygen atoms like O2, O3, O4, and O5) sites were identified. Thus, it was roughly determined at which atoms the molecule would be inserted into the protein. Quantum chemical calculations of the molecule were performed with Gaussian 09W package programme.

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THE FUNCTION OF GOTHIC OBJECTS IN "THE TRANSITION OF JUAN ROMEO" AND "THE ENORMOUS RADIO"

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Abstract
In the gothic works the dark, abandoned and decaying places often take place and there is a heavy reliance on symbolism. The characters, settings, and objects are closely related to symbolic meanings. Supernatural characters/beings such as vampires, monsters, demons, ghosts, witches, and supernatural objects are employed. H. P. Lovecraft in his "The Transition of Juan Romero" (1944) renders some strange occurrences at an extremely deep mine, including the rhythmic throbbing from the depths and the inexplicable sealing of the abyss. All these hint the supernatural forces at work. Romero who has an uncanny interest in the narrator's Hindoo ring succumbs to the abyss, while the narrator experiences a moment of oblivion. In John Cheever's "The Enormous Radio" (1947) a newly bought, enormous, and expensive radio, representing uncanny technology, violating the happiness and privacy of the family by broadcasting the private conversations of the neighbors is a supernatural intrusion, a common trope in gothic literature, and it isolates its owners from their environment. In the two American short stories the gothic clichés are used both to constitute gothic atmosphere and to convey symbolic meanings. The stories reflect the anxiety about and the fear of the unknown, including the developing technology and old lore.
Keywords: Gothic, Uncanny, "The Enormous Radio", John Cheever, "The Transition of Juan Romero", H. P. Lovecraft

Introduction

Gothic architecture is associated with churches, cathedrals, ribbed vaults, pointed arches, and flying buttresses. As a genre, the gothic dates back to the eighteenth century when *The Castle of Otranto* by Horace Walpole (1717-1797) was published in 1764. Moreover, the dark, abandoned, decaying places frequently take place in gothic works. Besides, there is a heavy reliance on symbolism in gothic works, characters, settings, and objects are engaged with symbolic meanings. The reader encounters supernatural characters such as vampires, monsters, demons, ghosts, witches, and supernatural objects like the ring in "The Transition of Juan Romero" by H. P. Lovecraft (1890-1937), and the radio in "The Enormous Radio" by John Cheever (1912-1982). There are also supernatural events in gothic fiction. The anti-hero figure or the gothic protagonist portrayed as flawed, isolated, or a marginalized outcast are common.

"The Transition of Juan Romero" by Howard Phillips Lovecraft is a short story about the unsettling past experiences of the unnamed narrator with the enigmatic Mexican miner Juan Romero in the Norton Mine in 1894. This experience was fraught with horror and ominous incidents. From the beginning, the introduction of Juan Romero creates an eerie atmosphere. Lovecraft's use of gothic descriptions, vivid imagery, and the desolate setting lead to a sense of unease and dread throughout the mysterious story. The story includes the common features of gothic literature but most importantly there is a gothic object in the story, the narrator's Hindoo ring with strange writing on it which attracts the attention of Juan Romero."The Enormous Radio" by John Cheever, published in the *New Yorker Magazine* in 1947 narrates the story of a nine-years married couple with two children. They have an "average of income, endeavour and respectability" (Cheever, 2024) in an apartment near Sutton Place. Their relationship with the newly bought gothic-like, enormous, and expensive radio violates privacy by broadcasting the private conversations of their neighbours. Jim and Irene Wescott are fond of serious music unlike their environment, and they frequently go to the cinema, listen to music on the radio, and go to concerts. That is why, music has a crucial role in their lives. In the beginning, the couple and their way of living with their two children seem normal, yet towards the end of the story, the reader understands that they are not acting ethically like their neighbours whose conversations they hear on the radio. This radio is interesting because the family can hear the voices in the apartment through it.

Discussion

The narrator of "The Transition of Juan Romero" by Howard Phillips Lovecraft is nameless since according to him a man who "suddenly migrates to the States or the Colonies, … leaves his past behind him" (Lovecraft, 2024). However, he always tells about a character named Juan Romero with his name at every turn. He states that not so long after his arrival at the Norton Mine, Juan Romero comes. He describes Romero as a noble Aztec, and states that "Juan differed little from his fellows" (Lovecraft, 2024). Nonetheless, there is a communication problem between the narrator and Juan Romero because Romero knows a few words of English, and the narrator is not acquainted with Oxonian Spanish. His past experiences with Juan Romero take place in a desolate setting, at a mine. There is an eerie setting throughout the story. The use of words such as 'uncanny' and 'eerie' in the story again attracts the reader's attention. The narrator's Hindoo ring attracts Juan Romero's attention. Everything related to the ring is mysterious. The narrator does not know how he got the ring. Juan Romero a native sees it and he is fascinated and becomes like a slave a narrator. Maybe the ring evokes something for him or he feels that he should be a slave to the owner of the ring. Juan lives the ring' s magic and sacred power. It reminds him of Aztec religion. "The attachment which Romero manifested toward me was undoubtedly commenced through the quaint and ancient Hindoo ring which I wore when not engaged in active labour" (Lovecraft, 2024). The narrator is also aware of this; "... my ring had affected him peculiarly..." (Lovecraft, 2024). These foreshadow the importance of the gothic object, the ring. The narrator does not even desire to talk about the incidents: "in the last years of my life, scenes and happenings fraught with a terror doubly acute because I cannot wholly define it" (Lovecraft, 2024), but there is an urge to narrate what happened on October eighteenth and nineteenth, 1894 at the Norton Mine. The narrator wants to explain the transition of Juan Romero since the narrator desires everyone to know this supernatural and mysterious story even though it is hard to explain it for him.Lovecraft's use of atmospheric descriptions creates a sense of unease and dread as Romero's fascination with the ancient ring leads to their descent into a supernatural abyss beneath the mine. The bizarre and otherworldly events that unfold challenge the narrator's understanding of reality, culminating in Romero's disappearance and the narrator's struggle to make sense of the inexplicable horrors he has witnessed. The narrator's ring appears as a gothic object in the story. After they discover the abyss, they try to understand what is going on. It is as if the abyss calls them and invites them. Then the narrator realizes: "... the ancient ring on my finger was glowing with eerie

radiance, diffusing a pallid lustre through the damp, heavy air around" (Lovecraft, 2024). At first, the narrator points out that they hear a noise and then go investigation. In a night the narrator hears a strange howling and pulsing sounds of 'a creature'. The colour of the ring changes and Juan goes to the place where these sounds come. They realize "a new abyss yawned indefinitely below the seat of the blast; an abyss so monstrous that no handy line might fathom it, nor any lamp illuminate it" (Lovecraft, 2024). With Juan Romero, the narrator goes to "the infinite void" (Lovecraft, 2024) and Juan Romero is the leading one. Suddenly, Juan Romero shouts at him with dread and terror "Madre de Dios! - el sonido - ese sonido - oiga Vd! - lo oye Vd? - señor, THAT SOUND!" (Lovecraft, 2024). However, the narrator does not understand anything. Then the supernatural effect of the ring is explained by the narrator: "I realized that the ancient ring on my finger was glowing with eerie radiance, diffusing a pallid lustre through the damp, heavy air around" (Lovecraft, 2024). The reader understands that there is a strange relationship between the abyss and the ring.At the climax of the story, "the light from my ring was extinguished, and I saw a new light glimmering from lower space but a few yards ahead of me" (Lovecraft, 2024). When the light of the ring is extinguished, the narrator understands that Juan Romero is swallowed by the infinite void and the ring is lost. 'God! I dare not tell you what I saw! … Some power from heaven, coming to my aid, obliterated both sights and sounds in such a crash as may be heard when two universes collide in space. Chaos supervened, and I knew the peace of oblivion. I hardly know how to continue, since conditions so singular are involved; but I will do my best, not even trying to differentiate betwixt the real and the apparent' (Lovecraft, 2024)Juan goes into the abyss and disappears in the fire. The ring that guided with its light announces the death of Juan Romero when its shine faded. Even though the narrator narrates the incidents that happen at the Norton Mine, later he explains that these happenings are experienced only by him. All the other people are not aware of what he has undergone. Thus it is obvious that there is a supernatural event has occurred. The narrator at the end of the story thinks that everything was a dream.'When I awakened, I was safe in my bunk and the red glow of dawn was visible at the window. Some distance away the lifeless body of Juan Romero lay upon a table, surrounded by a group of men, including the camp doctor. The men were discussing the strange death of the Mexican as he lay asleep; a death seemingly connected in some way with the terrible bolt of lightning which had struck and shaken the mountain. No direct cause was evident, and an autopsy failed to show any reason why Romero should not be living. Snatches of conversation indicated beyond a doubt that neither Romero nor I had left

the bunk-house during the night; that neither of us had been awake during the frightful storm which had passed over the Cactus range' (Lovecraft, 2024)

It is seen that all the events, all the screams, and all the fear are not perceived by the others. It is like a nightmare. All these events are inexplicable by mere reason.Through this tale of cosmic horror, and the use of the ring as a gothic object, Lovecraft explores the limits of human understanding and the fragility of the human psyche in the face of the unknown. The characters of Cheever's short story, Jim and Irene Wescott live in an apartment building with their two children in New York. It is an upper-middle class family. At the beginning of "The Enormous Radio," there is an old radio appearing as a gothic element in the way Cheveer describes it: 'old instrument, sensitive, unpredictable, and beyond repair' (Cheever, 2024). Neither Jim nor Irene understands the mechanics of the old radio, and when it falters, the only thing Jim can do is to strike the side of the cabinet with his hand. Sometimes this works out, sometimes not. That is why, in order to make his wife happy, after the old radio breaks down, Jim buys a new one because they are fond of listening to classical music as a couple and the radio is essential for Irene.The newly purchased radio is not as functional as expected. Jim purchases it to entertain his wife but at the end of the story, it is seen that it overthrows Irene. As soon as the radio enters the scene, there is a gradual change in mood and atmosphere. The scene suggests the presence of sinister influences disturbing the reader and exposing the feeling of discomfort. That is why, the new one is a gothic object. When the radio takes its place in the living room, Irene is disturbed by the presence of "the physical ugliness of the large gumwood cabinet" (Cheever, 2024) spoiling the harmony of the furniture since it does not blend with the living room's colours, which is crucial for Irene. Irene even chooses her clothes colour according to the furniture's colour because she desires to be in harmony with her house. She is an obsessive woman. She hides radio behind the armchair. That is why, it is perceived as "an aggressive intruder" by her. Besides, when she switches it, an ornament falls from the table into the floor due to the "noise" that it produces. It creates noise, it is not a radio for listening to classical music or even any type of music. The sounds are an unpredictable producing a gothic atmosphere. The radio fails to give Irene a good first impression.On the second try, Irene listens to Mozart's quintet. Despite initially enjoying the quintet, she soon encounters interference, including crackling sounds in addition to other noises. Despite her attempts, she could not fix the problem, and the instrument is depicted as "powerful and ugly" (Cheever, 2024). It is like Irene feels the uncomfortable side of the radio even when she sees it for the first time. When Jim comes and tries to switch the radio, he has the same experience as Irene. "A man was

speaking on the station Jim had chosen, and his voice swung instantly from the distance into a force so powerful that it shook the apartment" (Cheever, 2024). It is not desirable to listen to music via the radio. It appears unbearable not only for Irene but also for Jim. They find it out of order, abnormal and uncanny; thus, they try to make it repaired. Furthermore, the radio is a supernatural element, representing the uncanny technology. It is "a radio whose 'enormous' power is its ability to broadcast not the standard range of programs available at normal frequencies, but instead, the private dramas enacted in each of the apartments in the Wescotts' building." (Gerlach, 2024, p. 146-147) While Irene listens to Chopin, she hears a man's voice speaking to a woman. While the man and the woman are speaking obscenely, the couple continues to listen to them. Irene continues to listen to the conversations of the neighbours whenever she has time. They are afraid of the possibility of being heard by the others. Although listening to their neighbours' conversations is not a problem for the couple, being heard by them is a problem. They do not have the feeling of guilt. They do not have moral dilemmas but they act amorally by listening to these private conversations. They wonder about the other people's personal lives. Irene spends all of her spare time in front of the radio. She only listens to the radio. The radio represents uncanny technology by violating the privacies of the neighbours and revealing their secrets and troubles. It transmits the neighbours' conversations to the Wescotts leading to an unpleasant atmosphere later. It becomes a supernatural intrusion, a common trope in gothic literature.After making sure no one heard them, they continue listening to the radio. Irene becomes curious about the lives of the other people's, and so obsessed with the radio that at the end her husband points out that listening to the radio is like voyeurism and she should give it up. The radio isolates Irene from her environment because she does not desire to meet her friends and relatives. It causes obsession and isolation which are common themes in gothic literature. Through the conversations on the radio, the moral decay of the urban people is perceived because there is infidelity, addiction, mental illness, and lies. As Irene continues to listen to these conversations, she begins to experience psychological turmoil. She wants Jim to interfere because Mr. Osborn is beating his wife. She wants her husband to interfere in the lives of the people she is eavesdropping on. After that point the couple starts to argue; Irene asks Jim not to argue with her because she desires to be different from their unethical and unhappy neighbours. Irene differentiates his relationship with Jim by stating:"Don't, don't, don't, don't quarrel with me, ... All the others have been quarreling all day. Everybody's been quarreling. They're all worried about money. Mrs. Hutchinson's mother is dying of cancer in Florida and they don't have enough money to send her to the Mayo Clinic. At least, Mr. Hutchinson says

they don't have enough money. And some woman in this building is having an affair with the handyman- with that hideous handyman. It's too disgusting. And Mrs. Melville has heart trouble, and Mr. Hendricks is going to lose his job in April and Mrs. Hendricks is horrid about the whole thing and that girl that plays the 'Missouri Waltz' is a whore, a common whore, and the elevator man has tuberculosis and Mr. Osborn has been beating his wife. ... Life is too terrible, too sordid and awful. But we've never been like that, have we, darling? Have we? I mean, we've always been good and decent and loving to one another, haven't we? And we have two children, two beautiful children. Our lives aren't sordid, are they, darling? Are they? ... We're happy, aren't we, darling? We are happy, aren't we?" (Cheever, 2024)She is aware of the fact that their neighbours are not proper people, yet according to Irene, she and Jim are normal because they are not cheating on each other, they do not quarrel, and the only thing that is important for them is not money, they are ethical people. As Gerlach states: "'Normal' is compartmentalizing suffering or corruption so that we can consider ourselves above them; 'normal' is our desire to seek out the worst in others, to know the worst that can happen to them, while maintaining that we ourselves are different, untouched by what we are most curious to learn" (Gerlach, 2024, p. 148). In the story, Irene closes her eyes to their problems, she only talks about the problems of their neighbours. This is how she normalizes her relationship with her husband. Nonetheless, Jim is aware of their situation and does not place them above the others. He states that she is not an ethical person as well since she spends the money entitled to her sister. On the other hand, Jim is concerned about the money and he complains about the expenses of both the old radio and the new one. In fact, the couple is also concerned about the money like their neighbours. That is why, it is obvious that there is a lack of communication between Irene and Jim: "You've got to learn to handle the money I give you a little more intelligently, Irene ... You've got to understand that we don't have as much money this year as we had last. I had a very sobering talk with Mitchell today. No one is buying anything. We're spending all of our time promoting new issues, and you know how long that takes. I'm not getting any younger you know. I'm thirty-seven. My hair will be gray next year. I haven't done as well as I hoped to do. And I don't suppose things will get any better." (Cheever, 2024)

Jim emphasizes the fact that he is not young anymore and he will not be productive as he was before. There are also some economic problems. He pours out his heart, tells things he hasn't told his wife before and paints a pessimistic picture, and complains about Irene's spending too much. That is why, the radio serves as a turning point in their marriage, causing the man to reveal the things he keeps inside. She sees that her family has the same problems like the

neighbours. And her innocence is lost. It's as if Irene wakes up from a dream and encounters reality. And she undergoes an awareness; financial and family problems. Thus, the radio's ugliness symbolizes people's ugly lives.However, instead of taking into account what her husband says, becomes afraid of the fact that the other people will hear their conversation because this is how the radio works. If you do not hear others' conversations, most probably the others hear your conversations. She has anxiety due to the radio, and even in her own house she does not feel safe and she has suspicions that she is being eavesdropped because this is what she does. It can be said that the radio as a gothic object creates a displeasing atmosphere, violates the privacy of the neighbours and leads Jim and Irene to quarrel.

Conclusion

From the Middle Ages, gothic has been associated with depressing, scary themes. Besides, the representation of dark, abandoned, and decaying places often takes place and there is a heavy reliance on symbolism. The characters, settings, and objects are closely related to symbolic meanings. Supernatural characters/beings such as vampires, monsters, demons, ghosts, witches, and supernatural objects are employed to highlight the dark atmosphere. H. P. Lovecraft in his "The Transition of Juan Romero" (2024) renders some strange occurrences at an intense mine, including the rhythmic throbbing from the depths and the inexplicable sealing of the abyss. All these hint at the supernatural forces at work. Romero who has an uncanny interest in the narrator's Hindoo ring succumbs to the abyss, while the narrator experiences a moment of oblivion. The ring is a gothic object in the story.On the other hand, in John Cheever's "The Enormous Radio" (2024) a newly bought, enormous, and expensive radio, representing uncanny technology, violating the happiness and privacy of the family by broadcasting the private conversations of the neighbours is a supernatural intrusion, a common trope in gothic literature, and it isolates its owners from their environment. In the two American short stories, the gothic clichés are used both to create a gothic atmosphere and to convey symbolic meanings. The stories reflect the anxiety about and the fear of the unknown, including the developing technology and old lore.

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KIRSAL YERLEŞİMLERDE YÖRESEL KONUTLARIN TURİZM İLE KORUNMASI: KUZEY KIBRIS ÖRNEĞİ

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Özet
Yerel (vernaküler) konut mimarisi coğrafi konum, iklim, aile yapısı, kültür, üretim-tüketim biçimleriyle şekillenen ve deneyimle inşa edilmiş yapılardır. Yerel konutlar, bulunduğu bölgenin özgünlüğünü, önceki yapı ve yaşam deneyimlerini günümüze taşıyan; aynı zamanda çevre, kültür ve ekonomik koşullara uygun çözümleri ile ekolojik ve sürdürülebilir yapılardır. Konut mimarisinde yerel kavramı, konutun mekana ve forma ait şekillenişini ortaya koymaya yarayan, tipolojik yaklaşımların temelini oluşturmaktadır. Yerel konut olgusu, kentler dışındaki belirli bir yerdeki geleneksel konutu tanımlarken, o yerdeki yapıların benzer yaklaşımlarla kurgulanıp örgütlendiği savını ortaya çıkarmaktadır.Kültürel miras niteliği taşıyan yerel konut mimarisi, bir toplumun geçmişi ile bugünü arasında bağ kurmasını sağlayan; toplumu kimliklendiren; yerel ve evrensel 'değer' niteliği taşıyan korunması amaçlanan değerdir. Kültürel mirasla ilgili odağın sadece kentsel ölçekte geleneksel ve anıtsal mimari miras için değil, aynı zamanda benzer bir hassasiyetin Yerel mimari için de gösterilmesi gerekmektedir.
Kıbrıs adasına yerleşimin ne zamandan beri oluştuğu kestirmek oldukça zordur. Ancak bulunan ilk insan kalıntıları, adada ilk yerleşmelerin Yeni Taş devrine ait olduğu bilinmektedir. O günden bugüne pek çok medeniyete ev sahipliği yapmış olan Kıbrıs adasının hem kentlerde hem de kırsal alanlarında zengin bir kültürel mirası vardır. Yerel konut mirası da bu değerli mirasın en önemlilerindendir.Yerel konut mirası, kültür turizm potansiyeli yüksek yapılardır. Bu çalışmada, adada bu mirasın korunması için, "ICOMOS'un 2003 yılında yapılan 14. Genel Kurulu'nda Mimari Mirasın Analizi, Korunması ve Strüktürel Restorasyonu için İlkeler sözleşmesi" ve "Kültür turizminin sağlıklı bir şekilde sürdürülmesi için ICOMOS'un 1999 yılında belirlenen Kültürel Turizm Tüzüğü İlkeleri" ışığında çalışmalar yapılmıştır. Çalışmada ayrıca, literatür çalışmasına dayandırılarak Kıbrıs yerel konut yapılarının korunması gerekliliği ve yöntemleri üzerinde durulmuştur. Kuzey Kıbrıs'ta kırsal yerleşimler çalışma alanı olarak seçilmiştir.
Anahtar Kelimeler: Kültürel miras, koruma, kültür turizmi, kırsal yerleşimler, yerel (verneküler) konut.

CONSERVATION OF VERNACULAR HOUSING IN RURAL SETTLEMENTS WITH TOURISM: NORTHERN CYPRUS CASE

Abstract
Vernacular housing architecture refers to buildings that are shaped by geographical location, climate, family structure, culture, and production-consumption patterns, and are built through experience. Vernacular houses are unique to the region they are located in, carrying forward past construction and living experiences to the present day. They are also ecological and sustainable structures with solutions that are appropriate to environmental, cultural, and economic conditions.In vernacular housing architecture concept is fundamental to typological approaches, revealing the spatial and formal configuration of the dwelling. The vernacular housing phenomenon defines traditional housing in a specific location outside of cities, arguing that the structures in that location are designed and organized with similar approaches.Vernacular housing architecture, which has the character of cultural heritage, establishes a link between the past and present of a society; it identifies the society; it is a value that is local and universal and it is a value that is worth conserving. The focus on cultural heritage should not only be on traditional and monumental architectural heritage at the urban scale, but also on vernacular architecture in rural settlement with a similar sensitivity.It is difficult to determine when settlement on the island of Cyprus first occurred. However, the earliest human remains found indicate that the first settlements on the island date back to the Neolithic period. Having hosted many civilizations since then, the island of Cyprus has a rich cultural heritage in both its cities and rural areas. The vernacular housing heritage is one of the most important of these valuable heritages.Vernacular housing heritage is highly valuable for cultural tourism. This study focuses on the conservation of this heritage on the island of Cyprus, based on the "ICOMOS Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage" adopted at the 14th ICOMOS General Assembly in 2003 and the "ICOMOS Charter for Cultural Tourism" adopted in 1999. The study also discuss the necessity and methods of protecting vernacular housing structures in Cyprus based on a literature review. Rural settlements in Northern Cyprus have been selected as the study area.
Keywords: Cultural heritage, conservation, cultural tourism, rural settlements, vernacular housing.

Introduction

The concept of locality can be said to encompass both the tangible and intangible aspects of a place, including its physical attributes and characteristics as well as its abstract and concrete values. Understanding and evaluating the concept of locality requires consideration of its historical, social, and cultural dimensions, as well as its political and psychological implications.The changing world order driven by rapid production and consumption relationships Post-Industrial Revolution has directly impacted the local / vernacular. Particularly, the concept of locality has been increasingly questioned and examined with the onset of the modernist movement, especially Post-Industrial Revolution. As the presentation of the 'modern' in place of traditional and local spread, every aspect of the local became subject to debate. Especially since the latter half of the 20th century, evaluations, activities, and action plans have been put forth to ensure that locality under the pressure of modernization is not lost. Vernacular housing architecture is shaped by geographical location, climate, family structure, culture, and production-consumption patterns (Günçe &at al., 2008). At the same time, these houses are developed and built through experience. Local housing carries the uniqueness of the region, bringing forward past building and living experiences to the present. These houses are referred to as ecological and sustainable structures due to their solutions suitable for environmental, cultural, and economic conditions.Vernacular housing, which carries the characteristic of cultural heritage, is significant in bridging a society's past and present. These houses, possessing both local and universal 'value' that identifies the community, are structures that need preservation. Just as awareness, care, importance, and sensitivity are required for traditional and monumental architectural heritage structures at the urban scale, the same should be extended to local architectural heritage.The island of Cyprus, with its rich cultural history, has hosted many civilizations (Günçe & Mısırlısoy, 2019). Therefore, the island has a rich cultural heritage in both its cities and rural settlements. Vernacular housing heritage is one of the most important components of this valuable heritage and should be preserved and sustained.

Materials and Methods

The transmission of vernacular housing heritage to future generations is necessary for the cultural continuity on the island. Conservation and perpetuation of this heritage are inevitable for it to be passed on to future generations. Alongside necessary restoration efforts, it is essential to revitalize these aging structures with new functions. Vernacular housing heritage represents structures with high potential for cultural tourism. Repurposing rural settlements and vernacular structures with cultural tourism functions is an important approach to sustain them.

Vernacular houses, one of the most important components of architectural heritage in rural settlements, have significant potential for tourism purposes, especially for accommodation. Proper analysis of these houses is necessary to utilize this potential. Preserving authentic structures without compromising their integrity and repurposing them for cultural tourism is one way forward. Thus, tourists will not only experience rural settlements in various dimensions but also have the opportunity to stay in the authentic vernacular houses.A comprehensive literature review was conducted on locality, rural life, vernacular architecture, vernacular housing, cultural heritage preservation, and cultural tourism. Additionally, visits were made to rural settlements in Northern Cyprus. These visits involved detailed examinations of both the region and vernacular architectural heritage. Photographs of these heritages, sketches, and historical information were gathered, especially focusing on the houses.In-depth research was conducted to preserve this heritage, guided by the principles established in the 'ICOMOS Principles for the Analysis, Conservation, and Structural Restoration of Architectural Heritage' from the 14th General Assembly in 2003 (URL 01), and the 'ICOMOS Charter on Cultural Tourism Principles' defined in 1999 (URL 02) for the sustainable management of cultural tourism. In this study, rural settlements in Northern Cyprus were chosen as the research area, and the necessity and methods of preserving Cyprus' vernacular housing were discussed based on ICOMOS guidelines.

Vernacular Housing Phenomenon

From the very existence of humans until today, there has been a tendency to shape living environments according to needs, in other words, to create organized environments. The most straightforward observation of this can be made in local built environments. Described by various terms such as civil architecture, folk architecture, traditional architecture, architecture without architects, spontaneous, indigenous, primitive, ethnic, folkloric, anonymous, and regional architecture, "vernacular architecture" conveys the unique architectural language of a region (Paköz, 2017), reflecting its socio-cultural structure and natural-physical environment (Figure 1).One of the most important building blocks of vernacular architecture is undoubtedly the house, which is the spiral of human life. Originally arising from the need for shelter, this construct later became an indispensable part of life. The concept of vernacular housing has matured over the years through continuous and diverse experiences, adapting to local conditions and evolving through integration with the past. Concerning vernacular housing, the integration of 'meeting human needs with simple solutions', 'utilizing existing local resources' and

'considering environmentally respectful design principles' together contribute to the sustainable identity of such structures.

Factors Determining Housing Form	**Environmental Factors**	Climate, Topography, Materials and technology available in nearest surroundings.
	Socio-Cultural Factors	Working area and welfare level of the society, Familial structure (kinship) and neighbourliness, Religion, Way of living and behaviours.

Figure 1. Factors Determining Housing Form - Developed based on Rapoport (Rapoport, 1969)

Vernacular housing architecture is shaped by geographical location, climate, family structure, culture, and production-consumption patterns, and constructed through experiential knowledge. Vernacular housing not only carry the uniqueness of the region they are located in, preserving previous building and living experiences to the present day, but also provide ecological and sustainable solutions tailored to environmental, cultural, and economic conditions. The concept of locality in housing architecture forms the basis of typological approaches, revealing the shaping of the dwelling's space and form. While defining the vernacular housing dwelling in a specific location outside urban areas, local housing also suggests that structures in that area are similarly organized and constructed with comparable approaches.Vernacular housing, often situated in rural settlements and also referred to as vernacular homes, is characterized by being produced not by trained architect designers, but by experienced human hands, and organized in a natural manner. The significant role of local masters in the formation of vernacular housing, also described as architecture without architects, is emphasized (Rudofsky, 1964; Aran, 2000; Bektaş, 2001; Kozak, Evren, Çakır, 2013). The structure language (shape grammar) utilized by these masters and the norms they conceptualize are among the most critical elements of local housing. Besides being based on traditions, vernacular housing architecture in rural settlement is shaped by Environmental Factors and Socio-Cultural Factors (Figure 1).

Assessment of Vernacular Housing as Cultural Heritage

Culture encompasses the tangible and intangible elements shared by a society, including beliefs, values, and objects passed down to future generations, serving as a bridge between the past, present, and future. Cultural values tend to persist more strongly in rural life compared to urban areas, making rural settlements valuable sources of traditional values and significant cultural heritage.Not everything left by past generations constitutes 'heritage'. Objects reflecting tangible culture (such as structures, monuments, architectural works, archival materials, books, artworks, among others) and intangible culture (folklore, oral history, traditions, customs, cuisine, depictions, ceremonies, language, and knowledge) and believed to possess universal values are considered cultural heritage (URL 03).In the dynamic and advancing global landscape, dynamism and evolution persist as enduring characteristics. Urban areas undergo rapid changes, whereas rural communities undergo slower transformations, largely owing to their inherently conservative disposition. Rural settlements, along with their rich socio-cultural structure, undergo changes in demographic, economic, environmental, and spatial diversity over time, leading to the evolution of locality. Consequently, the definitions of 'rural settlements' and 'locality' change and evolve. This evolution inevitably affects the phenomenon of vernacular housing in rural settlements.Examining vernacular housing architecture within the historical and cultural context, the significance of the culture-space relationship and heritage values in the formation and organization of these structures is highlighted (Turgut 1989, Çahantimur 1997, Muşkara 2017). Vernacular housing architecture, with its documentary, historical, architectural, aesthetic, economic, and utilitarian values, constitutes an essential building block of our cultural heritage. However, this cultural heritage is at risk due to the changes in the life cycle of rural settlements in which they are located.The cultural heritage values outlined above underscore the importance of preserving this heritage. Cultural heritage possesses documentary value due to the information it contains and transmits to contemporary society. Through vernacular housing, it is possible to interpret and learn about various aspects of society, including its social, cultural, political, and economic characteristics, technical levels, trends, aesthetic approaches, lifestyles, rituals, and social norms (Ahunbay 1994, Kuban 1995). In a rapidly globalizing world increasingly tending towards uniformity, preserving the sustainability of societal identities and environmental characteristics is crucial. Vernacular housing architecture, as a significant cultural heritage transmitting values to future generations, encompasses both sustainability aspects.

Especially in rural settlements, traditional housing heritage, when preserved alongside the geography and history, culture, and traditions of the local population, can maintain its original value holistically.

Addressing the Relationship between Cultural Heritage and Tourism

The acceleration of social and economic, or class-based, disparities among people, alongside changes, transformations, and developments in human rights; the widespread expansion of transportation, communication, and production; the emergence of tourism as a humanitarian need; have led to the emergence of 'Modern Tourism Paradigms' (Urry, 2002; Goeldner, Ritchie & McIntosh, 2000). The importance of tourism-related activities has rapidly increased in today's world, making tourism one of the prominent sectors.As a result of globalization, people's needs related to tourism have diversified, and new quests have gained momentum. These developments have led to a diversification and intensification of research on tourism (Urry, 2002; Stylianou-Lambert, 2011). It is observed that alongside the classical tourism known as sun, sand, and sea tourism, there is an increasing demand for alternative forms of tourism among individuals or groups participating in tourism activities. Among these types, 'Cultural Heritage Tourism' stands out. With the prominence of cultural tourism, the concept of 'culture' has become more debated. Thus, the value of 'Cultural Heritage Tourism' has increased, depending on both tangible and intangible values (Turok, 2009).Especially from the late 20th century to the beginning of the 21st century, tourism has evolved into a multi-dimensional phenomenon of significant ecological, economic, political, social, and cultural importance worldwide. The World Tourism Organization defines cultural tourism as the movement of individuals motivated by cultural factors such as participating in education, art, festivals, and events; visiting monuments and sites; exploring nature or folklore; and engaging in religious visits. The most significant difference that sets cultural tourism apart from other forms of tourism is its educational function. Culture encompasses what people think (attitudes, beliefs, ideas, and values), what they do (behaviours and ways of life), and what they create (architecture, artworks, handicrafts, and other cultural products). From this perspective, cultural tourism is not just about visiting places and monuments but also about learning about the way of life in the visited area.The Charter on the Management of Tourism in Cultural Heritage Areas, endorsed by ICOMOS in October 1999 during the 12th General Assembly in Mexico, highlights that heritage, encompassing both natural and cultural environments, belongs to all humanity, and understanding, appreciating, and protecting its universal values is the right and responsibility of every individual. It emphasizes: “Heritage is a broad concept that includes

landscapes, historic areas, sites, and built environments, as well as biological diversity, collections, ongoing and past cultural practices, knowledge, and life experiences. It narrates and records long historical development processes that form the basis of various national, regional, indigenous, and local identities and is an integral part of contemporary life. It is a dynamic reference point for growth and change, a positive tool. Cultural heritage and collective memory of every place and community are invaluable treasures, forming an essential basis for current and future developments."Especially towards the end of the 20th century, developments in world tourism have turned cultural heritage into a revenue-generating phenomenon. With an awareness of the necessity of preserving cultural heritage, indirect economic contributions should be made through tourism without commodifying cultural heritage. In this regard, principles have been established by ICOMOS (1999) for the healthy sustainability of cultural tourism. 'The Principles of the Charter on Cultural Tourism' are listed as follows (URL 01):

Principles of the Cultural Tourism Charter (URL 01)

- *Principle 1 - Since domestic and international tourism is among the foremost vehicles for cultural exchange, conservation should provide responsible and well managed opportunities for members of the host community and visitors to experience and understand that community's heritage and culture at first hand.*
- *Principle 2 - The relationship between Heritage Places and Tourism is dynamic and may involve conflicting values. It should be managed in a sustainable way for present and future generations.*
- *Principle 3 - Conservation and Tourism Planning for Heritage Places should ensure that the Visitor Experience will be worthwhile, satisfying and enjoyable.*
- *Principle 4 - Host communities and indigenous peoples should be involved in planning for conservation and tourism.*
- *Principle 5 - Tourism and conservation activities should benefit the host community.*
- *Principle 6 - Tourism promotion programmes should protect and enhance Natural and Cultural Heritage characteristics.*

The Objectives of the International Cultural Tourism Charter are (URL 01):

- *To facilitate and encourage those involved with heritage conservation and management to make the significance of that heritage accessible to the host community and visitors.*

- *To facilitate and encourage the tourism industry to promote and manage tourism in ways that respect and enhance the heritage and living cultures of host communities.*
- *To facilitate and encourage a dialogue between conservation interests and the tourism industry about the importance and fragile nature of heritage places, collections and living cultures, including the need to achieve a sustainable future for them.*
- *To encourage those formulating plans and policies to develop detailed, measurable goals and strategies relating to the presentation and interpretation of heritage places and cultural activities, in the context of their preservation and conservation. In addition,*
- *The Charter supports wider initiatives by ICOMOS, other international bodies and the tourism industry in maintaining the integrity of heritage management and conservation.*
- *The Charter encourages the involvement of all those with relevant or at times conflicting interests, responsibilities and obligations to join in achieving its objectives.*
- *The Charter encourages the formulation of detailed guidelines by interested parties, facilitating the implementation of the Principles to their specific circumstances or the requirements of particular organisations and communities.*

In light of these principles and 'ICOMOS Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage' adopted at the 14th ICOMOS General Assembly in 2003 (URL 02), must be conserved and kept alive. Only in the light of these approaches is it possible to convey this cultural heritage to future generations.

Cultural assets attract the interest of people from different communities due to the values they carry. These works, which contain many experiences within their historical context, are important as objects of value for tourism. Despite their unique values and aging physical conditions, cultural heritage structures strive to stand upright and attract people from different parts of the world for various purposes. Therefore, these assets make significant contributions to tourism.Rural tourism can be defined as the totality of tourist activities conducted in a geography other than sea and mountain areas. Rural tourism is a type of tourism that is integrated with rural culture, natural environment, and agriculture, and can also be easily integrated with other types of tourism. Therefore, rural tourism, enriched with various local,

national, and international initiatives, can attract both local and foreign people to rural settlements for holidays (Soykan, 1999). In rural tourism, the rural world is presented to the tourist in all its aspects. During the tourist's stay, besides resting, it is possible to watch, participate, learn, and engage in various activities. The applicability of rural tourism in all four seasons increases the variety of activities. Moreover, the rural geographical environment is a unique place where many recreational activities based on outdoor activities can be carried out. Rural culture, on the other hand, encompasses different activities, all of which are specific to the region, and even if similarities are found, it is difficult to encounter the same elsewhere (Stojanović, & Denadić, 2020). Since tourists of sea tourism are tired of the same architecture and animations in all coastal facilities, they look for locality at least in food and music in the countries they visit. Rural tourism is the one that will provide them with authenticity (Soykan, 2003).

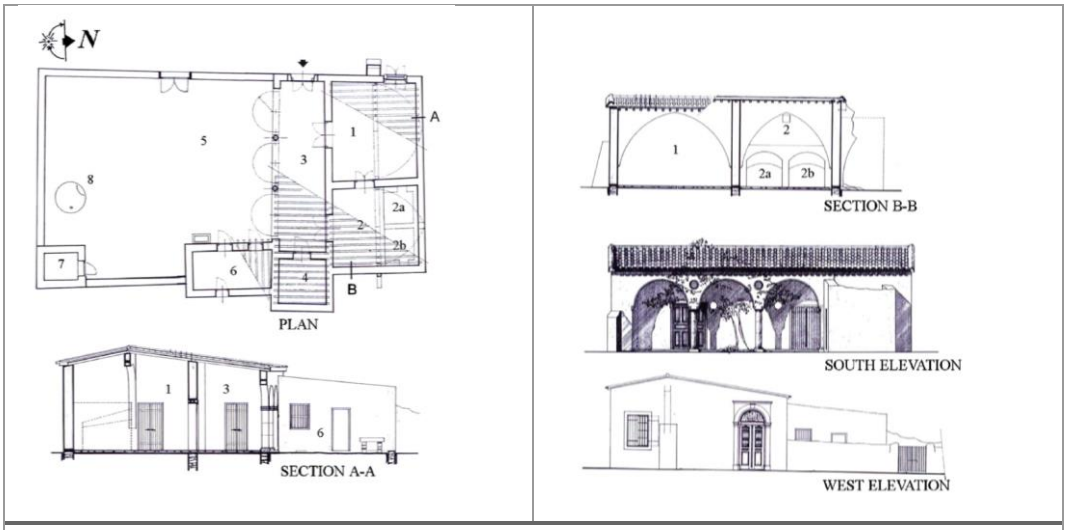
An overview of the Vernacular Housing Phenomenon in Cyprus

Due to its significant historical background, the island of Cyprus has hosted many communities with differences in religion, language, race, and thus their civilizations. Therefore, the island of Cyprus possesses a rich cultural heritage. A mobilization should be declared to preserve our country's rich cultural heritage.

Period	Duration
Late Paleolithic Period	9000–7000 BC
Neolithic Period	7000–3800 BC
Chalcolithic Period	3900–2500 BC
Early Bronze Age	2500–1900 BC
Middle Bronze Age	1900–1650 BC
Late Bronze Age	1650–1050 BC
Geometric Period	1050–750 BC
Archaic Period	750–475 BC
Classical Period	475–325 BC
Hellenistic Period	325–50 BC
Roman Period	50 BC–395 AD
Byzantine Period	395–1185
Frankish Rule	1191–1489
Venetian Rule	1489–1571
Ottoman Rule	1571–1878
British Colonial Rule	1878–1960
Cyprus, an Independent Republic	1960-?
Division of the island and separation of Greek Cypriot and Turkish Cypriot administration	1974

Figure 2. Historical periods in Cyprus before 1960 (Karageorgis, 1969).

On the island, traces of the Lusignan, Venetian, Ottoman, and British periods are still frequently encountered today. The richness of this multiculturalism has increased with each new period, akin to a 'palimpsest'.



1- Room, 2-Depot, 3- Porch, 4-Kitchen, 5- Courtyard, 6- Animal Shelter, 7-WC, 8- Oven

Figure 3. An important example of the typology illustrating the vernacular housing scheme (Christou & et al., 1995).



Figure 4. Vernacular Housing Examples from Rural Northern Cyprus. (Photo by K. Günçe)

Based on the findings of numerous studies conducted on traditional Cypriot housing, it is evident that the 'courtyard', where many activities take place and where a significant portion of daily life unfolds, holds an important place in this typology. Thus, the courtyard, as a large open space, has emerged as a result of the subdivision into smaller enclosed spaces such as residential units. There are two main enclosed spaces: one is the living room, carefully

constructed to accommodate various functions and designed to protect against the short but harsh winters and scorching summers, and the other is the storage room, where seasonal food needs essential for life can be stored. Positioned between the open and enclosed spaces is a semi-open area, known as the canopy, which serves as a sun control element (Günçe, K. & at al., 2008). Rural settlements in Cyprus and the vernacular architectural examples produced here can be classified geographically into three categories: 'Seaside - Coastal settlements', 'Mountain slopes - Hillside settlements' and 'Plains - Plain settlements'.In light of the research conducted by UNHCR, as depicted in Figure 3. (Christou & et al., 1995), the identified vernacular Cypriot housing layout constitutes a holistic structure from south to north, comprising open, semi-open, and enclosed spaces. The semi-open canopy space, referred to as the 'canopy', is situated between the open space termed the 'courtyard' and the enclosed space referred to as the 'multi-purpose room', 'storage' and 'kitchen'. Consistent with the principles advocated by Altman, Sommer, and Zeisel, the concept of multifunctionality, implying the ability of designs to serve multiple purposes within the same space, has been effectively applied in traditional Cypriot housing (Altman, 1975; Sommer, 1969; Zeısel, 1984). The multi-purpose room accommodates various activities such as sitting, receiving guests, cooking, dining, and sleeping. One of the significant rooms in the east-west oriented house is the 'storage' room, where seasonal food and agricultural tools are stored. Adjacent to the storage is a small room called the 'kitchen', where food preparation and dishwashing tasks are performed, and utensils are stored. Additionally, in many houses, this room also serves as a 'bathroom' where water is heated for bathing. All these rooms open onto the south-facing canopy, establishing an indirect relationship between the rooms and the street. The courtyard, where a significant part of life unfolds, hosts various activities such as vegetable cultivation, food preparation for winter storage, annual cheese (halloumi) production, relaxation, cooking, dining, laundry, and other daily household chores. Furthermore, the courtyard houses shelters for pets, a toilet (also used as a bathroom), and an oven used for baking bread. When examining the typological characteristics of vernacular Cypriot housing, we encounter striking features that underscore the determining role of 'Environmental Factors' and 'Socio-Cultural Factors' (Günçe, K. & at al., 2008).



Figure 5. Vernacular Housing Examples from Rural Northern Cyprus. (Photo by K. Günçe)

Strategies for Conserving Vernacular Architecture in Rural Northern Cyprus through Tourism

Preservation of cultural heritage is a multidimensional issue that requires knowledge and experience. The question of "what, why, and how should we preserve?" is the starting point of a nuanced debate with no single answer. These discussions, which remain relevant in many countries worldwide, lead to different outcomes in practice. However, the preservation of cultural heritage should not be about merely 'concealing' it but rather ensuring its continued existence and sustainability by allowing it to thrive and be passed down. Especially, the reuse and revitalization of many architectural heritage structures should be pursued.One of the most crucial components of cultural heritage is undoubtedly vernacular cultural heritage. Integrating vernacular cultural heritage with contemporary life is a significant factor in ensuring the cultural continuity of societies.

The significant destruction experienced by many European cities after World War II was a crucial factor in the development of the concept of conservation. The "Conference on the Conservation of the Identity and Attractiveness of Settlements and Natural Environment Settings," organized by UNESCO in 1962, was an early measure concerning the preservation of rural and associated natural environments (Eres, 2013; Muşkara, 2017). The Venice Charter, published in 1964, established principles that are still accepted today, particularly regarding architectural reconstruction, restoration, and repair (ICOMOS, 1964). In the 1980s, with the expansion of the concept of conservation, approaches to the preservation of vernacular architectural heritage also broadened. By the 1990s, rural architectural heritage began to be evaluated as a whole with its surrounding natural environment, shaping the concept of cultural heritage (Eres, 2013; Muşkara, 2017). In 2003, during the 14th General Assembly of ICOMOS,

the Principles for the Analysis, Conservation, and Structural Restoration of Architectural Heritage were adopted (URL 04). This document holds significant importance in the realm of architectural heritage and addresses the challenges posed by structures with historical and material significance.In order to ensure the conservation of the unique values of rural settlements in Northern Cyprus and their transfer to the future, the planning process of protection must be carried out with the participatory approaches of all stakeholders. In this context, rapid steps need to be taken to establish a sustainable relationship between cultural tourism and conservation. It is emphasized that the areas to be protected are different for each conservation area, as stated in the European Charter for Sustainable Tourism in Protected Areas by the EUROPARC Federation. Therefore, it is emphasized that this should be addressed at the local level (URL 05).In line with these conclusions, the general principles for the conservation of rural vernacular dwellings and other cultural heritage in rural settlements are (URL 05): 'preservation and enhancement of natural and cultural heritage', 'improvement of the quality of the tourism experience', 'increasing community awareness', 'development of area-specific tourism activities', 'organization of information and education programs for all stakeholders', 'support and preservation of the quality of life of the local population', 'promotion of social and economic development at the local level' and 'control of tourist numbers'.In addition to these principles, the conservation process for vernacular housing heritage in rural North Cyprus should encompass research, documentation, diagnosis, analysis, interpretation, determination of conservation approaches, definition of intervention measures, implementation, and monitoring activities. These activities should be based on the principles outlined in the ICOMOS (1999) 'The Principles of the Charter on Cultural Tourism' (URL 01). Therefore, conservation efforts for vernacular housing heritage in North Cyprus should be redeveloped to serve cultural tourism.ICOMOS conduct numerous studies on the preservation, sustainability, and development of vernacular structures in rural settlements for tourism purposes. Within the framework of the 'World Heritage and Sustainable Tourism Program', ICOMOS has introduced a new approach that integrates tourism and heritage management planning at the destination level, values and protects natural and cultural assets, develops sustainable tourism, and represents a new approach based on dialogue and stakeholder collaboration.

Studies demonstrate that 'cultural tourism' is one of the suitable models for rural settlements in Cyprus, given the richness of cultural heritage. In this context, within the framework established by ICOMOS, determining the shape and implementation methods of 'cultural tourism' is inevitable, but it should be done without forgetting local values.

Conclusion

The concept of cultural tourism transcends merely socio-economic value, representing a national asset capable of facilitating socio-cultural interaction with the people constituting rural culture, while also serving as a prime means for representing a nation's inherent values. These values, coupled with a serene ambiance, attract the interest of not only urban populations but also foreigners desiring to acquaint themselves with authentic and unique cultural values and local livelihoods. Cultural heritage and tourism are intricately intertwined, necessitating the preservation and enhancement of both natural and architectural assets for the continuity of tourism (Kiper & et al., 2006; Kalaycı & Özçatalbaş, 2021). Consequently, sustainability, creativity, locality, and authenticity emerge as indispensable concepts to be concurrently upheld in rural tourism.While globalization endeavors to foster a ubiquitous popular culture across all spheres, there exist domains where its influence has yet to reach, preserving original values. Among these, rural settlements that uphold societal values and coexist with these values assume paramount importance. Vernacular housing architectural spaces, reflecting rural life, serve as vital reservoirs for the preservation of traditional values and their transmission to future generations.Vernacular housing, as manifestations of rural life, symbolize a period and way of life with their local and regional architectures. Concurrently, the vernacular architectural heritage in rural areas symbolizes various cultural, social, economic, and political phenomena. Thus, the preservation and perpetuation of cultural values and vernacular architectural heritage are pivotal for sustaining the memory of Cyprus.To safeguard the vernacular architectural heritage in rural Cyprus, ‘cultural tourism’ should increasingly be perceived as a positive force. In alignment with the principles and approaches delineated by ICOMOS, the primary objective should entail the preservation, sustenance, and transmission of the unique values of every settlement in rural Cyprus to the future. In this regard, the evaluation of 'Cultural Tourism' as a tool necessitates the implementation of participatory approaches in the conservation planning process. Urgent steps must be taken to establish the nexus between sustainable tourism, cultural heritage, and conservation. Accordingly, traditional structures constructed using conventional methods to fulfill spatial needs should cease their physical deterioration and be imbued with new functions to foster continued vitality. TOMORROW MAY BE TOO LATE.

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ÇOCUK EĞİTİM MEKÂNLARI MOBİLYALARI ERGONOMİ AÇISINDAN İNCELENMESİ

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Özet
Kurumsal eğitimin ilk basamağı olan okul öncesi eğitim kurumları, çocukların zamanlarının önemli bir kısmını geçirdikleri mekânlardır. Bu anlamda okul öncesi eğitim kurumlarında çocukların motivasyonu, verimliliği, fiziksel ve bilişsel gelişimi açısından fiziksel koşullar önem arz etmektedir. Okul öncesi eğitim kurumlarındaki sınıflar ve eğlence alanları, çocukların etkinlik, grup çalışmaları, sunu, gösteri gibi birçok faklı eylem alanlarını oluşturmalıdır. Bu sebeple okul öncesi eğitim kurumlarındaki ders ve etkinlik alanlarındaki kullanılan mobilyaların kullanım açısından esneklik arz etmektedir. Ayrıca mekanın fiziksel ortam öğeleri olan mobilyaların, öğrencilerin verimliliği, konsantrasyonu ve sağlığı açısından optimum konfor koşullarında olması önemlidir.Okul öncesi eğitim kurumlarındaki eğitim ve eğlence mekânları ergonomik tasarım prensiplerine uygun olarak tasarlanması gerekmektedir. Okul öncesi eğitim kurumlarındaki kullanılan mobilyaların ergonomik tasarım prensiplerine uygunluğunu analiz etmeyi ve bulgulara bağlı olarak iç mekân tasarımından dikkat edilmesi gereken tasarım prensiplerine ilişkin öneriler sunmayı amaçlayan bu çalışma kapsamında İstanbul ilinde bulunan iki okul öncesi eğitim kurumlarında inceleme çalışması yapılmıştır.
Çalışma neticesinde İstanbul ilinde mevcut biri özel biri kurumsal olmak üzere iki farklı okul öncesi eğitim kurumlarında kullanılan mobilyaların ergonomik açıdan çok önemli farklılar olduğu tespit edilmiştir. Özel kurumda kullanılan malzemeler ile kurumsal olan mekândaki boyutsal anlamda farklılar bulunmaktadır. Kurumsal olan eğitim kurumunda kullanılan mobilyalar ve malzemeler okul öncesi eğitim kurumunda eğitim gören çocuklar için uygun standartlarda olmadığı, bu sebeple kurumdaki çocukların eğitim ve eğlence açısından olumsuzluklar barındırdığı görülmüştür.
Anahtar Kelimeler: Mobilya Ergonomisi, Okul Öncesi Eğitim Mekânları, Mobilya Standartları, Çocuk Mobilyaları.

INVESTIGATION OF CHILDREN'S EDUCATIONAL PLACE FURNITURE IN TERMS OF ERGONOMICS

Abstract
Preschool education institutions, which are the first step of institutional education, are places where children spend a significant part of their time. In this sense, physical conditions are important in terms of children's motivation, efficiency, physical and cognitive development in pre-school education institutions. Classrooms and entertainment areas in pre-school education institutions should create many different action areas for children, such as activities, group work, presentations and demonstrations. For this reason, the furniture used in lesson and activity areas in pre-school education institutions is flexible in terms of usage. In addition, it is important that furniture, which is the physical environment elements of the space, be in optimum comfort conditions for students' productivity, concentration and health.Education and entertainment spaces in pre-school education institutions should be designed in accordance with ergonomic design principles. Within the scope of this study, which aims to analyze the compliance of the furniture used in pre-school education institutions with ergonomic design principles and to offer suggestions regarding the design principles that should be taken into consideration in interior design, depending on the findings, an examination study was carried out in two pre-school education institutions in Istanbul.As a result of the study, it was determined that the furniture used in two different pre-school education institutions in Istanbul, one private and one institutional, had significant differences in terms of ergonomics. There are dimensional differences between the materials used in private institutions and corporate spaces. It has been observed that the furniture and materials used in the institutional educational institution are not of appropriate standards for children studying in the pre-school education institution, and therefore have negative effects on the education and entertainment of the children in the institution.
Keywords: Furniture Ergonomics, Preschool Education Spaces, Furniture Standards, Children's Furniture.

GİRİŞ

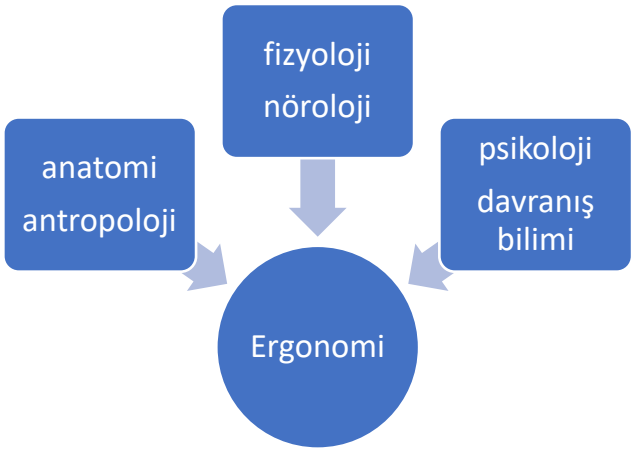
Hayatın vazgeçilmez bir parçası olan eğitim, bireyin ilk eğitimi bebeklik döneminde ailesi ile başlar, daha sonra eğitmenler vasıtasıyla eğitim kurumlarında devam eder. Çocuklar toplumların geleceğe uzanan merdiven basamaklarıdır. Geleceğin teminatı olan çocuklarımızın iyi bir eğitim alması için gerekli şartların oluşturulması tüm toplumun sorumluluğundadır.

Eğitim-öğretim hayatı belirli yaş grubuna gelindiğinde devlet tarafından verilmektedir. Türkiye'de ilk eğitim devlet tarafından zorunlu bir şekilde verilmektedir. Devlet kontrolünde gerçekleşen eğitimin sağlanması ve silsile şeklinde teşkilatlanması adına eğitim-öğretim, devletin Milli Eğitim Bakanlığı'nca ilgili kanun ve yönetmelikler çerçevesinde sağlanmaktadır. Türkiye'de Milli Eğitim Bakanlığı tarafından belirlenen zorunlu eğitim belirli kriterlerle yaş gruplarının belirlenmesi, öğrencilerin yaş grubuna göre sınıflandırılması ve aynı ortamda eşit eğitim alabilmesi standartlar belirlenmiştir. Türkiye'de MEB tarafından eğitimin başlama tarihi olarak eylül ayı referans alınırken, yaş olarak 57 haftalık olan çocuklar anaokulu veya okul öncesi eğitim kurumlarında eğitim-öğretime başlamaktadır. Ancak gerekli şartların sağlanması ve ailenin isteği doğrultusunda 36 haftalık iken de okul öncesi eğitim-öğretime başlanabilmektedir (Resmi Gazete 2019. Erişim Tarihi: 25.04.2024 18.00).Çocuğun güven içerisinde olduğu ev ortamından ayrılıp günün önemli bir kısmını geçirdiği mekânların başında okul öncesi eğitim kurumları gelmektedir. Okul öncesi eğitim kurumları genellikle 3-6 yaş aralığındaki yaş grubuna yönelik eğitim-öğretim sunmak amacıyla hizmet vermektedir. Burada önemli olan mesele çocukların 0-6 yaş dönemin diğer yaş dönemlerine göre ayrıcalık göstermesidir. Erken çocukluk dönemi olarak tanımlanan bu dönemde bilişsel, fiziksel, duygusal ve sosyal gelişim kişinin sonraki hayatındaki gelişimi için temel teşkil etmektedir (Kepekçi Yetkin, 2021).Birey karakter, ilgi ve isteklerin gelişmesi de bu dönemde gerçekleşmektedir. Birey için hayatının şekillendiği bu dönemde verilmesi gereken eğitimin niteliği ve önemini daha da arttırmaktadır. Bireyin gelişiminde eğitimin kalitesi, kurgulanan eğitim sistemine bağlı olduğu kadar bu kurgunun doğru ve etkili bir şekilde hayata geçirilmesini sağlayacak ortamların, mekânların tasarlanması ve ortaya konulmasına bağlıdır. Bir eylem gerçekleştirilirken eylemin gerçekleştiği mekan, mekanın kullanıcı ile ilişkisi ve kullanıcıya verdiği destek ve sağladığı konfor koşulları eylemin kalitesini, elde edilen sonuç ürünü, dolayısıyla da kullanıcı memnuniyetini doğrudan etkilemektedir (Bilgiç ve Surur, 2016).Okul öncesi eğitim kurumları; ilgili bakanlıkların belirlediği tip projeler kapsamında il müdürlüklerince uygun görülen alanlara inşa edilmektedir. Okul öncesi eğitim kurumlarının fizyolojik ve psikolojik yeterlilikleri, ergonomik özellikleri, bulunması gereken mekanlar,

kullanıcıların tercihlerine göre nasıl şekillenmesi gerektiği, mekanlardaki alan yeterlilikleri, kullanıcı ve mekan ilişkisi, kullanıcının talepleri ve bu taleplerin mekanlara nasıl uygulanabileceği gibi konuların araştırılması ve incelenmesi önem arz etmektedir. Bu çalışmada da çocuk eğitim mekanları mobilyalarının ergonomik açıdan incelenmesi üzerine gerçekleşmiştir.

Ergonomi Tanımı

Ergonomi kavramı anlam olarak en temel haliyle uygunluk anlamında gelmektedir. Kavram köken olarak Yunanca olup "ergo" ve "nomos" kelimelerin birleşmesiyle oluşan ergonomi sözcüğünde; "ergo" kelimesi iş kavramı, "nomos" kelimesi ise yasa kavramını karşılamaktadır (Tokat, 2018). Temel anlamda iş yasası olarak kelime karşılığı bulunan ergonomi kavramının Türkiye'deki karşılığı ise iş bilimidir (İsmailoğlu, 2016). Bunların yanında Türkçede ergonomik kavramının karşılığı kullanışlı ve elverişli olarak geçmektedir (Türk Dil Kurumu TDK, Erişim Tarihi: 28.04.2024).Çeşitli bilim dallarından edinilen veriler doğrultusunda insan yapısının ergonomisi belirlenmiş, bu kurallar çerçevesinde belirli kategorilere ayrılmıştır. Ergonominin al dalları anatomi, fizyolojik, psikolojik, antropoloji, nöroloji ve davranış bilimleri olarak sınıflandırılır (Doğan, 2007).



Çizim 1. Ergonomi ve diğer bilim dallarıyla ilişkileri (Doğan, 2007).

Her şeyden önce ergonomi, incelemelerden elde edilen verileri derleyip sonuç elde eden bir yöntemdir. Teknolojik ve yaşambilimsel verileri içermektedir. İş metotlarının, araç gereçlerin ve geniş anlamda çevrenin, insanın yapısına, işlev ve yetilerine göre tasarlanmasına yardımcı olmaktadır. İnsan değiş çevreyi değiştirir (Doğan, 2007).Ergonomik veriler doğrultusunda belirlenen tasarım ilkeleri, yapılacak olan tasarımın "insan için tasarım" ilkesinden hareketle benimsendiğini göstermektedir. Tasarımlarda, evrensel ergonomik faktörlerin dışında, bireysel özellikler de yer almaktadır. Kişiden kişiye farklılık gösteren bu özellikler, mekan

kullanıcılarının kendilerine yönelik tasarımlarla mekanı şekillendirmesine sebep olmaktadır. Burada önemli olan her kullanıcının kendi mekanında kendi kurallarının yer almasıdır. Bu da evrensellik genellemesinde bizi yeni boyutlar, estetik kaygılar çıkmaktadır (Albayrak, 2012). Ergonomide temel yaklaşım, insanın fizyolojik ve psikolojik özelliklerine ilişkin veri ve bilgilerin, toplanmasıdır. Bu bilgilerin toplanmasındaki amaç, daha sonra çeşitli eşya, araç, gereç, donanım ve fiziki çevre tasarımında, kişilerin rahatını, sağlığını ve üretkenliklerini arttıracak şekilde kullanılmasıdır (Aykal ve Günyel 2010).Ergonomi araştırmaları gerçekleştirilirken gerekli parametreler incelenmektedir. Bunlar antropometri, çalışma ortamı ve fiziksel çevre, iş ve işyeri düzenleme, ergonomik tasarım ve ergonomik yaklaşım olarak sıralanabilir (Eryılmaz, 2015). Tasarlanan mekanların ölçüleri, aydınlatması, havalandırılması, tefrişleri, konumları gibi özelliklerin tasarlanması ve ergonomide erişebilirlik ve kullanılabilirlik açısından değerlendirilmesi yapılırken, insan ölçeği referans alınmaktadır. İnsan ölçeğinden kasıt mekanların ve tasarımların kullanıcıları olan bireylerin antropometrik değerleridir (Kepekçi Yetkin, 2021).

Ergonominin Amacı

Bireylerin erkek-kadın, çocuk-yaşlı, üretici-tüketici, sakat-sağlam olmalarına göre farklı özellikleri bulunmaktadır. İnsanlar doğumları ile birlikte Çevre koşulları ve dış dünyadaki birçok durum ve araçla etkileşim ve ilişki içerisine girmektedirler. Ergonomi tasarımda insan merkeze alan bir bilim dalıdır. Temelde hayatın insana uygun hale getirilmesini amaçlamıştır (Shapanis, 1983). Ergonominin iki temel amacı bulunmaktadır:

Tablo 1. Ergonominin Temel Amaçları

1. Yürütülen işin etkililiğini ve etkinliğini artırmaktır: Kişi ile makineler arasındaki temel fark insanların hata yapmasıdır. Kişilerin hata nedenleri incelenecek olursa hatalar azaltılabilir. Bu yolla sistemin verim ve etkinliği yükselmektedir.
2. Çalışanların refahının artırılmasıdır: Güvenliğin ve teknoloji kullanım rahatlığının artırılması, operatörün yorgunluğunu azaltmakta ve kişilerin yaşam kalitesini yükseltici etki yapmaktadır.

Kaynak: Güler, 2012.

Ergonomi Biliminin Gelişimi

İnsanın araç-gereç ve donanımların kullanımını daha kolay ve faydalı hale dönüştürmek üzere asırlardır değişiklikler ve yeni eklemeler yapılmaktadır. Örneğin taş devrinde taştan daha sonra

hayvan kemiklerinden yapılan ara-gereçler ele tutulur bir şekilde biçimlendirilmiştir. Yine endüstri devriminde işlerin daha verimli ve kolay yapılabilmesi için birçok yeni icatlar, araç ve makinalar geliştirilmiştir. Lakin tüm bunlar "ergonomi denilebilecek bir bilimsel disiplin yaklaşımı içinde gerçeklememiştir (Bridger, 1995)İş sağlığı konusunda işçilerin yanı sıra işyeri ve çevresinin de değerlendirilmesi gerektiğini ileri süren ilk kişi Ramazanni'dir. Ramazanni işçi sağlığı ile ilgili hastalıkları ve olası zararları araştırırken günümüzde ergonominin yaptığı benzer yöntem ve yaklaşımlar kullanmıştır. Kullandığı sistematik yaklaşımlar arasında her işin teknik analizinin yapılması, hastalık patolojisinin klinik yönlerinin değerlendirilmesi, kaynak taraması, iş yeri ile ilgili düzenlemeler ve iyileştirmeler yer almaktadır (Tunçez, 2017).Ergonomi kavramı ilk olarak Polonyalı Profesör W. B. Jastrezebowski tarafından 1857'de yayımlanan bir makale ile bilim dünyasına tanıtılmıştır. Frederick Taylor 1900'lü yılların başında "Taylorism" olarak bilinen yaklaşımıyla endüstri işçilerinin seçimine yoğunlaşırken aynı zamanda insan kaynakları ve yöneylem yöneticilerince günümüzde de kullanılan çalışma yöntem ve standartlarına da ağırlık vermiştir. İşin talebine göre insan kısıtlılıklarını ve yeteneklerini de değerlendirmiştir. 1939-1945 yılları arasında ergonomi bir disiplin ve meslek haline gelme sürecini tamamlamıştır (Güler 2012).1952 yılında İngiltere'de "Ergonomic Society", 1957 yılında ise ABD'de "Human Factor Society" kurulmuştur. Daha sonra çeşitli ülkelerde ergonomi dernekleri kurulmaya devam etmiştir. 1990'lı yıllara gelindiğinde İngiltere'de "elle yük kaldırılmasına yönelik minimum güvenlik ve sağlık gereksinimleri" ile "ekranlı araçlarda çalışmanın minimum güvenlik ve sağlık gereksinimleri" direktifleri yayınlanmıştır (Tekbaş 2004). Ülkemizde ise 4857 sayılı iş yasası 2003 yılında yürürlüğe girmiştir. Yine "Ekranlı araçlarla çalışmalarda sağlık ve güvenlik önlemleri hakkında yönetmelik", "Elle taşıma işleri yönetmeliği" ve "İş sağlığı ve güvenliği yönetmeliği" gibi yönetmeliklerle ergonomi sözcüğü ilk kez yasada yer almış ve bu alanda çeşitli düzenlemeler yapılmıştır (Esmaeılzadeh 2008).

Ergonominin Sınıflandırılması

Ergonomi, geniş bir perspektife sahip olan ve çalışma ortamlarındaki etkileşimleri inceleyen bir disiplindir. Bu disiplin, genellikle fiziksel, bilişsel ve örgütsel olmak üzere 3 ana kategoriye ayrılır (Saygı, 2019):

1. Fiziksel ergonomi: Fiziksel ergonomi, çalışanların fiziksel çevreleriyle etkileşimlerini inceleyen bir alt dal olarak kabul edilir (Saygı, 2019). Bu kategori, işyerindeki ekipmanlar, araçlar ve çalışma ortamının tasarımını kapsar (Doğan vd., 2022). Bu şekilde, ergonomik mobilyalar, doğru yükseklikte masa ve sandalyeler gibi fiziksel unsurların optimal düzenlemesi sağlanarak çalışanların konforu ve performansı artırılır.

2. Bilişsel ergonomi: Bilişsel ergonomi, çalışanların zihinsel süreçleri, bilişsel işlevleri ve bilgi işleme kapasitelerini inceleyen bir alanı temsil eder. Bu kategori, görev karmaşıklığı, bilgi işleme hızı, öğrenme süreçleri gibi zihinsel faktörleri ele alır. Bu bağlamda, kullanıcı arayüzlerinin anlaşılır ve kullanıcı dostu olması, bilgi akışının düzenli ve etkili olması bilişsel ergonominin odak noktalarındandır (Doğan vd., 2022).
3. Örgütsel (Organizasyonel) ergonomi: Örgütsel ergonomi, işyerindeki örgüt yapısını, liderlik tarzlarını, iletişim ve iş düzenlemelerini inceleyen bir alanı ifade eder (Saygı, 2019).

Bu kategori, çalışanların işyerindeki ilişkilerini, iş bölümünü, motivasyonu ve örgüt kültürünü değerlendirir. Bu şekilde, bir organizasyonun verimliliği, çalışan memnuniyeti ve iş süreçlerinin düzenliliği üzerinde etki sağlanır (Saygı, 2019). Bu üç ana kategori, ergonominin geniş kapsamını anlamamıza yardımcı olarak, çalışma ortamlarının daha etkili, güvenli ve verimli olması için çeşitli faktörleri ele almaktadır.

Ergonomi İç Mimarlık İlişkisi

Mekan, algıya bağlı bir deneyimdir; sayısız farklı biçimde algılanabilir. Her deneyim ise farklı olsa da temelde ortak bir noktası bulunur. Bu nokta da “ilişkisel varoluş”tur. Denetim sürekli oluşmaktadır. Çünkü canlı varlık ile çevresel koşulların etkileşimi “denetim” sürecinde var olmaktadır. Mekanın algılanmasında kişisel denetim ve beceriler ile gözlem yapma, algılama, ayrıntıyı fark etme ve hayal gücünü kullanma gibi temel gereksinimler bulunmaktadır. bu gereksinimler ile mekana dair bilgiler, algılayan bireyin biriktirdiği her türlü deneyim ile bilişsel bir süreçte işlenerek anlamlandırılır (Nayeb ve Ark., 2021.; Asar, 2013).Ergonomi, insanlar arasındaki etkileşim ve sistemin diğer ögelerini anlama ile ilişkili bilimsel disiplin, kişilerin mutluluğunu ve tüm sistemin performansını en iyi hale getirmek için teori, ilke, veri ve metotlar uygulayan bir meslektir (Dul ve Weerdmeester, 2003).Bir mekânın ergonomik olması, kullanıcıların o mekanı sağlıklı bir şekilde kullanmasını sağlamaktadır. İç mekanı şekillendiren donatı ve mobilyaların ergonomik tassarımda kullanıcının antropometrik boyutları önem taşımaktadır. Bu da antropometrik ölçüleri, en çok kullanılan ergonomik verilen haline getirmektedir. (Kayış ve Özok, 1991). Mimari tasarım kullanıcısı “insandır.” Bir mekanın boyutu; içinde bulunacak insan sayısına, eşyalra, kullanış amacına ve içinde yapılacak eylem türüne göre, eylemin gerçekleştirilmesi için gerekli eşya, donatı ve makinalar gibi sabit ya da hareketli eşyanın boyutlarına, bunların bakım ve işletilmesi için gerekli alanlara, çalışma koşullarının gerektirdiği cihaz ve tesisat için gerekli olan ve hacimlere ve benzer gereksinimlerin gerektirdiği genişlik, uzunluk ve yüksekliklere bağlı olarak saptanır. Tüm bu

unsurlar saptanmasındaki temel kaynak ortalama insan ölçüleridir (Nayeb ve Ark., 2021). Bu bilgiler ışığında iç mimarlık ve ergonomi tasarımın tam anlamıyla insan için olması için önemli kriterlerdir.

Eğitim Mekanlarında Ergonomi

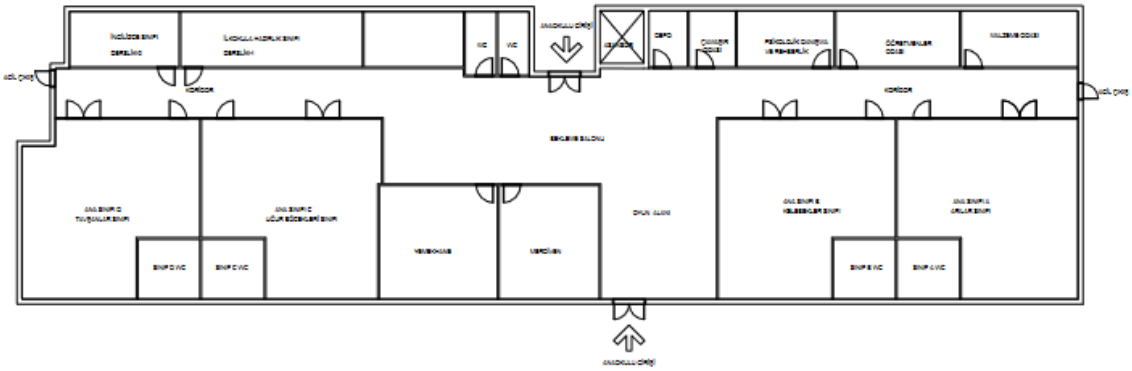
Ergonomi kavramı uyumu, uygunluğu simgelediği gibi okul öncesi eğitim mekanlarında da ergonomi okul ve kullanıcılar arasındaki uyumu ifade etmektedir. Okulda verilen eğitim öğretim faaliyetleri öğrencilerin özelliklerine uygun şekilde tasarlanan yapılarda verilmesi gerekmektedir. Yani yapının ergonomik olması verilen eğitimin kalitesini artırmakta ve öğrencinin eğitim-öğretim sürecine önemli katkılar sağlamaktadır. Yine okul öncesi eğitim kurumlarındaki öğrencilerin, yapıdaki mekanlarda geçirdiği zamanın kalitesi ve memnuniyeti, yapıdaki ergonomik tasarımlarla doğru orantılıdır. Okul öncesi verilen eğitim ve öğretimde, gerçek hayatın taşıdığı önemi ve yaklaşımın temel ilkelerinin, çocuk ergonomisine uygun olarak eğitim mekanlarına nasıl yansıtılacağı konusu, mimari disiplini yakından ilgilendirmektedir. Sınıf ortamında ortak kullanım alanlarına, hatta okulun bir bütün olarak tasarlanmasında iç-dış mekan iletişimin oluşturulmasında, mekanlardaki öğrenci-öğretmen iletişimini destekleyici donatıların tasarlanmasında mimari disiplininin varlığı gerekmektedir (Kelpekçi Yetkin, 2021).Okul öncesi eğitim kurumlarında ergonomi bilimi, kullanıcılarının fiziksel ve ruhsal açıdan problemlerini belirlemek ve çözüm getirmek amacıyla da kullanılmaktadır. Bir öğrenme ortamı planlandığında fiziksel çevre koşullarının göz önünde bulundurulması ergonominin bir gerekliliğidir. Öğrencilerin başarısına doğrudan etki eden fiziki ortamları; mekanın büyüklüğü, öğrenci sayısı, mekandaki donatıların örgütlenme biçimi, esnek kullanım imkanın olup olmaması, öğrencilerin kullandıkları mobilyaların onların antropometrik boyutlarına uygunlu, görsel, işitsel ve ısısal konfor koşulları, renk ve doku özellikleri, ortamın temizliği gibi birçok faktör göz önüne alınarak okul öncesi eğitim kurumlarında ergonomi kapsamında değerlendirilmektedir (İsmailoğlu, 2016.; Kepekçi Yetkin, 2021).

Materyal ve Metot

Çalışmanın bu bölümünde materyal ve metot hakkında bilgi verilmiştir. Materyal kısmında çalışma alanının genel tanıtımı verilmiştir. Metot kısmında ise çalışmada uygulanan bilimsel araştırma teknikleri anlatılmıştır.

Materyal

Çalışmada değerlendirmelerin yapıldığı mekanlarda bulunan mobilyaların tanıtımı yapılmıştır. Çalışma kapsamında değerlendirilen mekanlar, İstanbul ilinde bulunmaktadır. İstanbul Türkiye'nin Marmara bölgesinde bulunan önemli bir şehirdir. İstanbul ilinde kamu ve özel yüzlerce okul öncesi eğitim kurumu bulunmaktadır. Çalışmamızda İstanbul ilinde bulunan okul öncesi eğitim mekanlarından iki tanesi örnek seçilmiştir.Bunlardan ilki Özel Başakşehir Final Okulları Anaokulu Hakkında okuludur.Özel Başakşehir Final Okulları Anaokulu







Özel Başakşehir Final Okulları Anaokulu, çağdaş ve modern eğitim imkanlarının sağlandığı bir kurum olarak İstanbul'da hizmet vermektedir. Öğrencilerin keşfedilmeyi bekleyen ayrı bireyler olduğunu benimseyen, toplumsal ve duyusal gelişimleri destekleyen, keşfetmeye dayalı bir eğitim modeli yürütülmektedir. Öğrencilerin ilkokula adaptasyonunu hızlandıracak okul öncesi etkinlikler yapılmaktadır. Öğrenciler; beden eğitimi, görsel sanatlar, drama, müzik, satranç, dans, seramik gibi uygulamalı dersler sayesinde ilgi ve yetenekleri dahilinde kendilerini geliştirme imkanı bulmaktadır. Uygulamalı dersler sayesinde öğrencilerin dayanıklılık, koordinasyon, iletişim, yaratıcılık, takım çalışması ve gözlem yeteneği gelişmektedir.

Özel Başakşehir Final Okulları Anaokulu, "FinaLingual" adı verilen çift dilli eğitim programı ile İngilizce yabancı dil eğitimi vermektedir. İngilizce derslerini, yabancı ve Türk öğretmenler beraber yürütmektedir. Bu program sayesinde öğrenciler; oyunlar oynayarak, yaparak, yaşayarak, sürekli tekrar ederek ve maruz kalarak erken yaşta yabancı dil edinmektedir. Kurumda; sanat, sosyal bilimler, fen, tasarım, matematik gibi derslere ait kavram ve terimler de İngilizce dilinde öğretilmektedir. İngilizce okuma, dinleme, yazma ve konuşma becerilerinin ana dil düzeyinde olması hedeflenmektedir.

Özel Başakşehir Final Okulları Anaokulu; "FinalMaker" programı dahilinde, öğrencilerin gereksinim duyduğu becerileri oyun temelli bir modelleme ile sunmaktadır. Öğrenciler; adım adım problem çözme ve algoritmik düşünme yetenekleri edinmektedir. Öğrenciler küçük yaşta kodlama dünyası ile tanışmakta, küçük yaştan itibaren dijital dünyaya hazırlanmaktadır.

Bunlardan ikincisi İvat Turhan Anaokulu okuludur.

İvat Turhan Anaokulu



İvat Turhan Anaokulu İstanbul İli Sultangazi İlçesinde bulunan İvat Turhan İlkokulu ile aynı binada yer almaktadır. Çocukların gelişim düzeyleri, ilgi alanları ve ihtiyaçlarına göre hazırlanan eğitim programı, bilimsel bilgiyi ön plana çıkaran, sanatsal ve kültürel etkinliklere önem veren, yaratıcılığı destekleyen eğitim anlayışı ve aile katılımına olan desteği ile ulusal ve uluslararası düzeyde bilinen ve tercih edilen bir kurum olmaktır.

İvat Turhan Anaokulu'nda, öğrenciler, bilgiyi ezbere dayalı olarak değil, araştırarak, sorgulayarak, yaparak ve yaşayarak edinirler. Çocuklar, özdisiplini ve benlik saygısı gelişmiş, toplumda birey olarak yer aldığının farkında olan, paylaşımcı, kendini ifade edebilen, sorumluluk sahibi, kendi haklarını korurken başkalarının haklarına saygı gösteren, gelenek ve göreneklerimize karşı duyarlı, doğayı koruyan ve Atatürk ilke ve devrimlerine bağlı bireyler olmak üzere eğitim alırlar.

Metot

Çalışma kapsamında öncelikle konuyla alakalı literatür taraması yapılmıştır. Yapılan araştırmada elde edilen bilgilere göre belirlenen; ergonomi, iç mimarlık ergonomi ilişkisi, eğitim mekanlarında bulunan mobilyaların ergonomik açıdan incelenmesi amaçlanmıştır. Çalışma alanı olarak belirlenen İstanbul İlinde bulunan okul öncesi eğitim kurumlarda yapılan gözlemler sonucunda Okullarda uygulanan plan şemalarının benzerlikleri göz önüne alınarak iki farklı plan şemasına sahip biri özel diğeri kamuya bağlı okul seçilmiştir. Belirlenen okulların, mekan tasarımında kullanılan mobilyaların ergonomik tasarımları incelenmiş ve analiz edilmiştir. Yapılan araştırmalar, gözlemler, incelemeler ve ölçümler sonucunda elde edilen veriler sistematik bir şekilde çalışmada yer almıştır. Çalışma kapsamında ortaya konulan sonuçlar doğrultusunda değerlendirmeler yapılarak, seçilen okul öncesi eğitim mekanlarındaki mobilyalarda belirlenen olumlu ve olumsuz uygulamalar ifade edilmiş, olması gereken kriterlerin yürürlükteki mevcut tasarım kriterlerine nasıl entegre edileceği konusunda değerlendirilmelerde bulunulmuştur.

Bulgular ve Tartışma

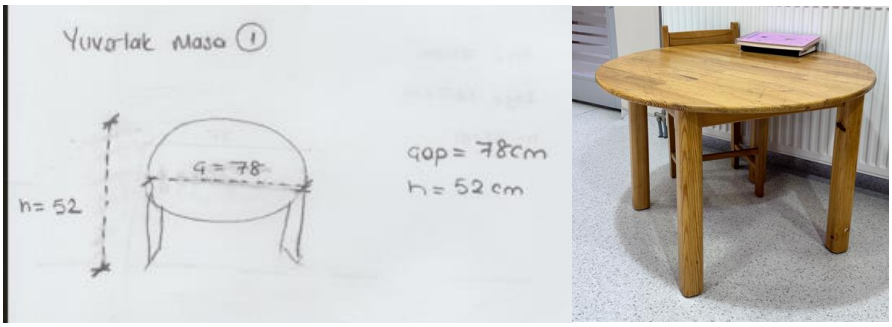
Sınıflar

Araştırma kapsamında incelediğimiz Özel Başakşehir Final Okulları Anaokulu bünyesinde bir İngilizce sınıfı, bir ilkokul hazırlık sınıfı ve iki anasınıf olmak üzere toplam dört sınıf bulunmaktadır. Sınıflar ana giriş kapısının karşısına zeminin sağ ve sol taraflarına konumlandırılmıştır. Zemin katta konumlandırılmış alanda bir yemekhane, oyun alanı, ingilizce ve ilkokula hazırlık derslikleri, Psikolojik danışmanlık ve rehberlik bölümü, öğretmenler odası, kız erkek öğrenci lavaboları, malzeme odası, çamaşır odası ve bir adet depo bulunmaktadır. Ayrıca bahçeye açılan bir kapıda bulunmaktadır. Araştırma kapsamında incelediğimiz İvat Turhan Anaokulu bünyesinde üç adet ana sınıfı bulunmaktadır. Sınıflar ana giriş kapısının sol tarafındaki bölüme karşılıklı yerleştirilmiştir. Sınıfların bulunduğu alanda mutfaz, hizmetli odası, revir, 2 adet lavabo, yangın çıkısı ve bina yan girişi bulunmaktadır.

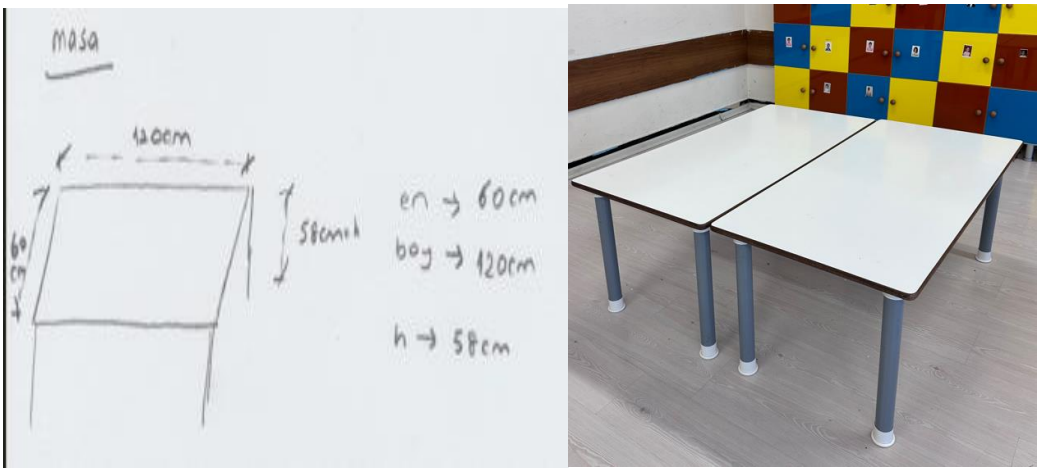
Mobilyaların Ergonomik Açıdan İncelenmesi

Masalar ve Sandalyeler

Her iki okul içerisinde farklı modellerde ve farklı sayılarda masa ve sandalyeler bulunmaktadır.



Şekil 1. Özel Başakşehir Final Okulları Anaokulu masa (Akbayır, arşiv 2024).



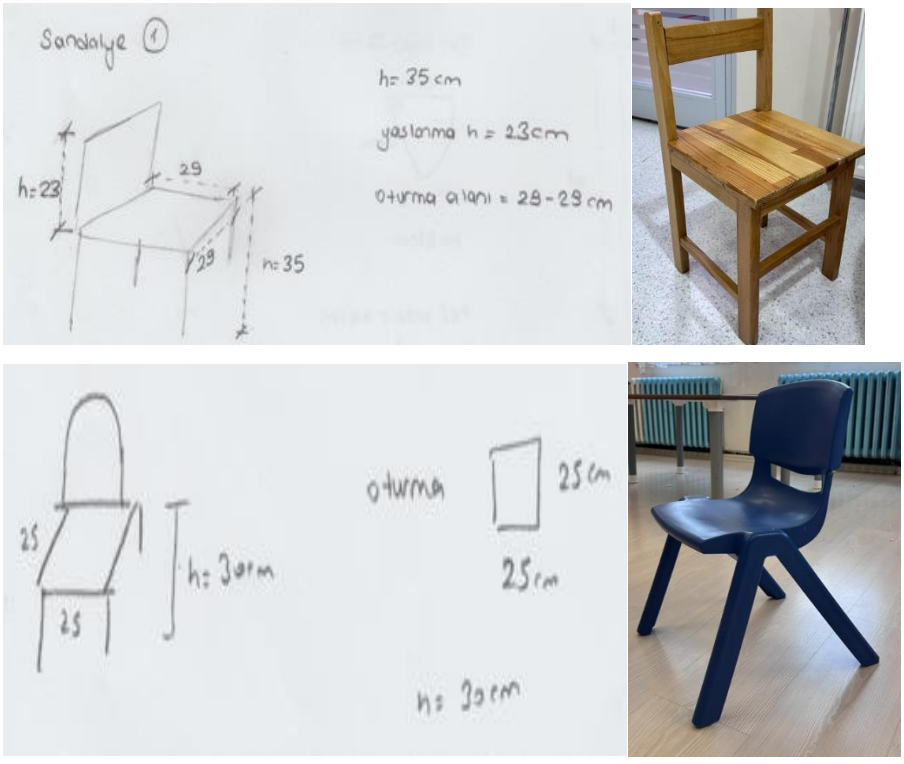
Şekil 2. Sultangazi İvat Turhan Anaokulu masa.

Yapılan ölçümler ve incelemeler doğrultusunda Final anaokulundaki sıra/masanın boyutları yuvarlak olarak dizayn edilmiş yapı itibari ile masanın çapı 78 cm'dir. Ayrıca 52 cm yüksekliğe sahiptir (Şekil 1). Ergonomik açıdan bakıldığında 4-5 yaş grubu öğrencilerinin oturma göğüs hizası olan 41-9-54.3 cm aralığı ölçülerine uygun olduğu görülmektedir. Ahşap malzemeden yapılmış olan yuvarlak masa çeşitli etkilerde öğrencilerin ortak çalışma yapmaları için elverişli olduğu görülmüştür. Yapılan ölçümler ve incelemeler neticesinde İvat Turhan anaokulundaki sıra/masanın boyutları 4 kişilik olarak dizayn edilmiş, yapı itibari ile kullanım alanı 0,72 cm^2'dir. Ayrıca yerden yüksekliği 58 cm yüksekliğe sahiptir (Şekil 2). Ergonomik açıdan bakıldığında 4-5 yaş grubu öğrencilerinin oturma göğüs hizası olan 41,9-54,3 cm aralığı ölçülerine uygun olmadığı görülmektedir. Ancak mevcut sıra/masa öğrencinin kullanımına yeterlidir. Bunun yanında sıra/masanın 4 kişilik olduğu göz önünde bulundurulduğunda 0,18 cm^2 alan düşmektedir. Bu da her etkinlik için uygun bir alan olmadığını göstermektedir. Ayrıca sıra/masının yerden yüksekliği de ergonomik açıdan gerekli üst sınır olan 54,3 cm'nin üzerindedir. Bu da öğrencinin masa kullanımı açısından antropetrik ölçümler açısından uygun değildir (Tablo 1).

Tablo 2. Yaşlarına göre çocukların ortalama antropometrik ölçüleri

	4 Yaş	5 Yaş
h (Boy Ölçüsü)	92 cm ≤ h ≤ 114 cm	97 ≤ h ≤ 121
9/10 h (Göz Hizası)	82.8 cm ≤ 9/10 h ≤ 102.6 cm	87.3 cm ≤ 9/10 h ≤ 108.9 cm
4/5 h (Omuz Hizası)	73.6 cm ≤ 4/5 h ≤ 91.2 cm	77.6 cm ≤ 4/5 h ≤ 96.8 cm
1/3 h (Bacak Boyu)	30.6 cm ≤ 1/3 h ≤ 38 cm	32.3 cm- ≤ 1/3 h ≤ 40.3 cm
h (Kollar Açık Genişlik)	92 cm ≤ h ≤ 114 cm	97 cm ≤ h ≤ 121 cm
1/4 h (Omuz Genişlik)	23 cm ≤ 1/4 h ≤ 28.5 cm	24.2 cm ≤ 1/4 h ≤ 30.2 cm
2/7 h (Oturma Bacak Boyu)	26.2 cm ≤ 2/7 h ≤ 32.5 cm	27.7 cm ≤ 2/7 h ≤ 34.5 cm
3/7 h+1'(1 inch= 2.54 cm) (Oturma Göğüs Hizası)	41.9 cm ≤ 3/7 h+1' ≤ 51.3 cm	44.1 cm ≤ 3/7 h+1' h ≤ 54.3 cm
1/3 h (Ayakta El Hizası)	30.6 cm ≤ 1/3 h ≤ 38 cm	32.3 cm ≤ 1/3 h ≤ 40.3 cm
6/5 h (Ayakta El UzanmaMesafesi)	110.4 cm ≤ 6/5 h ≤ 136.8 cm	116.4 cm ≤ 6/5 h ≤ 145.2 cm

Kaynak: Kepekçi Yetkin, 2021.



Şekil 3. İvat Turhan Anaokulu sandalye

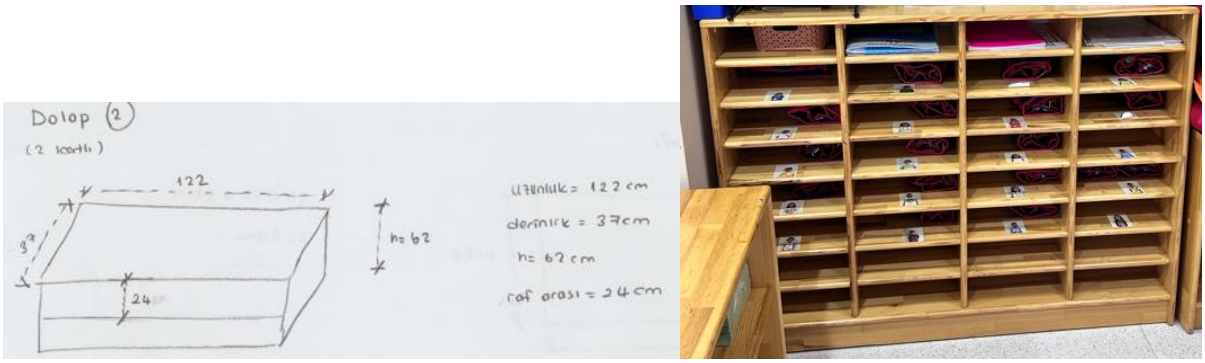
Yapılan ölçümler ve incelemeler doğrultusunda Final anaokulundaki sandalyelerin ölçüleri oturma alanı 0,0841 m^2'dir. Ahşap malzemeden yapılmış sandalyeler antropometrik açıdan standart oturma bacak boyu ölçüsü26,2-32,5 cm ölçülerine uygun olduğu görülmüştür. Yapılan ölçümler ve incelemeler doğrultusunda İvat Turhan anaokulundaki sandalyelerin ölçüleri oturma yüksekliği 30 cm, oturma alanı ise 25*25 cm/ 0,0625 m^2'dir. Plastik malzemeden yapılmış sandalye antropometrik açıdan standart oturma bacak boyu ölçüsü 26,2-32,5 cm

ölçülerine uygun olduğu görülmüştür. Her iki okulda da kullanılan sandalyeler ergonomik açıdan birbirine yakın olup, Final okullarındaki ahşap sandalyelerin oturma alanları daha geniştir. Buna karşın İvat Turhan anaokulundaki plastik sandalyelerin tasarımı daha vücut yapısına göre daha rahat bir oturma sağlamaktadır.

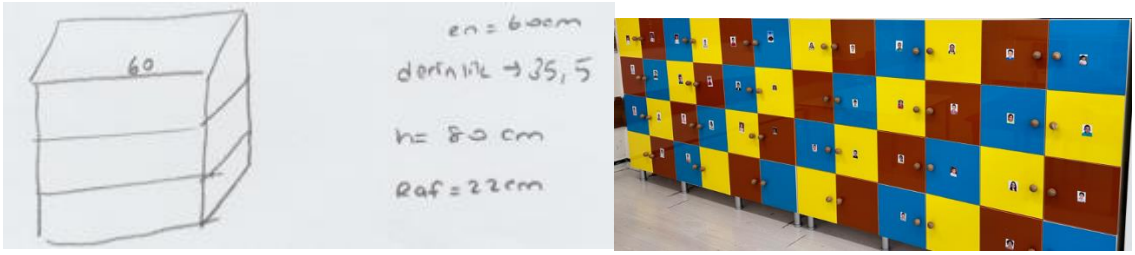
Dolaplar

Sınıf içerisinde bulunan dolaplar öğrencilerin eğitim sürecinde farklı zaman dilimlerinde kullanabilecekleri malzemelerin saklandığı, kişisel eşyalarının konulduğu genel olarak sınıfın duvarlarının olduğu bölümlere yerleştirilmiş mobilyalardır. Ergonomik açıdan antropometrik ölçüler göz önüne alındığında bu dolapların tasarımları çocuklara özel hazırlanmalıdır.

Her iki okulda da farklı boyutlarda birçok dolaplar bulunmaktadır. Bu dolapların bazıları kapaklı bazıları ise kapaksız şekilde dizayn edilmiştir. Her bir öğrencinin kendisine ait bir dolap kullanım alanı mevcuttur.



Şekil 4. Final Anaokulu Öğrenci Dolapları



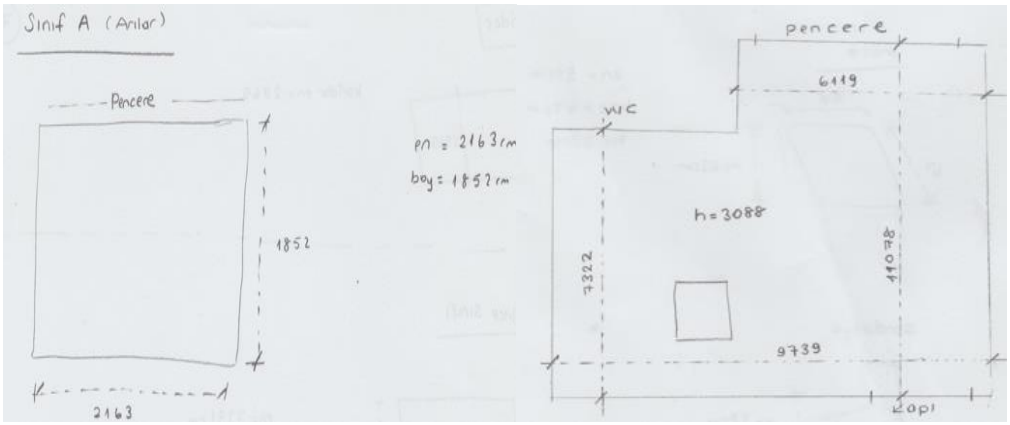
Şekil 5. İvat Turhan Anaokulu

Yapılan inceleme ve ölçümler sonucunda Final Anaokullarında bulunan sınıf içerisindeki dolaplar 62 cm yüksekliğe 122 cm genişliğe ve 37 cm derinliğe sahiptir. Dolaplar genel olarak 24 yüksekliğinde ve 48 cm en genişliğine sahiptir. Her öğrenciye ait dolap fotoğraf ve isimlik ile belirlenmiştir. Dolaplar kapaksız şekilde tasarlanmıştır. Dolaplar ergonomik açıdan incelendiğinde 4-6 yaş grubundaki çocukların boy ölçüsü olan 92-114 cm'nin biraz altında olduğu görülmektedir. Nitekim bu boy aralığında olan çocuklarındaki eşyalarını alacakları

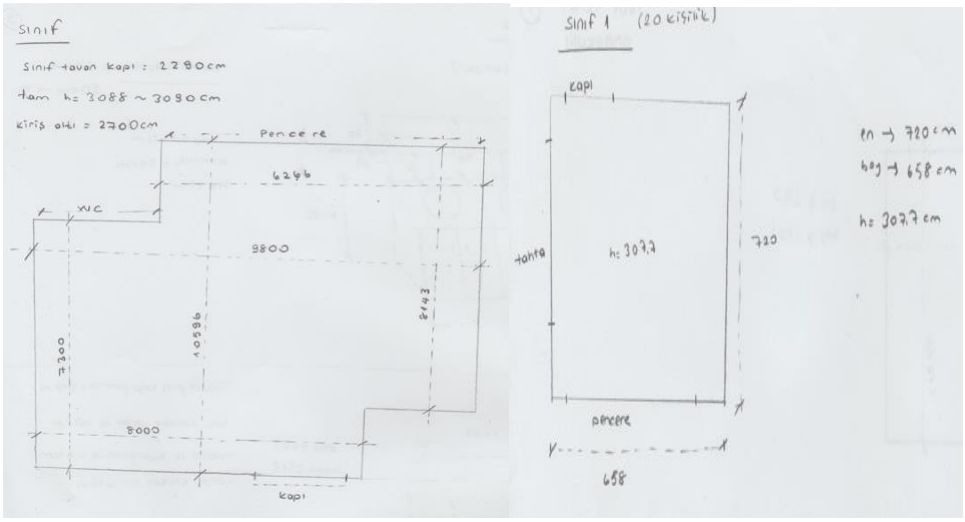
zaman dolabın içerisini görmeleri için eğilerek bakmaları gerekmektedir. Bunun yanında dolapların ahşap malzemeden yapılmıştır. Her dolap bulunduğu duvara sabitlenerek gerçekleşebilecek kazaların önüne geçilmiştir. Yapılan inceleme ve ölçümler neticesinde İvar Turhan Anaokulu'ndaki dolapların yüksekliği 120 cm, 30 cm genişliğe ve 35 cm derinliğe sahiptir. Dolaplar genel olarak 30*30 cm kullanım alanına sahiptir. Her öğrenciye ait dolaplar kapakların üzerine resim ve isimlik şeklinde etiketlenmiştir. Dolaplar ergonomik açıdan incelendiğinde 4-6 yaş grubundaki çocukların boy ölçüsü olan 92-114 cm uygun bir tasarım olduğu tespit edilmiştir. Aynı zamanda 4-6 yaş grubundaki çocukların ayakta el uzama mesafesi 110,4-136,8 cm ölçülerine göre kullanımı uygundur. Her iki okuldaki dolap tasarımları birbirinden farklı olarak tasarlanmıştır. İncelenen dolaplardan Final Anaokulunda bulunan ahşap dolaplar, İvat Turan Anaokulu'daki MDF malzemeden yapılan dolaplara göre daha az kullanışlı olduğu tespit edilmiştir.

Sınıflar

Her iki anaokulu mevcut ilkokul binasının giriş katında yer almaktadır. Final Ana Okulu'nda 4 adet ana sınıfı, İvat Turhan Ana Okulu'nda 3 adet sınıf bulunmaktadır. Her iki okulda da sınıflar çok amaçlı salon olarak kullanım özelliğine sahiptir. Her iki okulunda bulunan sınıflar doğal havalandırma ve aydınlatma sağlayan pencerelere sahiptir.



Şekil 6. Final Anaokulu Sınıf Ölçüleri



Şekil 7. İvat Turhan Anakulu sınıf ölçüleri

Yapılan inceleme ve ölçümler neticesinde Final Anaokulu'nda sınıf ölçüleri ortalama 10 m^2 ölçülerindedir (Şekil 6). MEB tarafından belirlenen standartlar incelendiğinde anaokullarında sınıflar ortalama 15 m^2 ve kişi başına 1,5 m^2 düşecek şekilde tasarlanması uygun görülmüştür. Final okullarındaki mevcut sınıflar 10 m^2 olup sınıflar 20 kişiliktir. Bu da standartların aşıldığını göstermektedir. Sınıfların mevcut yükseklikleri ise 3.8 m'dir. Standartlara uygundur. Ayrıca sınıfta doğal aydınlatma ve havalandırmayı sağlayan 2.163 cm x 1.852 cm ölçülere sahip iki tane pencere bulunmaktadır (Şekil, 8).



Şekil 8. Final Anaokulu sınıf pencereleri

Yapılan inceleme ve ölçümler neticesinde İvat Turab Anaokulu sınıf ölçüleri ortalama 13 m^2 ölçülerindedir (Şekil 7). MEB tarafından belirlenen standartlar incelendiğinde anaokullarında sınıflar ortalama 15 m^2 ve kişi başına 1,5 m^2 düşecek şekilde tasarlanması uygun görülmüştür. Sınıfın tacan yüksekliği 3.7 m olup standartlara uygundur. İvat Turhan Anaokulundaki mevcut sınıflar ortalama 13 m^2 olup sınıflar 12 kişiliktir. Bu da standartların uygun olduğunu göstermektedir. Ayrıca sınıfta doğal aydınlatma ve havalandırmayı sağlayan 100 cm x 200 cm

ölçülere sahip dört tane pencere bulunmaktadır (Şekil, 9).Yapılan incelemeler doğrultusunda Final anaokulunun sınıfları öğrenci sayısına göre uygun değilken, İvat Turhan anaokulunda bu oran öğrenci sayısına göre daha uygundur. Ayrıca her iki kurumdaki sınıfların tavan yükseklikleri 3 m'nin üzerindedir.

SONUÇ

Çocuklar, insanlığın geleceğinin teminatıdır. Onların yetişmesinde ve eğitilmesinde tüm insanlık için büyük önem taşımaktadır. Eğitim hayatlarının bir kısmını okul kurumlarında geçiren çocukların, en uygun şartlarda eğitim almasını sağlamak yetişkinlerin temel görevleri arasındadır. Uygun koşulların sağlanması çocukların aldığı, alacağı eğitim kalitesi ve verimi açısından çok değerlidir. Çalışma kapsamında İstanbul ilinde bulunan Bahçeşehir Final Anakolu ve Sultangazi Avit Turhan Anaokulu sınıfları ve mobilyaları ergonomik açıdan incelenmiştir. Çalışmanın sınırlılığı kapsamında biri özel diğeri devlet olmak üzere farklı özelliklere sahip iki anaokulu yapısı incelenmesinde; çocukların kullandıkları sınıflar, masa, sandalye ve dolaplar ergonomik açıdan ele alınmıştır.Çalışma kapsamında iki anaokulu sınıfları ve mobilyaları incelenerek ölçümleri yapılmıştır. Elde edilen veriler verilere ve literatür taraması sonucunda ulaşılan; olması gereken standartlara, çalışmanın içerisinde sistematik bir şekilde yer verilmiştir.Her iki okulda yapılan incelemeler sonucu sınıfların boyutları standartlara uygun olmadığı tespit edilmiştir. Ancak İvat Turhan Anaokulunda bu denge öğrenci sayısının az tutulması ile ideal kullanım sağlanmıştır. Final anaokulunda ise standartlara göre daha küçük olan sınıf öğrenci sayısının 20 olması ile daha az kullanım alanı sunmaktadır.Her iki okulda da kullanılan masa, sandalye ve dolaplar antropometrik açıdan incelendiğinde 4-6 yaş grubundaki çocuklara uygun tasarlandığı, ancak Final Anaokulunda kullanılan dolapların standartların altında bir yüksekliğe sahip olduğu tespit edilmiştir. Bu bağlamda, yapılan araştırmalar ve çalışmalar sonucunda, anaokulu yapılarının tasarımında; çocukların ergonomik konforunun önemsenerek yapılmasının bir zorunluluk olduğu tespit edilmiştir. Ancak çocuklara yönelik ergonomik konforun önemsenerek tasarım yapılmasının yetkili merciler tarafından zorunlu tutulmadığı tespit edilmiştir.Çalışma sonucunda; yapılan araştırmalar ve incelemeler ışığında, anaokulu yapıları için kullanıcı memnuniyeti ve ergonomik kriterler gözetilerek yapılan tasarımlarda olması gereken, eksikliğinin ise yaptırım sonucunu beraberinde getirmesi gereken tasarım kriterleri önerilmiştir.

*Plan tasarımlarında tek katlı yapılar tercih edilmeli, çok katlı yapıların çözümünde kullanılan merdivenler çocukların antropometrik özelliklerine göre tasarlanmalıdır.

*Mekânların büyüklükleri okulun en üst düzey öğrenci kapasitesine hizmet verecek şekilde planlanmalıdır.

*Plan şemaları doğal aydınlatmadan en üst seviyede yararlanacak şekilde tasarlanmalıdır.

*Yapıların tefriş elemanları çocukların antropometrik özelliklerine uygun seçilmedir.

*Tasarımlar bölgenin coğrafi ve kültürel şartları gözetilerek yapılmalıdır.

*Yapıların tasarım aşamasından önce o bölgede bulunan örnek okullar incelenmeli, kullanıcılarla görüşmeler yapılarak mevcut durumlarda meydana gelen sıkıntılar saptanmalı ve tekrarlanmamasına önem verilmelidir.

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ÖĞRETMEN ADAYLARININ KAVRAM KARİKATÜR GELİŞTİRME SÜRECİ

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Özet
Kavram karikatürleri, günlük yaşamdan alınan bilimsel olayların farklı bakış açıları ve görsel desteğiyle ifade eden araçlardır. Kavram karikatürleri, öğrencilerin bir kavram hakkındaki düşüncelerini ortaya çıkarmak, tartışmaya teşvik etmek, zihinsel belirsizlikleri ve yanlış anlamaları tespit etmek, farklı görüş ve düşünceleri ortaya çıkarmak amacıyla kullanılabilmektedir. Kavram karikatürleri, kâğıt kalem gibi klasik yöntemlerle geliştirilebileceği gibi, bilgisayar ortamında ya da kavram karikatürü oluşturmaya yardımcı web 2.0 araçlarıyla da hazırlanabilmektedir. Bu çalışmanın amacı, Fen Bilgisi öğretmen adaylarına Tübitak 2237 eğitimi kapsamında verilen bilgisayar destekli kavram karikatürü geliştirme eğitim programı sonunda ortaya çıkan ürünlerin değerlendirilmesidir. Çevrimiçi toplamda 24 saat süreli bu eğitime Türkiye'deki 13 farklı üniversiteden 24 öğretmen adayı aktif katılım sağlamıştır. Eğitim kapsamında Storyboardthat, Pixton ve Cartoon Animator olmak üzere iki farklı web 2.0 aracı ve bir masaüstü uygulama kullanılarak fen bilgisi eğitimi alanında bilgisayar destekli kavram karikatürleri oluşturulmuştur. Geliştirilmesi sürecinde fen bilgisi ve eğitim teknolojileri alan uzmanları tarafından rehberlik sağlanan ürünler süreç sonunda yine alan uzmanları tarafından değerlendirilmiştir. Araştırmada veri toplama aracı olarak "Kavram Karikatürü Değerlendirme Formu" kullanılmıştır. Form "yeterli", "kısmen yeterli" ya da "yetersiz" düzey göstergelerinden oluşmaktadır. Araştırma sonuçları, hazırlanan kavram karikatürlerinin geliştirildikleri alanlar ve yeterlilikleri açısından değerlendirilmiştir. Bu değerlendirme temelinde, gelecek eğitimlere yönelik önerilerde bulunulmuştur. Araştırma, bilgisayar destekli kavram karikatürleri geliştirme sürecinin etkili bir öğretim aracı olarak kullanılabilirliği konusunda önemli bilgiler sunmaktadır.
Anahtar Kelimeler: Bilgisayar Destekli Kavram Karikatürü, web 2.0, Öğretmen Eğitimi

CONCEPT CARTOON DEVELOPMENT PROCESS of TEACHER CANDIDATES

Abstract
Concept cartoons are instruments that articulate scientific events derived from daily life through different perspectives and visual support. They serve the purpose of eliciting students' thoughts on a given concept, fostering discussions, identifying cognitive uncertainties, detecting misconceptions, and revealing diverse perspectives and ideas. Concept cartoons can be developed through conventional methods such as pen and paper, as well as with the aid of web 2.0 tools designed to assist in creating concept cartoons in a digital environment. The aim of this study is to evaluate the outcomes of a computer-supported concept cartoon development training program provided to prospective science teachers as part of the Tübitak 2237 Training Project. A total of 24 prospective teachers from 13 different universities in Türkiye actively participated in this online training, which lasted a total of 24 hours. In the scope of the training, computer-supported concept cartoons in the field of science education were created using two different web 2.0 tools and an application: storyboardthat, pixton, and cartoon animator. Throughout the development process, guidance was provided by experts in science education and educational technologies, and the products were subsequently evaluated by these field experts at the end of the process. The data collection tool employed in the research was the "Concept Cartoon Evaluation Form," comprising indicators for "adequate," "partially adequate," or "inadequate" levels. Research results were scrutinized in terms of the areas and competencies in which concept cartoons were developed. Based on this evaluation, recommendations were formulated for future training programs. The study contributes significant insights into the effectiveness of computer-supported concept cartoon development as an instructional tool.
Keywords: Computer-supported Concept Cartoon, Web 2.0, Teacher Training

Introduction

During primary school, students are introduced to concepts related to science and technology for the first time in science classes. This period is important for the attitude that students will develop towards science, the profession they will choose in the future, their interest in science, self-confidence and motivation. Accordingly, one of the teaching materials that will make science and technology lessons more fun and interesting are concept cartoons (Eroğlu, 2010, Şenocak, 2018). Concept cartoons are tools that can convey a scientific event taken from daily life, from different perspectives, with various visuals (Atasoy, 2017; Kara, 2017).These tools can be used to reveal students' thoughts about a concept, to encourage discussion, to detect ambiguities and misunderstandings in their minds, and to enable different views and thoughts to emerge (Balım et al., 2015; Erdoğan and Özsevgeç, 2012). Visuals in concept cartoons increase students' interest in the course and helps create a comfortable learning environment for them to express themselves more easily. Concept cartoons related to science teaching can be prepared in three ways: with pen and paper in hand, by rearranging ready-made images and with computer aid. The fact that hand drawings require skill and the ethical issues in the use of ready-made images are difficulties in creating such concept cartoons. On the other hand, it is said that computer-aided cartoons offer richer content (Pınarkaya,2017). While preparing computer-aided concept cartoons, web 2.0 technologies and animation creation applications are frequently used (Aydın, 2015; Can and Usta, 2021; Kruit and Bredeweg, 2020; Tatlı et al., 2016). It is known that the use of Web 2.0 and its tools increases students' interest and motivation in the course, positively affects course achievement, and contributes to the development of 21st century skills and the elimination of misconceptions (Akbaba and Ertaş Kılıç, 2022, Arslan and Yıldırım, 2021; Can, 2021; Gürleroğlu and Yıldırm, 2022; Karakuzu, B., Saraçoğlu and Bektas, 2023; Urooj, and Farooq, 2023). For this reason, web 2.0 tools appear as an effective alternative in the development of concept cartoons. These tools, which do not require much technical infrastructure in the computer environment, can be used for educational purposes and have a user-friendly interface (Arıcı, 2023). Content prepared with these tools, which help to easily create concept cartoons online without drawing skills, can be easily turned into a material and shared (Lornsen, 2010; Gürsoy and Göksun, 2019).Science teacher candidates will be able to prepare concept cartoons of their choice whenever needed, using web 2.0 tools. This will contribute to the development of their professional competence and self-confidence (Timur et al., 2021).

In this study, the process of developing computer-aided concept cartoons using web 2.0 tools is explained. The purpose of the study is to share the computer-aided concept cartoon development process given to science teacher candidates within the scope of Tübitak 2237 training and to evaluate the products that emerged as the results of the training program.

Method

In this study, the concept cartoon development process of science teacher candidates is presented in detail. Additionally, the data collection tool and data analysis process used to evaluate the products resulting from the training are explained.

Process

The "Computer-aided concept cartoon development course for science teacher candidates", which was offered within the scope of the research and supported within the scope of Tübitak 2237 activities, was held online. During the event, which lasted a total of three days, a total of 24 hours of training was provided, eight hours each day. Operation of the training program is shown in Figure 1.

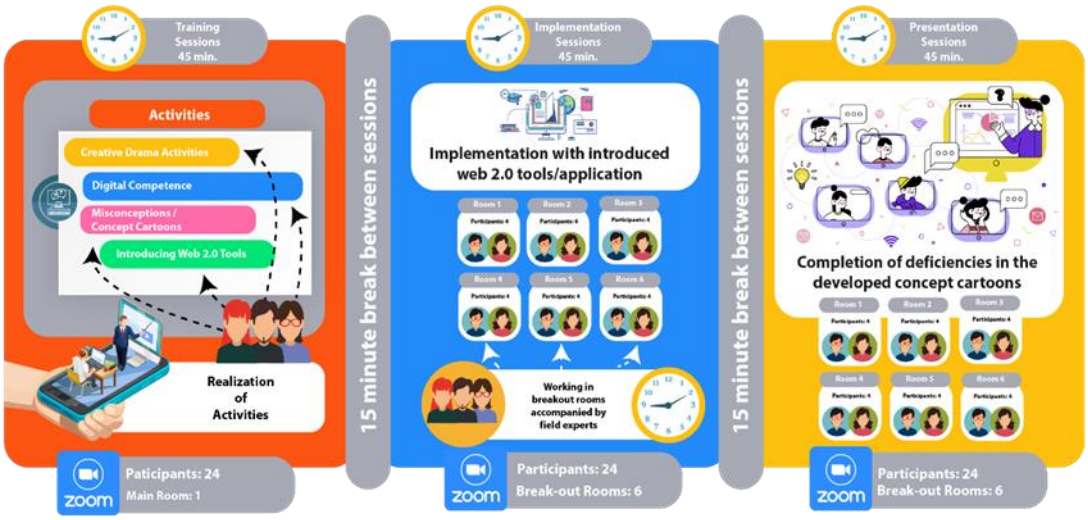


Figure 1. Operation of the training program

As seen in Figure 1, the training was carried out online via a videoconference application. Education was carried out in a single room for group events where all participants were in the same environment, and in lower rooms for events to be held in groups. The planned activity consists of 4 basic stages. The aim of the first stage was to create a theoretical infrastructure on information technologies basic competencies, misconceptions in science education and concept cartoons. In the second stage, web 2.0 tools for assessment purposes determined within the scope of the project will be introduced by CEIT field experts in the environment where all participants are present simultaneously. At this stage, CEIT field experts will provide

introductions to the relevant tools through interfaces, purpose of use and sample applications. In the third stage, using web 2.0 tools introduced by CEIT field experts, participants will be asked to develop content that can be used in assessment specific to their fields. At this stage, participants will be sent to four sub-rooms on the Zoom platform. Each subroom will include two science education experts and two CEIT field experts. In this process, a total of 4 experts working in 4 sub-rooms will carry out the process. In the fourth and final stage, the contents produced will be evaluated by relevant field experts and the contents will be improved by providing feedback to the participants.On the first day of the event, after the opening ceremony and project introduction, the teacher candidates were introduced to the program accompanied by creative drama. Then, prospective teachers were instructed about digital competence and finally, sessions were held on concepts, misconceptions and concept cartoons in science. At the end of the first day, the participants were divided into groups and each group was given misconceptions to work on by experts in the field.On the second day of the event, StoryboardThat and Pixton, web 2.0 tools used to create two-dimensional concept cartoons, were introduced, respectively. First, the StoryboardThat tool was introduced by CEIT field expert. After the interface, elements, and product creation features were explained, the participants were sent to the previously determined sub-rooms with their groups. Each sub-room can be considered as independent virtual workspaces. In these subrooms, groups developed concept cartoons using StoryboardThat on the identified misconceptions. During this process, the participants were accompanied by both IT field experts and science field experts. Afterwards, the same process was completed for the Padlet tool. At the end of the day, a free time activity was created for the participants to complete their work, and the completed concept cartoons were shared with the whole group at the end of the day and evaluated by field experts. On the third day of the event, Cartoon Animator software, which can be used to prepare concept cartoons based on animation, was introduced to the participants, followed by sound editing software for voice-over. The process of developing concept cartoons took longer with this software, which is more complex than Web 2.0 tools. Participants working in the sub-rooms completed their concept cartoons during free time activities and the products were shared with the whole group. As on the second day, the developed products were evaluated by field experts. At the end of the training, each group developed concept cartoons with StoryboardThat, Pixton and Cartoon Animator. A total of eighteen concept cartoons were created.

Participants

In this study, where six Computer and Instructional Technologies (CEIT) field experts and five Science (FB) field experts participated as instructors, 24 volunteer teacher candidates received training. The university where the participants studied is given in Table 1.

Table 1. Universities where the participants studied

Universities	Participant (f)
Akdeniz University	4
Aksaray University	1
Amasya University	1
Dokuz Eylül University	1
Ege University	1
Gazi University	4
Giresun University	3
Kahramam Maraş Sütçü İmam University	1
Mersin University	1
Middle East Technical University	1
Muş Alparslan Akdeniz University	1
Recep Tayyip Erdoğan University	3
Trabzon University	1

The teacher candidates participating in the study were enrolled in the Science Education programs of 13 different universities. The characteristics of the participants are given in Table 2.

Table 2. Characteristics of the participants

Gender	**Female**	**Male**	
	19	5	
Year	Second	Third	Fourth
	5	10	9

As seen in Table 2, nineteen of the participants are women and five are men. It is seen that the participants who participated in the Online Training were mostly third (n = 10) and fourth (n = 9) year teacher candidates.

Data collection tools

The Concept Cartoon Evaluation Form developed by Atasoy et al. (2022) was used in the study. This tool, prepared as a graded form, includes five dimensions (Presentation of the problem,

Language use, Attractiveness, Layout, and Visual Design). Any size; It is rated as 3 (adequate), 2 (partially adequate) and 1 (inadequate). Problem presentation dimension and indicators included in the data collection tool are presented in Table 3.

Table 3. Example of concept cartoon evaluation form dimensions and indicators

Dimension	Adequate: 3 points	Partially Adequate Level: 2 points	Inadequate	Explanation
Presentation of the Problem	The problem situation is clearly understood from the conversations in the concept cartoon. All dialogues are related to the problem situation.	The problem situation in the concept cartoon is partially understood from the conversations. But not all dialogues are related to the problem situation. ( )	The problem situation in the concept cartoon is not understood from the mutual conversations. Dialogues are not related to the problem situation. ( )	

Data Analysis

Eighteen cartoons created at the end of the training were evaluated by 4 Science and 3 other field experts through the Concept Cartoon Evaluation Form. The evaluator is coded as FEx, and the field experts are coded as BTx. Table 3 shows FE2's evaluation of the cartoon made by Group 1 with the Pixton tool.

Table 4. Sample evaluation

Dimensions	Presentation of the Problem	Language Use	Attractiveness	Layout	Visual Design	Average
FE2'nin puanları (Pİxton)	*2*	*2*	*3*	*2*	*2*	*2,2*

As seen in Table 4, each cartoon was scored by field experts on the five dimensions included in the form. If the relevant dimension is adequate, 3 (three) points are given, if it is partially adequate, 2 (two) points are given, and if it is inadequate, 1 (one) score is given. At the end of the evaluations in all dimensions, the average score of that cartoon was calculated. In this regard, cartoons with scores in the range of 1.0-1.6 were considered inadequate, cartoons with scores in the range of 1.7-2.3 were considered partially adequate, and cartoons with scores in the range of 2.4-3.0 were considered adequate.

Findings and Discussion

The evaluation findings regarding the 18 concept cartoons that emerged at the end of the online Tübitak 2237 training are presented in Table 5.

Table 5. Average scores of the concept cartoons

Web.2.0 tool/ applicaiton	Groups	FB1	FB2	FB3	FB4	BT1	BT2	BT3	Average
Pixton	1.Group	2,2	2,2	2,0	1,6	2,6	2,2	2,6	**2,2**
	2.Group	2,6	2,0	1,8	1,8	2,4	2,4	2,8	**2,3**
	3.Group	2,4	1,8	1,8	1,8	2,8	2,2	2,6	**2,2**
	4.Group	2,0	2,0	2,4	2,4	3,0	2,2	3,0	**2,4**
	5.Group	2,4	2,2	2,4	2,2	2,8	2,4	3,0	**2,5**
	6.Group	2,0	2,0	2,4	2,0	2,6	2,4	3,0	**2,3**
StoryboardThat	1.Group	2,0	2,8	2,2	1,6	2,6	2,6	2,8	**2,4**
	2.Group	3,0	2,8	2,4	2,8	3,0	3,0	2,8	**2,8**
	3.Group	2,8	2,0	2,0	2,2	2,8	2,6	2,8	**2,5**
	4.Group	1,8	2,0	2,2	2,2	2,6	2,2	2,2	**2,2**
	5.Group	2,4	2,6	2,0	2,2	2,8	2,4	2,6	**2,4**
	6.Group	2,2	1,6	2,0	2,0	2,6	2,2	2,8	**2,2**
Cartoon Animator	1.Group	2,2	2,6	2,0	2,3	2,8	2,4	2,6	**2,4**
	2.Group	3,0	3,0	2,4	2,8	3,0	3,0	3,0	**2,9**
	3.Group	3,0	2,8	1,8	2,5	2,6	2,4	2,5	**2,5**
	4.Group	2,4	2,8	2,6	2,6	2,6	2,6	2,6	**2,5**
	5.Group	2,0	2,0	1,8	1,9	2,8	2,0	2,4	**2,3**
	6.Group	2,0	1,2	2,0	1,7	3,0	2,2	2,6	**2,2**

All of the prepared cartoons received adequate (n=10) or partially adequate (n=8) scores. It is noteworthy that the cartoon scores, which are partially adequate, are 2.2 or 2.3.When evaluated in terms of web 2.0 tools and application used four of the concept cartoons prepared with the Cartoon Animator application were in the “adequate” category, two in the “partially adequate” category, four of the concept cartoons prepared with the StoryboardThat tool are in the “adequate” category, two in the “partially adequate” category, and two of the concept cartoons prepared with the Pixton tool are in the “partially adequate” category.When examined in terms of the scores received, it is seen that the concept cartoons prepared with the Cartoon Animator application received the highest scores. The second group, in particular, received a full score of 3.0 from five field experts. This group is followed by the third (x=2.5), fourth (x=2.5) and first (x=2.4) groups, respectively, with sufficient scores. The screenshot of the concept cartoon prepared by the second group is presented in Figure 2.



Figure 2. Screenshot of the concept cartoon prepared with the Cartooon Animator application

In this research, it is seen that animated concept cartoons received higher scores. This may be because the participants enjoyed preparing a material containing animation more. In their study with pre-service teachers (2019), Gürsoy and Göksun stated that web 2.0 tools with animations are more liked by pre-service teachers. Tatlı et al. (2016) also found similar findings.

The fifth group (x = 2.5) received the highest score in concept cartoons prepared with the Pixton tool. This group is followed by the fourth group (x=2.4). Figure 3 shows the concept cartoon prepared by the fifth group with this tool.



Figure 3. Concept cartoon made with Pixton tool Concept cartoons made by the participants with the Pixton tool were the cartoons that received the lowest scores.

During the development of these cartoons, it was observed that the participants had difficulty in placing the characters and speech bubbles. This may have caused them to reflect the problem situation and experience negativities in the visual design. Research in the literature indicates that the process of concept cartoons developed using the Pixton tool is entertaining and motivational (Yağcı, 2019; Bay&Bademci, 2022). The second group received the highest score in the concept cartoons prepared by the participants using the StoryboardThat tool (x = 2.8). This group was followed by the third group (x=2.5), the first and fifth groups (x=2.4), respectively. The concept cartoon prepared by the second group is presented in Figure 4.

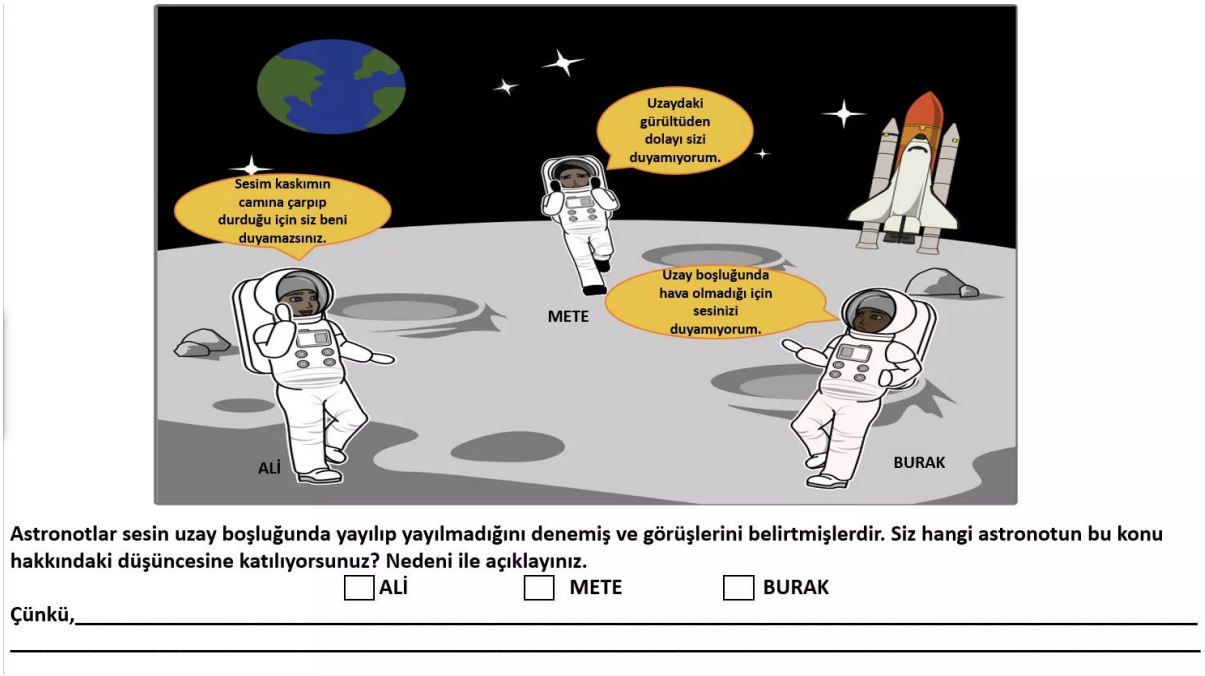


Figure 4. Concept cartoon made with StoryboardThat tool

In general, it can be considered as an important success that the concept cartoons prepared received scores in the "sufficient" and "partially sufficient" categories. Because the participants developed all the cartoons in a few hours on an online platform with group friends they had never met before. In cartoons with low scores, participants may not have been able to create the backgrounds or characters they wanted in this short time. Additionally, they may have had difficulty reflecting the problem situation presented in the concept cartoon.It is known that computer-aided concept cartoons attract students' attention and motivate them (Göksu, 2014; Yamık, 2015; Yürekli, 2020). Preparing computer-aided concept cartoons was a new experience for the participants. It is possible that teacher candidates with this experience will benefit from these materials in their professional lives.

Conclusion and Recommendations

This study was carried out within the scope of Tübitak 2237 Training. A total of 24 science teacher candidates working in the groups of four took part in the training. Trainings were given online by science field experts and other field experts. While the introduction of theoretical sections and applications in educational planning was carried out in a single virtual classroom, the concept cartoon development process took place in six sub-rooms under the guidance of field experts. Concept cartoons were made on the second and third days of the training. Using the tools introduced in this process, each group developed a concept cartoon. At the end of the training, a total of 18 concept cartoons were prepared for science achievements.These developed concept cartoons were evaluated by four science and three field experts. It was observed that the computer-aided concept cartoons developed by the participants in a short time were at an "adequate" level.The training is limited to 3 days. Concept cartoons were prepared during the training. By preparing with a longer-term training, the time for participants to develop computer-aided concept cartoons can also be increased. These concept cartoons can be evaluated. Trainings can be restructured by taking participants' opinions and suggestions regarding the process. It was observed that the prepared computer-aided concept cartoons received low scores in the problem presentation dimension. This issue can be emphasized more in theoretical presentations.It has been observed that the Cartoon Animator application has a complex structure. In the trainings animated concept cartoons can be created with another easier-to-use tool and evaluated.

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BİREYSEL VE TAKIM SPORLARINDA KUVVET ÖLÇÜM TESTLERİ

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Özet
Bu araştırmanın amacı bireysel ve takım sporlarında kuvvet ölçüm testlerini incelemektir. Bu kapsamda ulusal düzeyde son 10 yılda yapılmış çalışmalar incelenmiştir. Araştırmamız derleme bir çalışma olup, google akademik, pubmed ve web of science veri tabanlarında yayınlanmış tam metnine ulaşılabilen çalışmalar dahil edilmiştir. Bireysel spor davranışı çağdaş tarihsel bir perspektiften inceleyerek, sporda öne sürülen gelişmelerin sporla uğraşanların mikro düzeyinde ne ölçüde gözlemlenebileceğini incelemektedir. Takım sporları karmaşık spor disiplinlerine aittir ve karmaşıklıkları, hareketlerin ve durumların zorlu yapısında, antrenman ve müsabaka sırasında başarılı olabilmek için oyuncuların sahip olması gereken birçok özellikte kendini göstermektedir. Bireysel ve takım sporlarında kuvvet antrenmanının yetişkinler için güvenli ve etkili bir kondisyon yöntemi olduğu kanıtlanmıştır ve artık giderek daha fazla sayıda çocuk ve ergenin de sağlıklarını, kondisyonlarını ve spor performanslarını geliştirmek için antrenman yaptıkları görülmektedir. Kuvvet antrenmanı vücut kütlesini arttırmak, yumuşak doku yaralanma riskini azaltmak ve core stabilitesini geliştirmek amacıyla potansiyel olarak faydalıdır. Kuvvet antrenmanı, koşmaya dayalı aktivitelere göre atlama hareketlerinde daha fazla performans artışı sağlar ve bu başarılar motor göreve göre değişiklik gösterir. Uygun antrenman kuralları takip edilirse, gençlere yönelik kuvvet antrenmanı programına düzenli katılım, kemik mineral yoğunluğunu artırma, motor performans becerilerini geliştirme, spor performansını geliştirme ve genç sporcularımızı antrenman ve rekabet taleplerine daha iyi hazırlama potansiyeline sahiptir. Literatüre bakıldığında bireysel ve takım sporlarında kuvvet ölçüm testleri en fazla el pençe kuvveti, dikey sıçrama, mekik, şınav, sırt kuvveti, bacak kuvveti, durarak uzun atlama gibi ölçümler yapılarak ölçülmüştür.
Anahtar Kelimeler: Bireysel sporlar, takım sporları, kuvvet, kuvvet ölçüm yöntemleri

STRENGTH MEASUREMENT TESTS IN INDIVIDUAL AND TEAM SPORTS

Abstract
The purpose of this research is to examine strength measurement tests in individual and team sports. In this context, studies conducted at the national level in the last 10 years were examined. Our research is a compilation study, and studies with full text published in Google Scholar, Pubmed and Web of Science databases are included. By examining individual sports behavior from a contemporary historical perspective, it examines to what extent the proposed developments in sports can be observed at the micro level of those involved in sports. Team sports belong to complex sports disciplines, and their complexity is reflected in the challenging nature of movements and situations, as well as in the many characteristics that players must possess in order to be successful during training and competition. Strength training in individual and team sports has proven to be a safe and effective form of conditioning for adults, and more and more children and adolescents are now also training to improve their health, fitness and sports performance. Strength training is potentially beneficial for increasing body mass, reducing the risk of soft tissue injury, and improving core stability. Strength training provides greater performance improvements in jumping movements than in running-based activities, and these achievements vary by motor task. If proper training guidelines are followed, regular participation in a youth strength training program has the potential to increase bone mineral density, improve motor performance skills, enhance sports performance and better prepare our young athletes for the demands of training and competition. When we look at the literature, strength measurement tests in individual and team sports are mostly measured by measuring hand claw strength, vertical jump, sit-ups, push-ups, back strength, leg strength, standing long jump.
Keywords: Individual sports, team sports, strength, strength measurement methods

Giriş

Çoğu spor dalında başarı, kuvvet ve güç dahil olmak üzere fiziksel uygunluk özelliklerine büyük ölçüde bağlıdır. Antrenman programlarını tasarlarken, uygularken ve izlerken hangi mekanik değişkenlerin performansı belirlediğini tespit etmek de önemlidir. Gençleri fiziksel olarak aktif olmaya teşvik etmek önemlidir. Yaşamın erken dönemlerinde hareketsiz bir yaşam tarzının yetişkinliğe kadar uzandığı görülmekle birlikte, çocukluk ve ergenlik döneminde fiziksel olarak aktif bir yaşam tarzı, yaşamın ilerleyen dönemlerinde bazı kronik hastalıkların önlenmesine de yardımcı olabilir. Çocuk ve ergenlerin oyun, spor, iş, ulaşım, rekreasyon, beden eğitimi veya planlı egzersizin bir parçası olarak haftanın tüm günlerinde veya çoğu günlerinde fiziksel olarak aktif olmaları önerilmektedir (1, 2). Bireysel spor müsabakalarında fizyolojik izlemenin uygulanmasına büyük değer verilmektedir. Fizyolojik izleme, egzersiz dozu-yanıt, egzersiz yoğunluğu ve egzersiz performansı hakkında geri bildirim sağlar. Sporcular genellikle uygun antrenman yükünü tahmin etmek, aşırı antrenmanı taramak ve antrenörlerin antrenmanı sporun fizyolojik talepleriyle eşleştirmesini sağlamak için çeşitli fizyolojik ve performans izleme yöntemleri kullanılarak değerlendirilir (3-5). Yaş, ırk, cinsiyet ve kondisyon düzeyindeki benzerliklere rağmen, bireyler aynı antrenman veya müsabakaya farklı tepkiler verebilir. Bu nedenle, antrenman ve müsabakaların bireysel olarak izlenmesi çok önemlidir (6). Takım sporları karmaşık spor disiplinleri arasında yer alır ve karmaşıklığı, hareketlerin ve durumların zorlu doğasına ve oyuncuların antrenman ve müsabaka sırasında başarılı olmak için sahip olması gereken birçok özelliğe yansır. Dahası, tüm bu özellikler oyuncuların rekabetçi verimliliklerinden sorumlu olan bütünsel hazırlıklarının bir parçası olmalıdır. Takımın sahada daha etkili olabilmesi ve olumlu sportif sonuçlar elde edebilmesi için takımdaki tüm bireylerin birbiriyle uyum içinde olması gerekir. Bu temel nedenlerden dolayı takım sporlarında spora hazırlık sistemi son derece karmaşık ve zahmetlidir (7). Literatürü değerlendirdiğimizde birçok bilim insanının kuvvet kavramını aynı anlama gelen farklı ifadelerle tanımladığı görülmektedir. Fizyolojik yaklaşım açısından kuvvet, kas kasılması sırasında meydana gelen gerilimi ifade etmektedir. Kuvvet kavramı fizikte cisimlerin konumunu, hareketini ve şeklini değiştiren etki olarak tanımlanırken, biyomekanikte hareket ve dengeyi sağlayan etkiler olarak tanımlanmaktadır (8, 9).

2. Materyal Yöntem

Derleme çalışmamızda; Google akademik veri tabanından 2014-2024 yılları arasında yapılan çalışmalar, el pençe kuvveti, bacak kuvveti testi, mekik, şınav, dikey sıçrama, durarak uzun atlama, sırt kuvveti, relatif kol kuvveti, relatif bacak kuvveti, takım sporları, bireysel sporlar,

spor, fizyolojik ve motorik özellikler anahtar kelimeleri ile ulaşılan ulusal çalışmalar incelenerek gerçekleştirilmiştir.

3. Bireysel ve Takım Sporlarında Kuvvet Ölçüm Yöntemleri

Literatür incelendiğinde, el pençe kuvveti, dikey sıçrama, mekik, şınav, sırt kuvveti, bacak kuvveti, durarak uzun atlama, 1RM metodu, sırt kuvveti, relatif kuvvet gibi birçok testin sıklıkla kullanıldığı görülmektedir.

3.1. Kuvvet Ölçüm Yöntemlerinde Sık Kullanılan Yöntemler

3.1.1. El Pençe Kuvveti

El kavrama kuvveti olarakta bilinen el pençe kuvveti hem ayakta hem de oturarak yapılabilen bir testtir. El dinomametresi kullanılarak yapılan bu ölçüm de dinamometre deneğin el ölçüsüne göre ayarlanır. Deneğin kolu düz ve omuzdan 10-15 derecelik bir açı yaparak yan tarafta öncelikle sağ elden maksimum pençe kuvveti ölçümü yapılır. Test, çalışma grubunda dönüşümlü olarak her iki el ile 4 tekrar yapılacak şekilde tekrarlanır. Her denemeden sonra ibre sıfırlanır. Deneme sonuçları kaydedilir ve en iyi dereceleri karşılaştırma yapmak için sonuçlar kısmına dahil edilir (10-26).

3.1.2. Dikey Sıçrama Testi

Dikey sıçrama testleri kalça, diz ve kalça ekstansör kaslarının gücünü veya patlayıcı kuvvetini ölçmek için kullanılır. Seçilen düz bir duvar üzerinde santimetre cinsinden bir işaretleme yapılır. Ayaklar omuz genişliğinde açılır ve gövde işaretli duvara yan olacak şekilde durarak uzanabildikleri mesafe işaretlenir. Ardından deneğe aynı pozisyonda üç deneme hakkı verilerek bunların en iyisi değerlendirmeye alınır. Deneğin ayakta uzanabildiği mesafe ile zıplayıp dokunduğu mesafe arası metre cinsinden belirlenir (11-13, 15, 27-35).

3.1.3. Mekik Hareketi Testi (Curl Up)

Karın kaslarının kuvvet gelişimini sağlamak için abdominal bölgede bulunan kasları çalıştıran en iyi egzersiz şekli mekik hareketidir. Bu hareket sırt üstü yatar pozisyonda gerçekleştirilir. Mindere uzanan sporcu ellerini arkada birleştirir ve dizleri bükülü ayağını yerden kaldırmadan egzersize başlar. Karın fleksiyonu yaparken dirsekleri dizlere kadar gelir ve tekrar sırt üstü uzanır. Egzersiz sırasında ayakların yerle temasının kesilmesi hata olarak değerlendirilir. Kontrol amaçlı egzersizin üç defa yapılmasına izin verilir. Sporcuların tükenme noktasına ulaşana kadar yapabildikleri mekik sayısı kaydedilir (11, 12, 14, 27, 36-41).

3.1.4. Şınav Testi

Bu testin amacı sporcuların üst ekstremite kas grubunun dayanıklılığını belirlemektir. Düz bir yüzeye bir mat yerleştirilir. Eller omuz genişliğinde açık ve gergin olacak şekilde matın üzerine

yüz üstü uzanılır. Dirsekler 90 derece açıda olacak şekilde vücut yere yaklaştırılır. Kollar gergin bir şekilde başlangıç pozisyonuna geri dönülür. Şınav hareketine dinlenmeden devam edilir ve 1 dk da kaç tekrar yapıldığı kaydedilir (11, 24, 27, 36, 41, 42).

3.1.5. Bacak Kuvveti Testi

Bu testin amacı sporcularda elastik bacak kuvvetinin gelişimini takip etmektir. Bir çizgi üzerinde 2 koni ile 25 metrelik bir alan belirlenir. Sporcu başlama çizgisinin 10-15 m gerisinde başlar. Uyarı sesiyle birlikte sporcu koşmaya başlar, sporcu ilk koniden dominant bacağı üzerinde sıçrayarak başlar. İki koni arasındaki sıçramada geçen süre kaydedilir. Bu test daha sonra diğer bacak ile tekrar edilir. Sonuçlar önceki testlerin sonuçları ile karşılaştırılarak analiz edilir. Her iki test arasındaki uygun antrenman analizin iyileştiğini göstermesi beklenir (20, 21, 33, 43, 44).İzokinetik Kuvvet: İzokinetik kuvvetin belirlenmesinde, dinamometre, deneğin ayak uzunluğuna göre ayarlanır, ardından denekler dizleri bükülü, kolları gergin, sırtı düz ve gövdesi hafifçe öne eğik olarak ayaklarını dinamometre sehpasına yerleştirir ve elleriyle kavradıkları dinamometre çubuğunu bacaklarını kullanarak maksimum hızda dikey olarak yukarı çekerler. Denekler tarafından iki deneme sonucunda elde edilen en iyi sonuç en yüksek değer olarak kabul edilir (12, 14, 15, 17, 20, 21, 30, 31, 33, 40, 44-47).

3.1.6. Durarak Uzun Atlama

Bu testin amacı, atletlerin elastik bacak kuvvetinin gelişimini göstermektedir. Herhangi bir ekipman gerektirmeyen basit ve zaman kazandıran bir uygulama olması nedeniyle birçok spor dalının antrenörleri tarafından yetenek seçimi ve potansiyel tahmini için rutin olarak kullanılmaktadır. Bu testte sporcu sporcu yere çizilen bir çizginin arkasında hazır pozisyonda durur. Bacaklarının omuz genişliğinde açık olması istenir. Kollarının yardımı ile sallanarak sıçramayı gerçekleştirir. Yere yapıştırılan metre ile sporcunun ilk düştüğü yer topuk kısmından ölçülmek şartıyla ölçüm alınır (29, 30, 35-39, 48).

3.2. Kuvvet Ölçüm Yöntemlerinde Az Kullanılan Yöntemler

3.2.1. 1RM (1 Maksimal Tekrar)

Dinamik yöntemle kas gücünü ölçmek için 1-maksimum tekrar yöntemi kullanılır. Tek tekrarlı maksimum (1RM) testi, laboratuvar dışı durumlarda kas kuvvetinin değerlendirilmesinde altın standart olarak kabul edilir. Bu yöntem ağırlık kaldırma egzersiz sırasında, bir seferde kaldırılan maksimum ağırlık performansıdır. Herhangi bir kas grubunda (ön el fleksörü, ayak ekstansörleri ya da omuz gibi) deneğin maksimum kaldırma kapasitesine yakın, ancak altında olan uygun bir başlangıç ağırlığı seçilerek yapılır. İlk tekrar yapıldıktan sonra maksimum kaldırma kuvvetine erişene kadar ağırlık eklenir. Ağırlık artırılması genellikle 5.2 ve 1 kg'dır.

1 RM tekniği genellikle barbell ya da dambıl kullanılarak gerçekleştirilir (14, 15, 34, 40, 49-51).

3.2.2. Sırt Kuvveti

Sırt kuvveti bir sırt dinamometresi kullanılarak gerçekleştirilir. Sporcular dizleri gergin olacak şekilde ayaklarını dinamometre sehpasına yerleştirir. Kollar gergin, sırt düz ve gövde hafifçe öne eğikken, elleri ile kavradıkları dinamometre çubuğunu dikey olarak yukarı doğru maksimum ölçüde çekerler. Çekme işlemi üç kez tekrarlanır ve en iyi sonuç kaydedilir (15, 30, 44, 52).

3.2.3. Relatif Kuvvet

"Relatif kuvvet" terimi, bir kişinin vücut ağırlığına göre kuvvetinin ölçüldüğü bir kavramı ifade eder. Bu terim, bir sporcu veya bireyin, vücut ağırlığına göre ne kadar kuvvetli olduğunu belirlemek için kullanılır. Örneğin, bir kişinin kendi vücut ağırlığını kaldırma yeteneği, relatif kuvvetinin bir ölçüsü olabilir. Bu, sporcunun veya bireyin vücut kütlesi göz önüne alındığında ne kadar güçlü olduğunu gösterir (22, 53).

3.3. Son Yıllarda Kullanılmaya Başlayan Yeni Yöntemler

3.3.1. Relatif Kol Kuvvetinin Belirlenmesi

Kol (üst kol, alt kol ve el) ölçülür. Kol kütle hesaplama programında kol kütle toplamı hesaplanır. El pençe kuvveti ölçülür. El pençe kuvveti (kg) hesaplanan kolun toplam kütlesine (kg) bölünerek kolun relatif kuvveti tespit edilir (23).

3.3.2. Relatif Bacak Kuvvetinin Belirlenmesi

Bacak hacim ve kütlesi uyluk, baldır ve ayaktan ölçümler alınarak yapılır. Uyluk hacim belirlemesinde inguinal nokta ile tibial nokta arası ölçülür. Deneğin baldır hacmi için, tibial nokta ile medial malleolus noktası arasındaki mesafe belirlenir. Bu mesafeler %10 aralıklarla belirlendikten sonra önce %10 aralıklarla alınan parçaların hacimleri daha sonra tüm parçaların hacimleri Frustum işaret modeli yöntemine göre mesura ile ölçülerek kaydedilir (54).

4. Sonuç

Literatür incelendiğinde, el pençe kuvveti, dikey sıçrama, mekik, şınav, sırt kuvveti, bacak kuvveti, durarak uzun atlama, 1RM metodu, sırt kuvveti, relatif kuvvet gibi birçok testin sıklıkla kullanıldığı görülmektedir. Yapılan araştırmalar sonucunda literatüre yeni eklenen ölçüm yöntemleri olan relatif kol kuvveti ölçümü, relatif bacak kuvveti ölçümü gibi yöntemlerin son yıllarda kullanılmaya başlandığı görülmüştür.

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SPORCULARIN AEROBİK KAPASİTELERİNİN BELİRLENMESİNDE SIK KULLANILAN YÖNTEMLER

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Özet
Bu araştırmanın amacı sporcuların aerobik kapasitelerinin belirlenmesinde sık kullanılan yöntemlerinin incelenmesidir. Bu kapsamda son on yılda yapılmış ulusal ve uluslararası çalışmalar incelenmiştir. Araştırmamız derleme bir çalışma olup Google Akademik veri tabanında yayınlanmış tam metnine ulaşılabilen çalışmalar dahil edilmiştir. Maksimal oksijen tüketimi (MaxVO2), vücut ağırlığının kilogramı başına dakikada tükettiği maksimum oksijen miktarını ifade eder. Maksimum oksijen tüketimi kardiyorespiratuar gelişimin bir kriteri olan maksimal aerobik kapasitenin tayini için kullanılan en güvenilir testtir. Kişinin birim zamanda kullanabildiği oksijen miktarı ne kadar fazla ise kişinin aerobik kapasitesi de o oranda yüksek demektir. Aerobik güç dayanıklılık sporlarında performansa etkili en önemli faktördür. Maksimum oksijen tüketimi aerobik kapasitenin en iyi, kolay uygulanabilir ve güvenilir bir göstergesidir. Aerobik kapasite sadece antrenman için değil, toparlanmayı kolaylaştırmak ve hızlandırmak için de önem taşır. MaxVO2, hala kardiyovasküler direnç azalmasını ölçen en önemli test olarak kabul edilmektedir. MaxVO2, aerobik kapasite ölçümü için altın standart olarak kabul edilmektedir. Literatür incelendiğinde aerobik kapasitenin belirlenmesinde direkt ve indirekt olmak üzere birçok yöntem kullanılmaktadır. Aerobik kapasitenin direkt ölçülmesi oldukça güvenilir sonuçlar verir fakat pahalı, ulaşımı kolay olmayan ekipmanların kullanımı ve bu yöntemlerin tecrübeli kişilerce uygulanması gerektiğinden uygulanması sınırlı yöntemlerdir. Bu nedenle indirekt yöntemler olan; bisiklet testleri, koşu bandı testleri, basamak testleri ve saha testleri daha sık kullanılmaktadır. Bu indirekt yöntemler kendi içerisinde incelendiğinde ise Astrand Ryhming Bisiklet Testi, Bruce Protokolü, Balke Testi, Cooper Testi, 20m. Mekik Testi, Yo-Yo Testi gibi testlerin sık kullanıldığı göze çarpmaktadır. Ayrıca sporcuların aerobik kapasitelerinin belirlenmesinde saha testlerinin, bisiklet testleri, koşu bandı testleri ve basamak testlerine göre daha sık kullanıldığı tespit edilmiştir.
Anahtar Kelimeler: Dayanıklılık, Aerobik Kapasite, MaksVO2, Aerobik Kapasite Ölçüm Testleri

FREQUENTLY USED METHODS IN DETERMINING THE AEROBIC CAPACITIES OF ATHLETES

Abstract
The aim of this study was to examine the commonly used methods in determining the aerobic capacity of athletes. In this context, national and international studies conducted in the last decade were analyzed. Our research is a review study and the studies published in the Google Scholar database, the full text of which can be accessed, were included. Maximal oxygen consumption (MaxVO2) refers to the maximum amount of oxygen consumed per minute per kilogram of body weight. Maximal oxygen consumption is the most reliable test used to determine maximal aerobic capacity, a criterion of cardiorespiratory development. The more oxygen a person can use per unit time, the higher the aerobic capacity of the person. Aerobic power is the most important factor affecting performance in endurance sports. Maximum oxygen consumption is the best, easily applicable and reliable indicator of aerobic capacity. Aerobic capacity is important not only for training but also for facilitating and accelerating recovery. MaxVO2 is still recognized as the most important test to measure cardiovascular resistance reduction. MaxVO2 is considered the gold standard for measuring aerobic capacity. In the literature, many direct and indirect methods are used to determine aerobic capacity. Direct measurement of aerobic capacity gives very reliable results, but they are limited methods because they require the use of expensive, inaccessible equipment and these methods should be applied by experienced people. For this reason, indirect methods such as bicycle tests, treadmill tests, step tests and field tests are used more frequently. When these indirect methods are examined within themselves, Astrand Ryhming Bicycle Test, Bruce Protocol, Balke Test, Cooper Test, 20m. Shuttle Test, Yo-yo Test are used frequently. In addition, it was detected more frequently in the field than in field tests, bicycle tests, treadmill tests and step tests in determining the aerobic capacities of athletes.
Keywords: Endurance, Aerobic Capacity, MaxVO2, Aerobic Capacity Measurement Tests

Giriş

Kuvvet, dayanıklılık, sürat, hareketlilik ve beceri gibi kavramlar insan yaşamını işlevsel hale getiren temel motorik özelliklerdir (1). Kişinin özellikle yoğun tempolu sportif faaliyetlere uzun süre karşı koyabilme yeteneği ve bu faaliyetlerde yorgunluğa karşı gösterdiği direnç dayanıklılık olarak adlandırılmaktadır (2). Dayanıklılığın en önemli fizyolojik ölçütü Maksimal Oksijen Tüketimi (MaxVO2) yani aerobik kapasitedir. Maksimal oksijen tüketimi (MaxVO2), vücut ağırlığının kilogramı başına dakikada tükettiği maksimum oksijen miktarını ifade eder. Maksimum oksijen tüketimi kardiyorespiratuar gelişimin bir kriteri olan maksimal aerobik kapasitenin tayini için kullanılan en güvenilir testtir. Kişinin birim zamanda kullanabildiği oksijen miktarı ne kadar fazla ise kişinin aerobik kapasitesi de o oranda yüksek demektir. Aerobik kapasite, dayanıklılık sporlarında bireyin performansına etki eden en önemli faktördür. Maksimum oksijen tüketimi aerobik kapasitenin en iyi, kolay uygulanabilir ve güvenilir bir göstergesidir. Aerobik kapasite sadece antrenman için değil aynı zamanda toparlanmayı kolaylaştırmak ve hızlandırmak için de önem taşır. $MaxVO_2$, hala kardiyovasküler direnç azalmasını ölçen en önemli test olarak kabul edilmektedir. MaxVO2, aerobik kapasite ölçümü için altın standart olarak kabul edilmektedir (44). Aerobik kapasite, egzersiz test protokolüne bağlı kalarak gerçekleştirilen birtakım egzersizler ile kişinin oksijen tüketiminin en yüksek değeri olarak tanımlanabilmektedir. Bu egzersiz testleri kademeli bir şekilde artırılarak uygulanmaktadır. Egzersiz testleri sırasında yapılan kademeli yükleme, kişi adına maksimum noktaya ulaştığında kişinin aerobik kapasitesi (MaxVO2) değeri elde edilmektedir (4). $MaxVO_2$ değerinin yüksek olması kişinin iş yapabilme kapasitesinin daha fazla olması ya da yapılan egzersizin uzun soluklu ve yorgunluk hissiyatına daha geç ulaşması anlamına gelir (3). Aerobik kapasitenin belirlenmesinde direkt ve indirekt olmak üzere maksimal veya submaksimal yöntemler kullanılarak tespit edilebilir. Aerobik kapasitenin direkt ölçülmesi oldukça güvenilir sonuçlar verir fakat pahalı, ulaşımı kolay olmayan ekipmanların kullanımı ve bu yöntemlerin tecrübeli kişilerce uygulanması gerektiğinden kesin sonuçlar vermese de indirekt yöntemlerin kullanıldığını daha sık görürüz (8). Aerobik kapasitenin belirlenmesinde kullanılan egzersiz şiddeti kademeli olarak artarken ortaya çıkan sonuçlara göre kişinin oksijen kullanım eğilimi lineer bir grafik çizmektedir. Oksijen kullanımındaki bu lineer artış belirli bir noktadan sonra stady state olarak adlandırılan ve oksijen seviyesinin sabit noktada devam ettiği bölgeye ulaşmaktadır. Bu nokta maksimum oksijen tüketiminin gerçekleştiği değerdir ve iş yükü artmaya devam ederken oksijen kullanımı sabit bir şekilde devam etmektedir (7). Elit sporcularda MaxVO2 değerinin, 70-85 ml/kg/dk olduğu ifade edilmektedir. Bu MaxVO2

değerinin kadın sporcularda yaklaşık %10 daha az olduğu belirtilmektedir. Bunun nedeni ise kadınların vücut yağ yüzdelerinin erkeklere göre daha yüksek olması ve kadınların hemoglobin yoğunluklarının yine erkeklere göre daha düşük düzeylerde olmasından kaynaklandığı ifade edilmektedir (5). Genellikle yüksek düzeydeki MaxVO2 değeri yaş, maksimum kalp hacmi, solunum sisteminin katkısı, oksijeni taşıma kapasitesi ve iskelet kası ile ilişkilidir (6).

2. Materyal ve Yöntem

Çalışmamız derleme bir çalışmadır. Bu çalışma; Google akademik veri tabanından (dayanıklılık, aerobik, aerobik kapasite, VO2max, Aerobik kapasite ölçüm testleri) anahtar kelimeler kullanılarak son on yıl içerisinde yayınlanmış ulusal ve uluslararası çalışmalar incelenerek yapılmıştır.

3. Aerobik Kapasitenin Belirlenme Yöntemleri

MaxVO2, Egzersiz Test Protokolleri kapsamında kademeleri yoğunluk artışları ile gerçekleştirilen direkt ve indirekt yöntemlerle ölçülmektedir. (4).

3.1. Direkt Yöntem

Laboratuvar şartlarında maksimal yüklenme sırasında ekspirasyondaki O_2 ve CO_2 miktarının gaz analizörleriyle tespit edildiği yöntemdir. Douglas torbaları ve Breath by Breath yöntemleri direkt yöntemlere örnek olarak gösterilebilmektedir (9). MaxVO2'nin direkt ölçüm yöntemi son derece geçerli ve güvenilir bir yöntemdir fakat pahalı, ulaşımı kolay olmayan ekipmanların kullanımı ve bu yöntemlerin tecrübeli kişilerce uygulanması gerektiğinden kullanımı sınırlıdır (8).

3.1.1.Breath by Breath

Her nefes alışverişteki gaz miktarının ölçümüdür. Ölçümlerde tüm gazların yoğunluğunu belirlemek amacıyla kullanılan kütle spektrometreler ve gazların ayrı ayrı belirlenmesini sağlayan analizörlerin bulunduğu sistemler olarak iki farklı sistem kullanılmaktadır. Maksimum egzersiz testi esnasında açık devre spirometri kullanımı, anaerobik eşiğin belirlenmesinde daha doğru sonuçlar elde edilmesini sağlamaktadır MaxVO2 ve VO2 zirve değerinin direkt ölçümünü sağlar.

3.1.2.Douglas Torbaları

Ekspirasyondaki solunum gazlarının belirli süre torbada toplanmasıyla ölçüm yapılır. Ölçümdeki hata payının yüksek olması nedeniyle günümüzde pek kullanılmamaktadır (19).

3.2. İndirekt Yöntem

İndirekt yöntemlerde ekspirasyondaki O_2 ve CO_2 miktarının gaz analizörleriyle belirlenmesi yerine kalp atım hızı kullanılmaktadır. Kalp atım hızı ile oksijen tüketimi arasında doğrusal bir

ilişki vardır ilkesinden yola çıkılarak maksimal veya submaksimal egzersiz protokolleriyle aerobik kapasite tahmin edilebilir (42). Aerobik Kapasite Ölçüm Testleri incelendiğinde bisiklet ergometresi testleri, koşu bandı testleri, saha ve basamak testleri olarak gruplandırıldığını görmekteyiz (Tablo 1) (43,11). Bu testlerin içinden de en sık kullanılan testler aşağıda açıklanmıştır.

Tablo 3. Aerobik Kapasite Ölçüm Testleri

Bisiklet Ergometresi Testleri	Koşu Bandı Testleri	Saha Testleri	Basamak Testleri
Astrand Rhyming Bisiklet Testi	Bruce Yöntemi	20m Mekik Testi	Hardvard Basamak Testi
Ex-10 Test	Balke Protokolü	Yo-Yo Test	Queens Kolej Basamak Testi
Fox Denklemi	Bonen Koşu Bandı Testi	Cooper Test	Astrand Basamak Testi
3 Basamak Test	Submaksimal Koşu Bandı Testi	Balke Testi	McArdle Basamak Testi
PWC170 Test		1 mil Koş/Yürü Test	
Giessen Test		Rockport Yürüyüş Testi	
YMCA			

3.2.1. Bisiklet Metotları

Bisiklet testleri, genellikle tanı testi olarak kullanılan, özellikle Avrupa'da kullanılan bir test yöntemidir. Submaksimal veya maksimal testler şeklinde uygulanması mümkündür (31).

3.2.1.1. Astrand Rhyming Bisiklet Testi

Astrand Test uygun klinik ortamlarda en yaygın olarak kullanılan submaksimal bisiklet ergometri testlerinden biridir (22, 24). Yaygın olarak kullanılan tek etaplı bu test Astrand ve Rhyming tarafından geliştirilmiştir. Astrand-Rhyming test sporcuların submaksimal performansıyla MaxVO2 değerlerinin tahmin edilmesi için geliştirilmiştir. Bu testin uygulanışında öncelikle oturma yüksekliği her bir sporcu için ayarlanır. Sporcuların ısınması için iş yükü olmaksızın pedalı 50rpm hızla çevirmesi istenir. Testin başlangıcında aktif bireyler için iş yükü 100-150 watt sedanterler için ise iş yükü 75 watt olarak belirlenmiştir. İş yükü 6 dakika boyunca devam ettirilir. Testin 5. ve 6. dakikalarının sonunda sporcuların kalp atım sayıları not edilir. Eğer 5. Ve 6. Dakikanın sonunda oluşan kalp atım sayısı farkı 5 veya daha fazla değilse ve ortalama 130-170 KAS arasında ise test sonlandırılır. Eğer kalp atım sayısı

130'un altındaysa iş yükü 50-100watt artırılarak devam edilir. Eğer 5.ve 6. Dakikalar arasındaki kalp atım sayısı farkı 5 ten fazla ise test birbirini izleyen iki dakika arasında kalp atım sayısı 5 ten az oluncaya kadar devam ettirilir. Test sonlandığında ise direnç azaltılarak venöz birikimi önlemek amacıyla pedalın 3-5 dakika çevirilmesi istenir (10). Astrand-Ryhming Test (26): VO2max = (0.00212 × W + 0.299) / (0.769 × HRmax - 48.5) × 100 Bisiklet ergometresi testleri incelendiğinde Astrand Rhyming Bisiklet Testi'nin diğerlerine göre daha sık kullanıldığı görülmektedir (45-57,33,34)

3.2.2. Koşu Bandı Metotları

3.2.2.1. Bruce Yöntemi

Koroner kalp rahatsızlığının tanısında sık kullanılan bir yöntemdir. Aynı zamanda maksimal performanstan MaxVO2'nin belirlenmesinde, diğer yöntemlerle karşılaştırıldığında geçerliliği en yüksek yöntem olarak kabul edilmektedir (58-70, 21, 33, 36). Bruce yöntemi başlangıçta düşük seviyelerde ve kişinin ısınması için zaman tanınarak uygulanmaktadır. Bu yöntemde iş yükü artışı diğer yöntemlere göre fazladır bu yüzden test çabucak tamamlanır (10).

Test, 2.7 km/s hızla ve %10 eğim ile başlamaktadır. Koşu bandı hızı ve eğimi her üç dakikada bir arttırılır. Kişi tükenene kadar teste devam eder (11).

Aktif ve sedanter erkeklerde hesaplama; (13)

MaxVO2 = 14,8- (1,379 x T) + (0,451 x T2) – (0,012 x T3)

Aktif ve sedanter kadınlarda hesaplama; (12)

MaxVO2 = 4,38 x T – 3,9

"T": Testin toplam zamanıdır (11).

3.2.2.2.Balke Protokolü

Bu test tıp ve fizyoloji laboratuvarında yapılan işin kapasitesini belirlemede veya maksimum oksijen tüketiminin belirlenmesinde yaygın bir şekilde kullanılmaktadır ve geçerliliği kabul görmektedir (71-76, 33,). Koşu bandında eğim %0, hız ise erkeklerde 5,5km hızda kadınlarda ise 4,8km hızda yürümeye başlarlar. Test boyunca hız sabit kalır. Koşu bandı ilk dakikadan sonra %2 seviyesine getirilir ve ondan sonra geçen her bir dakikada %1 artırılır. Her dakikanın son 15 saniyesinde kalp atım sayısı kontrol edilir kalp dakikada 180 atıma ulaşıncaya kadar test devam ettirilir (11).

Aktif ve sedanter erkeklerde hesaplama; (14)

MaxVO2 = 1,444 x T+14,99

R= 0,92, SEE=2,50ml/kg/dk

Aktif ve sedanter kadınlarda hesaplama; (12)

MaxVO2 = 1,38xT+5,22

R=0,94, SEE=2,20 ml/kg/dk

3.2.3. Basamak Testleri

Basamak testleri zamanın kısıtlı olduğu, laboratuvar ekipmanı olmadığı veya yoğunluğu yüksek olan egzersizlerin güvenliği olmadığı durumlarda uygulanan submaksimal testlerdir. MaxVO2'nin tahmin edilmesinde kullanılan bu testlerin uygulanması kolay, ucuz, taşınabilirdir. Aynı zamanda yaygın olarak da kullanılır (77-88, 27).

3.2.3.1.Queens College Steps Test

McArddle ve arkadaşları aerobik kapasiteyi belirlemek için 3 dakikalık adım testini geliştirdiler. Deneğe platforma nasıl inip çıkacağı gösterilir. Daha sonra denek eğer kadınsa platforma dakikada 22, eğer denek erkekse platforma 24 inme ve çıkma yapacak şekilde testi 3 dakika boyunca sürdürür. Test sonlandığında denek ayaktayken 5. ve 20. saniyeler arasında 15 saniye boyunca sayılan kalp atım sayısı ölçülüp not edilir. Not edilen değer dakika değerine çevrilir (4xKAS) (10).

Kadınlarda;

MaxVO2 = 65,81- (0,1847 x KAS)

Erkeklerde;

MaxVO2 = 111,3- (0,42 x KAS) (10).

3.2.3.2.Harvard Basamak Testi

Bu teste deneklerin maksimal performansını tahmin edebilmek için egzersizden sonraki toparlanma kalp atım sayısı kullanılmaktadır (28). Denekler belirli yükseklikteki platforma iniş ve çıkış yaparlar. Bu platformun yüksekliği erkek denekler için 50 cm kadın denekler için 40 cmdir. Denekler dakikada 30 iniş çıkış yaparlar (29). Bu iniş çıkışlar 5 dakika süreyle veya tükeninceye kadar devam eder. İniş çıkışların düzenli yapılması için metronom kullanılabilir ve 120 vuruşa ayarlanabilir. Test sırasında düzenli inip çıkmanın yapılabilmesi için dakikada 120 vuruşa ayarlanmış bir metronom kullanılabilir. Deneğin dinlenme sırasındaki kalp atım sayısı 1-1.5, 2-2.5 ve 3-3.5 dakikalar arası baz alınarak sayılır. Baz alınan süreler 30 saniyedir ve bu süreler içerisinde nabız değerleri not edilir (30).

MaxVO2 = (100 x test süresi (sn)) / 2 x (toparlanmadaki sayılan toplam kalp atımların toplamı) (11).

3.2.4. Saha Testleri

3.2.4.1. 20 metre mekik testi (Shuttle Run)

Leger ve Lambert tarafından (1982) geliştirilen bu test ortaya çıkmasından bu yana yaygın olarak kullanılmaktadır. Shuttle Run testi 20 metre uzunluğunda bir parkur içerisinde gerçekleştirilir. Kişi hızını her dakika 0,5 km/saat olacak şekilde düzenli olarak artırır. 23 bölümden oluşan bu testin uygulamasında dinlenme zamanı bulunmamaktadır. Testin uygulamasında sporcular 20 metre uzunluğundaki parkuru uçtan uca gidip gelmektedirler. Hız kontrolü ortama verilen sinyal sesi ile kontrol edilmektedir. Bu sinyal sesi 20 metrelik parkurun başında ve sonunda bulunmayı hedefler. Sporcular sinyal sesi her çalındığında 20 metrelik mesafeyi tamamlamalıdır. Eğer sporcu sinyal sesinden önce 20 metrelik koşusunu tamamlamışsa bir sonraki sinyal sesini beklemeli ve sinyalden sonra koşuya devam etmelidir. Sporcu, çalınan sinyal sesi ile 20m mesafeyi üst üste üç sefer tamamlayamazsa sporcunun testi sonlandırılır ve sporcu diskalifiye edilir. Testin sonucu, sporcunun geldiği seviye kullanılarak aşağıdaki bağıntılar yardımıyla hesaplanmaktadır. (16).MaxVo2(ml.kg-1.dk-1) = 31.025+3.238X-3.248A+0.1536AX X= koşu hızı (km.sa-1), A= yaş (yıl) (15).Saha testi olan 20 metre mekik testi “Shuttle Run” aerobik kapasitenin belirlenmesinde sıkça kullanıldığı görülmektedir (89-108).

3.2.4.2. Yo-Yo Aralıklı Toparlanma Testi IRT1

MaxVO2’nin belirlenmesinde Bangsbo tarafından geliştirilmiş en sık kullanılan saha testidir (9). Bu testin iki farklı biçimi vardır ve her ikisinin uygulanışı da shuttle run testine benzemektedir. Yoyo testi 20 metrelik (20m x 2) başlama, dönüş ve bitirme çizgilerinin bulunduğu toplamda 40 metrelik bir alanda uygulanmaktadır. Test sinyal sesiyle ve belirtilen çizgiler arasında sporcuların 10 km/s hızda koşmasıyla başlar. Koşu hızının aşamalı olarak artırıldığı bu test birbirini takip eden tekrarlı testlerden oluşur. Bu testte her bir tur yani 40 metrelik koşu tamamlandığında sporcular 2x5 metreden oluşan 10 saniyelik aktif toparlanma yaparlar. Test 10-13km/s’de 4 koşu, 13,5-14 km/s’de 7 koşu ve sonrasında her 8 turdan sonra hız 0,5 km/s artırılarak devam eder. 12 ve13 km/s’ hızla birer tur, 13.5 km/s hızla 3 tur, 14 km/s hızla 4 tur, 14.5 km/s hızla 8 tur ve ardından 0.5 km/s hız artışları ile 19.5 km/s hıza kadar sekizer tur şeklinde uygulanmaktadır. Sporcu bitkin düştüğünde veya art arda üç sinyal sesini kaçırdığında Yo-Yo testi sonlandırılır (18).Yo-Yo Aralıklı Toparlanma Testi Seviye 1:
MaxVO2 (ml/kg/dk) = IR1 mesafe (m) × 0,0084 + 36,4 şeklinde formüle edilmiştir. (18).
Saha testlerinden Yo-YoIR1 testi aerobik kapasitenin belirlenmesinde sıkça kullanıldığı görülmektedir (109-124).

3.2.4.3. Cooper Test

Cooper testi, Kenneth Cooper tarafından geliştirilen ve aerobik kapasitenin belirlenmesinde kullanılan testler arasında en yaygın kullanılan testlerden biridir. Cooper testi Amerika Birleşik Devletleri'ne bağlı askeri faaliyetlerinde, askerlerin aerobik kapasitesinin belirlemek amacıyla düzenli olarak uygulanmaktadır. Cooper testi iki farklı versiyon olarak karşımıza çıkmaktadır. Bunlardan biri 1.5 mil mesafe baz alınarak gerçekleştirilen ölçümdür. Bir diğer versiyonu ise 12 dakikalık koşudan oluşmaktadır. Testin popülaritesi ölçümün pratik ve maliyetinin düşük olmasına dayanmaktadır. Cooper'ın koşu testi 12 dakika sürmektedir. Kat edilen mesafenin belirlenmesi için bir ölçüm bandı gerekmektedir. Cooper testi ile VO2max belirlenirken;VO2maks: (Katedilen mesafe (m) -504,9) / 44,73 bağıntısı kullanılmaktadır.Aerobik kapasitenin Cooper'ın koşu testi ile arasındaki korelasyon ilişkisi r=0,9 olarak belirtilmiştir (20, 21).Saha testlerinden Cooper testinin aerobik kapasiteyi belirlemede sıkça kullanıldığı görülmektedir (125-133, 23,47).

3.2.4.4. Bir Mil Koşma/Yürüme Testi

Bir mil koşma/yürüme testi uygulanabilirliği kolay, araç, gereci ucuz ve çok sayıda çocuğun aynı anda ölçülmesine olanak sağlayan bir yöntemdir. Bu nedenle bu test birçok okulun bataryasında yer almaktadır (10).Bir mil koşma/yürüme testi çocuğa uygulanırken ilk olarak gerekli açıklamalar yapılır. Çocuktan tüm mesafe yani 1mil (1,609 km) koşması istenir. Eğer çocuk bu mesafeyi koşarak tamamlayamıyorsa yürümesi istenir. Testin sonunda koşulan süre kayıt altına alınır. Test bitirildiğinde çocukların soğuması için 3-5 dakika yavaş tempoda yürümesi unutulmamalıdır. Bu test için literatürde yer alan fitnesgram ve AAHPERD (American Alliance For Health, Physical Education, Recreation and Dance) standartları tavsiye edilmektedir (10).

3.2.5. Maksimal Kol Ergometresi

Hareket etme yeteneği olmayan ve bacaklarını egzersizde kullanamayan kişilerin MaxVO2 lerinin belirlenmesi için çok uygun bir yöntemdir. Bu ergometrede denek bacaklarını uzatarak oturtulmalı ve krankın orta noktası omuz genişliğine göre ayarlanmalıdır. Denek kollarını bu ergometrede maksimal şekilde germelidir. Başlangıç yükü 75-150 kgm ve artışta 75-150 kgm olacak şekilde bacak ergometresindeki yöntem devam ettirilir. Denek bu artışlara yetişemediğinde test sonlandırılır (10, 41).MaxVO2 = kgm/dk x 3ml/kgm + (3,5ml/kg.dk x ağırlık)

4.Sonuç

Sonuç olarak literatür incelendiğinde aerobik kapasitenin belirlenmesinde direkt ve indirekt olmak üzere birçok yöntem kullanılmaktadır. Aerobik kapasitenin direkt ölçülmesi oldukça güvenilir sonuçlar verir fakat pahalı, ulaşımı kolay olmayan ekipmanların kullanımı ve bu yöntemlerin tecrübeli kişilerce uygulanması gerektiğinden uygulanması sınırlı yöntemlerdir. Bu nedenle indirekt yöntemler olan; bisiklet testleri, koşu bandı testleri, basamak testleri ve saha testleri daha sık kullanılmaktadır. Bu indirekt yöntemler kendi içerisinde incelendiğinde ise Astrand Ryhming Bisiklet Testi, Bruce Protokolü, Balke Testi, Cooper Testi, 20 metre Mekik Testi, Yo-Yo Testi gibi testlerin sık kullanıldığı göze çarpmaktadır. Ayrıca sporcuların aerobik kapasitelerinin belirlenmesinde saha testlerinin, bisiklet testleri, koşu bandı testleri ve basamak testlerine göre daha sık kullanıldığı tespit edilmiştir.

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KURUMSAL KİMLİK TAŞIYICISI OLARAK ÜRETİLEN KİBRİT KUTUSU AMBALAJ TASARIMLARINDA 20. YÜZYIL SANAT AKIMLARININ YANSIMALARI

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ÖZET
Kurumsal kimlik tasarımı, bir markanın piyasada nasıl var olmak istediğini, nasıl algılanmak istendiğini ve hangi özelliklerini, değerlerini tanıtmak istediğini belirlemek için oluşturulan bir grafik ve görsel kimlik sistemidir. Bu görsel kimlik sistemi, markanın birliğini ve zamansal süreçteki profesyonel olarak ilerlemesini sağlar. Tüketici ve rakip markalar arasında marka algısının yapılandırılmasına katkıda bulunur. Kurumun benliğini, vizyon ve misyonunu, hedeflerini, özgün kişiliğini yansıtan bir marka kimliği ve görsel çözümlemesini oluşturmak için tasarlanır. Tıpkı her bireyin farklı benliğinin olması gibi, her markanın da kurumsal kimlik tasarımının görsel betimlemesi karakteristik olarak marka hakkında bilgi verir.Kurumsal kimlik tasarımı; logo tasarımı, ambalaj tasarımı, web sitesi tasarımı, tipografi, görsel iletişim, kurumsal dokümanlar, renk paleti unsurlarını içerebilir. Kurumsal kimliğin ana üretim kanallarının dışında birçok tanıtıcı malzemeler vardır ve bu kanallardan biri de promosyon ürünleridir. Promosyon ürünleri, markanın kurumsal kimliğinin bir taşıyıcısı olarak; markanın bilinirliğini artırma, itibar ve güven inşası, pazarlama ve tanıtım, rekabet üstünlüğünü sağlama açısından büyük bir öneme sahiptir. Promosyon ürünü olarak tasarlanan, tarihsel süreçte geçmişten günümüze kadar uygulama alanlarından biri de kibrit kutusu tasarımlarıdır. Bu araştırmanın amacı; kurumsal kimlik tasarımlarının önemli bir taşıyıcısı olarak var olan kibrit kutusu tasarımlarındaki 20. yüzyıl sanat akımlarının yansımalarını açığa çıkarmaktır. Araştırmada kibrit kutularının içinde bulunduğu dönemin popüler kültürünün hafızalara kazınan imgesel izleğinden yansımaları nasıl taşıdığı incelenecektir. Nitel araştırma yöntemlerinden betimsel tarama modelinin kullanıldığı bu çalışmada; kibrit kutusu ambalaj tasarımlarının zaman içerisindeki biçimsel ve tasarımsal gelişimi, değişimi irdelenecektir.
Anahtar Kelimeler: Grafik Tasarım, Kurumsal Kimlik Tasarımı, İllüstrasyon, Promosyon Ürünü, Kibrit Kutusu Tasarımı

MATCH BOX PACKAGING DESIGNS PRODUCED AS CORPORATE IDENTITY CARRIER REFLECTIONS OF 20TH CENTURY ART MOVEMENTS

Abstract
Corporate identity design is a graphic and visual identity system created to determine how a brand wants to exist in the market, how it wants to be perceived and what features and values it wants to promote. This visual identity system ensures the unity of the brand and its professional progress in the temporal process. It contributes to the structuring of brand perception among consumers and competing brands. It is designed to create a brand identity and visual analysis that reflects the organization's identity, vision and mission, goals and unique personality. Just as each individual has a different self, the visual description of the corporate identity design of each brand characteristically provides information about the brand. Corporate identity design can include logo design, packaging design, website design, typography, visual communication, corporate documents, color palette. There are many promotional materials outside the main production channels of corporate identity and one of these channels is promotional products. Promotional products, as a carrier of the brand's corporate identity, have a great importance in terms of increasing brand awareness, building reputation and trust, marketing and promotion, and ensuring competitive advantage. Matchbox designs are one of the application areas that have been designed as promotional products from the past to the present. The aim of this research is to reveal the reflections of 20th century art movements in matchbox designs that exist as a carrier of corporate identity designs. In the research, it will be examined how matchboxes carry reflections from the imaginary trace of the popular culture of the period in which they are located. In this study, in which the descriptive survey model, one of the qualitative research methods, is used; the formal and design development and change of matchbox packaging designs over time will be examined.
Keywords: Graphic Design, Corporate Identity Design, Illustration, Promotional Product, Matchbox Design;

GİRİŞ

Benlik kavramı, var olmanın başlıca konularından biridir. Bu kavram ile birlikte, insanların yaşam biçimlerinin şekillenmesi gibi kurumların da görsel kimliği şekillenmektedir. Bu nitelikle insanlar benliklerini kimlik algısıyla tarif edebilirler. "Değerlerin oluşumunun kaynağı nedir?", "Temsil edilen ve yansıtılan özellikler nelerdir?" gibi sorular kimlik algısının oluşumuna katkı sağlar. Kimlik algısı, kurumlarda vizyon-misyonu, değer, anlam ve hedeflerini yansıtmaktadır. Kimlik kavramı kendi içinde bireysel, kolektif ve kurumsal kimlik olmak üzere üç şekilde oluşabilir.Literatürde gelmiş geçmiş ilk ve en büyük endüstriyel tasarımcı ve kurumsal kimlik olgusunun duayeni sayılan Peter Behrens, "Tasarım, işlevsel formları dekore etmek değildir; nesnenin karakterine uygun ve yeni teknolojileri avantajlı gösteren formlar yaratmaktır" diyerek kimlik kavramının, kurumsal kimlik çerçevesinde markalar için tasarlanırken, tıpkı bireylerde gelişen benlik kavramında olduğu gibi, spesifik olarak tasarlanması gerektiğine atıfta bulunmuştur (Georgia Cheirchanteri, 2016). Behrens'in, endüstri alanında bütünleştirici düzeyde yaptığı; markanın algı standartlarını yükseltmenin ancak tasarımla sağlanabileceğine dair olan çalışmaları geçmişten günümüze, kimlik kavramının gelişmesine ve ilerlemesine ışık tutmuştur.Her marka, kendi benliğini ifade etmek ve rekabet avantajı elde etmek için özel bir kurumsal kimlik tasarımına ihtiyaç duyar. Kurumsal kimlik tasarımı, genellikle logo tasarımı, ambalaj tasarımı, web sitesi tasarımı, tipografi, renk paleti, görsel iletişim ve kurumsal dokümanlar gibi farklı öğeleri içerir. Bunlar, markanın tutarlı bir şekilde tanıtılmasını ve tüketiciye güçlü bir marka izlenimi sunmasını sağlar. Ayrıca, promosyon ürünleri gibi farklı kanallarda da markanın kimliğini taşır. Promosyon ürünleri, markanın bilinirliğini artırma, itibar oluşturma, pazarlama ve rekabet üstünlüğü sağlama amacıyla kullanılır. Kibrit kutusu tasarımları da bu promosyon ürünlerinin örneklerindendir.

Bu araştırmanın amacı, 20. yüzyıl sanat akımlarının kibrit kutusu tasarımlarına nasıl yansıdığını incelemektir. Promosyon ürünlerinden biri olan kibrit kutusu tasarımlarının; süslemeden oldukça uzakta, yalın bir görsel üslupta illüstre edilerek tasarlanmasının nedeni; işlevin güzellik kavramı ile kolektif çalışmasıdır. Kibrit kutuları, içerdikleri dönemin popüler kültürünü ve görsel unsurlarını yansıtarak tarihsel bir iz bırakır. Bu çalışma, kibrit kutusu ambalajlarının biçimsel ve tasarımsal evrimini ve dönemsel değişimlerini detaylı bir şekilde ele alarak bu yansımaları analiz edecektir.

1. KURUMSAL KİMLİK TASARIMI

"Kimlik" kelimesi, "bir 'kişi' ya da 'şey'i tanıtan tekil karakteristikler" şeklinde bütünsel olarak tanımlanmıştır. Bu çerçeveden bakılınca kimlik olgusu, diğerinden farklılaştıran özellikler ile bireyselliğe atıfta bulunur. Kurumsal kimlik için tanımlanmış evrensel bir tanım bulunmamakla birlikte literatürde kurumsal kimlik kavramının geniş ve dar yelpazede tanımları vardır. Kurumsal kimliğin temasta bulunduğu multidisipliner yapı sebebiyle tanımı ile ilgili tarihsel süreçte değişkenlik göstermiştir (Collins English Dictionary, 2002, s.482). Tüm bu süreçteki en nihai bulgu; bir markanın tanımında ifade biçimi olarak tercih edilen üslup, iletişim yöntemi olarak kurgulanan ifade öbekleridir. Kimlik olgusu, genel olarak bir bireyin benzersiz özelliklerini, karakterini ve tanımlayıcı unsurlarını ifade eder (Erikson, 1959, s.18-26). Bu kavram, bir kişinin kendini tanımlama, aidiyet duygusu, kim olduğunu anlama ve diğer insanlarla ilişkiler kurma sürecini içerir. Kimlik, sosyal, kültürel, cinsel, etnik, dini ve kişisel faktörlerin bir kombinasyonu olarak ortaya çıkabilir (Keyman, 2007, s.217-230). "*Guichaoua'ya göre (1998); "Bütün diğer toplumsal olgular gibi etnik, dini, kültürel vd. kimlikler de mevcut ve kabul gören değil, kurulan, inşa edilen olgulardır."" (Günay, 2010, s.144)* Kimlik, bireyin sahip olduğu özelliklerle şekillenir ve genellikle şu unsurları içerir: kişisel kimlik, sosyal kimlik, kültürel kimlik, cinsel kimlik ve etik kimlik. Aynı zamanda kimlik olgusunda, bireyin içsel algısıyla dış dünyadaki algılar arasında farklılıklar olabilir. Bu açıdan bakılınca kimlik, kişinin kendisini ve başkalarını anlaması, kabul etmesi ve iletişimde denge yaratması açısından önemlidir. Markanın görsel kimliğinde öncelikle kimlik olgusunun inşası kurulur; hangi duyguyu vereceği ve eylem ayağının nasıl ön planda oluşacağı gibi sorular çerçevesinde şekillenir. 19. Yüzyılın başlarında sadece logo tasarımı ile kurulmaya başlanan kimlik inşası, 1970'lerden itibaren kimlik üzerine markayı kurgulamak daha bilinçli bir şekilde ele alınmıştır (Karsak, 2008).Kurumsal kimlik, iletişim kanalında markanın benzersiz ve tanınabilir bir karaktere sahip olmasını sağlayan görsel ve sözlü unsurların bütünüdür. Bu unsurlar arasında logo, renk paleti, tipografi, dil ve iletişim tarzı, kurumsal misyon ve vizyon gibi öğeler bulunur. Kurumsal kimlik, bir şirketin hedef kitlesi ile iletişim kurmasını, güvenilir bir imaj oluşturmasını ve marka değerini artırmasını amaçlar. Bu durumda kurumsal iletişim, kurumsal dil, mesajlar, ton ve tarz gibi unsurların bir bütünüdür ve böylece kurumun hedef kitlesiyle nasıl iletişim kuracağını belirler. Alman sanatçı, mimar ve endüstriyel tasarımcı Peter Behrens; endüstri alanında, Alman Jugendstil ve Alman Ekspresyonist akımlarında önemli ve öncü bir figürdür. Behrens; 19. Yüzyılın başında, Alman sanayi devi olarak görülen AEG (Allgemeine Elektricitäts-Gesellschaft) isimli firmada genel sanat yönetmeni olarak aktif rol

aldığı periyotta, mimarlık ve tasarım dünyasında büyük izler bırakmıştır. Behrens, kurumsal kimlik tasarımı sürecinde; toplum ve sanatın birleşimi, kurumsal kimliğin bütünselliği, özgün ve tanınabilir tasarımlar gibi özellikleri prensip olarak ele almıştır. Bu sebeple, AEG markası için tasarlamak için giriştiği logo ve ürün tasarımları, markanın güçlü bir kimlik oluşturmasını sağlamıştır. (Anderson, 2002). Peter Behrens'in tasarımları ve kurumsal kimlik anlayışı, modern endüstriyel tasarım ve kurumsal kimlik oluşturma süreçlerine önemli adımlar olmuştur. Bu dönemde; Walter Gropius gibi, Behrens ile birlikte çalışan bazı genç yetenekler, Bauhaus'un öğrenci ve öğretmenleri olacak isimlerdir. En nihai sonuç olarak; Gropius'un disiplininde Behrens'in etkisi olarak, sanat ve endüstriyi birleştirme vizyonu görülmektedir. Bauhaus'un en baş prensiplerinden biri, sanatı ve zanaatı bir bütün olarak ele alıp, endüstriyel tasarımı öne çıkarmaktır (Droste,1994, s.22-34). Bu prensipler, Behrens'in öncüsü olduğu endüstriyel tasarım ekolünün etkisi altında kalmış olabilir. Bu açıdan bakılınca, Behrens ile Bauhaus disiplini arasındaki köklü bağ, tasarım tarihindeki önemli bir geçiş dönemine ve modern tasarımın evrimine ışık tutan bir etkileşim örneği olarak görülebilir.19. Yüzyılın birinci yarısının erken döneminde, kurumsal kimliği tasarlanmak üzere profesyonel süreçten geçen ilk marka, Bass Ale olmuştur. 1876'da İngiltere merkezli bir bira üreticisi olan Bass & Company, firmanın birası olan Bass Ale için dünyada tanınan bir marka oluşturma amacıyla, kırmızı üçgen şeklindeki logo ve diğer marka öğelerini kullanmaya başlamıştır (Bass&Company, 2001). Bu, marka ve ürün arasında bir bağlantı yaratmak ve tüketicilerin zihinlerinde markanın kalıcı bir imajını oluşturmak amacıyla yapılan erken bir girişimdir. Ancak, kurumsal kimliğin tam anlamıyla tasarlanması ve yönetilmesi konsepti daha sonraki yıllarda gelişmiştir. Modern anlamda kurumsal kimlik tasarımı, markanın görsel öğeleri, mesajları ve diğer unsurlarıyla bütünlüğünü sürdürme çabalarından gelmektedir. 19.Yüzyıl sonlarında, birinci sanayi devrimi ile birlikte; tüketim toplumu oluşmuş, seri üretim ve markalaşmada rekabetin artması nedeniyle kurumsal kimlik yapılaşmaya başlamıştır. Bu çağda endüstrileşme ve ticaretin artmasıyla birlikte şirketlerin rekabeti artmış, bu da kurumsal kimliğin önemini ortaya çıkarmıştır. İlk başlarda, kurumsal kimlik unsurları sadece logoları içermiş, ancak zamanla bu unsurlar da gelişmiştir. 1920'ler ve 1930'lar, marka kimliği ve tasarım alanında önemli gelişmelerin yaşandığı dönemlerdir. Bu aralıkta, şirketler alıcı ile bağ kurmak ve ürünlerini diğerlerinden ayırmak için markalaşma ve kurumsal kimlik unsurlarını kullanma eğilimine girmiştir. 1950'ler ve 1960'lar, kurumsal kimlik alanında daha fazla standardizasyon ve bilinçli strateji dönemleridir. Öyle ki bu dönemde, renk seçimi, tipografi ve logoların kullanımı daha bilinçli bir şekilde ele alınmıştır. 1970'lerde kurumsal kimlik alanında; tasarım ve tasarlamak bilincinin

gelişmesiyle birlikte, kurumsal düzeydeki bir tasarım sorunu olarak yoğunlaşmıştır (Meral, 2011). Bu var olma durumu, kurumsal kimliğin sistematik düzende stratejik bir kazanım ve rakip markalar arasında avantaj niteliğinde bir adım olarak görülmesidir. Kurumsal kimlik tasarımı markaların, itibarının artırması ile birlikte kurumsal paydaşlarının yatırım planlarını ve marka ürünlerinin tercih edilmesini önemli ölçüde etkilediği izlenilmektedir. Bununla birlikte, çalışanların kurumsal aidiyetinde kimlik olgusunun gelişmesi, vizyon ve misyonunu benimsemesi; yaratılan kimlik olgusuna daha duyarlı olmalarını sağlamış ve entegrasyonunu pratik hale getirmiştir. Geçmişten günümüze etkileri çığ gibi büyüyen markalaşma hali, marka yönetimi stratejilerinin ayrılmaz bir parçası olmuştur ve markaların başarı adımlarında önemli bir rol oynamıştır.David Aaker, kurumsal kimlik konusunda önemli katkılarda bulunan akademisyen ve yazarlardan biridir. Aaker, “Building Strong Brands” (Güçlü Markalar İnşa Etmek) adlı kitabında, marka yönetimi ve kurumsal kimlik konularına değinerek bu alanda öncü bir figür olarak kabul edilmiştir. Bu alandaki diğer önemli figürler arasında Wally Olins, Paul Rand, Saul Bass gibi isimler de bulunmaktadır. Ancak, kurumsal kimlik kavramının evrimi birçok farklı faktör ve etkenle şekillendiği için, tek bir öncü belirlemek oldukça güçtür. Bu sebeple öncü isimleri dönemsel olarak, gelişen ve genişleyen unsurlar çerçevesinde incelemekte fayda vardır. (Aaker, 1996 s.41).Kurumsal kimlik tasarımı, bir şirketin veya kurumun görsel olarak temsil edildiği ve tanındığı bir dizi grafik öğeyi içerir. Bu öğeler, kurumsal kimlik tasarımının yapısal ve biçimsel özelliklerini oluşturur. Bu sebeple kurumsal kimlik tasarımı; kurumun değerlerini, kültürünü ve kimliğini yansıtarak genel bir birlik ve tanıma sağlar. Tarihsel süreç içindeki bu olgunun gelişimi, hem kimlik algısının tam olarak oturması hem de tasarım çözümlemesi açısından çeşitlenmesi ile farklı üsluplar ve yeniliklerle evrimleşmiştir. Bu evrim, kurumsal kimlik tasarımının yapısında biçimsel değişikliklere yol açmıştır. Bu noktada, yapısal ve biçimsel özelliklerin neler olduğunu açıklığa kavuşturmadan önce; bu değişimin, araştırmanın doğru bir şekilde iletilmesi ve anlaşılabilirliğinin artması açısından önemini vurgulamak gerekmektedir.

2. KURUMSAL KİMLİK TASARIMININ YAPISAL VE BİÇİMSEL ÖZELLİKLERİ

Görsel kimlik tasarımının inşasında; kurumsal kimliğin iletişimsel, işlevsel ve etken yönlerinin belirlenmesi, paydaşlar ve alıcılar arasında algı gücünü arttırmaktadır. Bu sebeple; kurumsal kimlik tasarımının yapısal ve biçimsel özellikleri belirlenirken; markanın karakter oluşumunu, vizyon-misyonunu ve tanımlayıcı unsurlarını kapsar. Bu unsurlar sayesinde kurumsal kimlik tasarımının en temel oluşum özellikleri şekillenir. Logo, renk paleti, tipografi, illüstrasyon, fotoğraf, görsel iletişim kuralları, kurumsal belge şablonları, kurumsal iletişim stili; slogan ve

iletişim tonu, ambalaj tasarımı ile promosyon ürünleri bu unsurları oluşturur ve görsel kimliği belirler (Olins, 1989, s.464-467). Bir markanın kaliteli ve prestijli duruş sergileyebilmesi için kimlik olgusu üzerine bir görsel çözümleme oluşturması gerekmektedir. Bu görsel çözümleme de yapısal ve biçimsel özelliklerinin tespit edilip, bu üslupta inşa edilmesi ile mümkün olmaktadır. Biçimsel özellikler, kurumsal kimliği oluşturan öğelerin formunu, ergonomik biçimini kapsar. Yapısal özellikler ise antetli kağıt, kartvizit, afiş, flyer, zarf ve dosya çeşitleri, bigilendirme grafikleri, isimlikler vb. ürünleri kapsamaktadır. Bu ürünlerin yanında da promosyon ürünleri olarak belirlenen kurumsal kimliğin en belirgin taşıyıcı ürünleri vardır. Kurumsal kimlik ürünlerinin aynı üsluba ait bir şekilde mutabık kalarak tasarlanması; markanın akılda kalıcılığını ve bu sayede bilinirliliğini arttırır. Tercih edilen renk skalası, markanın karakteristik olarak oluşturulan kimlik inşasının duygu ve atmosferini yansıtarak tüketiciyle duygusal bağ kurmasını elverişli kılar. Renk paletinin tutarlı kullanımı da marka algısının güçlenmesine fayda sağlar. Bununla birlikte, markanın kimlik olgusuyla bütünleşen yazı karakterleri ve tipografi tercihleri; markanın yazılı iletişiminin bütününü oluşturur. Tasarlanan tipografik görselleştirme, markanın profesyonel ve güvenilir bir imaj sergilemesini destekler. Tipografi unsurunun güçlü ifadesi; fotoğraf ve imgelere senkronize bir şekilde, görsel kimliğin genel estetiğini belirler. Bir diğer unsurlardan biri de markanın reklam sloganı ve iletişim kanalını oluşturan iletişim tonudur. İletişim tonu; markanın kişiliği ile birlikte sesini ifade eder. Bu sebeple; bir üslubu biçimsel olarak marka ile eşleştirmek, markanın tutarlı bir duruşa sahip olmasına katkı sağlar. Bunun yanında, kurumsal kimlik oluşumu için tasarlanan promosyon ürünleri ve diğer iletişim araçları üzerinde kullanılan kurumsal belirteçler, markanın yekpare bir üslupta algılanmasına katkıda bulunur. Promosyon ürünleri: Kimliğin taşıyıcı rolünü üstlenmesi ile birlikte tüketiciyle en yaygın ve pratik şekilde etkileşim kuran grafik ürünlerdir. Promosyon ürünlerine kimlik algısını aktaran tipografi, imge, renk, fotoğraf, illüstrasyon gibi unsurlar; logo ile birlikte nokta, çizgi, renk, biçim, yön, ölçü, aralık ve doku gibi tasarım prensiplerinin çerçevesinde kurgulanır. Kurumsal kimlik tasarımının, tasarım prensiplerinin kullanım kolaylığının ve birliğinin sağlanması açısından kılavuzları oluşturulur. Oluşturulan kılavuzlarda; grafik ürünlerin kullanım kuralları ve standartları mevcuttur. Bu standartlar, materyallerin ve iletişim araçlarının bir bütünlük içinde olmasını, iletinin net ve etkili bir şekilde aktarılmasını sağlar.Başarılı bir tasarım ortaya çıkabilmesi için kurumun kimliğini yansıtan yapısal ve biçimsel özelliklerin ön planda olması gerekmektedir. Örneğin; kullanılan kırmızı renginin tonu, fontun sans veya serifli tercih edilmesi, minimal çizgilerin görsel öğelere eşlikçi olması, imgenin güçlü ifadesi ve kimlik olgusuyla şekillenen illüstratif çözümleme gibi

yapıların spesifik oluşu; tarihte birçok markanın ikonik hale gelmesine katkı sağlayan unsurlara örnektir. Bu yapısal ve biçimsel özelliklerin şekillenmesi ilk olarak Bauhaus öğretisi ile başlamıştır.1920'li yıllarda Almanya'da kurulan Bauhaus okulu, estetik olgusu ile tasarımın işlevselliğini birleştiren bir ekol ile eğitim vermiştir. Kurumsal kimliğin babası olarak anılan Behrens'in öğretilerinin etkisinde olan Bauhaus disiplini, modern kurumsal kimlik tasarımının temellerine katkıda bulunan minimalist ve fonksiyonel tasarım prensiplerini benimsemiştir (Chakraborty and Forgas, 1997, s.15-30). Kurumsal kimlik tasarımının yapısal ve biçimsel özellikleri tarihsel süreçte, birçok markanın gelişimi ve pazar lideri oluşumu nedeniyle evrilerek günümüze kadar aktarılmıştır. IBM (International Business Machines) markası, bu süreç içerisindeki önemli bir örnektir. IBM, 1950'li yıllardan beri kurumsal kimlik tasarımı alanında öncü markalardan biri olmuştur. 1956'da Paul Rand, 1956 yılında ünlü "IBM" logosunu tasarlamıştır (Rand, 1993, s.113). Bu logonun tasarım tercihi olarak, sade ve modern oluşu ile döneme damga vurmuş, dikkat çekmiştir. Minimal yapısıyla öncü olan bu logo, mavi renk kullanımı ile markanın güvenilirliliğine atıfta bulunarak profesyonelliğine vurgu yapmış ve ikonik hale gelmiştir. Geniş ürün yelpazesi ile karmaşık bir teknoloji markası olmasına tezat, yalın ve açıklayıcı bir dil ile inşa edilmiş kurumsal kimlik tasarımı onu döneminde spesifik kılmıştır.Bu kronolojik düzende aktarılan ve döneminde elde ettiği başarı ile kalıcı olan örnekler, kurumsal kimlik tasarımının zaman kavramı ile nasıl evrildiğini ve tasarımsal prensipleri nasıl benimsediğini göstermektedir. Her örnek, döneminin sosyo-kültürel ve tasarım trendlerine uygun bir şekilde, markanın kimlik inşasına göre nasıl oluştuğunu; yapısal ve biçimsel özelliklerinin belirleyici unsurlarını yansıtmaktadır. Kurumsal kimlik tasarımının; marka logosu, renk paleti, tipografi, ambalaj tasarımı gibi unsurları, promosyon ürünlerinde kimliğin taşıyıcısı olarak rol üstlenmektedir. Promosyon ürünleri; bir markanın değerlerini, kalitesini yansıtarak hedef kitlesine tutarlı ve bütünsel bir izlenim sunar. Günümüzde, dijital pazarlama ve sosyal medya gibi faktörlerin etkisiyle kurumsal kimlik tasarımı daha da önemli hale gelmiş ve bu sayede markaların sektörlerinde rekabet avantajı kazanmalarını sağlamıştır. Böylece kurumsal kimlik tasarımı sadece bir estetik tercih değil, aynı zamanda stratejik bir iletişim aracı haline gelmiştir.

3. KURUMSAL KİMLİK TAŞIYISI OLARAK PROMOSYON ÜRÜNLERİ

Kurumsal kimlik taşıyıcısı olarak tasarlanan promosyon ürünleri, bir markanın veya kurumun pazarda pozitif algısını desteklemek için kullanılan etkili bir stratejik araçtır. Promosyon ürünleri; fiziksel olarak temsil edilen, markanın kimlik olgusunu doğrudan aktaran ve bir taşıyıcı olarak genellikle logonun öne çıktığı tasarımlarla şekillenmektedir. Tanınabilirlik ve

marka imajı, müşteri sadakati ve memnuniyeti, reklam ve pazarlama etkisi, çeşitlilik ve kişiselleştirme, etkileşim ve iletişim promosyon ürünlerinin etki alanlarıdır (Mullin, 2010, s.35-43).Promosyon ürünleri, kurumun kimliğini oluşturan görsel elemanlardan; logo, renk paleti, illüstrasyon, fotoğraf, tipografi, gibi özgün unsurlarını içerdiği için markanın bilinirliğini arttıran en önemli taşıyıcılardır. Promosyon ürünlerinin aktarımı ile paydaşlar, alıcılar ve marka çalışanları aidiyet duygusu ile güçlü bir bağ kurar ve bu marka imajına olumlu şekilde yansır (Airey, 2019, s. 14-19). Ücretsiz olarak verilen veya uygun fiyatlı satılan promosyon ürünleri, alıcılar için değerli bir hediyeyi temsil eder. Bu durum, paydaşlara kıyasla memnuniyet yaratır ve marka sadakatini kazandırır. Promosyon ürünleri, taşıyıcısı olduğu marka üslubunu farklı kategorilerdeki küçük ürünler ile alıcılara sürekli bir hatırlatma sağlar. Özellikle günlük kullanımda bu ürünler, rutinlerinde markanın varlığını sürekli kılar, böylece çok etkili bir reklam ve organik kanallarla iletilen bir pazarlama aracı haline gelir. Promosyon ürünlerinin geniş bir yelpazesi vardır. Bu çeşitlilik, markanın hedef kitlesine uygun olarak seçilebilir. Ürünlerin çeşitliliği arttırılabilir ve potansiyel taşıyan alıcılara veya hedef gruplara istinaden özeleştirilmesi mümkündür. Promosyon ürünleri, marka ile potansiyel alıcılar arasında doğrudan bir etkileşim kanalıdır. Etkin bir promosyon stratejisi planlanırsa, alıcı ile marka arasında iletişim doğru bir şekilde kurulabilir, güçlendirilebilir ve böylece markanın geniş kitlelere ulaşmasını sağlanabilir.Kurumsal kimliğin taşıyıcısı olarak kullanılan promosyon ürünleri: kalem, defter, ajanda, bardak, termos anahtarlık, rozet; şapka, tişört, çorap, havlu, önlük ve kanvas çanta gibi tekstil ürünleri; usb bellek ve teknoloji ürünleri, fuar stand ürünleri ile kristal ürünler gibi geniş bir ürün yelpazesine sahiptir. Markanın sektörüne göre de spesifik olarak çeşitlilik gösterebilir (Airey, 2019, s.235-240). Markayı taşıyan etkili iletişim araçları, promosyon ürünleri, fiziksel nesneler aracılığıyla marka mesajını iletmek ve alıcı ile doğrudan etkileşim kurmak amacıyla kullanılan güçlü bir aracıdır. İyi planlanmış bir promosyon ürün stratejisi, markanın tanınabilirliğini arttırıp, hedef kitleyle güçlü bir bağ kurabilir. Bu nedenle, işletmelerin promosyon ürünlerini etkili bir şekilde kullanmaları, marka yönetimi ve pazarlama stratejilerini destekleyerek prestij sağlar ve başarıya giden yolda önemli bir adımdır. Kibrit kutusu tasarımı da promosyon ürünleri içerisinde görsel üslubu ve işlevselliği bir arada yansıtarak marka imajını güçlendirebilecek önemli bir üründür.Markanın kimliğini yansıtan bir tasarım, kibrit kutusunu sadece bir tasarım çözümü olarak değil, aynı zamanda markanın özünü yansıtan bir taşıyıcı haline getirir. Örneğin, kibrit kutusunun ambalaj tasarımında; yumuşak tonlarda bir yüzey üzerine yerleştirilmiş marka logosu, markanın öne çıkan renklerini ve sembollerini vurgular. Aynı zamanda, kutunun üzerindeki minimalist tasarım veya çizim ile

tercih edilen yazı karakterleri, modern ve sofistike bir imaj yaratır. Kibrit kutusunun tasarımı kadar formu da markanın bir taşıyıcısı olarak kabul edilir. Genellikle dikdörtgen formda kullanılan biçim, markanın tasarım üslubuna göre; kare, iki kanatlı, çekmeceli, diyagonal açılı sağ-sol bitişli gibi farklı fonksiyonellikte tasarlanabilir. Böylece, kullanıcılar günlük hayatta kibritleri kullanırken markayı hatırlayacak ve marka sadakati oluşturacaktır. Kibrit kutusu tasarımı, küçük boyutuna rağmen marka etkileşimini ve tanıtımını maksimum seviyeye çıkarmak için güçlü bir araçtır.

4. KİBRİT KUTUSU TASARIMI

Kibrit kutusu tasarımı, kibritin icadından başlayarak zaman içindeki evrimi ve tasarımındaki değişiklikleri içerir. Kibritin İcadı, Kimyager John Walker tarafından 1826'da tesadüfen kibritin ilk formülünü keşfedilmiştir (Stone, 2014). Ancak, bu kibritler zamanla güvenlik sorunlarına neden olduğu için pek popüler olmamıştır. 1830 yılında ise fosforlu kibrit icat edilmiştir. İsveçli kimyager Jöns Jakob Berzelius ve İngiliz mucit Charles Sauria, güvenli ve kullanışlı bir kibrit formülü olarak bu kibriti geliştirmişlerdir. Bu yeni kibrit türü, sülfür ve fosfor içeren başlığı sayesinde sürtüşmeyle ateşlenmektedir. 1836 yılında üretilen kibritlerin kullanımının fonksiyonel olması açısından İngiliz kâğıt üreticisi olan Joshua Pusey, ilk pratik kibrit kutusunu tasarlamıştır (Jones, 2004, s.7-12.) Bu tasarım, günümüzdeki en yaygın kullanımı olan; kibritleri içeren bir kutunun yan tarafındaki sürtüşme yüzeyi ile kibritleri ateşleme prensibine dayanmaktadır. 19. yüzyılın sonlarına doğru gelişen ve değişen kibrit kutusu tasarımları; materyal ve yüzey kullanımı açısından da zenginleşmiştir. O dönemlerde metal, karton, tahta dokularında üretilen kutular, çeşitli konulardaki illüstratif anlatımlarla oluşturulmuştur. 20. yüzyılda kibrit kutusu tasarımları, marka tanıtımı ve pazarlaması amacıyla promosyon ürünü olarak kullanılmaya başlanmıştır. Reklam ve marka bilincini kazandırmak amacıyla 20. yüzyıl sanat akımlarının izleriyle renkli baskı teknolojisinin de gelişimi ile birlikte dikkat çekici illüstrasyon ve tipografi kullanımları kibrit kutularına entegre edilmiştir.20. yüzyıl ortalarında, 1930-1960'lı yıllar arasında; ikinci Dünya Savaşı sonrasında, Amerika ve Avrupa'da Midcentury tasarım öne çıkan bir stil olmuştur. Bu dönemde tasarımcılar, modernlik ve işlevselliği ön planda tutmuşlardır. Savaş sonras döneminin adaptasyonunu kolaylaştırmak için modern tasarımcılar, yeni bir kimlik oluşturma yolunda ilerlerken; güzellik kavramına basitlik, rahatlık ve konfor katmak için tamamen yenilikçiliğe yönelmiştir. 1980'ler sonrası post modernizmin hakimiyeti ile birlikte karmaşıklığı, ironiyi, parodi ve referansları içeren bir renkli bir estetik ile bilinir. Nonkonformist yaklaşımlar ve sembolizm ile öne çıkan Postmodernizm dönemi; grafik tasarımın ve reklam stratejilerinin yükselişte olması sebebiyle, kibrit kutusu

tasarımlarının da daha çeşitli ve çarpıcı olmasına olanak tanımıştır (Antmen, 2003, s.30-33-s.112) 2000'ler ve daha sonrası: Diğer ambalaj tasarımlarında olduğu gibi, kibrit kutusu ambalaj tasarımlarında da çevre dostu materyaller ile yenilikçi tasarımlar daha çok ön planda tutulmuştur. Son yıllarda, geri dönüşüm bilincinin de artmasıyla birlikte; çevre dostu malzemelerin ve sıfır atık ambalajlarının önem kazanması, kibrit kutusu tasarımlarında da çevreci tasarımsal tercihler odak haline gelmiştir. Bu doğa dostu tasarımlar ve geri dönüştürülebilir materyaller, tüketicilerin dikkatini çekmeye başladı. Bugün, kibrit kutusu ambalaj tasarımları, markanın kimlik olgusu, hedef kitle beklentileri ve çevresel farkındalık gibi faktörlerle paralel olarak çeşitli ve özgün tasarlanabilmektedir. Estetik, ergonomik tasarım ve popüler tüketim kaygılarıyla kurumsal kimliğin bir taşıyıcısı olarak tasarlanan kibrit kutusu tasarımlarının her biri, kendi içinde benzersiz özelliklere sahip ve farklı hedef kitleler üzerine etki etmektedir. Kurumsal kimlik tasarımının yapısal ve biçimsel özellikleri bölümünde bahsedilen, marka sloganı ve ileti tonu da tasarımların dönemsel olarak etkisindeki önemli bir unsur olmuştur.

5. 20.YÜZYIL SANAT AKIMLARI ÇERÇEVESİNDE KİBRİT KUTUSU TASARIMLARININ İLLÜSTRATİF ÇÖZÜMLEMESİ

20. yüzyıl sanat akımlarının geniş yelpazesinde; promosyon ürünlerinden biri olan, kurumsal kimlik taşıyıcısı kibrit kutusu tasarımları, dönemine ait birçok farklı estetik üslubun ve tasarım anlayışının izlerini taşımaktadır. 20. Yüzyıl sanat akımlarının etkisiyle kibrit kutusu ambalaj tasarımlarında görülen illüstratif betimlemelerin, etkisinin görüldüğü bazı sanat akımları arasında; Bauhaus, Art Deco, Pop Art, Minimalizm ve Postmodernizm vardır (Denvir, 1992). Bu akımların kibrit kutusu tasarımlarındaki kurumsal kimliğin olası etkilerini kronolojik olarak dönemine göre incelenmesi araştırmanın amacını oluşturmaktadır.



Naftagas Promet isimli petrol markası Sırbistan'ın Voyvodina yerleşkesini mesken tutmuş, 19. Yüzyılın erken döneminin ilk yarısında kurulmuştur. Kibrit kutusu tasarımında, diagonal

kompozisyon ve dengeli dağılmış unsurlar kullanılmıştır. Bu özellikler, Bauhaus tarzının genel kurumsal kimlik özelliklerini yansıtmaktadır. 1933'te sanat okulu kapanmasına rağmen etkisini çok uzun yıllar farklı disiplinler üzerinde de gösteren Bauhaus ekolü; kibrit kutusu tasarımında da kullanılan display ve stencil fontun, Bauhaus dönemindeki Joost yazı biçimine atıfta bulunmaktadır. *"Joost type adını, Bauhaus'ta eğitmen olan tipografi tasarımcısı Joost Schmidt'ten almıştır"* (Akitera, 2019). José Manuel Urós, 1995'teki ilk tasarımlarında Schmidt'in "bauhaus im gewerbemuseum basel" posteri ve Bauhaus'un farklı stilleri üzerinden yazı biçimini geliştirmiştir. Bauhaus, 20. yüzyılın ilk döneminde, Almanya'da bir sanat okulu ve tasarım akımı olarak, fonksiyonelliği ve estetiği birleştiren bir tasarım anlayışını benimsemiştir (Grapius, 1997, s.231-237). Kibrit kutusu tasarımında bu etki; linear espaslar, geometrik formlar ve kullanım öncelikleriyle kendini göstermektedir. Bauhaus'un minimalizmi, kurumsal kimlik tasarımında sade ve işlevsel unsurların önemini vurgular. Bu dönemde kullanılan; kırmızı, mavi, sarı gibi canlı renkler yalın ve dengeli kullanımı ile öne çıkaran bir estetik, birçok kurumsal markanın kimlik tasarımında etkili olmuştur.



Jupiter Markası: 1960'lı yıllarda etkisinin görüldüğü Minimalizm akımının etkisinde, kibrit kutusu tasarımlarında dönemini yansıtan kutu üzerinde basit geometrik desenler ve düz hatlar kullanmıştır. Renk paleti nötr tonlara ve belirgin kontrastlara odaklanmıştır. Logo ve marka adı, Bauhaus tarzında minimalist bir yazı tipiyle tasarlanmıştır. Minimalizm akımı (ABC sanatı), gereksiz detaylardan kaçınarak sadeliği vurgulamaktadır Kibrit kutusu tasarımında da bu yaklaşım; karmaşıklıktan uzak, yalın anlatım ve dengeli espas kullanımı ile işlevselliği ön plana çıkarmaktadır. Bu anlatım, sadelik, temizlik ve azaltılma prensibine dayanmaktadır. Bu marka, kutunun yüzeyinde tek bir renk tonu kullanarak bu anlatım dilini pekiştirmektedir. Marka logosu, display yazı karakteri ile light kullanımda tercih edimiş, küçük ve zarif bir şekilde boyutlandırılarak kutunun alt kısmında yer almış böylece illüstratif form ile bütünleşmiştir.

Minimalizm'in en önemli belirleyici tasarım ilkesi; negatif-pozitif alan kullanımı ve dengesidir. Tasarlanan boşluklar, tasarımın odaklanılmasını ve anlaşılmasını kolaylaştırır. Aktarılan Kurumsal kimlik olgusu imge ile birlikte en yalın haliyle tasarımda yerini almıştır. Minimalist tasarımın bir diğer temel prensiplerinden biri de fonksiyonelliktir. Bu sebeple kibrit kutusu tasarımı, kullanıcıya pratik ve ergonomik bir kullanım sunacak şekilde tasarlanmıştır. Minimalist tasarım, tasarımın özüne odaklanmayı ve detaylardan kaçınmayı amaçlayan bir yaklaşım olduğu için kurumsal kimlikte de sadelik, şıklık ve anlaşılabilirlik öne çıkar. Bu prensipler ile tasarlanan kibrit kutusu tasarımı marka kimliğini güçlendirmiş ve tüketicilerle etkileşimini arttırmıştır.



Mann Mobilia, Art Deco akımının etkisinde Alman asıllı bir endüstriyel ürün tasarımı markasıdır. 1920'lerin sonlarına doğru ortaya çıkan Art Deco akımı; kontrastı yüksek parlak renkler, geometrik desen ve formlar, lüks detaylar ve modernizmin etkilerini içermektedir. Bu akım, lüks ve süslemenin önemli olduğu bir stil olarak bilinir (Benton, 2015). Bu sebeple döneminde, özellikle de lüks markaların kimlik tasarımında etkili olmuştur. Kibrit kutusu tasarımında bu etki, detaylı desenler, parlak renkler ve simetrik düzenlemelerle ifade bulmuştur. Şık ve lüks bir üslup ile kullanılan geometrik desenler ve zarif süslemeler ve organik formların geometrik çözümlemesi ile kullanılmıştır. Art Deco'nun belirgin özelliklerinden biri, jeoformik (geometrik) desenlerin ve çizgilerin kullanımıdır. Kare, dikdörtgen, üçgenler gibi şekiller ile kullanılan tasarım unsurları akımın belirleyici özelliklerindendir. Kibrit kutusu tasarımlarında bu tarz öğeler, düzenli ve estetik bir görünüm sağlayabilir. Art Deco, simetriye ve dengeye önem veren bir tarzdır. Kibrit kutusu tasarımlarında simetrik düzenlemeler ve dengeli kompozisyonlar, kurumsal kimliğin düzenli ve profesyonel bir izlenim bırakmasına katkı sağlamaktadır. Art Deco, dekoratif unsurları vurgular; kibrit kutusu tasarımlarında zenginleştirilmiş detaylar, markanın dikkat çekici ve özgün bir görsel kimliği aktarmada rol

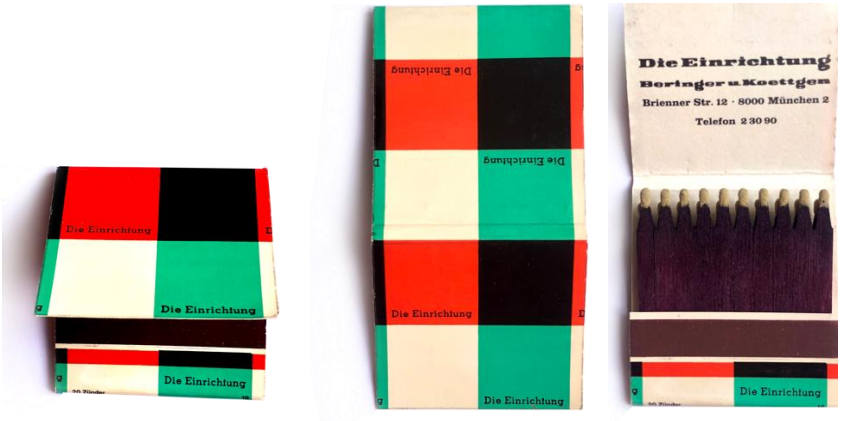
oynamıştır. Art Deco'nun, 1930'ların orta dönemlerine kadar uzanan dönemde, sandalye ve mobilya tasarımına belirgin bir yansıması görülmektedir. Bu akımın; geometrik desenler, simetrik hatlar ve lüks malzemelerin öne çıktığı bir estetikle özdeşleşmesi sebebiyle, sandalye tasarımlarında da sıklıkla görülen dikdörtgen hatlar, zarif süslemeler ve cilalı ahşap gibi öğeler Art Deco'nun imzası niteliğindedir (VAM, 2015). Canlı renk kontrastları, sürrealist motifler ve egzotik detaylar da bu tarzın mobilya tasarımına kattığı karakteristik özellikler arasındadır. Art Deco'nun mobilya tasarımına getirdiği modern ve çağının ötesindeki hatları, günümüzde bile popülerliğini koruyan şık ve çağdaş tasarımların ilham kaynağını oluşturmuştur. Bu akım, işlevsellik ve konforu kollektif bir şekilde kullanarak, mobilya dünyasında da estetik açıdan çarpıcı ve zamansız eserlere imza atmıştır. Mann Mobilia isimli marka, Art Deco tazrı mobilya tasarımlarını, kibrit kutusunun içinde konumlandırırken, canlı, kontrastı yüksek ve simetrik logo tasarımını kurumsal kimlik rengi olan "fire engine red" ile kibrit kutusunun ambalaj tasarımını kurgulamıştır.



Pop Art, günlük tüketilen nesneleri ve tüketim kültürünü sanat ile yorumlayan bir akımdır. Kibrit kutusu tasarımında, kullanılan canlı renkler, büyük grafikler ve popüler kültürü referans eden unsurlar ile bu etki net bir şekilde görülmektedir. 1950'lerin sonlarından itibaren ortaya çıkan Pop Art, popüler kültürden beslenir ve sıkça solid parlak renkleri, grafik desenleri ve büyük ölçekli imgeler içerir. Pop Art'ın enerjik ve canlı görsel inşası, döneminde bazı markaların dinamik kurumsal kimlik tasarımlarına ilham olmuştur (Restany, 1997, s. 344-349). Bu sanat hareketi; basitletirilmiş, net, vurgulu ve kontürlü şekiller, desenler ve tekrarlanan öğeleri görselleştirir. Kibrit kutusu tasarımlarında, ikonik pop art öğeleri; şeritler, yıldızlar, noktalar kullanılmıştır. Pop art, mizah ve esprili unsurlarını görselletirmede kullanırken, dönemindeki tasarım ve sanatçılara esneklik kazandırmıştır. İllüstratif anlatımda, sıklıkla ünlü

kişilikleri, markaları ve simgeleri içermektedir. Pop art, enerji, dinamizm ve hareketi yansıtan bir stildir. Alman asıllı marka, Knalleinlagen; "Knalleinlagen für Zigaretten" isimli kampanyası için tasarladığı kibrit kutularını satışı olmadan, ücretsiz promosyon ürünü olarak ortaya çıkarmıştır. "Sigara dolu patlayan havaifişekler" mottosuyla pop art sanat hareketinin anlatım dilini benimsemişlerdir. Genellikle görselleştirilen kadın imgesi, ikonik olan patlangaç formu ile sigaraya vurgu yapar nitelikte illüstre edilmiştir. Tercih edilen parlak pembe tonu ile siyah-beyaz kontrastı nötr dengesini sağlamak için tasarlanmıştır.





De Stijl hareketi, 20. yüzyılın erken döneminde Hollandalı sanatçı ve tasarımcıların bir araya gelerek oluşturduğu kollektif bir sanat ve tasarım akımıdır. Bu akım, soyut geometrik biçimleri ve temel renkleri, onların üst üste gelişinden oluşan katmanlı bir anlatımı vurgulayan estetik anlayışa sahiptir. De Stijl'in öncülerinden biri olan Theo Van Doesburg'un görselleştirdiği geometrik grid imgelemi, bu akımın en önemli temsillerini taşımaktadır. De Stijl prensipleri, geometrik yapılanmaya ve simetrik düzenlemeye büyük önem vermektedir (Doesburg, 1992, s. 270-281).Kibrit kutusu tasarımında da düzenli ve geometrik desenler, simetrik düzenlemeler ve net hatlar kullanılmıştır. De Stijl akımının temel temsil renkleri: kırmızı, sarı ve mavi vurgulardır. Genellikle düz beyaz veya kontrastı düşük zemin tercih edilir. Bu sayede tasarım, sade ve modern bir görünüme kavuşur. Kibrit kutusu tasarımında da sade ve minimalist bir

yaklaşım izlenerek, fazla detaydan kaçınılmıştır. Die Einrichtung isimli marka; tasarladığı renk blokları ile tasarımın görsel ihtişamını arttırmış, tasarladığı modüler yapılar ile birimleri kullanılarak, bütünsel bir uyum ve denge sağlamıştır. Kibrit kutusu tasarımları alternatifli olarak üretilmiş fakat aynı üsluba mutabık kalınmıştır. Marka, kibrit kutularının formları farklı olsa bile kedni içerisinde De stijl akımının tasarım prensiplerini sürdürmüştür. Birinci kibrit kutusu tasarımında, gri solid bir yüzey üzerine beyaz lekeleri ve siyah yarım çerçevesi ile dinamik bir anlatıya sahip olan bir görselleştirme tercih edilmiştir. Logo, dönemin tipografik diline atıfta bulunan serifli ve kapalı espas yazı karakteri ile tasarlanmıştır. Kibrit kutusunun kurumsal kimlik tasarımı ile bütünsel olarak ele alındığı birinci kibritte; kutunun iç bölümünün arka yüzeyi daha parlak bir materyalden seçilirken, kibritlerin de kimlik inşasının bir parçası olarak o renklerde çeşitlenmesi promosyon ürünlerinin kurumsal kimliğin en başarılı ve işlevsel taşıyıcısı olduğuna örnek niteliğindedir. İkinci kibrit kutusu tasarımında, biçimsel olarak daha ergonomik bir form tercih edilmiştir. Katlanır yapısı ve inceliği sayesinde 20. Yüzyılın ikinci yarısında en çok tercih edilen kibrit kutusu formlarından biridir. Beyaz alanların denge kurduğu, logo kullanımı ve kimlik bilgilerinin büyük bir titizlikte; minimal bir estetikle tasarlandığı kibrit kutusunda da kibritlerin renk seçimi ve kırmızı fosfor, cam tozu ve bağlayıcı maddeden oluşan ateşleme yüzeyi tasarıma uygun, linear çizgiyi takip etmektedir.



Sürrealizm; “rüya” kavramının uçsuz bucaksızlığı gibi soyut ve düşsel öğeler ile imgelerin oluştuğu bir sanat akımıdır. Bu akımın etkileri, dönemindeki bazı markaların kimlik olgularında yaratıcı ve çağrışımsal inşaların kurulumuna şekil vermiştir. Sürrealizm, temsili olan soyut desenler ve renklerle birlikte gerçeküstü duygusal bir anlatımda, rasyonel bir hayal gücünü vurgular. Tasarıma gerçeküstü öğelerin, hayali figürlerin, fantastik unsurların eklenmesi, canlı, kontrastlı ve sıra dışı renklerin kullanılması; gerçeküstü atmosferini vurgulamaktadır (Chirico,

1992, s.59-63). Sürrealist tarza uygun olarak, dışbükey ve içbükey formların kullanılması; şekillerin normalde beklenmeyen biçimlerde metamorfoz ve deforme oluşu ile birlikte absürd bir anlatım dili, kompozisyonlarda rüya gibi bir atmosfer yaratmak için soyut ve akışkan formların kullanılması ile ilintilidir. Sürrealist bakış açısı; sanatın "rüya" kavramındaki izdüşümüne, dünyanın yansıyan unsurlarına entegrasyonudur. Mekansal ilizyonlar, hava perspektifiyle oluşan derinlik algısını için kullanılan görsel teknikleri ve duygusal etkileri vurgular. Hereinspaziert isimli marka, tarihi1907 yıllarına dayanan köklü bir restaurant işletmesi ve bira üreticisir. "Gasthaus zum fischmeister" (balık ustasının misafirhanesi) mottosuyla, kurumsal kimliğinin bir taşıyıcısı olarak sürrealist tarzda illüstre edilmiş kibrit kutusunu tasarlamıştır. Balık formu, anlam bulanıklaştırmaya yönelik ele alındığı gerçeküstü bir anlatım ile görselleştirilmiştir. Döneminde, olağanüstü imgelemi ile kurumsal kimliği ilgi çekici hale getirmiş, alıcıya mesajı ve marka kimliğini pratik bir şekilde taşımıştır.



Fütürizm, 20. yüzyılın erken dönenimde etkili olan bir sanat ve tasarım akımıdır. Bu akım, endüstrileşme dalgasının yaygınlaştığı ve teknolojinin hızlı bir ivmeyle yükselişe geçtiği dönemde varlığını sürdürmüştür. Fütürist tarzda üretilen tasarımlar; hareket, enerji, hız ve dinamizmi vurgular (Carra, 1997, s.97-100). Kimlik taşıyıcısı promosyon ürünlerinden biri olan kibrit kutusu tasarımında; akıcı çizgiler, hareket izlenimi veren desenler ve enerjiyi yansıtan grafik öğelerle bu akımın yansımaları görülmektedir. Fütürist tasarımlar genellikle keskin hatlar ile geometrik şekillerden oluşur. Bu oluşum, Fütürizm'in yapıtaşları olan dinamizm ve hareket kavramları ile birlikte görülmektedir. Kibrit kutusu tasarımında da bu özellikler, modern ve teknolojik bir üslupta ele alınmıştır. Kullanılan canlı ve kontrastlı renkler, Fütürizm tarzında üretilen tasarımların vazgeçilmez özelliklerindendir. Fütürist tarz, teknoloji ve endüstriyel

gelişmelere olan ilgiyi yansıtarak metalik yüzeyler, dişli çarklar, dijital öğeler gibi unsurları içererek akımın spesifik görsel inşasını kapsamaktadır. Bu unsurlar, Kroplın Schnelltaster markasının inovasyon ve moderniteye vurgu yapmasına yardımcı olmuştur. Kroplın Schnelltaster, "Pur schnelles messen" mottosu ile saf hızlı ölçüm vaadi veren bir ölçü ekipmanları markasıdır. Ölçüm cihazı, horoz figürünün başı ve gagası ile dijital ve soyut öğeler kullanılarakillüstre edilmiştir. Kullanılan renkler ve geometrik parçalanmaklar; soyut imgenin teknolojik ve dinamik üslup ile fütüristik bir algıda tasarlanması ile akımın temel prensiplerine gönderme yapmaktadır. Kullanılan tipografinin görsel öğe olarak diyagonal kompoze edilmesi, illüstrasyonun ölçüm cihazına atıfta bulunan formu ile paralellik göstermektedir. Tüm bu tasarım çözümlemesi ile marka, geleceğe yönelik bir bakış açısını yansıtarak inovasyonu vurgulamıştır (Marinetti, 1997, s.75-81).



Dadaizm, diğer adıyla başkaldırı. 20. yüzyılın ilk yarısında, Edebiyat ve sanatta etkisini göstermiştir. Dadaizm akımı, folklorik sanat ve kültür normlarına karşı bir duruş sergileyerek; rasyonalite, mantık ve anlamın geleneksel nizama tezatlık olarak ortaya çıkmıştır. Bu akımın etkisi altında tasarlanan Ostmann kibrit kutusu tasarımı; absürd, ironik ve çelişki uyandıran imgelere sahiptir. Dadaizm, kaotik düzende rasgelelik nosyonuyla varolmuştur. Tasarımlar anlamın dışında, beklenmedik şekilde düzenlenmiş, rastgele öğeler içermektedir. Dadaist tasarımlar, geleneksel tasarım prensiplerine başkaldırı niteliğindedir. Bu sebeple; simetri, düzen ve diğer geleneksel tasarım ilkelerini bilinçli bir şekilde ihlal eder. Böylece Dadaizm, anlamsızlığa ve çelişkiye vurgu yapmaktadır. Bunun sonucunda Tasarımlar, birbiriyle çelişen öğelerin kombinasyonu ve zaman-mekan uyuşmazlığı çerçevesinde, anlamsız bağlantılar kurarak izleyiciyi düşündürmeyi amaçlar. Bu tasarımlar, toplumsal normlara, siyasi yapıya

veya sanatsal konvansiyonlara karşı bir eleştiri içerir (Dempsey, 2007). Dadaizm, yaratıcılığı teşvik eder ve geleneksel kalıplardan çıkarak yenilikçi ve özgün tasarımları destekler. Ostmann markası, çelişkisi ile ilgi çeken imgesel anlatımına eşlikçi olarak tasarladığı; diyagonal ve el yazısı ile özensizce oluşturulmuş, harf anatomisi ve üslup olmaksızın kurgulanan tipografisi ile "Vergessen sie nicht das gehackte dazu" (Doğranmış malzemeleri unutmayın) yazarak, imge ile tipografinin absürd algısına destek vermiştir. Kutunun arka yüzeyi, illüstratif imgenin lekesel değerine uygun; logoyu öne çıkaran nitelikte, daha solid yüzeylerle tasarlanmıştır.



"Post izlenimcilik", 19. yüzyıl sonu, 20. yüzyıl ilk yıllarına doğru etkisini sürdüren bir sanat akımıdır. Henri de Toulouse-Lautrec, Post-İzlenimcilik akımının en önemli temsilcisidir. Paris'in gece hayatını konu alan eserlerinde; canlı ve cesur renkleri, dans sahnelerini, tiyatro ve kafe kültürünü kullanmıştır. Afiş tasarımlarını üstlendiği Moulin Rouge pavyonunun renkli sahnelerini büyük bir ihtişamla çalışmalarına yansıtmıştır. Bu tasarımlardaki tipografi kullanımı; büyük, dikkat çekici başlıklar ve elle yazılmış tarzda harf anatomileri Toulouse-Lautrec'in stili ile özdeşleşmiştir. Tasarımlardaki karakteristik duruşlar ve kompozisyonlar, dinamizm ve özgünlük döneminde üretilen bazı tasarımlara esneklik kazandırmıştır. Kibrit kutusu tasarımı, markanın kimliğini ve değerlerini yansıtmak için önemli bir araçtır. Paris merkezli, Stardust isimli Hotel ve Gasino markası; döneminde etkisini gösteren Post izlenimci akımın öncüsü, H. Toulouse -Lautrec'in kullanıdığı tipografi ile kontrastı yüksek, parlak renkler ve kadın imgesinin dans figürü olarak illüstre edilmesine atıfta bulunmaktadır. Kibrit kutusu tasarımı; ergonomik olarak kolay açılan ve inceliği yapısı ile taşınabilirliği pratik biçimde tercih edilmiş, kibritlerin renk seçimi logoya atıfta bulunan beyaz tonda oluşturulmuştur (Kolektif, 2005).



Art Neuveau

6. SONUÇ

Bu araştırma, kimlik olgusunun gelişimi ile birlikte kurumsal kimlik tasarımının taşıyıcısı kibrit kutusu tasarımlarının, 20. yüzyıl sanat akımlarının etkisiyle nasıl şekillendiği ve evrildiğini; bununla beraber markanın kimlik inşasını oluşturan unsurlarının da irdelenerek incelemesini amaçlamıştır. Markaların kimlik olgusunu güçlendirmek, algı oluşturmak ve hedef kitleye güçlü bir mesaj vermek amacıyla kullanılan kibrit kutusu tasarımları; sade ve işlevsel yapılarıyla birlikte dönemin sanat ve kültür akımlarını başarıyla yansıtırken estetik anlamda da birer zaman kapsülü gibidir. Her bir tasarımın içerdiği sanatsal öğeler ve dönemin estetik zevkleri, o döneme ait bir görsel dilin izlerini taşımaktadır. Kibrit kutusu tasarımlarının sadece günlük kullanım ürünleri olmanın ötesinde, aynı zamanda sanatsal ve kültürel birer ifade aracı olarak işlev gördüğü açığa kavuşturulmuştur. Araştırma aynı zamanda, kibrit kutusu tasarımlarının zaman içerisindeki değişimiyle beraber; teknolojik, toplumsal, sosyo-kültürel değişimleri ve sanatsal hareketlenmelerin tasarımları nasıl etkilediğini incelemiştir. Tasarımların evriminde, kurumsal kimlik tasarımındaki kimlik olgusunun adaptasyon kabiliyetini ve zamanla değişen kültürel etkileşimlere olan duyarlılığını vurgulamaktadır.

Sonuç olarak, kibrit kutusu tasarımları üzerinden yapılan bu kapsamlı analiz, kurumsal kimlik tasarımının sadece marka tanıtımı değil, aynı zamanda kültürel ve sanatsal birer belge olarak nasıl değerlendirilebileceğini göstermektedir. Tasarımcılar, pazarlamacılar ve araştırmacılar için bu çalışma, kurumsal kimlik tasarımının geçmişten günümüze olan evrimini anlamak ve gelecekteki tasarım stratejilerini biçimlendirmek adına derinlemesine bir kaynak niteliği taşımaktadır.

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GÜNCEL BİR PROTEZ KAİDE MATERYALİ: POLİETERETERKETON (PEEK)

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Abstract
With the development of technology and the increasing interest in esthetic restorations, a high level of esthetics is sought in dentistry today. This situation is bringing new metal-free restorative materials to the fore every day in place of dentures with metal substructures. Polyetheretherketone (PEEK) is preferred in dentistry as a denture base material, particularly because of its esthetic similarity to the natural tooth structure, its biocompatibility and its good physical and mechanical properties. PEEK belongs to the polyaryletherketone (PAEK) family and is widely used in dentistry due to its mechanical and thermal resistance, ease of sterilization, resistance to radiation, fatigue resistance and strong bond strength in restorations where it is used. PEEK is widely used as implant material, orthodontic wires, CAD/CAM (Computer Aided Design/Computer Aided Manufacturing) material, substructure in fixed prostheses, precision fittings in removable prostheses, hook and obturator prostheses. Due to their biocompatibility and excellent mechanical properties, these materials are ideal for rapid 3D design and prototyping of patient-specific implants and other specialty devices. Studies show that these materials are important in many clinical and biomedical applications such as orthopedics, oral and maxillofacial surgery, cardiovascular and cardiothoracic applications, dental applications and tissue engineering. However, there are important aspects to consider when working with these materials. First of all, exposure of PEEK to concentrated nitric acid and some halogen elements (such as chlorine and bromine) compromises its resistance to ionizing radiation and other important properties. Despite their desirable properties as an alternative to conventional metal compounds for use in drug delivery, clinical and surgical medicine, dentistry, etc., the use of materials such as PEEK in their pure form in surgical applications poses a challenge due to their suboptimal strength and stiffness or slight deviations from the elastic modulus of bone. This review describes how such observed drawbacks can be overcome with materials that are/can be doped into polymers (carbon fibers, other biocompatible polymers and nanotechnology products), thereby improving their mechanical and chemical properties and ultimately reducing the patient's immune response.
Keywords: Biocompatible polymers, dental prosthesis, restoration material, biomedical application

A CURRENT DENTURE BASE MATERIALS: POLYETHERETHERKETONE (PEEK)

Özet
Gelişen teknoloji ile beraber günümüzde estetik restorasyonlara artan ilgi ile diş hekimliğinde yüksek seviyede estetik arayışına gidilmektedir. Bu durum gün geçtikçe metal alt yapılı protezlerin yerine metal içermeyen yeni restorasyon malzemelerini ön plana çıkarmaktadır. Özellikle estetik açıdan doğal diş yapısına benzerliği, biyouyumlu olması, fiziksel ve mekanik özelliklerinin iyi olması nedenleri ile polietereterketon (PEEK) protez kaide materyali olarak diş hekimliğinde tercih sebebi olmaktadır. PEEK materyali poliarileterketon (PAEK) ailesinin bir üyesidir ve bu özelliklerinin yanı sıra mekanik ve termal dayanıklılığı, sterilizasyon kolaylığı, ışınlara karşı dayanıklılığı, yorulma direnci, kullanıldığı restorasyonlarda bağlantı dayanıklılığının güçlü olması gibi özelliklerinden dolayı diş hekimliğinde geniş bir alanda kullanılmaktadır. İmplant materyali, ortodontik teller, CAD/CAM (Bilgisayar Destekli Tasarım/Bilgisayar Destekli Üretim) materyali, sabit protezlerde alt yapı, hareketli protezlerde hassas bağlantı parçası, kroşe ve obtüratör protez yapımında PEEK kullanımı yaygındır. Bu materyallerin biyouyumlu olması ve üstün mekanik özellikler göstermesi hasta özelinde implantların ve diğer özel cihazların hızlı 3D tasarımında prototiplenmesi için bu malzemeleri ideal hale getirmiştir. Yapılan çalışmalar bu malzemelerin ortopedi, ağız-çene-yüz ve kraniofasiyal cerrahi, kardiyovasküler ve kardiyotorasik uygulamalar, diş uygulamaları ve doku mühendisliği gibi daha birçok klinik ve biyomedikal uygulamalar için önemli uygulamaları olduğunu göstermektedir. Ancak bu malzemelerle çalışmalarda dikkat edilmesi gereken önemli başlıklar bulunmaktadır. Öncelikle PEEK'in konsantre nitrik asite ek olarak bazı halojen elementlere (klor ve brom gibi) maruziyeti iyonlaştırıcı radyasyon direncini ve diğer önemli özelliklerini bozmaktadır. İlaç dağıtımı, klinik ve cerrahi tıpta, diş hekimliğinde kullanım için geleneksel metalik bileşiklere alternatif istenen özelliklere rağmen PEEK gibi malzemelerin saf halde kullanımı optimal olmayan güç ve sertlik veya kemiğin elastik modülünden hafif sapmalar gibi özellikler gösterdiği için cerrahi uygulamalarda zorluklara neden olmaktadır. Bu derlemede gözlenen bu tür dezavantajların polimerlere katkılanan/katkılanabilecek materyallerle (karbon fiberler, diğer biyouyumlu polimerler ve nanoteknolojik ürünler) nasıl aşıldığı, mekanik özelliklerin ve kimyasal özelliklerinin iyileştirilmesi ve son olarak hasta bağışıklık sistemi tepkisinin nasıl azaltılabileceği açıklanmıştır.
Anahtar Kelimeler: Biyouyumlu polimerler, diş protez, restorasyon malzemesi, biyomedikal uygulama

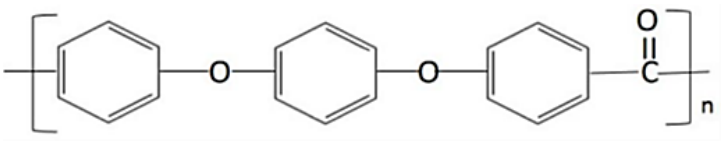
Giriş

Gelişen teknoloji ve endüstrideki hızlı değişim diş hekimliğinde kullanılan materyallerin de değişimine sebep olmuştur. Günümüzde tercih edilen protez materyaller için estetik özelliğinin yanı sıra kullanımda yüksek sıcaklık dayanımı (300 °C'yi aşan) ve kimyasal ve mekanik direncinin yüksek olması bakımından Poliarileterketon (PAEK) polimer ailesinin bir üyesi olan polietereterketon (PEEK) tercih edilmektedir (Chen et al., 2016).Mükemmel fiziksel özelliklere sahip bu organik polimerler üzerine yapılan araştırmalar 1960'lı yıllara dayanmaktadır (Hearle, 2001). Tarihçesi 1962 yılında Amerikalı bilim insanı Robert Bonner Polimer tarafından tanıtımının yapılması ile başlamış olan PEEK, ilk olarak 1978 yılında İngiliz bilim insanı tarafından polimer olarak geliştirilmiştir (Najeeb et al., 2016). 1980'li yıllardan itibaren ticari olarak endüstri, mühendislik ve askeri alanlarda kullanılmaya başlanmıştır (Mark et al., 1987). Elastikiyet modülünün kemiğe yakın olması, aşınma ve kırılma direncinin yüksek olması, cilalanabilir özelliği, şok absorbsiyonu ve metal restorasyonlara göre daha hafif bir materyal olması özellikleri sayesinde tıpta kullanımı özellikle travma ve ortopedi vakalarında son derece yaygın bir hal almış ve titanyum materyaliyle rekabet sürecine dahil olmuştur (Kurtz & Devine, 2007). Diş hekimliğinde metal altyapıyı gizlemek amacı ile metal alaşımlı kuronlar, köprüler ve hareketli protezlerde birçok katman içeren restorasyonlar yapılmaktaydı ancak metal alaşımların açık gri rengi tam olarak kompanse edilememekteydi (Najeeb et al., 2016). Bu nedenle metal altyapılı restorasyonlar zamanla yerini alternatif materyallere bırakmıştır. Özellikle estetik restorasyonlarda krom kobalt altyapılı protetik restorasyonlarla kıyaslandığında zirkonyumun yüksek maliyetli oluşu bilim insanlarını polimerler üstünde çalışmalar yapmaya itmiştir (Sereno et al., 2015).Teknolojik gelişmelerle konvansiyonel yöntem ile yapılan uygulamaların yerini PEEK ve PEKK materyalleri ile yapılan uygulamalar almaya başlamıştır. Firmaların da bu alandaki gelişimleriyle kuron ve köprü restorasyonların üretimi için freze makineleri geliştirilmiş ve yüksek performans polimer blokları üretilmiştir (Kewekordes et al., 2018).İnsan kemiğiyle benzer mekanik mukavemete ve elastik modüle sahip olması PEEK materyallere ilgiyi artırmaktadır. PAEK ailesinden olan PEEK'lerin bu özelliği metal bazlı implantlara uygun bir alternatif olmasını sağlamıştır. Üç boyutlu baskı yoluyla özel ve hızlı bir şekilde üretilebilme özellikleri dikkate alındığında biyomedikal ve malzeme mühendisliği alanlarına ek olarak medikal uygulamalarda PEEK ürünlerinin önemi artmakta ve bu alanda yapılacak olan çalışmalar önem arz edecektir (Sacks et al., 2024). Bu çalışma PEEK'in mekanik, fiziksel ve kimyasal özelliklerinin yanı sıra modern tıptaki çeşitli uygulamalarını özetlemektedir. Ayrıca PEEK uygulamalrında gözlenen dezavantajların

polimerlere katkılanan/katkılanabilecek materyallerle (karbon fiberler, diğer biyouyumlu polimerler ve nanoteknolojik ürünler) aşılabileceği, mekanik özelliklerin ve kimyasal özelliklerinin iyileştirilmesi de vurgulanmıştır.

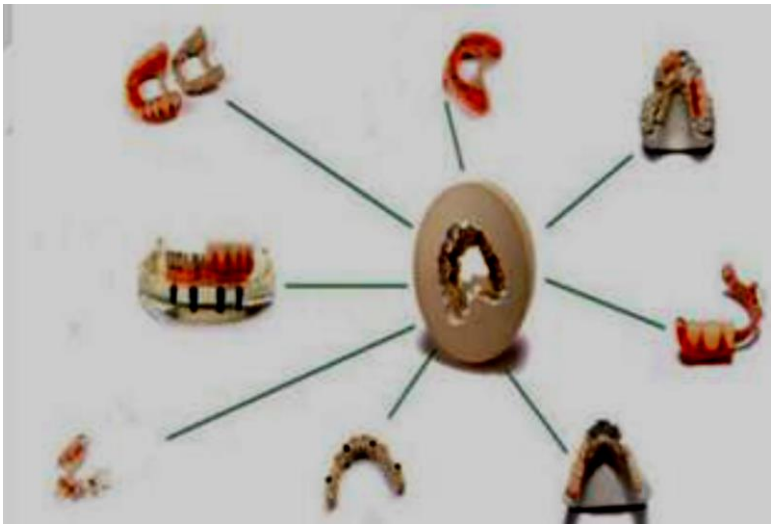
PEEK'in Genel Özellikleri

Yüksek performanslı bir termoplastik polimer ailesinin üyesi olan polietereterketon (PEEK); yüksek mukavemet, aşınma ve yorulma direnci gibi özelliklerinden dolayı biyomedikal uygulamalar için ilgi görmektedir. Biyouyumluluğu ve üstün mekanik özellikleriyle son yıllarda dental uygulamalarda da kullanılmaktadır (Henriques et al., 2018).



Şekil 1. PEEK'in kimyasal yapısı (Staniland et al., 1992)

PEEK materyali birçok dental uygulamada abutmentler, implantlar, kroşeler, hareketli protezlerin alt yapıları ve sabit protezler dâhil alternatif materyal olarak kullanımı gün geçtikçe artmaktadır (Tekin et al., 2018).



Şekil 2. Diş Hekimliğinde PEEK (Sarot et al., 2010)

PEEK materyali yüksek ısıya karşı dirençlidir ve erime sıcaklığı 334 °C'dir. Ayrıca kendine özgü aromatik kimyasal yapısı nedeniyle tıbbi cihazları sterilize etmek için kullanılan gama ve elektron ışınları gibi bir çok sterilizasyon yöntemine uygundur. Termal özelliklerinden dolayı insan vücudunda stabil kalmaktadır (Tekin et al., 2018). Kimyasal olarak inert özelliktedir ve diğer materyallerle düşük reaksiyon gösterir ve birçok geleneksel çözeltilerde çözünmemektedir (Simsiriwong et al., 2015). Bu özelliklerinden dolayı metal içermeyen diş restorasyonlarında tercih edilmiştir ve metal alerjisine karşı da iyi bir alternatif olmaktadır

(Zoidis & Papathanasiou, 2016).PEEK çoğu dental uygulama için yeterli olan düşük bir yarı saydamlığa sahip olmasına rağmen diş hekimliğinde estetik gereklilikler için rezin materyaller ile kombine kullanılması önerilmektedir (Rosentritt et al., 2015). Bununla birlikte, opaklığı ve grimsi beyaz rengi, monolitik ve anatomik kontürlü restorasyonların üretiminde PEEK'in kullanımını sınırlandırmaktadır (Stawarczyk et al., 2013). Estetik görüntünün sağlanabilmesi için veneer kompozit rezinler kullanılmaktadır. Ancak PEEK'in mekanik ve kimyasal işlemlere olan direnci ve hidrofobik yapısından dolayı diş hekimliğindeki kullanımı kısıtlanmıştır (Adem et al., 2022). PEEK'in dental uygulamalarda etkin ve başarılı kullanımı için PEEK ve veneer kompozit rezinler arasındaki bağlantı dayanıklılığının sağlanmasına yönelik yöntemler geliştirilmelidir. PEEK ile beraber hem rezin simanların hem de kompozit rezinlerin diş hekimliğinde kullanılması için aralarındaki bağlanmanın biyomekanik kuvvetlere karşı dayanıklı olması gerekmektedir (Henriques et al., 2018). Bağlantı tipi kimyasal, (mikro) mekanik tutunma veya bunların bir birleşimi ile oluşturulabilir. Bu durum kullanılan malzemelerin bileşimine ve etkileşimine göre değişmektedir (Piwowarczyk et al., 2004).PEEK'in yüzey enerjisini değiştirmek ve hem rezin simanlar hem de kompozit rezinler ile olan bağlantısını geliştirmek için birçok teknik ve yüzey işlemleri üzerinde çalışmalar yapılmıştır. Araştırmalar herhangi bir yüzey işlemi yapılmayan inert PEEK yüzeyi ile rezin materyaller arasında bağlanmanın gerçekleşmediğini ortaya koymuştur. Bağlantının geliştirilmesi için ıslanabilirliğin ve yüzey alanının pürüzlendirilerek arttırılması kullanılan yöntemlerdendir. Asitle aşındırma, lazer, plazma teknikleri bunlardan bazılarıdır (Henriques et al., 2018). PEEK'in yüzey alanını modifiye etmek için %98 sülfürik asit (H_2SO_4) kullanımının gözenekli ve geçirgen bir yüzey oluşturduğu sonucuna varmıştır (Hallmann et al., 2012; Keul et al., 2014; Rosentritt et al., 2015). Bununla birlikte alüminyum oksit (Al2O3) ile kumlama, silika kaplama ve bunların kombine uygulanması PEEK yüzeyindeki pürüzlülükte artış sağlamıştır (Ates et al., 2018).Ultraviyole ışık (UV) lazer uygulaması, polimer yüzeylerin temizlenmesi ve fonksiyonellik kazanması için kullanılan başka bir yöntemdir (Sham et al., 2009). Literatürde, %98 sülfürik asit ile pürüzlendirme (Hallmann et al., 2012; Keul et al., 2014; Rosentritt et al., 2015) Al_2O_3 ile kumlama (Fokas et al., 2019), adhesive uygulaması (Schmidlin et al., 2010), UV ışığa maruz bırakma (Shi et al., 2017) gibi işlemlerin PEEK'in bağlantı dayanımını artırdığı ile ilgili çalışmalar yer almaktadır. Ancak bu yöntemlerin birbirleriyle kombinasyonlu şekilde uygulandığı sınırlı sayıda çalışma vardır. Literatürde, UV ışık uygulamasından sonra bağlantı dayanımının ölçüldüğü sadece bir araştırma bulunmaktadır (Okawa et al., 2020).

PEEK'in Üretim Yöntemleri

Laboratuvarlarda yüksek performans polimerleri kullanılarak protetik altyapı ve restorasyonlar üretmek için enjeksiyon kalıplama, bilgisayar destekli tasarım ve bilgisayar destekli üretim (CAD/CAM) ve 3 boyutlu yazıcı olmak üzere üç yöntem mevcuttur (Han et al., 2019).

CAD/CAM ile Üretim Yöntemi

CAD-CAM, bilgisayar destekli üretim/tasarım manasına gelmektedir (Palin & Burke, 2005). Üretim yolu CAD/CAM teknolojisidir. CAD/CAM sistemleri daha kısa sürede daha yüksek kalitede üretim yapılmasına olanak tanımaktadır. CAD/CAM sistemleri üç bileşenden oluşmaktadır:1. Dijital tarayıcı: Dental CAD/CAM sistemlerinin en önemli komponentlerinden biridir. Ağız içinde veya ağız dışında modellerden, prepare edilen dişlerin yapıların ve karşıt dişlerin üç boyutlu bilgisini toplayarak elde ettiği geometriyi bilgisayar tarafından işlenebilecek dijital verilere dönüştüren bir dijitalleştirme aracı/tarayıcı sistemidir. Elde edilen görüntülerin verileri, restorasyonların hasta başında üretiminde veya laboratuvara transferinde kullanılır (Beuer et al., 2009). Bu işlem esnasında ağız içi tarama kalitesini arttırmak için oksit tozu püskürtülmektedir. (Sakaguchi & Powers, 2011).2. Tasarım yazılımı: Verileri işleyen ve uygulamaya bağlı olarak, üretilecek ürün için bir veri seti üreten yazılım sistemidir. Tarama yöntemiyle elde edilen verinin görselleştirilmesi, dental restorasyonun üç boyutlu tasarımının ve planlamasının yapılabilmesi için yazılım programlarını kullanan bir bilgisayar birimidir (Fasbinder, 2012). Hareketli ve sabit protezler, veneer tasarımları ve implant cerrahisinde kullanılan stentler gibi çeşitli dental restorasyonların tasarımı yapılabilir (Beuer et al., 2009; Strub et al., 2006).3. Verileri istenilen restorasyona dönüştüren bir üretim teknolojisi CAD yazılımıyla elde edilen veriler, CAM süreci için freze cihazına aktarılır (Beuer et al., 2009). Seramik, kompozit ve metal gibi çeşitli prefabrike bloklar farklı eksenlerde freze edilerek istenilen restorasyon elde edilir (Sakaguchi & Powers, 2011).Bu üretim yolu, polimerin yeniden eritilmesi için enjeksiyon kalıplama yöntemindeki tüm riskleri ortadan kaldırır. Malzeme özellikleri stabil kalır ve altyapı üretimi, dijital bir iş akışı içerisinde gerçekleşeceği için kesinliğin artmasıyla beraber tekrarlanabilirlikten de yararlanılır. PAEK malzemeleri, frezlerde daha az aşınmaya neden olmalarıyla birlikte daha hızlı frezeleme süreleri olduğundan ve frezelemek için gerekli olan ekipmanının metal altyapıları frezelemek için kullanılan makineler kadar pahalı olmadığından, metal altyapıların frezelenmesine kıyasla CAD/CAM verimliliklerini daha da artırır (Han et al., 2019).



Şekil 3. CAD/CAM ile PEEK üretimi (Tipton, 2015)

Enjeksiyon Kalıplama Yöntemi

Endüstriyel enjeksiyon kalıplama makineleri; polimeri, diş laboratuvarlarında bulunan örneğin 10 bar basınç ile çalışan klasik tezgah üstü presleme makineleriyle kıyaslandığında çok daha yüksek basınç (1000 bar) ve hız altında işler. PAEK'in küçük ölçekli enjeksiyon kalıplaması, tasarım sınırlamaları nedeniyle zor bir işlemdir. Ayrıca PAEK'lerin yeniden eritilmesi, altyapı doğru bir şekilde soğutulmamış ve yeniden kristalleştirilmemişse, öngörülebilir olmayan; renk, kırılganlık ve esneklik gibi mekanik ve fiziksel özelliklerin bozulmasına sebep olabilir.

Ayrıca, ekipmanın hatalı kullanıldığı ya da çok iyi kontrol edilemediği durumlarda, PAEK malzemelerinin yeniden eritilmesi de fenol oluşumuyla beraber polimerin bozulmasına yol açabilir. Bu nedenle, bu malzemelerin eritilerek işlemesi yalnızca yetkili bir laboratuvar tarafından ve tedarikçi tarafından önerilen ekipman kullanılarak yapılmalıdır (Tipton, 2015).



Şekil 4. Enjeksiyon kalıplama yöntemiyle PEEK üretimi (Türkkal)

Üç Boyutlu (3D) Yazıcı ile Üretim Yöntemi

Düşük maliyet, kullanım kolaylığı, malzeme bozulması ve kontaminasyonunun minimuma indiği bir yöntem olan 3 boyutlu yazıcılar ile üretim son yıllarda PEEK polimer için de sıklıkla kullanılmaya başlanmıştır (Han et al., 2019).

PEEK'in Kullanım Alanları

Mekanik özelliklerinden dolayı PEEK, ortodontik teller, implant materyali, CAD/CAM materyali, dayanak materyali olarak ve protetik alanlarda kullanılmaktadır (Kaleli et al., 2018).

İmplant Materyali

PEEK implant materyali olarak, bruksizm veya metallere karşı alerjik reaksiyonları olan hastalar için bir alternatif olarak ortaya çıkmıştır (Elawadly et al., 2017). Üstün mekanik özellikleri, biyouyumluluğu ve kemik benzeri sertliğe sahip yapısı ile ortopedik implant uygulamaları için umut verici bir biyomateryal haline gelmiştir (Mishra & Chowdhary, 2019). Bununla birlikte, PEEK tarafından üretilen dental implantlar, ortopedik implantlarla karşılaştırıldığında klinik kullanımda henüz yaygın değildir (Najeeb et al., 2016; Wang et al., 2019). Anguiano-Sanchez ve arkadaşlarının yaptığı bir çalışmada, PEEK malzemesinin düşük stres koruyucu etkilerinin implant ömrünü uzatmak için faydalı olduğunu gösterilmiştir (Anguiano-Sanchez et al., 2016).PEEK, son zamanlarda implant dayanak materyali olarak da kullanılmaya başlanmıştır (Sacks et al., 2024). Hahnel ve arkadaşlarının (2015), titanyum, zirkonyum ve PEEK implant dayanak materyallerinde biyofilm oluşumunu analiz ettikleri çalışmalarında; PEEK'in, titanyum ve zirkonyumdan üretilen geleneksel dayanak materyallerine göre yüzeyinde daha düşük biyofilm oluşumuna ve olumlu özelliklere sahip bir dayanak materyali olduğu bulunmuştur (Hahnel et al., 2015). Geçmiş çalışmalarda, termomekanik yaşlandırmanın ardından, güçlendirilmiş PEEK dayanaklar, zirkonya dayanaklara benzer kırılma direnci sergilemiştir (Atsü et al., 2019).Titanyumla güçlendirilmiş PEEK, mükemmel biyouyumluluğu göz önüne alındığında geleneksel dayanaklara etkili bir alternatif olmakla birlikte kemik yüksekliğini koruyabilir.

PEEK Ortodontik Teller

Hastaların estetik taleplerinin gün geçtikçe artması nedeniyle metalik olmayan ortodontik teller daha popüler hale gelmektedir. PEEK, metal alaşımlarına mükemmel bir alternatif olarak karşımıza çıkmaktadır. Dental uygulamalar için PEEK, ağız ortamında korozyon, metal iyonlarının salınması, metal alerjileri ve estetik olmayan görünüm gibi metal alaşımlarının bazı temel eksikliklerini giderir (Shirakawa et al., 2018).PEEK tellerin yük-eğilme ve sürtünme özelliklerini değerlendirdiği bir çalışmada, PEEK tellerin ortodontik apareyler olarak kullanıma uygun olduğu sonucuna varılmıştır (Tada et al., 2017). Yük-eğilme eğrileri, test edilen teller arasında benzerlikler göstermiş bununla beraber, tüm malzemelerin kalıcı deformasyonu ve statik sürtünmesi arasındaki farklar önemsiz bulunmuştur.PEEK, nikel-titanyum (Ni-Ti) teller üzerinde korozyon direncini arttırmak ve mekanik özellikleri iyileştirmek için kaplama materyali olarak kullanılabilir (Rokaya et al., 2018). Bununla birlikte, uzun süreli oral kullanım, PEEK kaplamanın stabilitesinde bozulmaya neden olabilir (da Silva et al., 2013).

PEEK'in Protetik Kullanımı

PEEK polimerinin, hareketli ve sabit protezlerde kullanımının yanı sıra implant destekli sabit ve hareketli bölümlü protezlerde kullanımı da giderek artmaktadır. Bu durum, elastik modülünün kemik ve dişe yakın olması, şok absorbe etme özelliği, üstün biyouyumluluğu, yüksek termal ve kimyasal direnci ve mekanik özelliklerinin iyi olması gibi avantajlarından kaynaklanmaktadır (Türksayar & Atsü, 2021).

PEEK'in Hareketli Bölümlü Protezlerde Kullanımı

Günümüzde diş eksikliği olan hastalar, implant restorasyonlarını seçme eğilimindedir. Bununla birlikte, sistemik durum, mevcut anatomik yapı, psikolojik veya finansal nedenlerle implant için uygun aday olmayan birçok hasta hala vardır. Bu hastalar, kaybedilen dişlerin restorasyonu için konservatif ve ucuz bir yaklaşım olan hareketli bölümlü protezleri (HBP) tercih ederler (Saeed et al., 2020). Harb ve arkadaşları (2019), Kennedy Sınıf I bölümlü protezin PEEK altyapısının CAD/CAM frezeleme teknolojisiyle üretilmesi ile ilgili klinik bir rapor yayınlamıştır (Harb et al., 2019). CAD/CAM veya geleneksel kayıp mum tekniği kullanılarak, PEEK ile üretilen protez altyapısı, geleneksel malzemelere alerjisi olan veya tat duyusu daha hassas olan hastalar için Co-Cr altyapının yerini alabilir (Zoidis & Papathanasiou, 2016). PEEK gibi elastik bir materyal, dayanak dişlerde devrilme kuvveti ve gerilimi azaltabileceğinden, dayanak dişlerin periodontal sağlığına faydalı olduğu gösterilmiştir (Negm et al., 2019). Bir başka klinik çalışma, PEEK altyapılar için ağız sağlığı ile ilgili yaşam kalitesi, hasta memnuniyeti ve periodontal sağlık gibi durumlar Co-Cr altyapılar ile karşılaştırıldığında benzer sonuçlar bulmuştur (Ali et al., 2020).Tannous ve arkadaşları (2012), PEEK ile üretilen kroşelerinin Co-Cr kroşelerden daha düşük retansiyon sergilediğini bulmuştur (Tannous et al., 2012). Ayrıca çıkarma esnasında undercut bölgesinde oluşan stresin PEEK'in dayanımından daha yüksek olması, kroşeler için uygun bir materyal olmadığı sonucunu ortaya koymuştur (Tribst et al., 2020).

PEEK'in Sınırlılığı

PEEK üstünde uzun dönem klinik takiplerin yetersiz olması ile birlikte yapılan araştırma ve geliştirme çalışmalarının sunduğu bazı bilgiler şu şekildedir:

- PEEK artan klinik ilgisine rağmen, zayıf entegrasyonu ve biyolojik inertliğinden dolayı çevre kemik dokulara girmesi sorun olmaktadır. Bu özellikle bakteri enfeksiyonlu operasyon bölgelerinde yapılan PEEK implantlar uygulamaları için geçerlidir. Dolayısı ile enfeksiyon direncini ve osseintegrasyonu artırmak için daha fazla çalışmaya ihtiyaç vardır.

- PEEK implantların alternatif olarak kullanılması için klinik öncesi ve klinik vakalarda tatmin edici osseintegrasyon sonuçları göstermesi gereklidir
- Düşük su emme kapasitesi, iyi sürtünme direnci ve kemiğe yakın mukavemet gücünden dolayı tercih edilen PEEK 'e uzun vadeli oral maruz kalma sonucu zamanla PEEK kaplamaların stabilitesinde bozulmalar meydana geldiği gözlenmiştir. Bu nedenle PEEK kaplama stabilitesini değerlendirmek için yeterli klinik çalışmaya ihtiyaç vardır. Özellikle PEEK ortodontik telleri ile ilgili pral kavitedeki uzun vadeli maruz kalımı, yük dayanımı, statik-karakteristik sürtünmesi gibi kullanıma bağlı durum değerlendirici ve diş fırçalamadan, gıda renklenmeleri ve bu renklenmenin çıkarımı, yemek yeme alışkanlıklarından etkilenmesi ile ilgili yeterli klinik çalışmalara ihtiyaç vardır.
- Tannous ve arkadaşları PEEK kroşeler ile kobalt-krom kroşeleri karşılaştırmış ve PEEK kroşelerin yeterli retansiyonu göstermediğini öne sürmüştür. Bu nedenle klinik kullanımda PEEK kroşelerin retansiyon kuvvetinin değerlendirilmesi ile ilgili vaka analizlerine ihtiyaç vardır.

İleri PEEK Çalışmalarına Yönelik Öneriler

PEEK, diş hekimliğinde metal alaşımlara alternatif yüksek performans polimer materyal olarak görülmektedir. Dayanıklılığı, kırılma direnci, dentine ve kemiğe yakın elastikiyet modülü, şok absorbsiyon yeteneği ve biyouyumluluğu, korozyon direnci sayesinde diş hekimliğinde yaygın kullanım alanına sahip olmuştur. Ayrıca düşük ağırlığı ve estetiği kabul edilebilir oranda sağlayabildiği için kullanımı metallere oranla giderek artmaktadır. Özellikle protetik tedavide alt yapı materyali olarak kullanılmakla birlikte implanttoloji, ortodonti, endodonti, restoratif restorasyonlar gibi çeşitli diş hekimliği alanlarında da kullanılmaktadır. CAD-CAM teknoloji ile kullanılması sayesinde hızlı, kolay ve daha az hatalı restorasyonlar üretilebilmektedir. PEEK üstünde uzun dönem klinik çalışmaların yetersiz olmasından dolayı polimerlerin, diş hekimliğinde kullanımını kısıtlamaktadır.. Bu nedenle daha fazla vaka çalışmasına, randomize klinik çalışmalara ve in vitro çalışmalara ihtiyaç olduğu görülmektedir. PEEK polimeri gelecek vadetse de polimer esaslı materyallerin diş hekimliği ve protetik tedavide kullanımı için zamana ihtiyaç olduğu anlaşılmaktadır.

Sonuç

PEEK mekanik, fiziksel ve kimyasal özelliklerinin yanı sıra modern tıptaki çeşitli uygulamaları yönüyle büyük umut vaat etmektedir. Ortopedi uygulamalarında omurga füzyonu, disk artroplastisi, laminektomi, travma ve onkolojik cerrahi, eklem artroplastisi ve artroskopik cerrahi alanlarında popüler bir seçimdir. Ayrıca ağız-çene-yüz ve kraniyofasiyal cerrahide

yörünge ve mandibular rekonstrüksiyonları, temporomandibular eklem değişimi ve kraniyoplasti uygulamalarında komplikasyon ve hasta memnuniyeti açısından olumlu rapor edilmiştir. Kardiyovasküler ve kardiyotorasik uygulamalar açısından değerlendirildiğinde ise kalp damar cerrahisine yönelik implantlar, kalp kapak protezleri ve yaprakçık kalp kapakçıkları oluşturmada, kemik fiksasyon etkinliği ve uygulama kolaylığı yönüyle PEEK uygulamaları önerilmektedir. Ameliyat sonrası antibiyotik verilmesi, antimikrobiyal uygulamalar ve kansere karşı ilaç dağıtımı sistemlerinde etkili bir şekilde kullanılmak üzere ilaç yüklü nanakapsül, nanopartikül veya misel sistemleri ile katkılanacak PEEK materyalleri geliştirilebilir.

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Özet
Ni-Hard alaşımları arasında Ni-Hard 4, yüksek Cr ve Ni içeriği sebebiyle mekanik ve elektrokimyasal açıdan en iyi performansa sahip alaşım olarak bilinmektedir. Diğer bir adı yüksek Cr içeren beyaz dökme demir olan Ni-Hard 4 alaşımı aşınma ve korozyona maruz kalan parçaların kaplanması gibi çeşitli uygulama alanlarında yaygın bir şekilde tercih edilmektedir. Bu çalışmada konvansiyonel kaplama yöntemlerinden farklı olarak basınç destekli sinterleme ile saf demir üzerine Ni-Hard 4 kaplama yapılmış ve yüzey özelliklerine etkisi araştırılmıştır. Sinterleme ile kaplama işlemleri eş zamanlı olarak 950 °C'de 30 dakika süre boyunca uygulanmıştır. Karakterizasyon işlemlerine yoğunluk ölçümü ile başlanmıştır. Üretim yönteminin de etkisiyle %97 değerinde yüksek bir relatif yoğunluk elde edilmiştir. Mikroyapısal inceleme sonucunda altık ve kaplama arasında kuvvetli bir bağlantı oluşumu gözlemlenmiştir. Ayrıca Ni-Hard 4 kaplama, altlık malzemenin sertlik ve aşınma özelliklerinin gelişmesine yol açmıştır. Dolayısıyla Ni-Hard 4 kaplamanın yenilikçi bir yaklaşım olan sıcak pres ile uygulanması sonucunda altlık malzemeye üstün yüzey özellikleri kazandırılmıştır. Bu açıdan değerlendirildiğinde Ni-Hard 4 kaplama, saf demirin yüzey özelliklerini geliştirmiş ve yüksek performansa sahip kaplama elde edilmiştir.
Anahtar Kelimeler: Beyaz dökme demir, Ni-Hard 4 alaşımı, toz metalurjisi, yüzey özellikleri, mikroyapısal karakterizasyon

HOT-PRESS COATING OF NI-HARD 4 ALLOY ON PURE IRON

Abstract
Ni-Hard 4 is well-known among the Ni-Hard alloys for its superior mechanical and electrochemical properties, mostly attributed to its higher chromium (Cr) and nickel (Ni) composition. Ni-Hard 4 alloy, also known as high-Cr white cast iron, is widely selected in many application areas, such as the coating of parts subject to wear and corrosion. In this work, unlike conventional coating methods, Ni-Hard 4 coating was applied on pure iron by pressure assisted sintering and its influence on surface features was examined. Sintering and coating processes were carried out simultaneously at 950 °C for 30 minutes. Characterization processes started with density measurement. With the influence of the production method, a high relative density of 97% was obtained in the Ni-Hard 4 alloy. Furthermore, the microstructural investigation showed strong bond formation between the substrate and the coating. In addition, Ni-Hard 4 coating led to an increase in hardness and wear properties of substrate. As a consequence of the production of Ni-Hard 4 coatings by hot pressing, improved surface properties were obtained. In this regard, the surface properties of pure iron were improved by Ni-Hard 4 coating and high performance coating was improved.
Keywords: White cast iron, Ni-Hard 4 alloy, powder metallurgy, surface properties, microstructural characterisation

Introduction

Developing new methods and heat treatments for cast iron alloys allows new materials to show better mechanical properties and greater resistance to corrosion in various aggressive industrial environments (Abd El-Aziz et al., 2015; Banadkouki et al., 2018). High-alloyed cast irons are an important group of materials with an alloy content above 4%. High alloyed cast irons (450-850 HB) have superior wear, heat and corrosion resistance properties compared to other unalloyed or low alloyed cast irons. The main alloying elements used in high-alloy cast irons are nickel, chromium, molybdenum, copper and vanadium (Wei & Xu, 2019; Barutcuoglu et al., 2024). These materials are called Ni-Hard, Cr-Hard, etc. according to their alloy content. Ni-Hard is the name of highly alloyed white cast iron with very high wear resistance (Yücel & Günay, 2013). Among the Ni-hard alloys, Ni-Hard 4 is known as the hardest and most corrosion resistant alloy due to its high Cr and Ni content. Ni-Hard 4 alloy, also known as high Cr white cast iron, is frequently preferred in various application areas, such as mechanical parts exposed to wear and parts that will work in corrosive environments. In this alloy, depending on their chemical composition, $M_{23}C_6$, M_7C_3, M_6C, and M_3C type carbides can be seen in the microstructure (Çöl et al., 2016; Ruangchai et al., 2021). These carbides increase the hardness and wear resistance of the structure, enabling the material to be used as coatings in industry to improve the performance and life of cutting and drilling tools. Current coating technologies include thin film PVD and CVD coating techniques and thick coating types such as thermal spray and laser coating techniques (Sathish et al., 2023). Although the coating thickness to be applied varies according to the need, each method has its own advantages and disadvantages. Research for the development of coating methods continues. At this point in pressure-assisted sintering methods, applying pressure simultaneously with temperature to the powder compound during sintering creates the driving force for high density and leads to an increase in density kinetics. The external pressure increases the densification rate, allowing material production at lower sintering temperatures and times (Yamanoglu, 2019). However, coatings of Ni-hard alloys can be used as final parts after sintering. Such advantages make the application of industrial coatings by hot pressing attractive. In light of all this information, in this study, Ni-Hard 4 alloy was coated on pure Fe by pressure-assisted sintering technique. The surface properties of the coating and substrate materials were measured, and the applicability of the coating technique was evaluated.

Materials and Methods

In the study, pure Fe (10 µm) powder produced by chemical methods was used as the substrate, and Ni-Hard 4 alloy powder produced by gas atomization was used as the coating. The chemical composition of Ni-Hard 4 powder is also given in Table 1. The coating powders were produced using the gas atomization device in the Metallurgical and Materials Engineering Department of Kocaeli University. In our previous study (Muratal et al., 2024), we detailed the production and powder characterization of Ni-Hard 4 alloy powders.

Table 1. Chemical composition of Ni-Hard 4 alloys

Elements	C	Si	Mn	S	P	Ni	Cr	Mo	Fe
Amounts (wt. %)	3.0-3.6	0.3-0.5	0.3-0.7	≤ 0.15	≤ 0.3	3.3-4.8	7-11	≤ 1.5	Rest

First, the base powder was laid in the graphite die, and then the coating powders were added to the die. The prepared die was placed in a DIEX VS50 brand hot press device. The coating process was carried out at 950 °C for 30 minutes under a constant pressure of 50 MPa. In addition, the production chamber was kept under vacuum with a pressure of 10-4 mbar to avoid particle oxidation. Metallographic processing steps were performed before microstructural characterization. Firstly, the sample was sectioned using a METKON brand Microcut 150 precision cutting device. Then the cross-section surface was prepared by sanding and polishing. Finally, the samples were etched in 40 ml HCl and 20 ml HNO3 solution at 40°C. Optical microscope images were taken using an OLYMPUS BX41M-LED microscope. A JEOL JSM 6060 scanning electron microscope was used for SEM images. Hardness measurements were performed using a Zwick brand Roell ZHV model Vickers hardness tester with a 0.5 kgf loading for 10 s. A ball disc type TURKYUS POD/HT/WT brand abrasion device was used for the dry sliding wear test performed to evaluate the tribological properties of the samples. The wear tests were carried out at a 500 m distance, 20 N load, and 300 rpm rotational speed at room temperature using Si3N4 balls.

Results and Discussion

Microstructural Characterization

Figure 1(a) shows the presence of tiny holes in both the Ni-Hard coating and the pure iron substrate. The pores were mostly localized at the interfaces between particles and exhibited a spherical morphology. Thus, these factors are not anticipated to provide significant drawbacks in terms of the material's strength. In Figure 1(b), the etched interfacial picture shows the production of pearlite in the interfacial area due to carbon diffusion. As it moved away from

the coating area, the ferrite phase became the dominant component in the microstructure. The optical images showed the presence of martensitic phase and the production of hard coarse M_7C_3 type carbide in the coating area. The scanning electron microscope (SEM) image shown in Figure 1(c) reveals the presence of diffusion in the interfacial area between the substrate and the Ni-Hard coating. Consequently, carbon diffusion led to forming a pearlitic structure in the interfacial area, which was distinct from the matrix. carbon diffusion unlike the matrix.

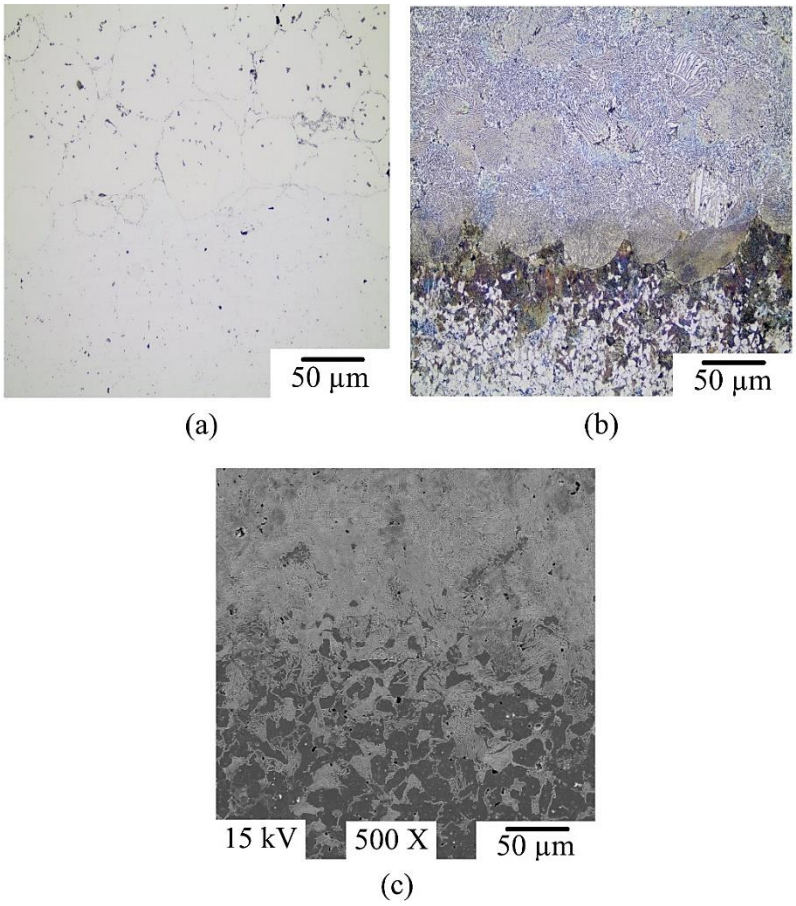


Figure 1. Microstructure images of the sample: (a) polished, (b) etched, (c) SEM image

Hardness Results

The interface Vickers hardness result of the sample obtained in the study is given in Figure 2. As can be observed, hardness testing was carried out in 3 separate regions: the substrate, the interfacial area and the coating. When results are evaluated, it is discovered that the hardness value of Ni-Hard 4 coating is higher than pure iron. The hardness increase is related to the unique microstructure of high-alloy cast iron. The microstructure is generally formed of three parts and two supporting elements. The three ingredients are Fe, C and a significant amount of Cr. Fe is the matrix element and forms the martensite phase with C, strengthening the material. The Cr and C presence increases the hardness and wear resistance of the structure by producing

M_7C_3 carbides. However, the size of these carbides should be kept under control in case of coarsening. Coarse-grained carbides adversely affect the impact strength of the structure. For this reason, Ni and Mo reinforcements in the alloy developed fine-grained carbides, resulting in high hardness and high impact strength. Therefore, the formation of M_7C_3 carbide in Ni-Hard 4 coating and its uniform distribution in the structure led to a substantial hardness increase compared to the base material.

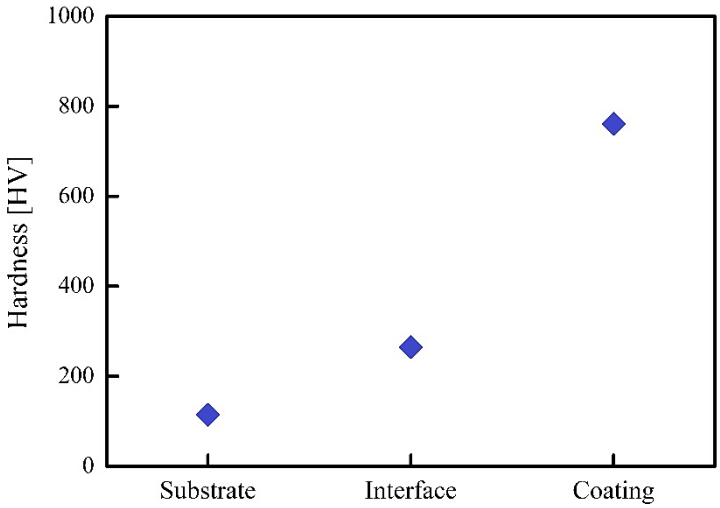


Figure 2. Vickers hardness test results from surface to centre

Wear Results

The dry wear test results applied to the pure iron substrate and Ni-Hard 4 coating are given in Figure 3 in terms of wear rate. As can be observed, the Ni-Hard 4 alloy showed better wear resistance than pure iron. The increased wear performance was due to the significant hardness differences between the substrate and the coating. As a result of the improved hardness, the coating experienced a lower wear rate. The wear rate of Ni-Hard coating was measured at 0.185 mm3m-1.10-3 and that of pure iron at 0.803 mm3m-1.10-3. On the other hand, microstructural differences in the substrate and coating caused the two regions to show different wear mechanisms. The Ni-Hard 4 alloy exhibited high abrasive wear with carbides, which increase hardness.

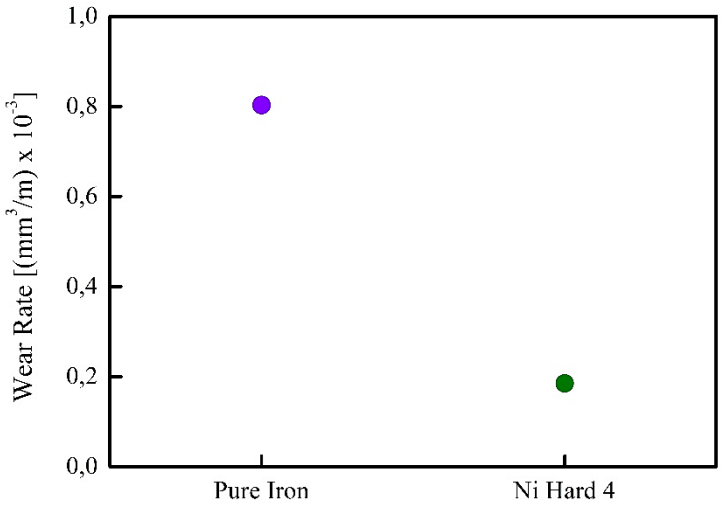


Figure 3. Wear rate values of materials

High plastic deformation zones were identified on the worn surface of pure iron. Furthermore, the wear of pure iron began with adhesive signs, followed by severe oxide growth due to friction and temperature. The oxide layers produced under load fractured and left abrasive markings in the system. This situation resulted in massive material losses. On the other hand, Figure 4 shows the friction coefficient values obtained as a result of the wear test. As can be observed, the coefficient of friction of the Ni-Hard 4 alloy was lower than that of pure iron. The low coefficient of friction could be shown as one of several factors leading to reduced material loss in the coating.The strong carbide structure prevented the abrasive tip from being embedded in the matrix, and reducing the contact area led to a reduction in the friction coefficient.

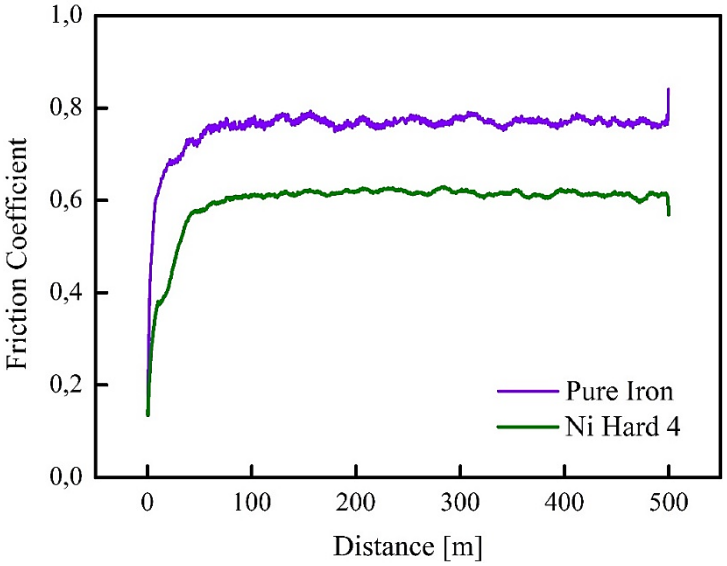


Figure 4. Friction coefficient graph of the materials

Conclusion

Powder metallurgical coatings are a solution against system responses like abrasion and corrosion, which negatively influence industry sustainability and raise company expenses. They are increasingly preferred because of their easy adaptability, wide range of materials, and application regions. This work aims to coat Ni-Hard 4 alloy, which stands out with its strong wear resistance and excellent corrosion resistance in its own material family, on iron using pressure-assisted sintering. This study was motivated by the limited research on the application of the hot press technique to a coating strategy. When the results were examined, superior wear performance was noticed with the Ni-Hard 4 alloy coating due to the enhanced hardness compared to pure iron. Furthermore, it was determined that there was a strong connection between the coating and the basic material. As a result, the findings obtained with pressure-assisted sintering demonstrated that this method can be an alternative to common coating procedures used in industry.

Thanks and Information Note

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GELENEKTEN AKILLIYA: ŞEHİRLERDE DEĞİŞİMİ YÖNETMEK

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Özet
Akıllı şehirler, bilgi ve iletişim teknolojilerinin entegrasyonuyla sürdürülebilirlik, verimlilik ve yaşam kalitesi açısından önemli fırsatlar sunmaktadır. Bunu; altyapı ve ulaşım, enerji yönetimi, bilgi ve iletişim teknolojileri, kamu hizmetleri, çevresel sürdürülebilirlik, toplumsal katılım ile veri analitiği ve yönetiminin bütün olarak gelişimi ve dönüşümüyle sağlamaktadır. Bu dönüşüm süreci karmaşık ve çok boyutlu olduğundan, etkili bir değişim yönetimi gerekmektedir. Bu çalışmada, geleneksel şehirlerden akıllı şehirlere geçişin zorlukları, fırsatları ve değişim yönetimi stratejileri incelenmektedir. İlk olarak, akıllı şehirlerin tanımı, temel özellikleri ve bileşenleri açıklanmaktadır. Bu bileşenler arasında altyapı ve ulaşım, enerji yönetimi, kamu hizmetleri, çevresel sürdürülebilirlik, bilgi ve iletişim teknolojileri, toplumsal katılım ve veri analitiği yer almaktadır. Daha sonra, şehirlerin dijital dönüşümü için önemli olan teknolojik altyapı, veri yönetimi ve güvenlik gibi konular ele alınmaktadır. Akıllı şehirlerin sürdürülebilirlik, enerji yönetimi, vatandaş katılımı ve kamu hizmetleri gibi alanlardaki etkileri ve fırsatları da tartışılmaktadır. Bu değişim sürecinde, yerel yönetimler, paydaşlar ve vatandaşlar arasında etkili iletişim, işbirliği ve liderlik önemli rol oynamaktadır. Değişim yönetimi stratejileri, kaynakların etkili kullanımını ve sürdürülebilirlik ilkesine dayanan bir yaklaşımı gerektirir. Akıllı şehirlerin geleceği için etkili bir değişim yönetimi stratejisi, teknolojik, sosyal ve kurumsal boyutları dikkate alan ve sürdürülebilirlik ilkesine dayanan bir yaklaşım gerektirmektedir. Sonuç olarak bu çalışma, şehirlerin gelenekselden akıllıya dönüşümünde karşılaşılan zorlukları ve başarı faktörlerini anlamak için bir çerçeve sunmaktadır.

Anahtar kelimeler: Akıllı şehirler, değişim yönetimi, sürdürülebilirlik, teknoloji entegrasyonu, veri yönetimi

FROM TRADITIONAL TO SMART: MANAGING CHANGE IN CITIES

Abstract
Smart cities offer significant opportunities for sustainability, efficiency and quality of life through the integration of information and communication technologies. This is achieved through the development and transformation of infrastructure and transportation, energy management, information and communication technologies, public services, environmental sustainability, social participation and data analytics and management. As this transformation process is complex and multidimensional, effective change management is required. This study examines the challenges, opportunities and change management strategies for the transition from traditional cities to smart cities. First, the definition, main characteristics and components of smart cities are explained. These components include infrastructure and transportation, energy management, public services, environmental sustainability, ICT, civic engagement and data analytics. Then, issues such as technological infrastructure, data management and security, which are important for the digital transformation of cities, are discussed. The impacts and opportunities of smart cities in areas such as sustainability, energy management, citizen engagement and public services are also discussed. Effective communication, cooperation and leadership between local governments, stakeholders and citizens play an important role in this change process. Change management strategies require effective use of resources and an approach based on the principle of sustainability. An effective change management strategy for the future of smart cities requires an approach that takes into account technological, social and institutional dimensions and is based on the principle of sustainability. In conclusion, this study provides a framework for understanding the challenges and success factors in the transformation of cities from traditional to smart.
Keywords: Smart Cities, Change Management, Sustainability, Technology Integration, Data Management

Introduction

According to various definitions, change is a process that refers to the transition from one structure to another structure, which has no orientation and can take place in different directions. This process can occur suddenly or be initiated by people in a planned or unplanned manner. While the results of change can have positive effects when it occurs in the desired direction, negative results may occur when it occurs in an undesired way. In other words, change refers to a process of activities carried out to ensure that a situation is transformed into a new structure by differentiating over time. This process can take place in a planned or unplanned manner and can have positive or negative consequences (Helvacı, 2015).Today, organizations and formations are faced with the necessity of taking into account the changes that occur in order to achieve their goals. Because any change in environmental conditions directly affects the activities of organizations and forces them to change. For this reason, three main problems affecting change are emphasized meticulously: problems arising from the competitive market structure, problems arising from the workforce and problems arising from the social environment (Güçlü & Şehitoğlu, 2006).Smart cities are another structure affected by changes in the social and social environment. Smart cities are formations created mainly for data collection using various electronic methods and sensors in urban areas. This data collection process aims to utilize resources more efficiently and continuously improve the quality of services and operations. Data is collected from sources such as city dwellers, buildings, infrastructure and other amenities, and through the analysis of the collected data, it is used for purposes such as traffic and transportation systems, energy generation and distribution systems, public services, water supply, treatment and distribution systems, waste management, recycling and disposal, security and crime detection, monitoring and management of public spaces.Smart cities connect information technologies and various physical devices connected to the Internet of Things to improve the efficiency of services and operations and to interact with city residents. In this way, smart cities are able to dynamically monitor the state of the city by interacting with both city infrastructure and residents. The information obtained improves service quality, performance and interactivity, while at the same time reducing costs and resource consumption.

In the following sections of the study, the concept of change and types of change, the aims and benefits of change, change management and strategies are examined, followed by information on smart cities, their characteristics and framework. Finally, the challenges faced with smart cities from a change management perspective are examined.

The Concept and Types of Change

Change is a concept in which the economic, social, cultural and political factors interacted with in existential processes are constantly changing along with the external environment, competitors and customer base. Capturing change is therefore a difficult challenge. Organizations have to change continuously to compete with the external environment, time and competitors (Tokat, 2012). Change refers to the process of moving an entity or situation from one level to another. The change process of organizations takes place through differentiation at individual and organizational level, production and implementation of innovative ideas (Koçel, 2015; Erdoğan, 2015). Change involves changes in the internal dynamics of the organization, business processes, structural values, authorities and responsibilities, production techniques, environmental regulations, competition policies and managerial strategies (Sabuncuoğlu & Tüz, 2016).Organizations evaluate over time and space to decide whether change is necessary. External causes include political factors, technology, competitors, customers, financial conditions, economic conditions, social conditions, natural conditions, public opinion and suppliers. Internal causes, on the other hand, are factors internal to the organization and include factors that force the organization to change, such as organizational inefficiencies, downsizing policy, change in organizational values, alternative working methods, change of senior managers, growth policy and mergers (Sabuncuoğlu & Tüz, 2016). Identifying and analyzing these factors helps organizations develop strategies to implement change and ensures successful management of change.With the increasing demand for change, organizations have started to implement various types of change. These types of change are divided into various categories such as continuous-root, planned-unplanned, pre-emptive-reactive, large-scale-small-scale, active-passive, individual, group and organizational change. Continuous change is a process of adaptation, restructuring and experimentation that organizations use to adapt to environmental conditions. Fundamental change is a type in which fundamental and in-depth changes take place in the structure or objectives of the organization. Individual change refers to changes in an individual's thinking and behavior, while group change refers to changes in the structure and relationships within a group. Institutional change refers to changes in behaviors, structures, procedures or outputs of certain units within an organization (Helvacı, 2015). Planned change is a type of change in which the change process is planned and implemented in advance, while in unplanned change, the purpose and stages of change are not determined in advance. While pre-emptive change enables the organization to anticipate and prepare for environmental changes, reactive change is a type of change that occurs by reacting to environmental conditions

when they occur. While large-scale change affects the overall structure of the organization, small-scale change refers to changes related to a specific issue. In active change, the organization actively changes, while in passive change, it accepts change within itself to adapt to the environment (Koçel, 2015).

Aims and Benefits of Change

The main objective of change is to increase efficiency by combining the requirements of the work and the qualifications of the people doing the work, and to achieve more output using fewer resources. Thus, increasing efficiency is also an important goal of change. In addition, change also has goals such as increasing motivation, preparing for the future, developing trust and cooperation, finding solutions to problems, and improving communication (Sabuncuoğlu & Tüz, 2016). The rapid development and change in technology reveals the necessity for organizations to keep pace with change and follow technological innovations. In this context, change is directed towards the goal of organizations to provide innovation, and in certain cases, organizations may have goals that are compatible with their long-term plans and programs. In such cases, the purpose of change is to create a structure that makes it easier for organizations to enter new areas to achieve these goals (Tokat, 2012).While it is known that change is generally aimed at achieving these goals, there are also goals that prioritize human resources. Objectives such as developing the ability to establish empathy and humanistic relationships, increasing organizational knowledge and work performance, building mutual trust and support, developing behaviors that will ensure open communication, cooperation and independence, and gaining the ability to understand group work and group behavior reflect the human-oriented dimension of change (Tokat, 2012). These objectives focus on the development and effective use of human resources in organizations, thus aiming to improve the performance of employees by increasing their motivation.For organizations, change is both a necessity and an effective process that ensures the continuity and development of the organization. Beyond being a technical process, change also requires a change in mindset. New approaches should be adopted to solve problems instead of acting with old mindsets. In addition, change not only brings solutions to current problems, but also requires being prepared for potential problems that may be encountered in the future. Change supports the growth and development of organizations as well as ensuring the continuation of their activities. In addition, change shapes the future by creating a vision for the organization and provides many positive results and benefits (Güçlü & Şehitoğlu, 2006).

Positive outcomes of change include creating excitement and vitality in the organization, enabling employees to focus, providing new opportunities, developing and satisfying employees. Groups formed with change add dynamism to the organization and ensure that routine activities are reviewed and organized (Erdoğan, 2015). However, if change is handled incorrectly, it can lead to negative consequences such as the risk of not achieving goals, increased costs, lost benefits, decreased motivation and negative attitudes of employees (Helvacı, 2015). Therefore, the change process should be managed carefully and strategies should be determined in accordance with the needs and priorities of the organization.

Change Management and Strategies

The fact that the environment is in a continuous process of change obliges organizations to change, whether they want to or not. Organizations that cannot adapt to change may lose their ability to compete and may even cease to exist. Therefore, organizations should be able to successfully manage change and exhibit a flexible attitude towards change.In order to manage change successfully, it is important to pay attention to the following factors. Creating a sense of urgency, building a strong guiding coalition, creating a vision, sharing the vision, empowering others to bring the vision to life, planning and creating short-term gains, consolidating progress and creating further change, institutionalizing new approaches play an important role in change management (Kotter, 1995).Change management involves a five-stage process. These stages are examining the factors that require change, diagnosing the change, creating a change program, implementation, and monitoring and evaluating the change. Effective use of factors such as leadership, communication, participation and training ensures the success of the change management process. In addition, dealing with resistance to change, increasing employee motivation and continuous improvement of the process are also important elements (Erdoğan, 2015).Different strategies are used for change management (Sabuncuoğlu & Tüz, 2016): Among these strategies are empirical-logical strategies. According to this strategy, people can be directed to change by persuading them with objective information. It is important for those who want to implement change to first convince the people who will be affected and benefit from the change about the advantages of change. By providing unbiased and solid information, people are made to understand the opportunities and improvements that change will bring. Use of force-coercion strategies are also an effective approach to change management. In this strategy, change is enforced through the use of political or economic sanctions and rules. While power strategies require people to be coerced if they do not dare to change, coercion strategies guide people to change through the incentives of power, law, reward

and punishment. These strategies aim to get individuals to respond to change out of fear of punishment or desire for reward rather than consent to change. Prescriptive-retraining strategies aim to support change by observing whether change occurs in behaviors, norms, relationships and skills. In this strategy, values and assumptions are clarified and based on participation. Power sharing is important to build consensus for change and foster collaboration. Prescriptive-retraining strategies take more time but allow for more internalization. In these strategies, individuals are encouraged to understand, accept and personally embrace change. In this way, different strategies for change management are used, aiming at effective management and acceptance of change. The choice of strategies may vary depending on the nature of the change, its objectives and the characteristics of the organization or community. What is important is that the strategies are carefully planned and implemented so that the change is successful and lasting.

Smart Cities

There are many different definitions of smart cities in the literature (Partigöç, 2023). Factors used to define smart cities include the application of various electronic and digital technologies, transforming life and work environments within the city through the use of ICTs, integrating ICT applications into government and public systems, and developing innovations and knowledge regionally through applications that bring ICTs and people together (Deakin, 2013). Different researchers have defined smart cities as a process of researching and identifying smart solutions to improve the quality of services provided to citizens, a city that provides economic growth and high quality of life in a sustainable way, and systems that support city development and improve urban services using communication technologies (Caragliu et al., 2011; Law & Lynch, 2019).For a better understanding of the smart city concept, it is important to identify its basic components. Technology factors consist of physical infrastructure, smart, mobile and virtual technologies and virtual networks. Human factors are related to human infrastructure and social capital, while institutional factors consist of governance, policy, regulation and directives (Nam & Pardo, 2011). Smart city technologies are especially manifested in applications in areas such as transportation, environmental sustainability, energy and natural resource conservation, health and education. These applications contribute to making cities more efficient, sustainable and people-oriented.The journey of smart cities started in the 1970s with the Los Angeles Cluster Analysis project. The first smart city concept emerged in Amsterdam in 1994. Smart city studies gained momentum in the 2000s with the initiatives of IBM and Cisco. Later, many countries supported the development of smart cities by

implementing similar projects (Verdict, 2020). In the last two decades, rapid developments in information technologies, advances in sensor technologies, and exponential growth in computing power have led to an increase and expansion of technology applications in cities. Smart cities utilize IoT networked devices, various software, user interfaces and communication networks to make life easier. IoT is a network of connected devices such as vehicles, household appliances, traffic lights, street lights, etc. that communicate with each other and exchange data. The data from these devices is stored in the cloud or on servers, enabling efficiency gains in both the public and private sectors and helping citizens realize economic benefits and improvements in quality of life.Smart cities have many features. First of all, smart cities are a concept based on the idea of utilizing technology and digital tools to increase the smartness of a city (Hollands, 2008). In this concept, information technologies are used to increase economic and political efficiency and to ensure social, cultural and urban development. Key components of smart cities include informed, educated and engaged citizens, as they play an important role in creating a high quality of life and civic space (Deakin, 2013). Moreover, supporting sustainable business initiatives is of great importance for strategic planning (Angelidou & Psaltoglou, 2017). Therefore, it is important to monitor and cooperate with neighboring cities (Angelidou, 2017). Privacy and security are considered critical issues in smart cities and relate to how data is used (Kitchin, 2015). Smart city strategies are also characterized by their ability to take into account local challenges, needs and opportunities (Paskaleva, 2011). Stakeholder involvement is also an important feature in the planning and implementation of smart city initiatives (Angelidou & Psaltoglou, 2017). They are large and costly projects that require ethical and political considerations and should be carried out with a planning approach that takes into account long-term community interests (Watson, 2014). For these initiatives to succeed, a clear strategic framework and an architecture that pays attention to complementarities are needed (Angelidou, 2014). Moreover, the development of smart cities should be a product of interdisciplinary planning, as it covers a broad spectrum of development and tackles pressing urban challenges (Burger et al., 2013). This development aims to integrate different dimensions of intelligence, such as information systems, human intelligence, collective intelligence and artificial intelligence (Deakin, 2013). The intelligence of smart cities is realized through the effective combination of communication lines, sensors and software (Manshanden & Lambooy, 2007).

Smart City Framework

Several frameworks should be used for the creation, consolidation and adoption of smart city capabilities (Govada et al., 2017). These frameworks can be divided into five key dimensions that include different categories related to smart city development (Sharifi, 2019):The technology framework includes the technological infrastructure and solutions used in smart cities. The effective use of technologies such as sensors, communication networks, artificial intelligence and automation are important elements of this framework. The people framework encompasses the residents, communities and users of smart cities. Factors such as human-centered design, participation, education and awareness form the basis of this framework. It is of great importance that smart cities are in line with the needs and expectations of people. The institutional structure dimension includes the institutions that manage and operate smart cities. The cooperation and coordination of public institutions, private sector companies, civil society organizations and other stakeholders form the basis of this framework. A good governance and policy framework ensures that smart cities operate in a sustainable and effective manner. The energy framework includes elements such as energy efficiency, renewable energy sources and smart energy management. Optimizing energy consumption and using sustainable energy sources is of utmost importance in smart cities. The data management framework includes the effective management and utilization of large amounts of data collected in smart cities. Issues such as data security, privacy, analysis and sharing are important components of this framework.These five key dimensions serve as guiding frameworks for the successful development and implementation of smart cities. Consideration of each dimension is crucial for smart cities to realize their full potential.

Assessing the Challenges of Smart Cities from a Change Management Perspective

In smart city initiatives, creating a roadmap is the first step. The key elements of this roadmap are community analysis, smart city policy development and community engagement with e-government services and a strong city-wide Wi-Fi infrastructure. Research has identified common challenges of smart city initiatives. While budget constraints pose a key challenge to sustainability, social media and mobile communication technologies offer new opportunities for community engagement (Alawadhi et al., 2012). In addition, it has been stated that smart city applications change the organizational culture and increase the level of transparency and accountability through data-driven management.Integrating different technologies and existing infrastructure, ensuring data privacy and cybersecurity, promoting citizen participation and inclusion in decision-making, addressing the digital divide, managing sustainable and energy-

efficient practices, dealing with complex regulatory frameworks, securing adequate funding and investment, and developing flexible strategies to deal with potential disasters and emergencies are some of the challenges that need to be overcome in the process of implementing smart city initiatives. These challenges require collaborative efforts and innovative solutions and are important to achieve the goal of creating efficient, inclusive and sustainable urban environments in the future (Gupta, 2023).Organizations have to adapt to change in order to survive and adapt to environmental conditions. However, elements of resistance may emerge in the change process. Resistance is defined as forces that oppose change and prevent transformation. These elements of resistance may differ from organization to organization and may make it difficult for change to be successful. Therefore, it is important for organizations to remain robust, consistent and willing to change when faced with resistance to change. There are different reasons why people resist change. Work-related reasons include fear of technological unemployment, fear of increased workload, fear of lack of technical knowledge, fear of changes in the wage/reward relationship and high costs. Personal reasons include fear of the unknown, the need for security, the difficulty of giving up habits and the fear of failure, while social reasons include group norms and goals versus the goals of change, negative attitudes and mistrust towards change, unwillingness to give up existing social relationships and the perception that change is only in the interest of a particular group.Organizations use a variety of strategies to reduce or eliminate resistance to change. These strategies include participation, communication and education, negotiation, explicit or implicit coercion, manipulation and cooptation. Participation helps to reduce resistance by ensuring that those who are subject to or affected by the change are actively involved in the process. Communication and training are important for explaining the necessity of change, adopting new approaches and enabling individuals to adapt to change. Negotiation aims to gain the approval and support of those who will be affected by the change, while explicit or implicit coercion methods can be used to overcome resistance. Manipulation and cooptation can help reduce resistance by influencing those who are against change. However, if it is considered that the basic principles for change management can be applied to smart cities:Communication and Persuasion: Effective communication between stakeholders is crucial in the smart city transformation process. In this process, city residents need to be regularly and clearly informed about the reasons, benefits and process of change. In addition, transparent and participatory communication strategies should be used to gain public support.

Leadership and Sponsorship: The role of leaders and influential sponsors is crucial in smart city transformation. Leaders should define and support the smart city vision and guide the process. Sponsors should assume responsibilities such as providing financial resources, participating in decision-making processes and removing barriers.Participation and Stakeholder Management: In smart city transformation, local communities, businesses, civil society organizations and other stakeholders should be actively involved in the process. This means understanding the expectations of the community, ensuring participation and taking into account the views of different stakeholders. Collaboration and partnership should be built to ensure stakeholder ownership and support.Vision and Goals of Change: A clear vision and goals should be set for smart city transformation. This vision should include smart city goals such as sustainability, quality of life, efficiency and innovation. The vision should provide a roadmap to bring all stakeholders together and guide the process.Planning and Resource Management: Smart city transformation requires comprehensive planning and resource management. This planning should meet the needs of technological infrastructure, data management, energy, transportation and other areas. Resources must be properly allocated to effectively meet the requirements, such as human, financial and technological resources.Dealing with Resistance: The smart city transformation process may encounter resistance. It is important to understand resistance, identify its source and deal with it with effective strategies. At this point, resistance should be reduced and public trust should be gained through methods such as education, information and transparency.Improvement and Learning: During the smart city transformation process, feedback should be continuously received and the process should be monitored. The experiences and learnings obtained in this way should be used to improve the process. In addition, the impacts and results of the change should be evaluated and lessons should be learned for future projects and initiatives.

Conclusion

These principles provide a basic framework for effectively managing change in smart cities. However, as each city has different needs and circumstances, change management strategies should be customized to local conditions. Key principles such as communication and persuasion, leadership and sponsorship, participation and stakeholder management, vision and goals of change, planning and resource management, dealing with resistance, improvement and learning are crucial for smart city transformation. These principles provide a framework for effectively managing change in smart cities and ensuring the active participation of society. The

more cities that want to change can comply with these principles, the more they will be able to realize change and transformation.

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AKILLI ŞEHİR OLMA YÖNÜNDE YEREL YÖNETİM ÇALIŞMALARI: İSTANBUL ÖRNEĞİ

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Özet
Akıllı şehirlerin bileşenleri teknoloji, veri ve sürdürülebilirlik ilkelerini bir araya getirerek şehirleri daha yaşanabilir, sürdürülebilir ve etkin hale getirmektedir. Akıllı şehirlerde altyapı ve ulaşım, enerji yönetimi, bilgi ve iletişim teknolojileri, kamu hizmetleri, çevresel sürdürülebilirlik, toplumsal katılım, veri analitiği ve yönetim bileşenlerinin bir bütün olarak geliştirilmesi önemlidir. Bu çalışma, yerel yönetimlerin akıllı şehir olma yolunda attıkları adımları ve şehirlerin dönüşüm sürecindeki ana adımları ele almaktadır. Büyük bir küresel metropol olan İstanbul, artan bir nüfus, karmaşık bir ulaşım ağı ve çeşitli altyapı ihtiyaçları ile karşı karşıyadır. Akıllı şehir konsepti, bu zorlukların üstesinden gelmek için teknolojik yenilikleri ve sürdürülebilirlik hedeflerini bir araya getirerek İstanbul'un gelecekteki gelişimini şekillendirmektedir. Çalışma, İstanbul'un akıllı şehir olma yolunda attığı adımları inceleyerek teknolojik altyapı, veri yönetimi, ulaşım, enerji ve sürdürülebilirlik gibi konulara dikkat çekmeye çalışmaktadır. İstanbul Büyükşehir Belediyesi'nin yönetiminde akıllı ulaşım sistemleri, dijital altyapı projeleri ve enerji yönetimi gibi alanlarda birçok girişim yürütülmektedir. Bunlar arasında şehir sakinlerinin yaşam kalitesini artıran, çevresel sürdürülebilirliği destekleyen ve ekonomik kalkınmayı teşvik eden çözümler de yer almaktadır. Yerel toplum katılımı, liderlik ve yönetim desteği, kaynak yönetimi ve teknoloji entegrasyonu gibi temel ilkeler ise İstanbul'un akıllı şehir hedeflerine ulaşmasında kritik öneme sahiptir. İstanbul'un akıllı şehir vizyonu sürdürülebilirlik, yenilikçilik ve yaşam kalitesi gibi önemli hedefler içermektedir. Ancak başarı için sürekli çaba, işbirliği ve toplum desteği gerekmektedir. Sonuç olarak bu çalışma, İstanbul'un akıllı şehir olma yolunda attığı adımları ve bu dönüşümün getirdiği fırsatları tartışmaktadır. Akıllı şehir dönüşümü ile İstanbul'un gelecekte daha yaşanabilir, bağlantılı ve sürdürülebilir bir şehir olma yolunda önemli ilerlemeler kaydetmesi beklenmektedir.
Anahtar Kelimeler: Akıllı şehirler, Yerel Yönetimler, Sürdürülebilirlik, Teknolojik yenilikler

LOCAL GOVERNMENT ACTIVITIES TOWARDS BECOMING A SMART CITY: THE CASE OF ISTANBUL

Abstract
The components of smart cities combine technology, data and sustainability principles to make cities more livable, sustainable and efficient. In smart cities, it is important to develop infrastructure and transportation, energy management, information and communication technologies, public services, environmental sustainability, social participation, data analytics and management components as a whole. This study examines the steps taken by local governments to become smart cities and the main steps in the transformation process of cities. As a major global metropolis, Istanbul faces a growing population, a complex transportation network and diverse infrastructure needs. The smart city concept is shaping Istanbul's future development by combining technological innovations and sustainability goals to address these challenges. The study examines Istanbul's steps towards becoming a smart city, highlighting issues such as technological infrastructure, data management, transportation, energy and sustainability. Under the Istanbul Metropolitan Municipality, many initiatives are underway in areas such as smart transportation systems, digital infrastructure projects and energy management. These include solutions that improve the quality of life of city residents, support environmental sustainability and promote economic development. Key principles such as local community engagement, leadership and management support, resource management and technology integration are critical to achieving Istanbul's smart city goals. Istanbul's smart city vision includes important goals such as sustainability, innovation and quality of life. However, success requires sustained effort, collaboration and community support. In conclusion, this study discusses the steps Istanbul has taken towards becoming a smart city and the opportunities that this transformation brings. With the smart city transformation, Istanbul is expected to make significant progress towards becoming a more livable, connected and sustainable city in the future.
Keywords: Smart cities, Local Goverment, Sustainability, Technological innovations

Introduction

The world's population has increased at an extraordinary rate throughout history, and much of this increase has taken place in cities. In the 21st century, the majority of the world's population now lives in urban areas and this trend is expected to continue. Rapid urbanization brings many opportunities as well as serious challenges. While cities offer attractive opportunities for economic growth, innovation, cultural diversity and social development, they also pose problems such as infrastructure deficiencies, environmental problems, traffic congestion and social inequalities. The solution to these problems and the future of urban areas are shaped around the concepts of urban transformation and smart cities (Komninos, 2008).Smart cities aim to make cities more efficient, sustainable and livable through the use of technology. Smart cities enable better management of cities through the use of various sensors, data analytics, internet connectivity and other digital technologies. These technologies support the development of cities in a range of areas, from optimizing transportation and reducing energy consumption to emergency management and environmental protection. Smart cities have the potential to transform not only physical infrastructure, but also community engagement and urban planning (Örselli & Can, 2019).Istanbul is the largest city in Turkey and is recognized worldwide for its historical and cultural heritage. As a bridge between the Anatolian and European continents, Istanbul is located at the junction of the Bosphorus and the Sea of Marmara. Thanks to this strategic location, Istanbul has been the center of many civilizations throughout history and has had a great influence in terms of trade, economy, culture and politics. In recent years, Istanbul has been undergoing a process of rapid urban development and change. The city is undergoing a major transformation due to factors such as population growth, economic growth and migration. High-rise housing, infrastructure projects, urban planning and social transformation efforts are changing the physical fabric and lifestyle of Istanbul. The steps taken and projects carried out by the Istanbul Metropolitan Municipality (IBB) within the scope of smart cities are among the determinants of this change and transformation.In the following sections of the study, information on smart cities is given first. Subsequently, IBB, as a local government, has provided information on the implementation of the Istanbul Smart City Strategic Plan and the activities carried out within the scope of the smart city perspective.

Smart Cities

The smart cities journey started in the 1970s with the Los Angeles Cluster Analysis project. Later, many countries supported the development of smart cities by implementing similar projects (Verdict, 2020). Factors used to define smart cities include the application of various

electronic and digital technologies, the use of ICTs to transform life and work environments within cities, the integration of ICT applications into government and public systems, and the regional development of innovation and knowledge through applications that bring ICTs and people together (Deakin, 2013).For a better understanding of the smart city concept, it is important to identify its basic components. Technology factors consist of physical infrastructure, smart, mobile and virtual technologies and virtual networks. Human factors are related to human infrastructure and social capital, while institutional factors consist of governance, policy, regulation and directives (Nam & Pardo, 2011).Smart cities are a concept based on the idea of utilizing technology and digital tools to increase the smartness of a city (Hollands, 2008). In this concept, information technologies are used to increase economic and political efficiency and to ensure social, cultural and urban development. Moreover, supporting sustainable business initiatives is of great importance for strategic planning (Angelidou & Psaltoglou, 2017). Therefore, it is important to observe and cooperate with neighboring cities (Angelidou, 2017). Moreover, for these initiatives to be successful, a clear strategic framework and an architecture that pays attention to complementarities are needed (Angelidou, 2014). Moreover, the development of smart cities should be a product of interdisciplinary planning, as it covers a broad spectrum of development and tackles pressing urban challenges (Burger et al., 2013). A variety of frameworks should be used for the creation, combination and adoption of smart city capabilities. Technology, people, organizational structure, energy and data management serve as guiding frameworks for the successful development and implementation of smart cities. Consideration of each dimension is crucial for smart cities to realize their full potential (Sharifi, 2019).

Istanbul as a Smart City

Istanbul Metropolitan Municipality (IBB) has prepared the Smart City Strategic Plan, a strategy that aims to improve the quality of life of its residents and use resources effectively and efficiently by taking advantage of the opportunities brought by the information age. This plan aims to utilize data and technology-based solutions to meet the needs and expectations of all Istanbulites. The Istanbul Smart City Strategic Plan (2021-2030) summarizes the process of the project, explains the project management principles, presents the findings obtained during the progress of the project, and includes smart city strategies, strategic objectives, initiatives and projects specific to Istanbul. This is the first Smart City Strategic Plan prepared at the local government level in Turkey and has been developed in line with Turkey's National Smart Cities Strategy and Action Plan (İstanbul Akıllı Şehir Stratejik Planı, 2021).

A basic vision, main strategies, thematic area strategies, initiatives and approximately 180 project plans to develop the city have been identified to ensure that Istanbul achieves its Smart City goals. These project plans, which are in line with IBB's strategy, are born out of real needs, can be realized by stakeholders in harmony, are in line with global trends, can be developed with a sustainable vision, and have a clear and understandable quality that can add "smart" elements to other projects. With the Roadmap, which is the final stage for planning Istanbul's Smart City journey, all the data obtained from the previous stages were combined and the priorities, resource requirements, governance principles, communication plan and performance indicators of the projects gradually targeting the years 2023, 2025 and 2030 were clarified. The whole process brought together different expertise, with the project being implemented within IBB (İstanbul Akıllı Şehir Stratejik Planı, 2021).On the other hand, there are many studies on smart cities. According to the IESE 2024 study, the top 10 smart cities are London, New York, Paris, Tokyo, Berlin, Singapore, Oslo, Amsterdam, San Francisco and Chicago, while Istanbul ranks 93rd among 183 cities (IESE, 2024). Many studies are being carried out within the scope of smart smart cities in Istanbul.

Studies carried out in Istanbul within the scope of Smart City Studies

This section provides information on the activities carried out by the Istanbul Metropolitan Municipality within the scope of the Istanbul Smart City Strategic Plan, the field strategies of these activities, the strategic goals and objectives in this direction, and the completed and not yet completed projects (Smart City Istanbul, 2024):

Smart Mobility

The Area Strategy envisages the use of dynamic and intelligent systems to ensure the most efficient use of available resources. Through these systems, the needs and demands of passengers will be identified and more comfortable, safe and environmentally friendly transportation services will continue to be provided. Istanbul stands out with its strengths in mobility. Factors such as the importance given to transportation by central and local governments and their openness to innovations, the implementation of many smart transportation systems in the city and the use of various modes of transportation support Istanbul's strengths in mobility. In addition, master plan studies and qualified human resources in the city also ensure that Istanbul has a strong position in terms of mobility.However, transportation demand has increased rapidly in recent years due to rapidly growing population and migration. However, despite accelerated transport investments after the 2000s, there are still infrastructure gaps and challenging expropriation processes for transport infrastructure in

urban planning. Moreover, the availability of different modes of transportation offers room for improvement in the integrated planning and operation of these modes.In the process of implementing the Area Strategy, a comfortable, safe, environmentally friendly, people-oriented and integrated transportation is targeted. An important step in this direction is to improve coordination and public transport, support sustainable modes of transport and make use of emerging information and communication technologies in the field of smart mobility to reduce traffic congestion. This strategy provides an important roadmap to find solutions to Istanbul's mobility problems and create a more sustainable transportation system in the future.Within the scope of Istanbul Smart City Strategic Plan, projects completed in the field of Smart Mobility include Public Transportation Control and Management Center Software, Dynamic Passenger Routing in Public Transportation, Real-Time Driver Analysis in Public Transportation and Real-Time Driver Analysis in IETT Vehicles. In addition, projects such as Artificial Intelligence Based Driver Behavior Analysis, Dynamic Asset Planning in Public Transport, Continuous Air Quality and Temperature Monitoring in Public Transport, Bicification, 34 Minutes Istanbul and Walk Be Istanbul have also been completed. However, projects such as Istanbul Transportation Management Control Center (IUYKM), Public Transportation for All, Smart Transportation Mobile Application (Transportation Assistant), Use of Istanbulkart in Minibuses, E-TUHİM Mobile Application, Dynamic Monitoring System in Public Transportation Vehicles, Electric Bicycle Sharing System, Smart Pedestrian Crossing System, Mobility Map, Urban Warehouse and Logistics Management System and many other projects have not yet been completed.

Smart Environment

In order to protect Istanbul's environmental resources, ensure sustainability and combat climate change, technological and environmental investments need to be realized in a timely and effective manner. In this direction, it is aimed to ensure that all organs and citizens of Istanbul are involved in the process so that the investments can be fully paid off. In addition, increasing environmental investments in public planning and the potential to cooperate with national and international organizations put Istanbul in a strong position in the field of environment. With the accumulation of knowledge in developed countries, the contribution of domestic researchers, financial support and increased environmental awareness, there are opportunities for progress in environmental issues. However, factors such as population growth, global economic contraction and consumption habits need to be taken into account.

Strategic objectives have been identified to realize Istanbul's environmental goals. The first strategic objective is to use environmental resources consciously. To this end, initiatives such as water management, wastewater management, smart waste management and zero waste program aim to ensure efficient use of environmental resources. The second strategic objective is to increase the use of technology in agriculture. Environmentally sensitive agricultural activities are encouraged through sustainable agricultural practices. The third strategic objective is to manage sustainability and climate change. To this end, sustainability and climate change are combated through initiatives such as combating environmental pollution, public awareness and climate-friendly green space management. These strategic objectives aim to advance Istanbul's environmental progress and create a sustainable future.In the field of Smart Environment, projects completed within the scope of the Istanbul Smart City Strategic Plan include Smart Water Spring and Electric Energy and Compost Production from Waste from the Market and Market Place. In addition, projects such as IoT Systems in Agriculture and Air-Cep Mobile Application have also been completed. However, Smart Water Network System, Loss-Leakage Management with Smart Sensors, Smart Irrigation Systems, Gray Water Recovery Systems in IBB Buildings, Zero Waste Project, Istanbul Environmental Protection and Pollution Management Center and many other projects have not yet been completed. In addition, Silent Istanbul, Istanbul Noise Maps and Noise Action Plan, Horizon 2020 EU Funded Pop Machina Project, Events to Raise Awareness on Environment and Develop Environmental Awareness, Information Training for Excavation Transporters, Renewal of Green Areas with Natural Plant Species, Green Roofs, Projects such as Development of Sustainable Energy and Climate Change Action Plan (SECAP), Artificial Intelligence Based Park, Garden and Green Areas Utilization Analysis, "Green and Carbon Neutral Building Transition Guide- Istanbul Model (Build4GreenIST)" and Istanbul Green City Action Plan are awaiting completion.

Smart Energy

Efforts are underway in line with Istanbul's strategic goals in the field of energy. In this context, it is aimed to reduce greenhouse gas emissions and increase energy efficiency by supporting smart grids and renewable energy generation. Istanbul is advancing in the use of technological services such as air pollution monitoring systems, and projects fuel cell and Internet of Things technologies in cooperation with TÜBİTAK. It also stands out as a city with a high awareness of smart and renewable energy. While formulating energy strategies, practices in nearby geographies and the country's high energy potential were taken into account. However, challenges such as dependence on fossil fuels, inadequate renewable energy investment

strategy, lack of coordination and communication, weak electric vehicle incentives and infrastructure, and excessive external dependence were also taken into account. In this framework, Istanbul's energy strategy has been formulated taking into account factors such as climate change, depletion of natural resources, regional political uncertainties and population growth forcing infrastructure development.The strategic goals and objectives of Istanbul's energy strategy have also been identified. The first strategic objective is to use energy efficiently. For this purpose, it aims to achieve energy efficiency through initiatives such as energy efficiency in buildings, energy efficiency in lighting and raising awareness on energy efficiency. The second strategic objective is to use renewable energy. For this purpose, it is aimed to expand the use of renewable energy sources. The third strategic objective is to improve and develop energy infrastructure. This aims to strengthen energy infrastructure through initiatives such as electric vehicles and improving energy management infrastructure. These strategic objectives represent steps towards building a sustainable energy future for Istanbul.

In the field of Smart Energy, projects completed under the Istanbul Smart City Strategic Plan include Smart Energy Management in IBB Buildings and Monitoring and Management of Smart Lighting Systems. In addition, a project to convert one bus in the IETT fleet into an electric vehicle has also been completed. However, projects such as Incentives for Renewable Energy Use, Dissemination of Electric Vehicle Use in Public Sector, Establishment of Istanbul Smart Energy Management Platform and Creation of Smart Natural Gas Meter Infrastructure have not yet been completed.

Smart Governance

Istanbul's spatial strategy aims to effectively manage the data collected from the city in order to adopt a holistic management approach and to include the urban ecosystem in the decision-making process. This will maximize the effectiveness of decision-making processes. Istanbul Metropolitan Municipality's establishment of the Smart City Branch Directorate and Smart City Governance structure, the existence of high awareness, the implementation of successful smart city initiatives, the current situation analysis, the existence of an e-Government initiative, a young population prone to technology, the support of competent universities, the existence of a technology startup ecosystem and the increase in the use of social media stand out as the points where Istanbul is advanced in governance. However, the lack of harmonization of legislation with the smart city, lack of a single e-service stop point, inadequate digital process management, difficulties in e-Government and smart city integration, institutional sensitivities regarding open data, lack of competent staff, management of smart city culture change,

immature smart city-oriented finance models, and low coordination and sharing in data collection and management represent the issues that Istanbul needs to improve in governance.

Istanbul's strategic goals and objectives include increasing data-driven decision support mechanisms in city management and improving the effectiveness of city management through city governance modeling. The data-driven foresight initiative targets the use of data analytics and foresight models in city governance. The smart city management initiative aims to effectively manage and coordinate smart city applications. Improving citizen service quality initiative aims to provide more effective and faster solutions to citizens' needs. The initiative to bring participatory solutions to city needs aims to ensure the participation of city residents so that the city government can produce more democratic and diverse solutions. These strategic objectives reflect Istanbul's vision to create a smart city that is more advanced in governance.

In the area of Smart Governance, projects completed under the Istanbul Smart City Strategic Plan include the Data Analytics Unit, Next Generation Data Driven Municipalism and IBB IT Enterprise Asset Management. In addition, projects such as Istanbul's Youth, Muhtardan Al Haberi and Söz Senin have also been completed. However, the Urban Management Center, e-Mahallem and many other projects are still pending.

Smart Economy

In the context of the spatial strategy, Istanbul's economic development potential is strengthened as a new commodity, "data", becomes available for every economic activity. This enables Istanbul to chart a new development scenario with a supported entrepreneurial spirit, a culture of collaboration, opportunities to attract investment and the productivity enabled by digitalized business processes. Istanbul's economic diversity, Turkey's largest urban economy, the presence of global companies' offices in Turkey, regional ICT R&D centers and technoparks in Istanbul, high municipal budget, entrepreneurial culture, dynamic workforce and young population represent Istanbul's economic strengths. However, the lack of open data, increasing demands for transparency, the negative impact of uncertainties in existing regulations on new initiatives, low per capita income compared to other competitive cities, exaggerated perception of risk and ecopolitical predictability represent areas where Istanbul's economy needs to improve.In the implementation of the strategies, Istanbul's young, competitive workforce, strategic location and logistics advantage should be utilized, brain drain should be taken into consideration and measures should be taken against the rapid development of rival cities. In line with the current situation analysis and the analyses conducted, it has been determined that creating a smart economy based on data and information, supported by open data and public-

private sector cooperation, is the most important development area for Istanbul. Accordingly, strategic goals and targets were identified. Supporting the public-private sector-academia cluster culture, developing public-private sector-academia collaborations and facilitating public procurement represent the first strategic objective. The second strategic objective focuses on increasing entrepreneurship and attractiveness. In order to achieve this objective, it is aimed to improve the business and investment environment and strengthen the entrepreneurship, productivity and innovation ecosystem. The third strategic objective is to increase employment and competence. In order to realize this objective, the initiative to increase human resources and competencies in the city stands out.In the field of Smart Economy, projects completed under the Istanbul Smart City Strategic Plan include the Internship Program in Public Sector (IstanbulSenin StajSenin), Istanbul Smart City Test Site and Take Action with IBB. In addition, the Vocational Competence School has also been completed. However, projects such as Istanbul Innovative City Platform Portal, Istanbul Business Clusters (Creative Industries Platform), IBB Public Market Project (E-Commerce Sales Project) and System Graduation have not yet been completed.

Smart Living

The area strategy aims to improve the quality of life through coordinated provision of technology-supported services and equal access for all. This strategy is supported by factors such as local governments taking life-oriented initiatives, integrating and coordinating the city's rich cultural and historical heritage with technology, and having a strong health and education infrastructure. In order to have a strong position in the living space, Istanbul aims to take advantage of opportunities such as increasing feedback mechanisms, conducting detailed feedback analyses, taking advantage of the conveniences provided by digital accessibility and evaluating active urban transformation projects. Strengthening the organizational structure, ensuring coordination and integration between units, improving emergency planning, improving data access infrastructure and focusing on innovation incentives are also among the strategic objectives.Within this framework, strategic goals and targets have been set. In order to ensure a high quality of life, various initiatives are planned to improve the urban experience, increase accessibility to services, provide integrated living spaces and ensure a healthy and barrier-free living environment. In order to expand smart applications in urban space management, initiatives to develop living spaces with smart technologies and to expand data-driven planning stand out. These strategic goals and targets support efforts to improve Istanbul's quality of life and urban space management.In the area of Smart Living, projects completed

under the Istanbul Smart City Strategic Plan include Tourism Information Bureaus, Istanbul is Yours, Insufficient Balance, Semtpati and Bayrampaşa Region City Digital Twin Pilot Project. In addition, the Istanbul is Renewing (Urban Transformation Support System) project has also been completed. However, projects such as Suspended Invoice Kiosk, Wet Area Button, Project Design of Mobile Sales Units throughout Istanbul, Smart City Boards (DOOH), Creation of Digital Neighborhood Marketplace and City Digital Twin have not yet been completed.

Smart Human

The area strategy aims to achieve greater equality of opportunity in access to quality and modern educational opportunities and participation in urban life in Istanbul. Factors such as the widespread use of smart devices, the wide coverage of IBB Wi-Fi service, 12 years of compulsory education, government policies supporting asylum-seeking migrants and investments in knowledge-intensive sectors play an important role in achieving this goal. However, there is potential for improvement in areas such as increasing gender equality in education and business life, improving foreign language skills in the service sector, becoming a city preferred by foreign students, and increasing the number of university graduates in line with the young population. Factors such as the young population's openness to new technologies and the utilization of features such as mobile payments offered by smart devices, the presence of a migrant population, the persistence of economic difficulties, differences in digital literacy levels, and the low rate of university graduates should be taken into account when formulating a strategy.Within the framework of strategic goals and targets, it is aimed to develop individual competencies. In this regard, initiatives such as providing trainings tailored to the needs and aspirations of all segments and raising smart city awareness are among the prioritized targets. In addition, initiatives such as supporting participatory innovation to increase social inclusion and encouraging citizens' participation in urban life are also among the strategic objectives. These strategic goals and targets aim to identify the steps to be taken to increase the competencies of individuals and strengthen social inclusion in Istanbul. In the area of Smart People, projects completed under the Istanbul Smart City Strategic Plan include IBB Tech Future, Information Technologies School, Tech Istanbul and Barrier-Free Living Center. In addition, Safe and Accessible Schools, Women's Labour Shop-Production Workshop, Organizing Istanbul Smart City Awareness Trainings: "What's Happening in Istanbul Smart City?" Project, Barrier-Free 1 Istanbul and Age-Friendly Centers are not yet completed.

Smart Security

The area strategy aims to use smart solutions to quickly assess potential security risks and make communication and coordination more effective. In determining this strategy, the opportunity to make maximum use of advances in connectivity, sensors, data storage, image processing technologies and IoT security standards was considered. The areas where Istanbul needs to improve in the area of security include the lack of coordination between different law enforcement agencies, the operation of the electricity grid under high load, and improvements in data analysis and forecasting processes. Accordingly, it is important to focus on strengths such as establishing comprehensive monitoring systems, increasing security know-how, adopting people-oriented management approaches and improving earthquake studies.Improved coordination and integration between law enforcement agencies, along with increased data sharing, and the effective use of this data through advanced analysis and forecasting systems will contribute to a safer city life. Factors such as Istanbul's location on an active fault line, the increase in global terrorist incidents and threats of cyber-attacks pose significant security risks. In addition, population growth and political fluctuations in neighboring countries can also affect Istanbul's ability to defend itself. Within the framework of the strategic goals and objectives, important targets have been identified as increasing the effectiveness of security activities, strengthening security, enhancing cyber security and ensuring the maintenance of quality of life in emergencies. In order to achieve these goals, initiatives such as increasing security coordination, rapidly detecting security incidents, establishing warning and deterrent systems, increasing the safety of life and property, strengthening cyber security coordination, and effectively carrying out emergency and disaster management are important.Projects completed within the scope of the Istanbul Smart City Strategic Plan in the field of Smart Security include Artificial Intelligence Based Parking Management System, Security Pole, Fire Smoke Detection with Image Processing, Modernization of Disaster Coordination Center (AKOM), Flood / Flood Detection and Early Warning System with Image Processing, Earthquake Risk Detection of Buildings with Rapid Scanning Methods and Building Inspection with Building Health Systems. In addition, projects such as Common Camera Platform, Smart Fire Alarm System, Emergency Response Planning and Routing System, Cyber Attack Warning and Prediction Systems, Fiber Optic Distributed Acoustic Detection System Based Early Warning and Monitoring System (FOTDES), Disaster and Earthquake Base - Mobile Earthquake Communication Centers and Inspection of IBB Owned Buildings have not yet been completed.

Smart Organization and Human Resources

One of the basic principles of the area strategy is that all stakeholders in the smart city ecosystem contribute to increasing the capacities of relevant institutions by cooperating in line with the common goals of Istanbul. Factors such as the realization of smart city investments in Istanbul with state support, the ownership of smart city projects by the Istanbul Metropolitan Municipality and the establishment of the Smart City Branch Directorate show that Istanbul is strong in terms of organization and human resources. At this point, it is of utmost importance that all institutions adopt data sharing in line with the strategic goals, ensure coordination between units and increase interaction between the public-private sector and academia.Within the framework of strategic goals and targets, one of the primary objectives is to increase data-based decision support mechanisms in city management. In this direction, initiatives to efficiently manage smart city projects and to train and acquire qualified human resources for smart city applications in Istanbul stand out. In order for Istanbul to be successful in the smart city field, the effective management and supervision of projects, the training of qualified human resources, and the presence of experts who are familiar with smart city technologies are of great importance. In this way, data-based decision support mechanisms will be strengthened and Istanbul's goal of becoming a sustainable and smart city will be supported.Within the scope of the Smart City Strategic Plan, no project has been completed in the field of Organization and Human Resources, while the Smart City Project Tracking Dashboard (My Project Smart City Project), Competent Human Resources for Innovative Istanbul and Smart City Employer Branding projects have not yet been completed.

Smart Information and Communication Technologies

For ICT applications to provide added value to services and for smart city solutions to be successfully implemented, it is important to adopt a holistic approach. This approach builds a structure that works together and enables integrated solutions by integrating the ICT perspective into investments and projects. Istanbul's strengths in the field of ICT include prioritization of ICT in the public sector, increased R&D support, increasing demand for ICT-based solutions from the young population, widespread ICT training, availability of cost-effective ICT human resources, strong mobile communication infrastructure and high public demand for ICT-based services.In line with the strategic goals and targets, the primary objectives are to anticipate and disseminate the benefits of emerging next generation technologies. In this context, the application of emerging next generation technologies to city services in Istanbul stands out as an initiative. In addition, in order to increase the level of smart city technology maturity and

ensure the sustainability of the city, initiatives such as the establishment of a smart city superstructure, the enrichment of smart city infrastructure and the establishment of a common communication backbone have been identified. By focusing on these strategic goals, Istanbul aims to progress towards becoming a smart city where next generation technologies are used effectively.Among the projects completed within the scope of the Istanbul Smart City Strategic Plan in the field of Information and Communication Technologies are RPA (Robotic Process Automation), 3D Mobile Robotic Concrete Printer, Digital Twin of Greek Orphanage and School building produced by Hybrid Methods, Architectural Design and Adaptation of Smart City Platform, Enrichment of Big Data Platform and IBB Wi-Fi. However, projects such as Blockchain - Digital Identity Management, ID Istanbul and API Istanbul have not yet been completed.

Smart Finance

In addition to public financing, smart city investments in Istanbul should focus on creative PPP models, private financing solutions and EU funds. Istanbul is in a strong financial position due to factors such as having a well-developed banking sector, being open to foreign direct investments, the central government's target to increase the R&D budget, the PPP model for large infrastructure projects, hosting the head offices of global and local companies, and the e-Government system.In formulating the strategies, it was aimed to capitalize on EU funds, the increase in liquidity around the world, and the global flow of funds for technologies supporting smart cities. However, challenges such as slow and inflexible bureaucratic processes, insufficient support for innovative work, the informal economy, low levels of EU funding and limited venture capital are emerging as areas for improvement. In order for Istanbul to attract more FDI, it is important to change the perception of risk, to ensure macroeconomic stability, and to realize events and innovative practices in the city that will continuously raise the image of the city.In line with the strategic goals and targets, one of the primary objectives is to make smart city projects investable and manage them. In this context, making smart city projects eligible for alternative project financing and managing them effectively stands out as an initiative. By focusing on these strategic objectives, Istanbul aims to develop sustainable and profitable financing models for smart city projects. While there are no completed projects in the field of finance within the scope of the Istanbul Smart City Strategic Plan, projects such as Smart Fund Platform, Istanbul Our Fund and Smart City Project Finance are among the projects that have not yet been completed.

Conclusion

Istanbul is recognized as an important metropolis with a large population and a dynamic economy. These characteristics of Istanbul have necessitated the launch of a series of projects within the scope of smart cities in order to find solutions to the city's various problems and ensure sustainable development. These projects aim to improve the city's physical infrastructure, services and quality of life. Smart cities aim to make cities more efficient, sustainable and livable through the use of technology and information systems. In this context, many smart city projects have been implemented in Istanbul. These projects include efforts to optimize transportation, reduce energy consumption, increase environmental sustainability and improve service quality. However, in addition to the projects that have been completed, there are many projects that have not yet been completed and are planned to take Istanbul further in the context of smart cities. These projects aim to further improve the city's infrastructure, utilize digital technologies more effectively and enhance quality of life. It is important to monitor the success of these projects during the implementation process and to conduct relevant audits and follow-ups. In this way, the effectiveness and efficiency of projects can be assessed and corrective measures can be taken where necessary. Further planning for Istanbul's smart city projects is also important. Areas that can be taken forward through the use of advanced technologies and innovative solutions should be identified and new projects should be developed accordingly. In addition, factors such as project financing, stakeholder collaboration and community involvement need to be considered. Istanbul's size, population and economic potential create a suitable ground for many projects within the scope of smart cities. Monitoring the success of these projects and conducting relevant audits and follow-ups are important steps for Istanbul to achieve maximum efficiency and transform into a sustainable smart city model. In addition, further planning and development of new projects in the future will enable Istanbul to move forward in the field of smart cities.

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GÜNCEL İNDÜKSİYON YÖNTEMLERİNİN İNTRAPARTUM SÜRECE ETKİSİ

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Özet
Doğum indüksiyonu, gebelik ve doğum sürecinde hayati öneme sahip bir müdahale olup anne ile bebeğin sağlığını etkileyen pek çok faktörü içerir. Bu müdahalenin doğru zamanda, uygun endikasyon varlığında ve bireyselleştirilmiş yaklaşımlarla gerçekleştirilmesi son derece önemlidir. İndüksiyon yönteminin mevcut risk ve fayda dengesi göz önünde bulundurularak, ilerleyen teknoloji ve protokollerin rehberliğinde planlanması ve uygulanması, anne-bebek sağlığı açısından hayati öneme sahiptir. Günümüzde, doğum indüksiyonunda; farmakolojik, mekanik ve non-farmakolojik yöntemler olmak üzere çeşitli yaklaşımlar mevcuttur. Farmakolojik yöntemler arasında Prostaglandin E1 Analoğu- Misoprostol ve Prostaglandin E2-Analoğu Dinoproston gibi ilaçlar bulunmaktadır. Mekanik yöntemler ise amniyotomi, transservikal foley kataterler ve higroskopik dilatörleri içerir. Non-farmakolojik yöntemler ise meme ucu stimülasyonu, uterus stimülasyonu, membranların sıyrılması ve cinsel etkileşim gibi doğal yöntemleri içerir. Hangi yöntemin tercih edileceği, hastanın ve hekimin tercihine bağlı olarak bütüncül bir yaklaşımla, gebe kadın ve ailesiyle iş birliği içinde planlanmalıdır. Gebe için en güvenli doğum sürecini; uygun tedavi basamakları ve kaliteli bakım hizmetleri ile sağlamak ebe ve doğum ekibi için temel sorumluluklar arasında yer almaktadır. Bu çalışma, güncel literatür incelenerek uygulanan indüksiyon yöntemlerinin intrapartum sürece etkisi konusunda sağlık profesyonellerini bilgilendirmek amaçlanmıştır.
Anahtar Kelimeler: Ebelik, intrapartum, doğum, indüksiyon

THE EFFECT OF CURRENT INDUCTION METHODS ON THE INTRAPARTUM PROCESS

Abstract
Inductions of labor are crucial interventions in pregnancy and childbirth, encompassing many factors that affect the health of both the mother and the baby. It is crucial that this intervention be performed at the right time, with appropriate indications, and through personalized approaches. Planning and implementing induction models in line with the existing balance of risks and benefits, guided by advancing technology and protocols, is one of the most critical steps for maternal and neonatal health. Today, the prevalence of labor inductions has increased, with various approaches available, including pharmacological, mechanical, and non-pharmacological methods. Among pharmacological methods are drugs such as Prostaglandin E1 Analog- Misoprostol and Prostaglandin E2 Analog- Dinoprostone. Mechanical methods include procedures like amniotomy, trans-cervical Foley catheters, and hygroscopic dilators. Non-pharmacological methods encompass natural techniques such as nipple stimulation, uterine stimulation, membrane stripping, and sexual intercourse. The choice of method should be based on the preferences of the patient and the physician, with a comprehensive approach involving collaboration with the pregnant woman and her family. Ensuring the safest childbirth process for the pregnant woman involves fundamental responsibilities for midwives and obstetric teams, including appropriate treatment steps and quality care services. This study evaluates the impact of current induction methods on the intrapartum process.
Keywords: Midwifery, intrapartum, labour, induction

GİRİŞ

Tarihin her evresinde, kadın yaşamının doğal ve fizyolojik bir süreci olarak tanımlanan gebelik; son menstrual periyottan yaklaşık 38- 40 hafta sonra doğum eyleminin gerçekleşmesi ile tamamlanmaktadır. Bu süreç bireysel farklılıkların yanı sıra var olan risk katmanlarına göre çeşitli değişikliklere zemin hazırlamaktadır. Hedeflenen vajinal doğum eylemi; termde (38-42 hafta), tek ve canlı bir fetüs varlığıyla, kendiliğinden başlayan, verteks pozisyonda, baş- pelvis uyuşmazlığı olmadan sağlıklı bir fetüs ve annenin varlığı ile gerçekleşme sürecidir (Yılmaz ve Kaya, 2023). Bu sürecin kendiliğinden başlaması ve gereksiz müdahalelerden kaçınılarak gerçekleştirilmesi, Dünya Sağlık Örgütü (DSÖ) tarafından önerilen ve benimsenen kritik bir dönüşüm basamadığıdır (Baran ve ark, 2023). Dolayısıyla doğum eylemini başlatan temel mekanizmaların değerlendirilmesi, gebede meydana gelen değişikliklerin tespit edilmesi sağlık profesyonelleri tarafından birincil veri kaynağını oluşturmaktadır. Bu bağlamda; kemik pelvis uygunluğu, fetüsün pozisyon, prezantasyon ve duruşu, fetal baş çapları, serviks uygunluğu, uterin aktivasyon, myometrial bağlantılarda artış gibi birçok nesnel ölçüt bütüncül yaklaşımlar doğrultusunda değerlendirilmelidir (Yeşiltaş, 2023).

1. DOĞUM İNDÜKSİYON YÖNTEMLERİ

Doğum indüksiyonu; eyleminin spontan başlamadığı veya ilerlemediği durumlarda farmakolojik, non- farmakolojik ve mekanik ajanlar yardımıyla servikal olgunlaşmanın ve düzenli uterin kasılmaların desteklenmesi için kullanılan indüksiyon yöntemleridir (Yorulmaz, 2022). Günümüzde kullanım sıklığının giderek arttığı düşünülse de indüksiyon uygulamalarının, hasta bazında bireyselleştirilmesi ve uygun tedavi protokollerinin uygulanması, maternal- fetal mortalite ve morbidite açısından kritik önem taşımaktadır.

Doğum indüksiyon başarısını etkilen faktörler arasında birincil parametre; servikal olgunlaşmanın değerlendirildiği Bishop Skorlama Sistemidir. İndüksiyon uygulamaya başlamadan önce bu değerlendirmenin gerçekleştirilmesi uygulanacak indüksiyon yönteminin seçiminde ve başarı oranında uygulayıcıya yol göstermektedir (Yeşiltaş, 2023).

Skor	Dilatasyon (cm)	Serviksin pozisyonu	Effasman (%)	Seviye	Serviksin kıvamı
0	Yok	Posterior	0 – 30	- 3	Sert
1	1 – 2	Orta	40 – 50	- 2	Orta
2	3 – 4	Anterior	60 – 70	- 1, 0	Yumuşak
3	5 – 6		80	+ 1, +2	

Tablo 1: Bishop Skoru, 1964

Yeşiltaş tarafından 2023 yılında yayınlanan bir çalışmada; Bishop Skorlama sisteminin uygulayan bireylere göre değişkenlik göstermesi, sonografik ve demografik özelliklerden yoksun olması ve çok az değişken içermesi nedeniyle nesnel bir ölçüm aracı olmadığı dolayısıyla güncel bir skorlama sistemine ihtiyaç duyulduğu belirtilmiştir. Çalışmacının tasarladığı Yeni Skorlama Sisteminde, Bishop Skorlama Sistemine ek olarak; yaş, vücut kitle indeksi, gravida, funneling varlığı ve genişliği, serviksin pozisyonu, servikal uzunluk, oksiput pozisyonu, fetal başın external osa uzaklığı, uteroservikal açı, servikal dilatasyon, tahmini fetal ağırlık gibi ölçüm ve sonografik bulgular yer almıştır (Yeşiltaş, 2023).

Günümüzde kullanılan farmakolojik, mekanik ve non- farmakolojik doğum indüksiyon yöntemleri aşağıda yer almaktadır.

Prostaglandin E1 Analoğu- Misoprostol: Misoprotol 1988'li yıllardan bu yana peptik ülser tedavisinde kullanılmakla birlikte günümüzde obstetrik ve jinekoloji alanında; Postpartum kanama tedavi ve cerrahisinde, abortusların tıbbi tahliyesinde, servikal olgunlaşma ve doğum indüksiyonu yöntemlerinde aktif olarak kullanılmaktadır (Karaca, 2020). Etkin maaliyet, kolay ulaşılabilir ve özel saklama koşulları gerektirmemesi avantajları arasında yer almaktadır (Yorulmaz, 2020). Misoprotol'un 100 ve 200 mikrogram tablet formları bulunmaktadır, Wing ve ark. tarafından hazırlanan çalışmada 25 mcg doz aralığının güvenilir doz aralığında olduğu ileri sürülmüştür (Wing ve ark, 1992).

Prostaglandin E2- Analoğu Dinoproston*:* Gıda ve İlaç Dairesi (FDA) tarafından kullanılması önerilen ve 3 temel formda bulunan Dinoprostol; servikal olgunlaşma ve fundusta myometrial kontraksiyonların oluşumuna etki eden çeşitli mekanizmalara sahiptir. Jel, yavaş salınımlı vajinal ovül ve 10 mg'lık suppozatuar formları bulunmakla birlikte yan etkileri arasında; uterin hiperstimülasyon, fetal distres ve gastrointestinal etkiler arasında ise bulantı, kusma ve ateş yer almaktadır. Dolayısıyla uygulamanın sık gözlem ve takip altında gerçekleştirilmesi önerilmektedir (Yılmaz, 2020).

Benalcazar-Parra ve ark. tarafından 2019 yılında yayınlanan çalışmada Bishop Skoru 6 ve üzeri olan travay sürecindeki gebelere Misoprostol ve Dinoprostol indüksiyon uygulaması uygulanmıştır. Misoprostol uygulanan grupta uterin aktivite değişimlerinin 60. dakikadan sonra bazal değerden anlamlı derecede yüksek olduğu, Dinoprostol grubunda ise uterin kasılma süre ve sayısının 120. dakikadan sonra artış gösterdiği sonucu elde edilmiştir. Uygulanan iki doğum indüksiyon ajanının farklı farmakokinetik etkiye sahip olduğu ve farklı salınım süresine sahip olduğu düşünülebilmektedir (Benalcazar- Parra ve ark, 2019).

Oksitosin: Doğum indüksiyon yöntemleri arasında en sık kullanılan farmakolojik bir ajan olarak yer almaktadır. Birçok alanda etkinliği kanıtlanan oksitosin; doğumun başlatılması ve sürdürülmesinde, postpartum dönemde, terapötik ve missed abortus tahliyesinde, laktasyonun arttırılmasında ve daha birçok alanda kullanılmaktadır (Yeşiltaş, 2023). 2-5-10 ünitelik ampüller şeklinde yer alır, yarılanma ömrü 3 ila 5 dakika arasında değişmektedir, etkinliği arasında myometrial aktivite ve hücreler arası bağlantının arttırılması, kontraksiyon oluşumunun desteklenmesi, şiddet, frekans, süre ve yoğunluğunun arttırılması yer almaktadır (Yeşiltaş, 2023).

Doz	Başlangıç Dozu mU/dk	Doz Artışı mU/dk	Dozaj Aralığı dk	Maksimum Doz mU/dk
Düşük doz	0,5- 2	1-2	15-60	20-40
Yüksek doz	4-6	4-6	15-30	40

Tablo 2: Oksitosin Protokolleri

Amniyotomi: Amniyon zarının ucu kancalı amnioper aracılığı ile rüptüre edilme işlemidir (Ekin, 2021). Her ne kadar doğum eylemini hızlandırdığı düşünülse de Dünya Sağlık Örgütü'nün 2018 yılında yayınladığı Pozitif Doğum Deneyim Rehberinde Amniyotominin tek başına indüksiyon yöntemi olarak kullanılmaması önerilmemektedir (WHO, 2018). Transservikal Foley ve Balon Kataterler: Her iki indüksiyon yöntemi de mekanik bir etki göstererek servikal olgunlaşma üzerine etki etmektedir. Foley Kataterler internal os üzerinde, Çift Balonlu Katater ise vajen ve serviks üzerinde gerginlik ve basınç etkisi oluşturarak endojen prostoglandin artışını arttırmaktadır (Yorulmaz, 2020).

Higroskopik Dilatörler: Endoservikal alana yerleştirilen Higroskopik Dilatörler endoservikal alandaki sıvıyı absorbe ederek mekanik bir basınç ve gerginlik etkisi yaratmaktadır. Foley ve

Balon Kateterden farklı olarak bu indüksiyon yönteminde dışarıdan bir şişirilme işlemi uygulanmamaktadır (Yeşiltaş, 2023).

Membranların Sıyrılması: Koryoamniyotik zarların alt uterin segmentten ayırılması işlemi olarak tanımlanmaktadır. İşaret ve orta parmağın internal ostan içeriye geçirilmesi ile sıyırılan memran miktarına paralel prostoglandin miktarında artış gözlemlenmektedir (Yorulmaz, 2022).

Meme Ucu Stimülasyonu: Tüm yöntemler arasında uygulanması en basit, kolay ve hiçbir ek araca ihtiyaç duyulmadan gerçekleştirilebilecek olan meme ucu stimülasyonu; baş, işaret ve orta parmak kullanılarak meme ucu etrafında dairesel hareketlerle ve uca doğru nazikçe çekme eylemiyle uygulanabilmektedir (İbrahim ve ark, 2021). Uygulama esnasında hint yağı, ylan yağı gibi aromatik bileşenler kullanılabilmektedir.2021 yılında Mısırda benzer demografik özelliklere sahip 150 primipar gebe ile yürütülen çalışmada; meme ucu stimülasyonu, uterus stimülasyonu ve kontrol grubu ile uygulanan yöntemlerin etkinliği değerlendirilmiştir. Çalışma sonucunda müdahale gruplarında daha kısa aralıklı, daha uzun süren ve yüksek yoğunluktaki uterus kasılmaları ile ilişkili olduğu değerlendirilmiştir. Kontrol grubunda yer alan gebelerin yüksek oranda oksitosiklere ihtiyaç duyulduğu, C/S doğum oranını yükselttiği ve doğumun ilk evresinin müdahale grubuna kıyasla daha uzun sürdüğü kayıt altına alınmıştır. 2018 yılında Takahata ve ark. tarafından yayınlanan çalışmada bir ebe eşliğinde 16 gebeye meme ucu stimülasyonu uygulanmıştır. Müdahaleden 15 dakika öne ve müdahaleden 15-30-60-75-90 dakika sonra tükürük oksitosin seviyeleri 3 gün süresince immünsorbent tahlili ile ölçülmüştür. Çalışma sonucunda elde edilen verilerde meme ucu stimülasyonu ile 1. günde tükürük oksitosin düzeyinin artmadığı, 2. günde 15. dakikada artış göstermeye başladığı 3. Günde ise en yüksek tükürük oksitosin seviyesine meme ucu stimülasyonundan 30 dakika sonra ulaşıldığı bulgusu ortaya çıkmıştır (Takahata ve ark, 2018).

2. SONUÇ VE ÖNERİLER

İndüksiyon uygulamaları, gebelik ve doğum sürecinde gebe ve fetüs için hayati öneme sahip uygulamalar arasındadır. Tedavinin bireyselleştirilmesi, sık gözlem ve takibin tedavinin her basamağında uygun önlem ve protokoller doğrultusunda gerçekleştirilmesi, gebenin psikososyal durumu ve tedaviye uyumu ile oryante edilmelidir. Her kadın, eşsiz bir gebelik ve doğum deneyimi için desteklenmeli, eşit koşullar ve hizmet kalitesi ile korunmalıdır. İndüksiyon uygulamalarının gerekliliği hekim ve sağlık profesyonelleri ile değerlendirilmeli, gebenin onamı alınmalı ve holikistik yaklaşımlar göz ardı edilmemelidir.

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VİTAMİNLERİN ORTODONTİK DİŞ HAREKETİNE ETKİLERİ

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Özet
Ortodontik tedavi, sadece estetik, fonasyon ve fonksiyonu iyileştirmeyi değil, aynı zamanda ağız sağlığını da iyileştirmeyi hedefler. Ortodontik tedavilerin mekanik yönleri yoğun bir şekilde araştırılmış ve geliştirilmiş olmasına rağmen, özellikle vitaminler gibi beslenme faktörlerinin ortodontik tedavi sonuçları üzerinde olası çok yönlü etkileri yeterince araştırılmamıştır. Bu sistematik derlemede, vitaminlerin ortodontik diş hareketleri, kök rezorbsiyonu, remodelling ve kemik turnover'ı üzerindeki etkilerini araştırmak amaçlanmıştır. Mevcut literatür vitaminler ve ortodontik tedavi arasındaki önemli ilişkiye ışık tutmaktadır. C vitamini, periodontal bağlar ve alveolar kemik bütünlüğünü destekleyerek, periodontal sağlığın korunmasına ve kök rezorbsiyonu riskinin azaltılmasına katkıda bulunabilir. Yeterli A vitamini seviyeleri, diş eti ve mukoza sağlığını iyileştirir ve periodontal dokuların ortodontik kuvvetlere yanıtını etkileyebilir. K vitamini, kemik metabolizmasına ve turnover'ına katkıda bulunur ve ortodontik tedavi sırasında diş hareketinin hızını ve alveolar kemiklerin yeniden şekillenmesini etkileyebilir. B6 (piridoksin), B12 (kobalamin) ve Folat (B9) gibi çeşitli B vitaminleri, enerji metabolizması, hücre çoğalması ve DNA sentezinde rol oynar. Ortodontiye özgü araştırmalar sınırlı olsa da, E vitamini, periodontal dokulardaki iltihabı ve oksidatif stresi azaltmada rol oynar ve böylece ortodontik tedaviye yanıtı etkileyebilir. Vitaminlerin ortodontik tedavi protokolleri üzerindeki etkisinin anlaşılması, hasta bakımını optimize etmek ve başarılı tedavi sonuçları elde etmek için önemlidir. Vitaminler ve metabolizma ilişkisiyle ilgili mevcut kanıtları sentezleyerek ve potansiyel etki mekanizmalarını keşfederek, vitaminlerin ortodontik tedavi açısından önemini açıklamayı ve bireysel beslenme ihtiyaçlarına uygun kişiselleştirilmiş ortodontik yaklaşımlara yönelik daha fazla araştırma teşvik edilmelidir.
Anahtar Kelimeler: Vitaminler, Ortodontik diş hareketi, Kök rezorbsiyonu, Kemik remodeling, Kemik turnover

EFFECTS OF VITAMINS ON ORTHODONTIC TOOTH MOVEMENT

Abstract
Orthodontic treatment aims not only to improve aesthetics, phonetics, and function but also to enhance oral health. Although the mechanical aspects of orthodontic treatments have been extensively researched and developed, the potential multifaceted effects of nutritional factors such as vitamins on orthodontic treatment outcomes have not been adequately investigated. The purpose of this systematic review was to investigate the effects of vitamins on orthodontic tooth movements, root resorption, remodeling, and bone turnover.The literature illuminates the effects of vitamins on orthodontic treatment. Vitamin C may contribute to the maintaining periodontal health and potentially reducing the root resorption risk by supporting the integrity of periodontal ligaments and alveolar bones. Adequate levels of vitamin A improve gum and mucosal health and may affect the reaction of periodontal structures to orthodontic forces. Vitamin K contributes to bone metabolism and remodeling, and it might influence speed of tooth movement and reshaping of alveolar bones during orthodontic treatment. Various B vitamins, such as B6 (pyridoxine), B12 (cobalamin), and Folate (B9), are involved in energy metabolism, cell proliferation, and DNA synthesis. Although research specific to orthodontics is limited, vitamin E plays a role in reducing inflammation and oxidative stress in periodontal tissues, thus potentially influencing the response to orthodontic treatment.Understanding the effect of vitamins on orthodontic treatment protocols is important for optimizing patient care and achieving successful treatment outcomes. By synthesizing the existing evidence on the relationship between vitamins and metabolism and exploring potential mechanisms of action, elucidating the importance of vitamins in orthodontic treatment and encouraging further research towards personalized orthodontic approaches tailored to individual nutritional needs should be promoted.
Keywords: Vitamins, Orthodontic tooth movement, Root resorption, Bone remodeling, Bone turnover

Introduction

Orthodontic treatment involves a multifaceted and detailed procedure necessitating a deep comprehension of teeth migration within the alveolar bone and adjacent periodontal tissues. (Ong et al., 2002).The efficacy of this procedure hinges significantly on the integrity and quantity of the underlying bone support, which undergoes a complex remodeling process reacting to the exerted pressure (Becker et al., 2003; Topouzeliset al., 2012; Lopatieneet al., 2012). The bone remodeling process is governed by an array of factors, including genetics, age, and nutrition, which can capable of significantly impacting the outcome of orthodontic procedures. (Terao et al., 2012; Hartsfield et al., 2012).This literature review aims to explore the current literature evidence concerning the influence of vitamins on teeth repositioning during orthodontic treatment. By synthesizing findings from relevant studies, we aim to explore the potential mechanisms through which vitamins may influence orthodontic treatment outcomes and discuss their clinical implications for optimizing patient care.There are some hypotheses that certain vitamins might affect the effectiveness of orthodontic treatment such as vitamin C, vitamin A and vitamin D(Krishnan et al., 2021). Research has examined how vitamin A affects bone metabolism and tooth movement, but the findings are inconclusive. Further investigation is necessary to understand the potential mechanisms through which vitamin A influences movement of teeth (Shi et al., 2023).Through a comprehensive analysis in existing researches, this review seeks to elucidate the role of vitamins as modulators of orthodontic tooth movement, paving the way for future investigations and informing clinical practices aimed at enhancing treatment effectiveness and patient satisfaction.

Materials and Methods

Understanding the impact of vitamins on tooth movement in orthodontic treatment requires a systematic approach to reviewing the available literatures and synthesizing the findings. In this section, we outline the materials and methods employed in conducting this literature review.

The materials utilized in this literature review include peer-reviewed articles, clinical trials, and observational studies retrieved from electronic databases such as Web of Science, Google Scholar and PubMed.

The search strategy aimed to locate studies examining the effects of vitamins on movement of teeth, with a specific focus on their roles.

The criteria for selecting studies varied but generally encompassed randomized controlled trials, peer-reviewed quantitative studies, non-randomized controlled trials, cross-sectional studies, comparative cohort studies, and case-control studies published in English.

The outcome measures also varied across the studies and assessed different aspects of orthodontic treatment and movement of teeth such as bone metabolism, root resorbtion and tooth movement acceleration.

Findings and Discussion

In this section, we outline the discoveries from the literature review, organized by specific vitamins that have been studied in relation to movement of teeth.By systematically reviewing the literature on various vitamins and their impact on orthodontic movement, we aim to provide insights into potential strategies for optimizing treatment outcomes and enhancing patient care in orthodontic practice.While the existing body of literature provides valuable insights into the potential effects of vitamins on orthodontic tooth movement, several limitations and knowledge gaps remain.By addressing these gaps in knowledge, future research endeavors have the potential to advance our comprehension of the intricate interaction among vitamins and orthodontic tooth movement, ultimately contributing to the optimization of orthodontic treatment outcomes and patient care.

Vitamin D:

Vitamin D plays a crucial role in calcium regulation and skeletal growth, impacting bone restructuring. Its active form, 1,25-dihydroxycholecalciferol, enhances tooth movement by promoting bone resorption and modulating osteoclast activity. However, further research is needed to assess the safety and efficacy of vitamin D supplementation in promoting movement of teeth , particularly in orthodontic patients. (Krishnan et al., 2021; Khalaf et al., 2021).

Additionally, a study by Kale et al. (2004) found that locally administered 1,25-dihydroxycholecalciferol and prostaglandin E2 both increased movement of teeth significantly compared to a control group, with 1,25-dihydroxycholecalciferol showing superior effectiveness in regulating bone turnover during tooth movement due to its balanced effects on bone formation and resorption.The study by Kawakami and Takano-Yamamoto et al. (2004) explored how 1,25-dihydroxycholecalciferol affects alveolar bone formation during orthodontic tooth movement in rats. They found that repeated injections of this substance led to increased mineral apposition and osteoblast activity on the tension side of the periodontal ligament, suggesting that localized administration of calcitriol could promote the regeneration of dental supporting tissues, particularly the alveolar bone, after orthodontic tooth movement.

Vitamin C:

Vitamin C, also known as ascorbic acid, plays a vital role in collagen synthesis by aiding in the hydroxylation of proline and lysine residues within collagen molecules. This process enhances the stability and tensile strength of collagen fibers, which are major components of both the periodontal ligament and the alveolar bone. These structures are crucial for orthodontic tooth movement. One suggested mechanism is that Vitamin C's involvement in collagen synthesis is essential for the remodeling of the periodontal ligament and alveolar bone required during orthodontic tooth movement (Krishnan et al., 2021; Miresmaeili et al., 2015).Numerous studies involving both animals and humans have explored how Vitamin C affects movement of teeth. One randomized controlled trial conducted on humans found that daily administration of 500 mg of Vitamin C during orthodontic treatment caused significantly less root resorption than the group who taking a placebo (Miresmaeili et al., 2015). Another investigation carried out on male Wistar rats revealed that Vitamin C supplementation enhanced orthodontic tooth movement by promoting bone formation on the tension side and bone resorption on the pressure side during movement of teeth (Bolat et al., 2020). However, a review concluded that the evidence regarding the effects of Vitamin C on tooth movement is inconclusive, leaving uncertainty about whether Vitamin C supplementation effectively accelerates movement of teeth (Krishnan et al., 2021). Further research is necessary to determine the potential effects of Vitamin C supplementation on movement of teeth in humans.

Vitamin K:

Scarce studies have explored the correlation between vitamin K and orthodontic teeth repositioning. One study delved into the impacts of Vitamin K2 on bone reaction surrounding orthodontic mini-screw implants. The findings suggested that Vitamin K2 might activate various Vitamin K-dependent proteins and enhance bone formation around the implants that facilitate orthodontic tooth movement (Khazaal & Alzubaidi , 2019). Furthermore, further studies are needed to evaluate the possible impacts of Vitamin K supplementation or administration on the speed and effectiveness of orthodontic tooth movement.

Vitamin A:

Vitamin A is a crucial micronutrient that holds significance in numerous physiological processes, such as bone remodeling and growth.(Henning et al., 2015; Ribaya-Mercado et al., 2007). Research indicates that a deficiency in vitamin A can result in compromised bone formation, reduced bone density, and increased resorption of bone(Jackson et al., 2005; Crandall et al ., 2004).

Conversely, excessive intake of vitamin A can also detrimentally impact bone health and metabolism.Shi and colleagues (2023) conducted an experimental investigation to examine how vitamin A affects movement of teeth in male rats. The results showed that movement of teeth increased in a manner dependent on the dosage of vitamin A. However, the observed variances did not achieve statistical significance. There was also no significant difference in osteoclast numbers, lacunae presence, and root resorption between the study groups. The examination of serum alkaline phosphatase levels revealed no notable distinction among the groups receiving varying doses of vitamin A. In light of these results, it can be interferred that although vitamin A has a reported effect on bone metabolism and in this specific study, there was no elevation observed in alveolar bone restructuring and movement of teeth.

Vitamin B:

Research on the effects of Vitamin B on movement of teeth is still relatively limited. Vitamin B is a crucial nutrient involved in various bodily functions. Vogiatzoglou et al. (2009) found that consuming vitamin B-12 from dairy products led to the greatest rise in plasma vitamin B-12 levels in the general population, highlighting the importance of sufficient intake of this vitamin.Vitamin B complex is essential for maintaining healthy bone metabolism and can indirectly impact orthodontic tooth movement. It is involved in various physiological processes, including the metabolism of important nutrients like calcium, magnesium, and phosphorus necessary for bone balance. Additionally, it may contribute to preserving the health and robustness of the bones, which are integral to orthodontic tooth movements.Hence, ensuring adequate levels of Vitamin B complex may be crucial for promoting optimal bone health and facilitating orthodontic tooth movements.In summary, Vitamin B complex may contribute to maintaining proper bone metabolism, which is essential for optimal tooth movement during orthodontic treatment.

Conclusion and Recommendations

The findings of this study add to the expanding body of knowledge in the literature investigating the relationship between vitamins and orthodontic tooth movements. However, the findings are not conclusive and further research, particularly through human experiments, is needed to elucidate the exact mechanisms that determine the effects of vitamins on movement of teeth. However, additional research is needed to determine the specific effects of Vitamins B and A on orthodontic tooth movements and their impact on orthodontic treatment outcomes.

Future studies could investigate the potential benefits of combining different vitamin supplements to enhance tooth movement during orthodontic treatment. Clinicians may need to consider alternative methods for accelerating tooth movement to improve treatment outcomes. In conclusion, the existing literature presents inconclusive findings regarding the effects of vitamins on movement of teeth, underscoring the necessity for additional research to delve deeper into the relationship between vitamins and movement of teeth. Maintaining a healthy, balanced diet, including sufficient vitamin and mineral intake, may be beneficial for optimal orthodontic outcomes.

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ARITMA ÇAMURUNDAN AKTİF KARBON ÜRETİMİ VE BOYAR MADDE GİDERİMİNİN İNCELENMESİ

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Özet
Günümüzde endüstrinin hızla gelişimi çevre kirliliği başta olmak üzere bir çok sorunu daha beraberinde getirmiştir. Doğal kaynakların tükenmesi ve ekosistemlerin zarar görmesi gibi sorunlar büyük bir endişe kaynağı oluşturmaktadır. Bu bağlamda, boyar maddelerin çevre kirliliği üzerindeki etkileri göz ardı edilmemelidir. Boyar maddeler çeşitli endüstriyel alanlarda kullanılan kimyasal bileşiklerdir. Tüketime sunulan tüm madde ve malzemelerin renklendirilmesinde, boyar maddeler yaygın olarak kullanılmaktadır. Boyar maddeler üretimleri ve tüketimleri sürecinde toprak ve su kirliliği oluşturmaktadır. Boyar maddeler atık oluşturması dolayısıyla doğrudan veya dolaylı olarak ekolojik dengenin bozulmasına yol açmaktadır. Boyar maddelerin gideriminde adsorpsiyon, koagülasyon-flokülasyon, oksidasyon, ozonlama, filtrasyon, elektrokimyasal işlemler gibi çeşitli fiziksel ve kimyasal yöntemler kullanılmaktadır. Adsorpsiyon atık sudan boyar madde gideriminde yaygın olarak kullanılan bir prosestir. Bu çalışmada atık su arıtma tesisinden çıkan arıtma çamuru çeşitli kimyasal ajanlarla aktive edilerek aktif karbon üretilmiştir. Arıtma çamurundan aktif karbon üretimi atıkların geri dönüşümünde verimli, uygun maliyetli, sürdürülebilir çözüm sunmaktadır. Arıtma çamurunun kimyasal aktivasyonunda potasyum hidroksit (KOH), çinko klorür ($ZnCl_2$) ve fosforik asit (H_3PO_4) aktivasyon ajanı olarak kullanılmıştır. Arıtma çamuru kütlece 1:1 oranında (biyokütle/impregnant) aktivasyon ajanı ile aktive edilmiştir. Aktive edilen arıtma çamuru 600^0C' de 1 saat süre ile azot gazı eşliğinde karbonizasyona tabii tutulmuştur. Farklı kimyasallarla aktive edilerek üretilen aktif karbon numunelerinin metilen mavi adsorpsiyon performansı incelenmiştir. Adsorpsiyon sonucunda 30 mL 20 mg L^{-1}konsantrasyondaki metilen mavi çözeltileri 0.01 g aktif karbon ile 24 saat, 140 rpm çalkalanmışlardır. Potasyum hidroksit (KOH), çinko klorür ($ZnCl_2$) ve fosforik asit (H_3PO_4) ile aktifleştirilmiş numunelerin metilen mavi giderim oranları sırası ile %97,43, %33,43 ve %55,74 olarak elde edilmiştir. En yüksek giderim performansını potasyum hidroksit (KOH) ile hazırlanan aktif karbon göstermiştir. Bu çalışmada hazırlanan aktif karbonlar başarı ile sentezlenmiş ve metilen mavi adsorpsiyonunda yüksek performans göstermiştir.
Anahtar Kelimeler: Arıtma çamuru, Aktif karbon, Adsorpsiyon

INVESTIGATION OF ACTIVATED CARBON PRODUCTION AND DYESTATE REMOVAL FROM SURGERY SLUDGE

Abstract
Nowadays, the rapid development of industry has brought many problems, especially environmental pollution. The problems such as depletion of natural resources and ecosystem damage are of great concern. In this context, the effects of organic dyes on environmental pollution should not be ignored. The organic dyes are widely used chemical compounds used in various industrial fields coloring of materials. The organic dyes results environmental pollution in production and consumption processes. As a result of organic dye contamination in the environment, it leads to the disruption of the ecological balance, directly or indirectly. Various physical and chemical methods such as adsorption, coagulation-flocculation, oxidation, ozonation, filtration and electrochemical method are utilized in waste water treatment. Adsorption is a widely used process for the removal of dyes from wastewater. In this study, activated carbon was produced by chemical activation of sewage sludge, resulted from wastewater treatment process. Activated carbon production from sewage sludge offers an efficient, cost-effective and sustainable solution for recovery of wastes. Potassium hydroxide (KOH), zinc chloride ($ZnCl_2$) and phosphoric acid (H_3PO_4) were used for chemical activation of sewage sludge. The sewage sludge was activated with chemicals at a ratio of 1:1 (biomass/impregnant). The activated sewage sludge was carbonized at 600^0C for 1 hour in the presence of nitrogen gas. The methylene blue adsorption performance of as-obtained activated carbon samples was investigated. 30 mL of methylene blue solutions with a concentration of 20 mg L^{-1} were shaken with 0.01 g activated carbon at 140 rpm for 24 hours. The methylene blue removal rates of the activated carbons activated with potassium hydroxide (KOH), zinc chloride ($ZnCl_2$) and phosphoric acid (H_3PO_4) were obtained as 97.43%, 33.43% and 55.74%, respectively. Activated carbon prepared with potassium hydroxide (KOH) presented the highest removal performance. The activated carbons prepared in this study were synthesized successfully and shown high potential in methylene blue adsorption.
Keywords: Sewage sludge, Actived carbon, Adsorption

Giriş

Boyalar genellikle sentetik kökenlidir ve karmaşık aromatik moleküler yapılara sahiptir, bu da onları daha kararlı hale getirir ve biyolojik olarak parçalanmalarını daha zor hale getirir. Günümüzde ticari olarak 10.000'den fazla boya mevcuttur. (Gong vd., 2005) Boyama teknolojisi keşfedildiğinden beri, kauçuk, plastik, tekstil, kağıt, deri ve gıda gibi endüstriler için boya uygulamalarının sayısındaki artış, su ortamında bulunmalarına yol açmıştır. Bu atık su, bozunmaya karşı inatçı olan azo, metan, nitro ve karbonil dahil olmak üzere doğal ve sentetik boya karışımı içerir. Sadece estetik değeri etkilemez, aynı zamanda ışık nüfuzunu ve fotosentezi de azaltır. Ayrıca bazı boyalar ya toksik ya da mutajenik ve kanserojendir. (Gong vd., 2005) Metilen mavisi, renklendirici maddelerde, geçici saç renklendiricilerde, pamukluların, yünlerin boyanmasında, kağıt stoğu için kaplamada vb. yaygın olarak kullanılan yüksek hacimli üretim ticari boyasıdır. (Kristanti ve Hadibarata, 2016) Metilen mavinin toksisitesi ve düşük biyolojik olarak parçalanabilirliği yüksektir ve kusma, ishal, gastrit, göz yanıkları, baş ağrısı ve göğüs ağrısı gibi birçok olumsuz sağlık etkisi vardır. (Kristanti ve Hadibarata, 2016)Atık su içeren boyaların arıtılması için geleneksel yöntemler, flokülasyon, oksidasyon veya ozonlama, membran ayırma ve aktif karbon adsorpsiyonudur. (Gong vd., 2005) Ancak bu teknolojiler önemli bir etkinlik veya ekonomik avantaj göstermemektedir. (Gong vd., 2005) Çok sayıda araştırma, atıksudan adsorpsiyon prosesi ile boya giderimi işlemini ortaya koymuştur. Adsorpsiyon işlemi sırasında polimerik adsorbanlar, aktif karbon ve karbonlu adsorbanlar gibi üç yan ürün vardır. (Kristanti ve Hadibarata, 2016) Tüm alternatif adsorbanlardan, boyayı çıkarmak için yaygın olarak kullanılan uygulanabilir yöntem aktif karbondur. Bu nedenle, aktif karbon alternatifi olarak yeni adsorbanın taranmasına ihtiyaç vardır.Arıtma çamuru, yüksek organik içeriği ve tehlikeli maddeler salma kabiliyeti nedeniyle çevresel bir sorundur. (Giwa vd., 2023) Ayrıca atıksularda fiziksel ve kimyasal arıtma yöntemlerinin kullanılması önemli miktarda geri dönüştürülebilir organik maddelerin oluşmasına neden olmaktadır. Arıtma yöntemleri arasında depolama, ıslak oksidasyon, kompostlama, kurutma, stabilizasyon, yakma, piroliz, karbonizasyon, sıvılaştırma ve gazlaştırma yer alır. (Giwa vd., 2023) Bu arıtma çamuru arıtma yöntemlerinden bazıları ekosisteme zarar verir ve arıtma çamurunun potansiyel kaynak değerinin gereğinden az kullanılmasına neden olur. Bu çalışma arıtma çamurundan aktif karbon üreterek geri kazanılması ve metilen mavi giderimindeki rolünü araştırmayı amaçlamıştır.

Metod

Arıtma çamuru ilk olarak 110 ^{0}C etüvde kurutularak nemi giderilmiştir. Arıtma çamurunun kimyasal aktivasyonunda potasyum hidroksit (KOH), çinko klorür ($ZnCl_2$) ve fosforik asit

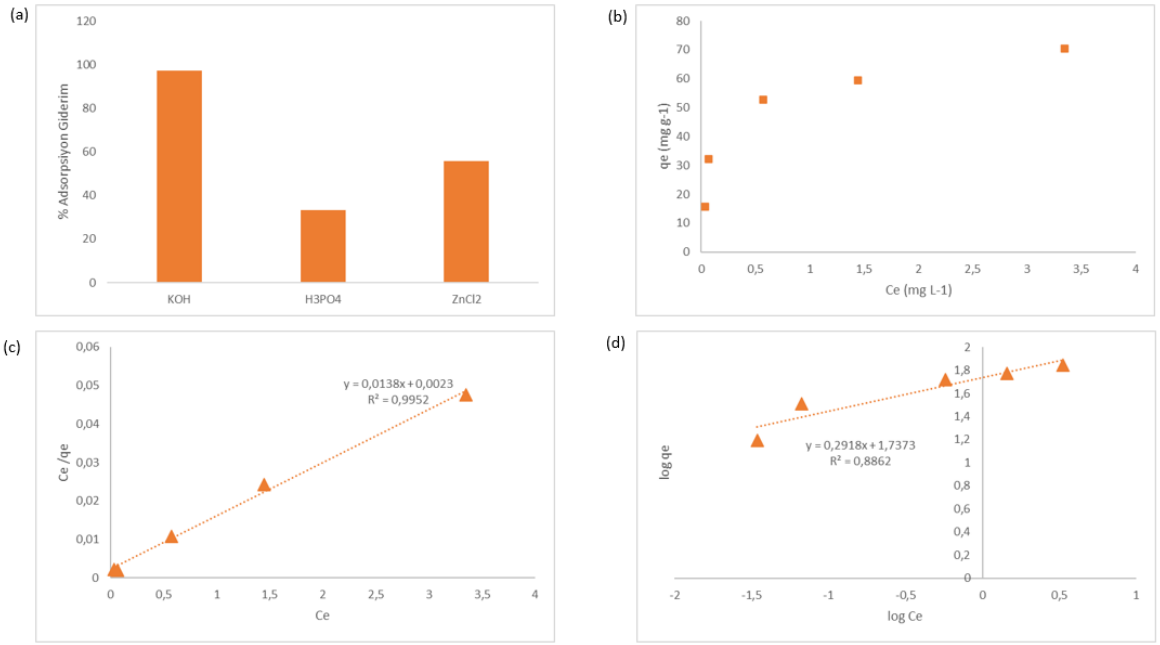
(H_3PO_4) aktivasyon ajanı olarak kullanılmıştır. Arıtma çamuru kütlece 1:1 oranında (biyokütle/impregnant) aktivasyon ajanı ile aktive edilmiştir. Aktive edilen arıtma çamuru 600^0C' de 1 saat süre ile azot gazı eşliğinde karbonizasyona tabii tutulmuştur. Aktif karbon numunesi sırası ile 1 M HCl , kaynar su ve saf su ile yıkanmıştır. Yıkanan aktif karbon numunesi 110 ^{0}C etüvde kurutulmuştur. Adsroban miktarının etkisini incelemek üzere 0,01 g aktif karbon numunelerinin üzerine 30 mL 20 mg L^{-1} konsantrasyonundaki metilen mavi çözeltisi eklenmiştir, 140 rpm'de 24 saat çalkalanmıştır. Adsorpsiyon sonrasındaki metilen mavi çözeltisi konsantrasyonları 665 nm'de UV-Vis spektrofotometre kullanılarak tayin edilmiştir.



Şekil 1. Kurutulmuş arıtma çamuru

Bulgular

Arıtma çamuru kütlece 1:1 oranında (biyokütle/impregnant) aktivasyon ajanı ile aktive edilmiştir. Aktive edilen arıtma çamurundan üretilen aktif karbon numunelerinin adsropsiyon yüzdesi etkisine bakılmıştır. Sonuçlar Şekil 2 (a)'da sunulmuştur. En yüksek adsropsiyon giderim yüzdesi potasyum hidroksit (KOH) aktivasyon ajanı ile elde edilmiştir. Aktivasyon ajanı olarak potasyum hidroksit (KOH) belirlenmiştir. Deneysel izoterm sonuçları Şekil 1 (b)' de verilmiştir. Deneysel olarak ulaşılabilen en yüksek adsorpsiyon kapasitesi 70,39 mg g^{-1} olarak elde edilmiştir. Deneysel izoterm sonuçlarına lineer Langmuir ve Freundlich izoterm denklemleri uygulanmış ve sonuçlar Şekil 1(c) ve Şekil 1(d)' de verilmiştir. Langmuir denkleminden elde edilen R^2 değeri 0,99, Freundlich denkleminden elde edilen R^2 değeri 0,88 olarak bulunmuştur. Sonuçlardan gözlemlendiği üzere tek tabakalı adsorpsiyon profili olan Langmuir modeline uyumlu olduğu belirlenmiştir. Langmuir model denkleminden hesaplanan maksimum adsorpsiyon kapasitesi 72,46 mg g^{-1} olarak bulunmuştur.



Şekil 2. (a) aktivasyon ajanının adsropsiyon yüzdesine etkisi (b) izoterm eğrisi, (c) lineer Langmuir izoterm modeli eğrisi ve (d) lineer Freundlich izoterm modeli eğrisi

Tartışma ve Sonuç

Boyarmaddelerin sulu çözeltilerden giderimi için çeşitli teknikler vardır. Adsropsiyon atık su içerisindeki yabancı maddelerin gideriminde düşük maliyet ve yüksek performans özellikleriyle en etkili yöntem olarak kullanılmaktadır. Çalışma kapsamında arıtma çamurunun aktivasyon ajanları ile aktive edilerek üretilen aktif karbonun metilen mavi adsorpsiyonundaki giderimi incelenmiştir. En uygun aktivasyon ajanı %97,43 adsorpsiyon giderim yüzdesi ile potasyum hidroksit(KOH) olarak belirlenmiştir. Metilen mavi adsorpsiyon izoterm modeli incelenmiştir. En uygun adsorban miktarının 72,46 mg g^{-1} olduğu ve tek tabakalı Langmuir izoterm modeline uyum sağladığı görülmüştür. Atık olarak değerlendirilen arıtma çamurundan aktive edilerek aktif karbon üretilmesi atık yönetimi ve çevresel sürdürülebilirlik açısından verimli bir alternatif olarak görülmüştür.

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HİDROTERMAL KARBONİZASYON YÖNTEMİ İLE AKTİFLEŞTİRİLMİŞ HİDROÇAR ÜRETİMİ VE KRİSTAL VİOLE ADSORPSYONUNDA DEĞERLENDİRİLMESİ

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Özet
Biyokütle günümüzde çeşitli endüstriyel süreçlerde ve enerji üretiminde yaygın bir şekilde kullanılmaktadır. Biyokütle, hayvansal ve bitkisel kaynaklı organik veya inorganik bileşiklerin doğal veya işlenmiş bir kompleksidir. Biyokütle rüzgar, güneş, su, jeotermal enerji kaynakları gibi yenilebilir ve alternatif bir enerji kaynağıdır. Tarım atıkları, orman endüstrisi atıkları, enerji tarımı ürünleri, her türlü bitki atıkları, evsel atıklar, hayvansal atıklar, endüstriyel atıklar ve ormansal atıklar, biyokütle atıklarını oluşturmaktadır. Biyokütle kaynakları, aktif karbon gibi değerli malzemelerin üretimi için de kullanılabilirler. Bu çalışmada biyokütle kaynağı olarak gilaburu ve hidrotermal karbonizasyon yöntemi kullanılmıştır. Hidrotermal karbonizasyon, sulu ortamda, düşük sıcaklıklarda ve kendiliğinden oluşan basınç altında gerçekleşen termokimyasal bir prosestir. Gilaburu, Güneydoğu Anadolu bölgesinde yetişen bir bitki olarak bilinir ve geleneksel tıpta çeşitli amaçlarla kullanılmaktadır. Hidrotermal karbonizasyon deneylerinde 3 g gilaburu posası, 50 mL H_2O ile paslanmaz çelik hidrotermal reaktör içerinde karıştırılmış ve 210^0C' ye ayarlanmış etüv içerisinde 24 saat süreyle ısıtılmıştır. Reaksiyon sonunda elde edilen hidroçar kurutulduktan sonra kütlece 1:2 oranında fosforik asit (H_3PO_4) ile impregne edilmiştir ve ardından 800^0C' de 1 saat süre ile azot gazı eşliğinde karbonizasyona tabii tutulmuştur. Fosforik asit ile aktive edilerek üretilen aktifleştirilmiş hidroçar numunesinin kristal viole adsorpsiyon performansı incelenmiştir. Adsorpsiyon işleminde 30 mL 20 mg L^{-1} konsantrasyondaki, kristal viole çözeltileri 0.01 g aktifleştirilmiş hidroçar ile 24 saat, 140 rpm' de çalkalanmıştır. Kütlece 2:1 oranında fosforik asit (H_3PO_4) ile aktifleştirilmiş numunenin kristal viole giderim oranı yaklaşık %98 olarak elde edilmiştir. Bu çalışmada hazırlanan aktifleştirilmiş hidroçar başarı ile sentezlenmiş ve kristal viole adsorpsiyonunda yüksek performans göstermiştir.
Anahtar Kelimeler: Hidrotermal karbonizasyon, Aktif karbon, Adsorpsiyon

PRODUCTION OF ACTIVATED HYDROCHAR BY HYDROTHERMAL CARBONIZATION METHOD AND ITS EVALUATION IN CRYSTAL VIOLET ADSORPTION

Abstract
Biomass is a natural or processed complex of organic or inorganic compounds derived from animal and plant source and widely used in various industrial processes and energy production. It is a renewable and alternative energy source such as wind, solar, water, and geothermal energy sources. Agricultural residues, forest industry residues, energy crops, all kinds of plant residues, household waste, animal waste, industrial waste, and forestry residues constitute biomass waste. Biomass resources can also be used for the production of valuable materials such as activated carbon. In this study, gilaburu pulp was hydrothermally activated Hydrothermal carbonization is a thermochemical process that occurs in water as carbonization media at low temperature and under spontaneous pressure. The gilaburu pulp is known as a plant grown in the Southeast Anatolia region and is used for various purposes in traditional medicine. In hydrothermal carbonization experiments, 3 g of gilaburu pulp was placed in a stainless steel autoclave reactor with 50 mL of H_2O, mixed in the hydrothermal reactor, and hydrothermally treated for 24 hours at 210°C in an oven. The hydrochar obtained at the end of the reaction was filtered and dried at 105°C for 24 hours. The as-obtained hydrochar was impregnated with phosphoric acid (H_3PO_4) at a mass ratio of 1:2 (biomass/impregnant). The impregnated hydrochar was carbonized at 800°C for 1 hour under nitrogen gas flow. The crystal violet removal performance of the activated hydrochar sample produced by activation with phosphoric acid was investigated in a batch adsorption system. In the adsorption process, 30 mL of crystal violet solutions with a concentration of 20 mg L^{-1} were shaken with 0.01 g of activated hydrochar at 140 rpm for 24 hours. The removal efficiency of crystal violet obtained for the sample activated with phosphoric acid at a mass ratio of 1:2 was approximately 98%. The activated hydrochar prepared in this study was successfully synthesized and exhibited high performance in crystal violet adsorption.
Keywords: Hydrothermal carbonization, Actived carbon, Adsorption

Giriş

Hidrotermal karbonizasyon yöntemi, son yıllarda çevresel sürdürülebilirlik ve alternatif enerji kaynakları arayışında önemli bir yer edinmiştir. Hidrotermal karbonizasyon süreci 20. Yüzyılın başlarında karbon açısından zengin katı yakıt üretmek için geliştirilen bir yöntemdir. (Evcil vd., 2020) Bu süreçte biyokütle, yüksek sıcaklık ve basınç altında birkaç saat boyunca karbon açısından zengin ürünlere dönüştürülür. (Evcil vd., 2020) Hidrotermal karbonizasyon prosesinde hidroliz, dehidrasyon, dekarboksilasyon, yoğunlaşma ve polimerizasyonu içeren bir dizi reaksiyon meydana gelir. (Salaudeen vd., 2021) Hidroçar olarak adlandırılan katı ürün, atık su kirliliğinin iyileştirilmesinde, kataliz, enerji depolama, adsorpsiyon gibi çok çeşitli uygulamalarda kullanılabilir. (Wang vd., 2018) Biyokütlelerin hidrotermal karbonizasyonu, çeşitli avantajlar içermektedir. Biyokütle olarak genellikle tarımsal atıklar, odun artıkları, selülozik materyaller ve diğer organik kaynakların kullanımını içermektedir. Bu çalışmada biyokütle kaynağı olarak kullanılan gilaburu Güneydoğu Anadolu bölgesinde yetişen bir bitki olarak bilinir ve geleneksel tıpta çeşitli amaçlarla kullanılmaktadır.Kristal viole boyası suda çözünebilen, toksik, dirençli, ciddi sağlık sorunlarına ve çevre kirliliğine neden olan organik bir boyadır. (Cheruiyot vd., 2019) Genellikle mor renkli bir toz veya sıvı halde bulunurlar. Kristal viole bir tri-fenilmetan boyasıdır. (Cheruiyot vd., 2019) Kanserojen, mutajenik olarak bilinse de ticari tekstil proseslerinde, biyolojik boyamada ve dermatolojik ajan olarak hala yaygın bir şekilde kullanılmaktadır. Azo boyaların atık sularda arıtılması büyük bir zorluktur çünkü bu boyalar bozunmaya karşı dirençli karmaşık bir yapıya sahiptirler. (Cheruiyot vd., 2019) Biyolojik bozunma, fotokatalitik, çökelme, adsorpsiyon, kimyasal oksidasyon, flokülasyon, çökeltme, ozonlama, iyon değişimi ve solvent ekstraksiyonu gibi geleneksel arıtma yöntemleri boya gideriminde kullanılmaktadır. (Cheruiyot vd., 2019) Adsorpsiyon düşük maliyetli oluşu ve etkinliği nedeniyle en yaygın arıtma yöntemlerinden biri olmaya devam etmektedir. (Cheruiyot vd., 2019) Bu çalışmada biyokütle olarak kullanılan gilaburu posasından hidrotermal karbonizasyon yöntemi ile hidroçar üretimi ve kristal viole adsorpsiyonunda incelenmesi amaçlanmıştır.

Metod

Hidrotermal karbonizasyon deneylerinde 3 g gilaburu posası, 50 ml saf su ile paslanmaz çelik hidrotermal reaktör içerisinde karıştırılmıştır. Etüv içerisinde 210°C' de 24 saat süreyle ısıtılmıştır. Reaksiyon sonunda elde edilen hidroçar kurutulduktan sonra kütlece 1:2 oranında fosforik asit ile impregne edilmiştir ve ardından 800°C' de 1 saat süre ile azot gazı eşliğinde karbonizasyona tabii tutulmuştur. Hidroçar numunesi sırası ile HCl , kaynar su ve saf su ile

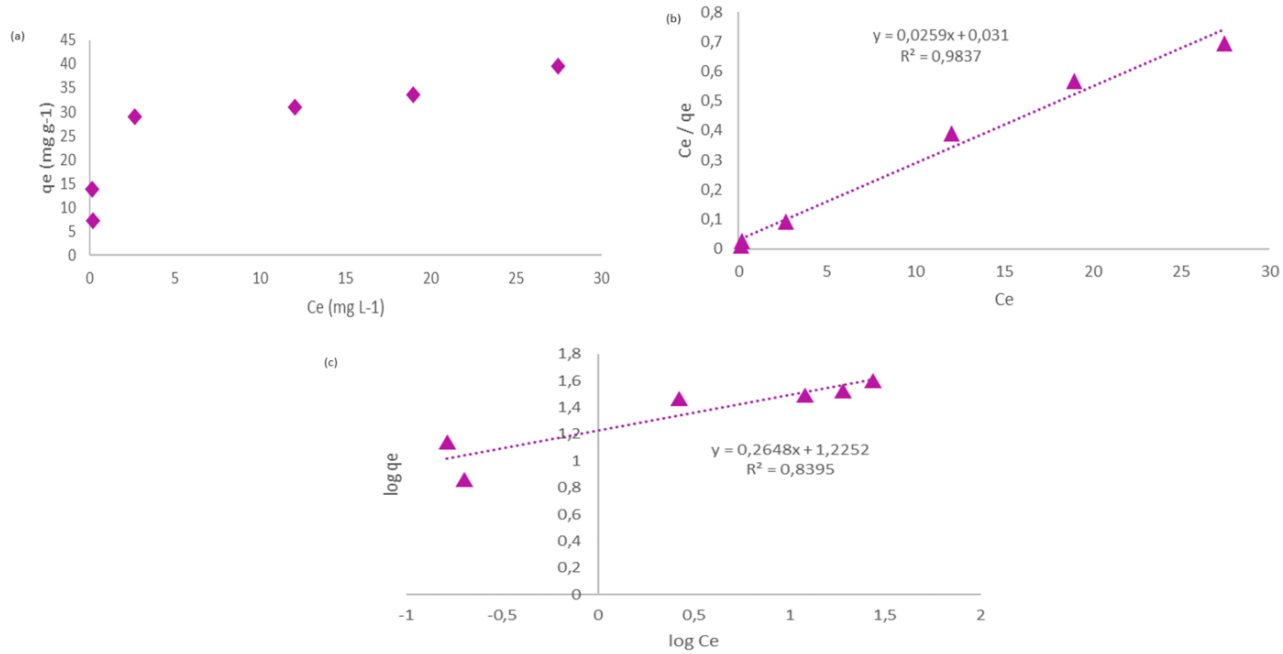
yıkanmıştır. Yıkanan hidroçar numunesi 110°C etüvde kurutulmuştur. Fosforik asit ile aktive edilerek üretilen aktifleştirilmiş hidroçar numunesinin kristal viole adsorpsiyon performansı incelenmiştir. Adsorpsiyon işleminde 30 mL 20 mg/L konsantrasyondaki, kristal viole çözeltileri 0.01 g aktifleştirilmiş hidroçar ile 24 saat, 140 rpm' de çalkalanmıştır. Süre sonunda çözeltiler şırınga filtrelerden süzülüp, gerekli seyreltmeler yapılıp 590 nm'de UV cihazında okunmuştur.



Şekil 1. Öğütülmüş gilaburu posası

Bulgular

Gilaburu posasından hidrotermal karbonizasyonla hidroçar üretilmiştir. Elde edilen hidroçar kütlece 1:2 oranında (biyokütle/impregnant) aktivasyon ajanı ile aktive edilmiştir. Aktive edilen hidroçar ile üretilen aktif karbon numunelerinin adsorpsiyon yüzdesi etkisine bakılmıştır. Deneysel izoterm sonuçları Şekil 2 (a)' de verilmiştir. Deneysel olarak ulaşılabilen en yüksek adsorpsiyon kapasitesi 39,61 mg g^{-1} olarak elde edilmiştir. Deneysel izoterm sonuçlarına lineer Langmuir ve Freundlich izoterm denklemleri uygulanmış ve sonuçlar Şekil 2(b) ve Şekil 2(c)' de verilmiştir. Langmuir denkleminden elde edilen R^2 değeri 0,9837, Freundlich denkleminden elde edilen R^2 değeri 0,8395 olarak bulunmuştur. Sonuçlardan gözlemlendiği üzere tek tabakalı adsorpsiyon profili olan Langmuir modeline uyumlu olduğu belirlenmiştir. Langmuir model denkleminden hesaplanan maksimum adsorpsiyon kapasitesi 38,61 mg g^{-1} olarak bulunmuştur.



Şekil 2. (a) izoterm eğrisi, (b) lineer Langmuir izoterm modeli eğrisi ve (c) lineer Freundlich izoterm modeli eğrisi

Tartışma ve Sonuç

Çalışma kapsamında hidroçar aktivasyon ajanları ile aktive edilerek üretilen aktif karbonun kristal viole adsorpsiyonundaki giderimi incelenmiştir. Hidrotermal karbonizasyon yöntemi ile aktifleştirilmiş hidroçar üretimi ve kristal viole adsorpsiyonu başarılı bir şekilde gerçekleşmiştir. Kristal viole adsorpsiyon izoterm modeli incelenmiştir. En uygun adsorban miktarının 38,61 mg g^{-1} olduğu ve tek tabakalı Langmuir izoterm modeline uyum sağladığı görülmüştür. Hidroçar üretiminde etkili bir yöntem olan hidrotermal karbonizasyonun, aktifleştirme işlemi ile birlikte adsorpsiyon uygulamalarında kullanılabileceği görülmektedir. Bu çalışma hem hidroçar üretimi hem de adsorpsiyon alanında yeni uygulama alanları sunmaktadır.

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HAM PETROLÜN ADSORPTİF KÜKÜRT GİDERMESİ İÇİN KLINOPTİLOLİNİN MODİFİKASYONU VE KARAKTERİZASYONU

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Özet
Günümüzde dünya nüfusunun artması ve artan nüfus ile birlikte enerji ihtiyacının artması ile Tükenen enerji kaynaklarının da arındırılması ve temizlenmesi büyük önem kazanmıştır. Ham petrol, günümüzde enerji ihtiyacının büyük bir kısmını karşılayan ve önemli bir enerji kaynağıdır. Ham petroldeki kükürt giderimi (desülfürizasyon) geçmişte olduğu gibi günümüzde yapılmaya devam edilmektedir. Çünkü sülfür bileşikleri, yanma sırasında egzoz gazlarında kükürt dioksit oluşturarak hava kirliliğine ve asit yağmurlarına yol açabilir. Ayrıca, sülfür bileşikleri, motorların ve katalizörlerin ömrünü kısaltabilir. Bu nedenle, ham petroldeki sülfür bileşiklerinin çıkarılması ve ürünlerin daha temiz hale getirilmesi önemlidir. Desülfürizasyon işlemi genellikle rafinasyon aşamasında gerçekleştirilir ve farklı yöntemler kullanılabilir. Kükürt gideriminin farklı yöntemleri bulunmakla birlikte bu çalışmada Adsorptif desülfürizasyon yöntemi kullanılmıştır. Bu yöntem için adsorbent olarak klinoptilolit kullanımı tercih edilmiştir. Volkanik kökenli bir alüminosilikat minerali olan klinoptilolitin seçiciliğini iyileştirmek ve adsorpsiyon süreçlerini daha verimli hale getirmek amacıyla NaCl ile modifiye edilerek kullanılmıştır. Yapılan çalışmada partikül boyutu, süre, hız ve dozlama olarak 4 farklı parametre ile işlem yapılmıştır. Daha sonra petrol bazlı ürünlerin yapısal analizi, fraksiyon tanıma, yanma özellikleri ve yakıt verimliliği ile kalite denetimleri hakkında bilgi edinmek için Fourier Dönüşümlü Kızılötesi Spektroskopisi (FTIR) ile önce ham petrolün desülfürizasyon işlemi yapılmadan önceki hali daha sonra desülfürizasyon işleminden sonraki hali analiz edilerek çalışmadan verimli sonuç alınmıştır.
Anahtar Kelimeler: Klinoptilolit, Modifikasyon, Ham petrol, Desülfürizasyon, Karakterizasyon, Kükürt giderimi

MODIFICATION AND CHARACTERIZATION OF CLINOPTHYLLOLINE FOR ADSORPTIVE DESULFURIZATION OF CRUDE OIL

Abstract
In today's world, the increasing global population and the rising energy demand have made it crucial to deplete and purify energy resources. Crude oil, a significant energy source that currently meets a large portion of the energy demand, requires sulfur removal (desulfurization) as it has been historically practiced and continues to be done so today. Sulfur compounds in crude oil can produce sulfur dioxide in exhaust gases during combustion, leading to air pollution and acid rain. Additionally, these sulfur compounds can shorten the lifespan of engines and catalysts. Therefore, it is important to remove sulfur compounds from crude oil and clean up the resulting products. Desulfurization is usually carried out during the refining stage and various methods can be used. While there are different methods for sulfur removal, this study utilizes the Adsorptive desulfurization technique. clinoptilolite has been chosen as the preferred adsorbent for this method. To enhance the selectivity of klinoptilolite, a volcanic aluminosilicate mineral, and to optimize adsorption processes, it has been modified with NaCl. The study involved processes with four different parameters: particle size, duration, rate, and dosing. Subsequently, through the analysis of crude oil states pre and post-desulfurization process using Fourier Transform Infrared Spectroscopy (FTIR), efficient results were obtained.
Keywords: Clinoptilolite, Modification, Crude oil, Desulfurization, Characterization

Introduction

Access to energy is crucial for a society's well-being, economic development and quality of life. Therefore, removing barriers to access to available energy can only be possible by increasing available energy. For this reason, researchers have increased their studies on energy in recent years and have made efforts to ensure that available energy resources do not harm the environment and human health (Kavak & Haspolat, 2022) Throughout history, energy systems have relied on fossil fuels (coal, oil and gas). The use of fossil fuels releases carbon dioxide and other greenhouse gases, which are considered to be the main cause of global climate change. The combustion of fossil fuels produces large amounts of carbon monoxide; oxides of sulphur, SO2 and SO3 (represented as SOx); oxides of nitrogen, NO and NO2 (represented as NOx) and particulates, which have been proven to be harmful to human health and the environment (Sonel Aü Fen Fakültesi, 1997). Sulfur content in gasoline and diesel fuels has been limited, especially due to the harmful effects of SOx gases released as a result of combustion. Governments try to reduce the concentration of petroleum products such as gasoline and diesel below 15 ppm in accordance with existing rules.Adsorption desulfurization studies have recently gained importance due to their potential applications in desulfurization of various materials (Gupta et al., 2021; Salehi et al., 2020; Tuna et al., 2020). In this method, the sulfur and sulfur-containing compounds of the hydrocarbon adhere to the solid adsorbent surface. The effectiveness of the method is proportional to the effectiveness of the adsorbent (Blanco Brieva et al., 2010).History and formation of crude oil Petroleum is known as crude oil or crude oil. It is a dark liquid and has a color close to black. It has a pronounced viscosity and has an acceptable odor if it contains a low proportion of sulfur compounds. If it has high proportions of nitrogen compounds, or both, it has an unpleasant odor. Petroleum liquid is lighter than water and different types have different densities. It is also a flammable liquid. The most important sulfur compounds found in petroleum are (methylthio and thiophene compounds, as well as hydrogen sulfide gas H2S) and some sulfur compounds (Younis Muhammad Al-Hassan, 2019).



Figure 1 (a) Tiyofen, (b)Mercaptan (Younis Muhammad Al-Hassan, 2019)

Production of Crude Oil

Oil and gas production is the process of extracting hydrocarbons and separating the mixture of liquid hydrocarbons, gas, water and solids (Bahadori et al., 2013). Production facilities usually process crude oil from multiple wells. Oil is almost always processed at a refinery; natural gas may be processed to remove contaminants in the field or at a natural gas processing plant. Crude oil and natural gas are usually removed from the fields where they are produced and transported to refineries and gas processing plants, where they are either made into feedstock for another production process or processed into final products.

Desulphurization

Given regulatory limits, the sulfur compounds or sulfur content in liquid fuels must be controlled. These controls require the application of various methods for the effective removal of sulfur from liquid fuels. (Crandall et al., 2019) These methods are used in a wide range of applications, from industrial applications to laboratory research. Figure 1.1 shows a schematic representation of various desulfurization techniques. (Khodadadi Dizaji et al., 2019; Nath Prajapati & Verma, 2018; Prajapati & Verma, 2017)

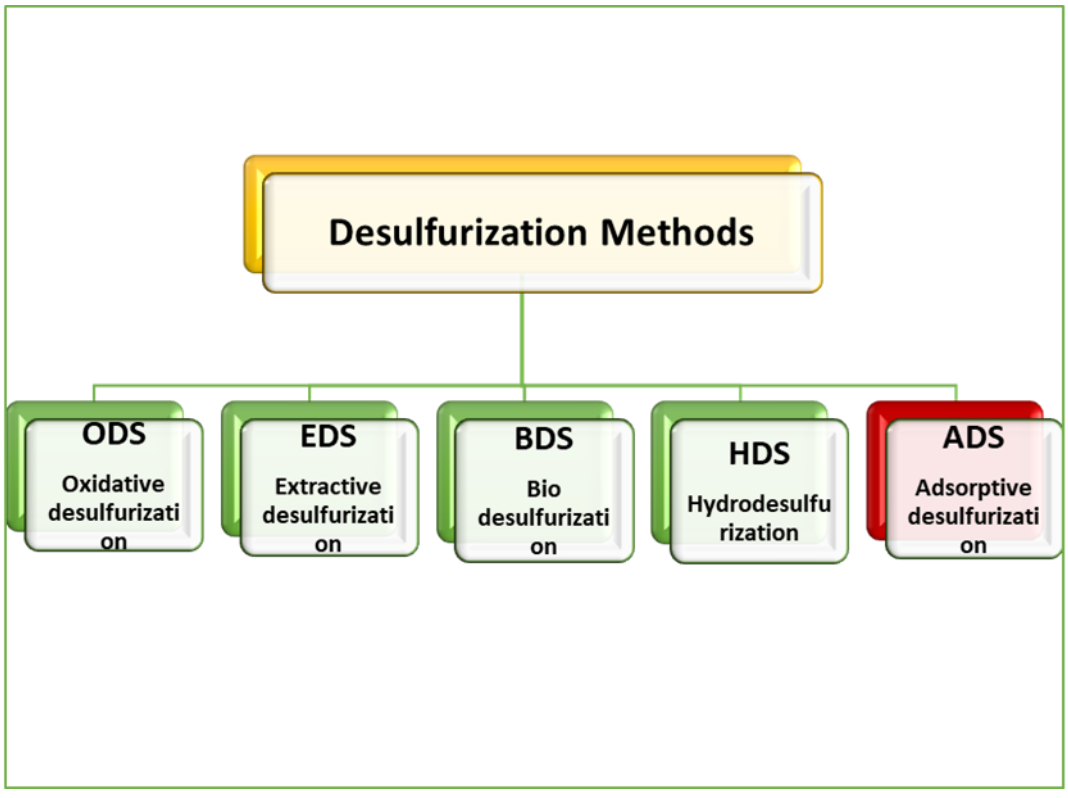


Figure 2 Desulfurization Methods

Adsorptive desulfurization (ADS)

It is a relatively new technology for sulfur removal from fuel. It is quite popular among researchers due to its inexpensive nature and ease of adaptation to different fuel processors. It involves the process of contacting an activated/functionalized adsorbent to remove sulfur from fuel. The fact that it does not require hydrogen, operates under moderate temperature conditions (from room temperature to about 100°C) and adsorbent renewability make it an economical desulfurization method. To date, many different adsorbents have been focused and the process technology adapted for ultra-low desulfurization. Many of the reported materials and processes together with various mechanisms and process conditions will be extensively investigated. In the adsorption desulfurization technique, the active adsorbent is placed on a rough, non-reacting substrate providing a high surface area. Adsorption occurs when sulfur molecules adhere to the adsorbent and remain separated from the fuel. Different researchers have used this technique to remove sulfur from different types of fuel oils and model oils using various types of adsorbents (Hernández-Maldonado & Yang, 2004; Lee et al., 2002; Li et al., 2007; Ma, Sun, et al., 2002; Sano et al., 2005; Weitkamp et al., 1991; Yu et al., 2005).

Effects of Process Parameters on Adsorptive Desulfurization

Contact time

Contact time has a great influence on the adsorption efficiency of any adsorbent. In general, with the increase in contact time, the adsorption capacity of an adsorbent increases until it reaches equilibrium.

Adsorbent dosage

In general, the percentage of adsorption or desulfurization increases with increasing adsorbent dosage due to the increased number of accessible active sites (Ganiyu et al., 2016; Saleh et al., 2017).

Adsorption temperature

Temperature is a critical process parameter in adsorption. It affects both the adsorption rate and the absorption capacity. With increasing temperature, the adsorption rate is expected to increase as sulfur compounds move faster through the pores of the adsorbents and overcome the activation energy barrier. The effect of temperature on adsorption capacity depends on whether the particular adsorption process is exothermic or endothermic.

Initial sulfur content of the feedstock

The Langmuir (1) and Freundlich (2) isotherms describe monolayer adsorption and heterogeneous adsorption, respectively. These isotherms relate the sulfur uptake per unit weight of adsorbent (qe) to the equilibrium sulfur concentration (Ce) in the bulk liquid as shown below. Ce/qe=1/KQm+C/Qm (1)logqe = logKF +1/n logCe (2)Where Ce, K, Qm, KF and n stand for the sulfur concentration in the fuel at equilibrium, Langmuir isotherm constant, Freundlich isotherm constants related to maximum monolayer coverage capacities, adsorption capacity and adsorption intensity, respectively.

Some Adsorbents Used in Adsorptive Desulfurization

The selection of a suitable adsorbent is important for all adsorption processes including ADS. An efficient adsorbent should be porous, physically and chemically stable, environmentally friendly and suitable for recovery. ADS adsorbents are substances such as microporous EC, zeolites, alumina, mesoporous silica and recently MOFs, which are widely discussed in the literature. In this chapter, detailed descriptions of these adsorbents and various sulfur removal studies using these adsorbents are presented. Furthermore, (adsorptive) sulfur removal tests and the experimental conditions used in the tests are briefly presented. In the desulfurization process of sulfur-containing liquid fuels, conditions such as S exposure times of adsorbents, S concentrations, temperatures and durations are important factors to be taken into account when establishing recovery strategies.

Zeolite-based adsorbents

Zeolites are microporous crystalline aluminosilicates with high external surface area (150-500 m2/g) and three-dimensional structure. Due to their stable skeletal structure and ability to cation exchange, zeolites are more widely studied materials for ADS treatment. The adsorption capacity and selectivity of metal cation-exchanged zeolites towards sulfur compounds were found to be very high due to the presence of metal-based active sites on the surface (Dehghan & Anbia, 2017). Among different types of zeolites, Y-type zeolites such as Ag/Y, Cu/Y, Ce/Y, Na/Y, Ni/Y, La/Y are the most studied materials for ADS due to tunable porosity for size-selective adsorption, high ion exchange capacity and good thermal stability. Like metal oxide-type adsorbents, adsorptive desulfidation with zeolites involves π complexation, sulfur-metal and Lewis acid-base interactions. Selective adsorption of sulfur compounds in the presence of aromatic and nitrogenous compounds is a challenging process as they have similar structures and adsorption energies (Song et al., 2013),(Zu et al., 2020),(Ma, Song, et al., 2002).

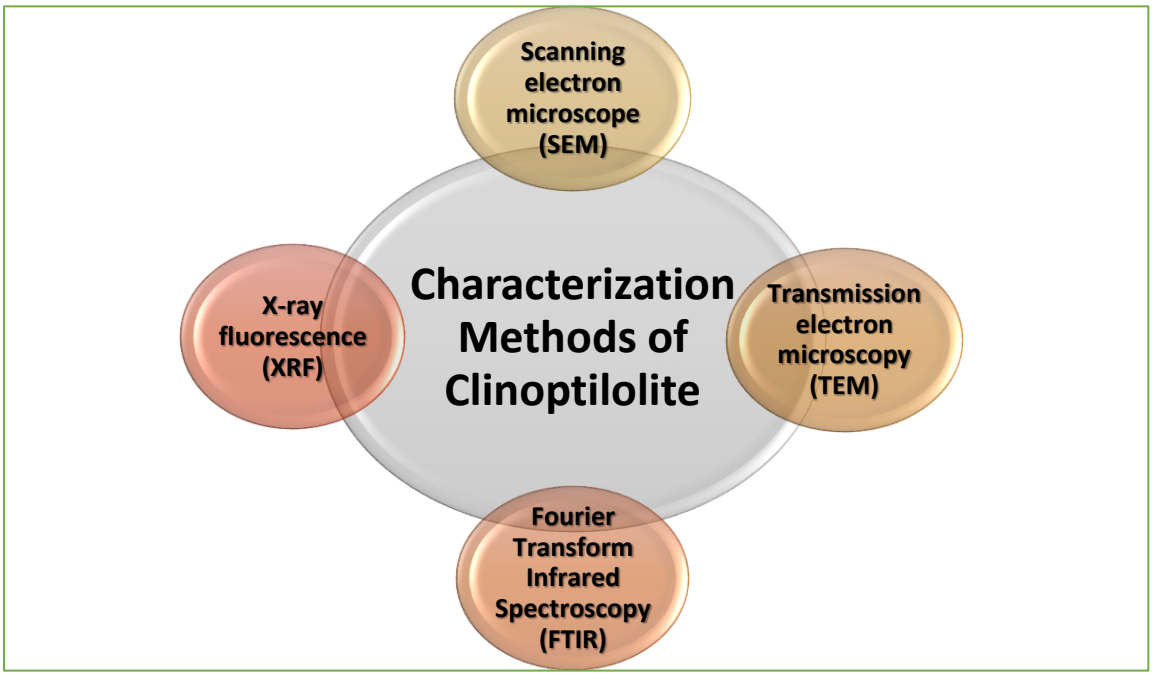


Figure 2 Characterization Methods of Clinoptilolite

Fourier Transform Infrared Spectroscopy (FTIR)

It is an extremely useful technique for confirming the identity of pure compounds, but of limited value when used for mixtures of compounds. The technique is based on the identification of functional groups within molecules, where these groups vibrate (stretch or bend in various ways) when irradiated with light of specific wavelengths (NicDaéid, 2019) Infrared spectroscopy is a field in which the electromagnetic field of matter interacts in the infrared radiation (IR) region as a function of photon frequency. First, a glowing blackbody light source emits a beam of infrared energy. Then, the infrared beam enters the interferometer, where it generates an interferogram signal. Next, the beam enters and passes through the sample chamber or reflects off the sample surface. When materials are exposed to infrared radiation, the sample molecules absorb certain wavelengths of radiation, causing a change in the dipole moment of the molecules. Some of the infrared radiation is transmitted by the sample, while some is absorbed. As a result, the vibrational energy levels of the sample molecules change from the ground state to the excited state. The resulting spectrum shows the transmission and absorption of the sample molecules and forms the molecular fingerprint of the sample. The absorption peak frequency determines the vibrational energy gap of the sample molecules and the absorption peak number corresponds to the vibrational freedom of the molecule. The absorption peak magnitude is a result of the probability of transition of energy levels and the

variation of the dipole moment. Finally, the infrared beam enters the detector for the final measurement. The measured signal is digitized and sent to the computer for Fourier transformation. The final infrared spectrum is then presented to the user for interpretation and further manipulation (McNaught & Wilkinson, 1997).

Materials and Methods

The types of chemicals used in the thesis study and the purposes for which these chemicals were used are detailed in Table 3.1 of the study.

Table 1 Chemicals used in the thesis study and their intended use

Name	Formula	Purpose of usage
Zeolite (Clinoptilolite)	(Na2, Ca, K2)2-3Al3(Al, Si)2Si13O36•12H2O	Adsorbent
Crude oil	CnH2n+2	Desulphurization
Sodium chloride	NaCl	Modification
Pure water	H2O	Washing process

Modification Method of Clinoptilolite

Chemically or physically changing clinoptilolite, a natural zeolite mineral, is done in order to increase the reactivity of the mineral, increase surface insulation or determine specific properties.



Figure 3 NaCl solution and two different sized clinoptilolite samples

Modification of clinoptilolite further enhances the properties of naturally occurring clinoptilolite, allowing it to be used more effectively in various applications. In this thesis, NaCl solution is first prepared by following the steps below.

Desulphurization of Crude Oil

The desulphurization process of crude oil was carried out using NaCl modified clinoptilolite with different particle sizes. 50µ and 200 µ sized modified clinoptilolite was used at room temperature for two different times (20, 60), two different speeds (300, 500) and two different dosages. As a result of the processes, sulfur measurement and characterization analysis of a total of 16 samples were carried out.

Fourier Transform Infrared Spectroscopy (FTIR)

Structural analysis of petroleum-based products is carried out to obtain information on fraction identification, combustion characteristics and fuel efficiency as well as quality controls. It also affects the quality of marketable products derived from crude oil products. Fourier transform infrared (FT-IR) spectroscopy has the advantage of being able to record spectra for solid and liquid samples without any pre-treatment. This makes FT-IR/ATR particularly attractive for easy and rapid characterization of natural and synthetic products (Griffiths & De Haseth, 2007). In the thesis study, FTIR spectroscopic analysis of the crude oil sample was performed using a Perkin Elmer Spectrum 2 FTIR Spectrophotometer. Each spectrum was taken at wavenumbers of 4000-650 cm^{-1} at a scan rate of 4 cm^{-1} and the data were evaluated using the software.

Conclusion and Recommendation

This thesis study was carried out in two stages. In the first stage, it was aimed to increase the adsorption capacity by modifying clinoptilolite. In the second stage, desulfurization of untreated crude oil was carried out with the modified clinoptilolite. FT-IR device was used as a characterization method to analyze the samples before and after the desulfurization process.

Fourier Transform Infrared Spectroscopy (FTIR)

Crude oil samples were firstly identified before desulphurization and then 16 samples after desulphurization were identified in the instrument. As shown in Figure 4.1, alkanes and carbonyl groups were found in the sample at certain frequency ranges and various intensities.

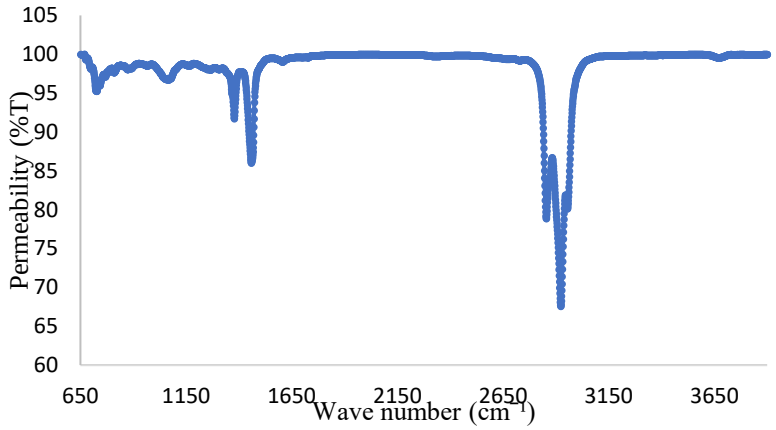


Figure 4 FT-IR imaging of crude oil

According to the information given in the identification, as shown in Table 4.1, it shows strong bands around 2955 cm^{-1}, 2923 cm^{-1} and 2854 cm^{-1}, which correspond to aromatic C-H, methyl C-H and methylene C-H. The weak absorption band at 1611 cm^{-1} corresponds to aromatic C=C. A strong band located around 1458 cm^{-1} represents methylene C-C, while an intense band appears at 1377 cm^{-1}, which corresponds to the S=O of sulfones. The S-C of sulfides is also indicated by a weak absorption band around 1267 cm^{-1} and 1166 cm^{-1}. At 1066 cm^{-1}, the S=O bond of sulfoxides is observed with moderate intensity. In the 873 cm^{-1} and 725 cm^{-1} bands, alkanes were again observed with medium intensity. Results of FT-IR analysis of crude oil before desulfurization and sulfur peaks and intensity levels

Table 2 Results of FT-IR analysis of crude oil before desulfurization and sulfur peaks and intensity levels

Observed wave number cm^{-1}	Bond	Compound type	Frequency range cm^{-1}	Intensity
2955	C-H	Alkanes	2850-2970	Strong
2923	C-H	Alkanes	2850-2970	Strong
2854	C-H	Alkanes	2850-2970	Strong
1611	C=C	Alkenes	1610-1680	Weak
1458	C-H	Alkanes	1350-1470	Strong
1377	C-H	Alkanes	1370-1390	Middle
1250	S=O	Carbonyls	1290-1415	Middle
	S-C	Carbonyls	1290-1415	Weak
1053	C=S	Carbonyls	1050-1080	Middle
873	C-H	Alkanes	690-900	Middle
725	CH2	Alkanes	720-725	Middle

When we consider one sample out of 16 samples (Sample 3), when we compare the FT-IR analysis of the crude oil and modified zeolite with a particle size of 50µ with 0.5 g of the modified zeolite at a speed of 500rpm for 60 minutes by increasing the time this time and the desulfurization treated sample and the untreated sample, it was seen that the amount of sulfur decreased more than the first sample in FT-IR imaging. At 1290 cm^{-1} and 1377 cm^{-1}, decreases in the amount of sulfur occurred as seen. It is seen in Figure 4.4 that a great decrease occurred around 1066 cm^{-1}.

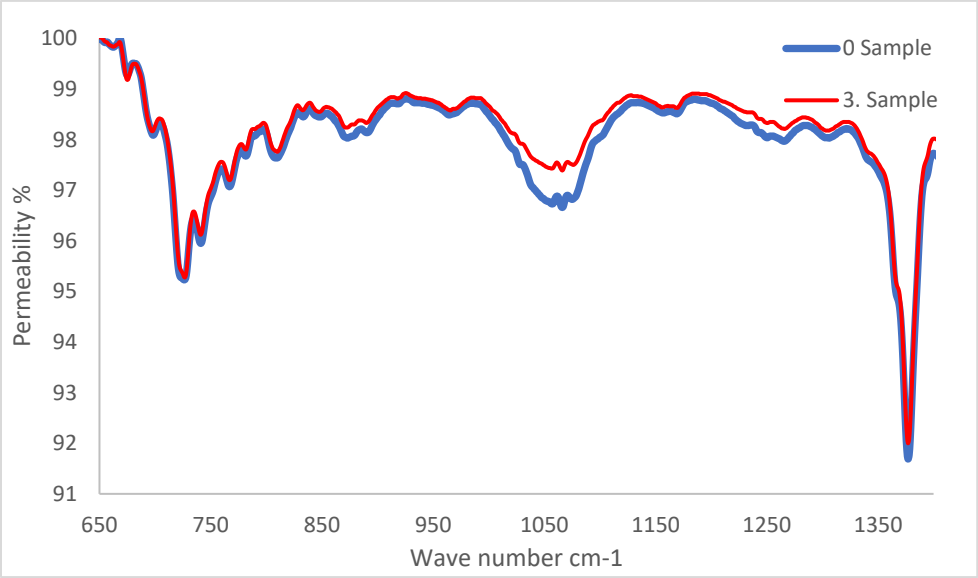


Figure 5 3. Sample FT-IR imaging of crude oil after desulfurization

Conclusion and Recommendations

The desulfurization process has gained importance since the removal of sulfur from crude oil allows the use of crude oil in various applications.

In this study, positive results were obtained for desulphurization of crude oil. Adsorptive desulphurization method was used to remove sulfur. Clinoptilolite was selected as adsorbent for adsorptive desulphurization method. After the modification of clinoptilolite, adsorptive desulfurization process was carried out and Fourier Transform Infrared Spectroscopy (FTIR) characterization method was used in this study and the decrease in the amount of sulfur in the characterized samples, especially around the 1066 cm-1 spectrum, indicates that the study has resulted positively.

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VİTAMİNİ B-12 VE İNSAN BAĞIRSAK MİKROBİYOMU İLİŞKİSİ

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Özet
Vitamin B12, bazı besinlerde doğal olarak bulunan suda çözünebilen bir vitamindir. Kobalt minerali içeriğinden dolayı Vitamin B12 aktivitesine sahip bileşiklere topluca kobalamin adı verilmektedir. Vitamin B12 eksikliği insanları yaşam boyu etkileyen, hematolojik, nörolojik ve obstetrik sonuçları olan önemli bir halk sağlığı sorunudur. Yeni kanıtlar, Vitamin B12'nin bağırsak mikrobiyomunun bileşimi ve işlevi de dahil olmak üzere insan sağlığının diğer yönlerinde de önemli bir rol oynayabileceğini öne sürmektedir. Vitamin B12 bağırsakta pasif difüzyon ve reseptör aracılı endositoz yoluyla emilebilmektedir. Diyette hayvansal kaynaklı gıdaların tüketilmesiyle elde edilen Vitamin B12; yalnızca bakteriler tarafından sentezlemekte ve bağırsak emilimi bağırsak mikrobiyotasından etkilenebilmektedir. *L.reuteri* ve *Enterococcus faecium* gibi birçok bakterinin Vitamin B12 ürettiği rapor edilmiştir. Vitamin B12 üreten bakterilerin takviyesinin, gastrointestinal kanalda Vitamin B12'nin kullanımını artırabileceği varsayılmaktadır. Böyle bir hipotez, Vitamin B12 eksikliği olan diyetlerle beslenen farelerde kanıtlanmıştır. Vitamin B12 üreten bir suş olan *L. reuteri* CRL1098'in diyete eklenmesi ile Vitamin B12 eksikliği semptomlarının önlendiği ve bağırsak bakterilerinin Vitamin B12 eksikliğinde tedavi edici etkisi olduğu gösterilmiştir. Gastrointestinal sistem mikrobiyotasının yaklaşık %80'inin Vitamin B12 tüketicileri olduğu düşünülmektedir. Bu nedenle bakteriyel aşırı büyüme, eksojen Vitamin B12 için konakçıyla rekabet edebilir ve ardından biyoyararlanımı azaltabilir. İnce bağırsakta anaerobik bakteri çoğalmasının artması nedeniyle Vitamin B12 eksikliğinin ve buna bağlı semptomların ana nedenlerinden biri olduğu bilinmektedir. Bazı bağırsak bakterileri, bağırsak geçirgenliğini normalleştirerek Vitamin B12 emilimini arttırıcı ve inflamatuar bağırsak hastalığı üzerinde iyileştirici bir etki göstermiştir. Bazı çalışmalarda Vitamin B12; intestinal mikrobiyomun beta çeşitliliğindeki değişikliklerle ilişkilendirilmiş olup intestinal mikrobiyomunun bileşimini modüle edebileceğini öne sürmektedir. Bir veya daha fazla besin eksikliği nedeniyle tek karbon metabolizmasındaki değişiklikler, Vitamin B12 ile etkileşime girebilir ve intestinal mikrobiyomun kompozisyonunu ve işlevini etkileyebilir. İnsan intestinal mikrobiyomunun önerilen günlük Vitamin B12 alımının yaklaşık üçte birini üretebildiği tahmin edilmektedir. Vitamin B12 takviyesi, bağırsak mikrobiyomu ile etkileşimler yoluyla malabsorbsiyonun neden olduğu Vitamin B12 eksikliğini tedavi etmenin ötesinde gastrointestinal koşullar için faydalı olabilir.
Anahtar Kelimeler: Vitamin B12, Gut mikrobiyotası, mikrobiyom

RELATIONSHIP BETWEEN VITAMIN B-12 AND THE HUMAN GUT MICROBIOME

ABSTRACT

Vitamin B12 is a water-soluble vitamin found naturally in some foods. Compounds with vitamin B12 activity due to their cobalt mineral content are collectively called cobalamin. Vitamin B12 deficiency is an important public health problem that affects people throughout life and has hematological, neurological, and obstetric consequences. New evidence suggests that vitamin B12 may also play an important role in other aspects of human health, including the composition and function of the gut microbiome. Vitamin B12 can be absorbed in the intestine by passive diffusion and receptor-mediated endocytosis. Vitamin B12 is obtained by consuming foods of animal origin in the diet. It is synthesized only by bacteria, and intestinal absorption can be affected by the intestinal microbiota. Many bacteria, such as L. reuteri and Enterococcus faecium, have been reported to produce vitamin B12. It is hypothesized that supplementation with vitamin B12-producing bacteria may increase the utilization of vitamin B12 in the gastrointestinal tract. Such a hypothesis has been proven in mice fed vitamin B12-deficient diets. It has been shown that adding L. reuteri CRL1098, a vitamin B12-producing strain, to the diet prevents the symptoms of vitamin B12 deficiency and that intestinal bacteria have a therapeutic effect on vitamin B12 deficiency.Approximately 80% of the gastrointestinal tract microbiota is thought to be a consumer of vitamin B12. Therefore, bacterial overgrowth may compete with the host for exogenous vitamin B12 and subsequently reduce bioavailability. It is known to be one of the main causes of vitamin B12 deficiency and its associated symptoms due to increased anaerobic bacterial proliferation in the small intestine. Some intestinal bacteria have shown an ameliorating effect on vitamin B12 absorption and inflammatory bowel disease by normalizing intestinal permeability.In some studies, vitamin B12 has been associated with changes in the beta diversity of the intestinal microbiome, suggesting that it may modulate the composition of the intestinal microbiome. Changes in one-carbon metabolism due to one or more nutrient deficiencies may interact with vitamin B12 and affect the composition and function of the intestinal microbiome. It is estimated that the human intestinal microbiome can produce approximately one-third of the recommended daily intake of vitamin B12. Vitamin B12 supplementation may be beneficial for gastrointestinal conditions beyond treating vitamin B12 deficiency caused by malabsorption through interactions with the gut microbiome.

Keywords: Vitamin B-12, Gut Microbiome, Microbiota

GİRİŞ

Vitaminler, vücudun fizyolojik işlevleri için gerekli olan, ancak vücut tarafından endojen olarak sentezlenmeyen ve bu nedenle diyetten alınması gereken bir grup organik bileşiklerdir. Toplamda insan vücudunun ihtiyaç duyduğu 13 adet vitamin bulunmaktadır. Bunların 4'ü yağda çözünen A,D,E ve K vitaminleriyken; 9'u suda çözünen C vitamini ve sekiz adet B vitamini grubunu içermektedir. B grubu vitaminleri arasında tiamin (B1) , riboflavin (B2), niasin (B3) , pantotenik asit (B5) , piridoksin (B6) , folat (B9) ve kobalamin (B12) vitaminleri yer almaktadır (1). B vitaminleri, çok sayıda enzim için vazgeçilmez kofaktörler olarak görev yapan veya konakçı metabolizmasına doğrudan katılan, hayati bir mikro besin grubunu temsil eder. Genel olarak, B vitaminleri tarafından üstlenilen çok sayıda fonksiyon genellikle enerji üretimine yol açan katabolik metabolizmadaki ve biyoaktif moleküllerin yapımı ve dönüşümüyle sonuçlanan anabolik metabolizmadaki rollerine bölünebilir (2).

B_{12} VİTAMİNİ

B_{12} vitamini vücuttaki tüm hücrelerin ihtiyaç duyduğu suda çözünebilen temel bir mikro besindir. Kobalamin, kırmızı kan hücrelerinin gelişimi, büyümesi ve sinir sistemleri için gereklidir. Günlük gereksinimler yaşa bağlıdır: yetişkinler ve bebekler için önerilen diyet miktarları sırasıyla 1,5 µg ve 0,4 µg'dır (3). B_{12} vitamini terminal ileum da emilir. Bu emilim neredeyse tamamen mide mukozasında yer alan paryetal hücreler tarafından salgılanan bir glikoprotein olan intrinsik faktöre bağlıdır. İçsel faktör B_{12} vitaminine bağlanır ve kompleks, transkobalamin adı verilen başka bir glikoproteine bağlı olarak hücre zarı boyunca taşınır. B_{12} vitamini eksikliğinin en yaygın nedeni, mide kanseri riskini artıran bir durum olan otoimmün pernisiyöz anemidir. Pernisiyöz anemide parietal hücrelerin otoimmün yıkımından kaynaklanan intrinsik faktör eksikliği nedeniyle emilim bozulur. B_{12} vitamini eksikliğinin diğer yaygın nedenleri arasında gastrektomi, ileal rezeksiyon, pankreas yetmezliği, Crohn hastalığı ve çölyak hastalığı dahil malabsorbsiyon sendromları yer alır. B_{12} vitamini eksikliğinin daha az yaygın nedenleri arasında biguanidler (metformin), antiasitler (proton pompa inhibitörleri ve H2 reseptör antagonistleri), aminoglikozid, antibiyotikler ve kolşisinler gibi ilaçların kullanımı yer alır. Saf beslenme eksikliği nadirdir ve genellikle katı vegan beslenme şeklini benimsemiş kişilerde görülür (4). B_{12} vitamini eksikliği kardiyovasküler hastalık için de bir risk faktörü olabilir (5). B_{12} vitamini eksikliğinin tanısı temel olarak serum B_{12} vitamini düzeyinin 200 pg/mL'den (148 pmol/L) düşük olduğu kan ölçümlerine dayanır ve metabolik göstergeler olan toplam homosistein ve metilmalonik asit düzeylerini içeren ikinci basamak testlerle tamamlanır (6). Dünya Sağlık Örgütü'ne (WHO)

göre, yetişkinlerde B_{12} vitamini durumu, mikro besin öğelerinin serum seviyeleri ile aşağıdaki kesme ve tanımlamalarla belirlenir: >221 pmol/L, "B_{12} vitamini yeterliliğidir"; 148 ile 221 pmol/L arası "düşük B_{12} vitamini seviyesi ", 148 pmol/L'den düşük ise "B_{12} vitamini eksikliği"dir (7). B_{12} vitamini yalnızca mikroorganizmalar tarafından sentezlenir ve et ve süt ürünleri de dahil olmak üzere hayvansal kaynaklı gıdaların tüketilmesi yoluyla diyetle elde edilir. Birçok çalışmada, kaynakların sınırlı olduğu ortamlarda, özellikle de diyette hayvansal ürün alımının düşük olduğu popülasyonlarda, B_{12} vitamini seviyesinin düşük olduğunu belirtilmiştir (8).

B_{12} VİTAMİNİ METABOLİZMASI

B_{12} vitamini et, yumurta ve süt ürünleri gibi besin kaynaklarından elde edilir. Günlük yaklaşık 2,4 µg B_{12} vitamini tüketiminde yalnızca %50-60'ı emilir. İnsan gastrointestinal (bağırsak) mikrobiyomunda bulunan bakteriler, B_{12} vitaminini sentezler ve konakçıdan emilmemiş B_{12} vitaminini kullanır ancak B_{12} vitamininin bağırsak mikrobiyomu üzerindeki etkisi büyük ölçüde keşfedilmemiş durumdadır. İleumda 1 µg oral dozda B_{12} vitamininin yaklaşık %50'si emilir ve artan dozla birlikte emilim oranı azalır. İleumda emilmeyen B_{12} vitamini kalın bağırsağa ulaşabilir; burada bağırsak bakterileri metabolize olur ve B_{12} vitamininin ~%80'ini B_{12} vitamini analoglarına (yani bilinen B_{12} vitamini aktivitesi olmayan kobamidlere) dönüştürürler. B_{12} vitaminini (ve B_{12} vitamini analoglarını) kullanma yeteneği, bazı bakteriler için rekabet avantajı olabilir. Ayrıca, bağırsak mikrobiyotasının bileşimi ve işlevi, B_{12} vitamini açısından zengin olan ortamlarda, B_{12} vitamininin yetersiz olduğu ortamlara göre farklılık gösterebilir (9). Diyetteki B_{12} vitamini, gıda proteinleriyle birlikte bulunur ve ince bağırsakta emilimi kolaylaştırmak için mide lümeni içindeki düşük pH'a maruz kaldığında salınması gerekir. B_{12} vitamini serbest kaldıktan sonra haptokorrin (transkobalamin I) ile bağlanır ve duodenumdaki kompleksin proteolitik bölünmesine kadar bağlı kalır. Burada mide mukozasının paryetal hücreleri tarafından sentezlenen ikinci bir taşıyıcı protein olan intrinsik faktörün (IF) bağlanması gerçekleşir. Terminal ileumda B_{12} vitamininin alımı için IF gereklidir. Fırça kenarını geçerken B_{12} vitamini IF'den ayrışır ve transkobalamin II veya haptokorrin'i bağlayacağı dolaşıma girer. Transkobalamin II ve haptokorrin, kobalaminin sırasıyla periferik dokulara ve karaciğere verilmesinden sorumludur. Emilimi takiben büyük miktarda B_{12} vitamini karaciğerde depolanır; sonuç olarak B_{12} vitamini alımındaki herhangi bir azalmanın klinik olarak kendini göstermesi 5-10 yılı bulabilir. Serbest B_{12} vitamininin küçük bir kısmı (%1-5) bağırsaktan intrinsik faktörden (IF) bağımsız bir süreçte pasif difüzyonla emilir (10).

BAĞIRSAK MİKROBİYOTASI

Mikrobiyom, genellikle insan/hayvan vücudunda veya derisinde yaşayan/yaşayan çeşitli mikroorganizmaların topluluğunu ifade eden bir terimdir. Trilyonlarca komensal, simbiyotik ve hatta patojen mikroorganizmayı içeren karmaşık bir ekosistemi oluşturur. Mikrobiyom çeşitli bakterilerden, arkelerden, mantarlardan, protozoalardan ve hatta virüslerden meydana gelir. Sağlıklı insanların bağırsağından en az 800 farklı bakteri türü izole edilebilmiştir. Dış çevre, beslenme ve yaşam tarzı, mikrobiyomun kompozisyonunu ve canlılığını etkileyen başlıca belirleyicilerdir. Son araştırmalar mikrobiyomun sağlık ve hastalık üzerindeki muazzam etkisini göstermiştir. Sayıları, yapıları, çeşitleri ve yaşayabilirlikleri dinamiktir. Tüm bu unsurlar birçok sağlık bozukluğunun ortaya çıkmasından, gelişmesinden ve tedavisinden sorumludur. Kanser, metabolik bozukluklar, kalp-damar hastalıkları gibi ciddi hastalıklar ve hatta şizofreni gibi psikolojik bozukluklar da mikrobiyotadan doğrudan veya dolaylı olarak etkilenmektedir. Sağlığımıza etkileri ancak insan kaynaklı hücrelerin insan vücudundaki toplam canlı hücre sayısının yalnızca %10'unu oluşturduğunu bildiğimizde anlaşılabilir. Karşılaştırıldığında, mikrobiyota hücrelerin kalan %90'ını temsil eder. Benzer şekilde, vücudumuzdaki toplam benzersiz genlerin yalnızca %1'i insan kökenlidir ve geri kalan %99'u bağırsak ve ağız boşluğu mikrobiyotasına aittir. Bu nedenle insan mikrobiyomu ikinci genomumuz olarak kabul edilir. Mikrobiyota bağırsağın yanı sıra ağız boşluğu, burun delikleri, vajina, göğüs ve deride de kolonize olabilir. Bebeklerin GİS kanalının mikrobiyal içeriği, bifidobakterilerin hakim olduğu basit yapılı bir bileşime sahiptir. Çeşitli bakteri türlerinin bileşimi ve yaygınlığı, hamilelik sırasında annenin beslenmesi, doğum şekli (normal doğum vs. sezaryen) ve beslenme şekli (emzirme vs. süt ikameleri) gibi birçok faktörden etkilenir. Ancak mikrobiyomun bileşimi yaşla birlikte sürekli olarak değişmektedir. Mikrobiyal yapı, yaş, diyet, yaşam tarzı, obezite gibi metabolik hastalıklar ve çevresel etkileyici faktörlere bağlı olarak değişmektedir (11).

BAĞIRSAK MİKROİYOTASI VE B_{12} VİTAMİNİ

Mikro besinler olarak adlandırılan vitaminler ve mineraller insan sağlığı için çok önemlidir. Mikro besinler, bağışıklık ve enerji fonksiyonlarının yanı sıra büyüme, kemik sağlığı, sıvı dengesi ve diğer biyolojik süreçler gibi temel biyosentetik hücresel reaksiyonların düzenleyicileridir. Mikro besin eksikliği, özellikle çocuklarda zayıf fiziksel veya zihinsel gelişime aynı zamanda patojen enfeksiyonlara, inflamatuar hastalıklara karşı duyarlılığın artmasına neden olan ciddi sağlık sorunlarıyla ilişkili olduğundan küresel bir sağlık sorunu olarak kabul edilmektedir (12). İnsanlar gerekli tüm mikro besinleri sentezleyemez; bu nedenle

bunların (i) diyet bileşenleri, (ii) oral takviyeler veya (iii) ortak bağırsak bakterileri tarafından sentezi olmak üzere üç ana kaynaktan ekzojen olarak elde edilmesi gerekir. Nüfusun büyük bir yüzdesi önerilen mikro besin alımlarını karşılayamadığından, mikro besinlerin ağızdan takviyesi ve gıda takviye programları dünya çapında uygulanmıştır. Etkinliğine ve olumlu etkilerine rağmen, son zamanlarda önemli sayıda çalışma, bazı mikro besin takviyelerinin sağlık üzerindeki olumsuz sonuçlarına ilişkin ciddi kaygıları gündeme getirmiştir (13). Örneğin folik asit (B9 vitamini) takviyesi, bağırsakta emilimin bozulmasından kaynaklanan çinko eksikliği , B_{12} (kobalamin) eksikliğinin belirtilerini maskelemedeki rolü nedeniyle nörolojik hasar ve kolorektal kanser riskinin artması gibi olumsuz sağlık sonuçlarıyla ilişkilendirilmiştir (14). Mikro besin biyoyararlılığı, vücutta kullanım ve depolama için mevcut olan bir mikro besin maddesinin fraksiyonudur. Mikro besinler çeşitli ve bazı durumlarda hem pasif hem de aktif olabilen spesifik emilim yolları ve mekanizmalarını kullanır. Örneğin, hem C vitamininin hem de B7 vitamininin (biyotin) emilimine Na+'ya bağımlı taşıyıcılar aracılık eder ve B9 vitamini (folat) folata özgü üç taşıyıcı kullanır (15). Kommensal bağırsak bakterileri, konakçılarına gerekli besin maddelerini sağlar ve mikro besin maddelerini elde etmek için en az araştırılan kaynaktır. Bağırsak mikrobiyotası, çeşitli bileşikleri faydalı veya zararlı metabolitlere dönüştüren, dolayısıyla bunların biyoyararlılığında önemli bir role sahip olan, insan bağırsak sisteminde etkili bir biyoreaktör olarak kabul edilir. Mikrobiyom araştırmalarındaki birçok çaba, mikrobiyomu sağlığı iyileştirmek amacıyla modüle etmek için etkili araçlar keşfetmeye yönelik olmasına rağmen, bağırsak mikroorganizmalarının mikro besinlerin biyosentezi , alımı, emilimi ve biyoyararlanımına katkısı daha az araştırılmıştır (16). Mikro besin-mikrobiyom ekseni çift yönlüdür. Bir yandan bağırsaktaki mikroorganizmalar, büyümeleri ve işleyişleri için mikro besinlerin tüketicileridir. Konakçının beslenmesi ve mikro besin takviyesi, bağırsak mikrobiyotasının kompozisyonunu ve fonksiyonunu büyük ölçüde etkiler. Özellikle A vitamini, C vitamini, B_{12} vitamini ve D vitamini takviyesi *Bifidobacterium'dan* çeşitli faydalı türlerin kolonizasyonunu teşvik ederek bağırsak mikrobiyotasının bileşimindeki *Lactobacillus ve Roseburia* cinslerinde değişikliklere katkıda bulunur. Mineral eksikliğinin veya takviyesinin bağırsak mikrobiyotası üzerindeki etkisinin değerlendirilmesi yeni ortaya çıkan bir alandır (17). Öte yandan bağırsak mikrobiyotası, başta K vitamini ve B grubu vitaminleri olmak üzere çok çeşitli vitaminleri önemli miktarlarda üreterek demir, kalsiyum gibi minerallerin alımını ve emilimini kolaylaştırır (18).

Magnusdottir ve ark., sekiz B vitamini (biyotin, kobalamin, folat, niasin, pantotenat, piridoksin, riboflavin ve tiamin) için biyosentetik yolların varlığı açısından 256 yaygın bağırsak bakterisinin genomlarını sistematik olarak araştırmışlardır. Her bir vitaminin potansiyel üreticilerini içeren her filumun oranını tahmin etmeye olanak sağlayan bu çalışma sonucunda bazı genomların bu vitaminlerin tüm biyosentetik yollarını içerdiği, bazılarının ise hiçbirini içermediği belirlenmiştir. En yaygın olarak sentezlenen vitaminlerin riboflavin (166 potansiyel üretici) ve niasin (162 üretici) olduğu saptanmıştır. Riboflavin ve biyotin için, Bacteroidetes, Fusobacteria ve Proteobacteria filumlarındaki mikroorganizmaların neredeyse tamamı gerekli yolaklara sahipken Firmicutes ve Actinobacteria'ların ise çok daha küçük bir kısmının B vitamini biyosentezi potansiyeline sahip olduğu görülmüştür. B_{12} vitamini örneğinde, tüm Fusobakterilerin, diğer dört filumun %10-50'sinin üretici olduğu tahmin edilmiştir. Genel olarak Bacteroidetes'in, en fazla B vitamini üreticisine sahip şube olduğu ortaya çıkmıştır (19). Bacteroides , Enterococcus ve Bifidobacterium türleri, K vitamini ve suda çözünen B vitaminlerinin çoğunu *de novo* olarak sentezleyebilir. İntestinal mikrobiyota bakterilerinin B vitamini üretimi için in silico biyosentetik kapasitesinin değerlendirildiği çalışmada bu vitaminlerin %40-65'inin incelenen intestinal mikroorganizmalar tarafından üretildiği gösterilmiştir. Bununla birlikte, konakçıya ulaşabilmek için, mikro besinlerin bakteriyel *de novo* sentezinin, kendilerine ayrılmış bağırsak emilim bölgesinin yukarısında gerçekleşmesi gerekmektedir. Örneğin, kobalamin yalnızca ileumda emildiğinden, B_{12} üreten kolonik bakterilerin , kemirgenlerde ve insan olmayan primatlarda görülen koprofaji durumu dışında, bu vitaminin konakçı için biyoyararlanımını artırmaya katkıda bulunmaları olası değildir (20). Son *in vivo* çalışmalar ve klinik deneyler, mikrobiyotanın konakçının vitamin dengesindeki rolüne ışık tutmaktadır (Tablo 1). *C. elegans* kullanılarak *Escherichia coli'nin,* parçalanma ürününün (PABA-glu) alımı yoluyla ve tetrahidrofolatın *de novo* sentezi yoluyla biyoyararlılığını artırarak B9 vitamininin (folik asit) metabolizmasına yardımcı olduğu gösterilmiştir. Ek olarak *E. coli, tonB* siderofor yoluyla eksojen B_{12} vitaminini (kobalamin) temizleyerek konakçı için vazgeçilmez bir B_{12} vitamini kanalı görevi görebilir (21).

Tablo1: Bağırsak mikrobiyotası ile konak mikrobesinleri arasındaki ilişkiyi gösteren in vivo ve klinik çalışmalar

Vitaminler	Okuduğu yer	Kommensal bakteriler	Referanslar
B9 Vitamini ve B12 Vitamini	*C. elegans*	*Escherichia coli*	C. Maynard ve ark. (2020)
D vitamini	*İnsanlar*	*Ruminococcacus cinsi Coprococcus cinsi Mogibacterium cinsi Blautia cinsi*	RL Thomas ve ark. (2020)
	İnsanlar	*Lactobacillus reuteri*	ML Jones ve ark. (2013)
	Fareler	Kolon bütirat üreticileri	S. Wu ve diğerleri. (2015)
E vitamini	*Fareler*	Antibiyotik aracılı mikrobiyota tükenmesi	L. Ran ve ark. (2019)
C vitamini	*Fareler*	Gram negatif bakterilerin aşırı büyümesi	VS Subramanian ve diğerleri. (2018)

B $_{12}$ TAKVİYESİ İLE ALFA – BETA ÇEŞİTLİLİĞİ VE BAKTERİ BOLLUĞU

B $_{12}$ vitamin takviyesinin alfa ve beta çeşitliliğine etkisini araştıran in vitro çalışmalar Tablo 2 de gösterilmiştir. In vitro çalışmalardan elde edilen bulgular, B $_{12}$ vitamini takviyesinin alfa çeşitliliğini artırabileceğini ve sonuçların uygulanan kobalaminin formuna, dozuna ve ortak müdahalelere göre değiştiğini göstermektedir. Adenosilkobalaminin, siyanokobalamin ile karşılaştırıldığında alfa çeşitliliğinin artmasına neden olduğu, ancak her ikisi de alfa-laktalbumin ile birleştirildiğinde çeşitliliğin daha düşük olduğu tespit edilmiştir. Aynı zamanda *kolon modelinde kobalamin takviyesinin Firmicutes ve Bacteroidetes'in göreceli bolluğunu artırdığı, Proteobakteriler ve Pseudomonasi azalttığı belirtilmiştir (22)*. Peynir altı suyu proteinleri ile kombinasyon halinde siyanokobalamin veya adenosilkobalamin, tek başına beta-laktoglobulin ile karşılaştırıldığında alfa çeşitliliğinin artmasına neden olmuş, ancak tek başına alfa-laktalbümin ile sonuçlanmamıştır. 7 günlük metilkobalamin takviyesinden sonra, *Acinetobacter oranında artış ve Bacteroides*, *Enterobacteriaceae*, Ruminococcaceae oranında azalma gözlemlenmiştir (23). Farklı bir çalışmada, metilkobalamin, siyanokobalamin ve kontrol gruplarıyla karşılaştırıldığında, Chao1'e (zenginliğin ölçümü) dayalı olarak daha düşük alfa çeşitliliğe, ancak Shannon indeksine (zenginlik ve düzgünlüğün ölçümü) dayalı olarak daha yüksek çeşitliliğe neden olduğu belirlenmiştir. Siyanokobalamin grubu, kontrol grubuyla karşılaştırıldığında ise benzer bir Chao1 indeksine ancak kontrol grubuyla karşılaştırıldığında Shannon indeksine göre daha yüksek çeşitliliğe sahip olduğu gözlemlenmiştir (24). Üç in vitro çalışmada beta çeşitliliğinde değişiklikler bildirilmiştir: bulgular B $_{12}$ vitamininin mikrobiyom

kompozisyonunu değiştirdiği yönündedir. Peynir altı suyu proteini çalışmasında, temel bileşen analizleri (PCA) hiyerarşik kümelemeye dayalı olarak bu inceleme için ilgili verileri sağlamasa da, tek başına alfa-laktalbumin ve beta-laktoglobulin ile kombinasyon halinde siyanokobalamin alan grupların bir arada kümelendiği ortaya çıkmıştır. Başka bir çalışmada, düşük dozda siyanokobalamin takviyesi ve yüksek dozda siyanokobalaminle zenginleştirilmiş ıspanak alan grupların, PCA grafiklerine göre başlangıçtan ve diğer gruplardan daha uzakta kümelendiği görülmüştür (24). Aynı çalışmalarda B_{12} vitamini takviyesi ile göreceli bakteri bolluğu arasındaki ilişkiler bildirilmiştir. Filum düzeyinde, tek başına adenosilkobalamin veya siyanokobalamin takviyesi, tek başına peynir altı suyu proteini veya B_{12} vitamini ile kombinasyon halinde peynir altı suyu proteini alan çoğu grupla karşılaştırıldığında daha yüksek Bacteroidetes:Firmicutes oranlarıyla sonuçlanmış, ancak B_{12} vitamininin 2 formu birinden önemli ölçüde farklı olmadığı belirlenmiştir. Peynir altı suyu proteini ile kombinasyon halinde siyanokobalamin veya adenosilkobalamin alan gruplardaki Bacteroidetes:Firmicutes oranının birbirinden veya tek başına peynir altı suyu proteininden farklı olmadığı bildirilmiştir. Başka bir çalışma, 3 ana şubenin göreceli bolluğunda grup içi değişiklikler olduğu; çoğu grupta siyanokobalamin takviyesi veya siyanokobalaminle zenginleştirilmiş ıspanağın Proteobakterileri artırdığı ve Firmicutes ve Bacteroidetes'i azalttığı belirtilmiştir. Ancak düşük doz siyanokobalamin ile zenginleştirilmiş ıspanak grubunda Proteobakterilerin azaldığı, Firmicutesin değişmediği ve yüksek doz siyanokobalamin ile zenginleştirilmiş ıspanak grubunda Bacteroidetesin değişmediği tespit edilmiştir (22, 23, 24).Hayvanlarda yapılan çalışmalarda alfa çeşitlilik açısından heterojen sonuçlar bildirilmiştir. Farelerde kontrol grubuyla karşılaştırıldığında siyanokobalamin alan grupta alfa çeşitliliğin (Chao1, Shannon indeksi, Simpson indeksi) önemli ölçüde farklı olmadığı bildirilmiştir (25). Farelerde yapılan başka bir çalışmada, Chao1 ve Shannon endekslerine dayalı alfa çeşitlilik, siyanokobalamin dozuna (yem peletlerinde 0 mg/kg, 50 mg/kg veya 200 mg/kg) göre önemli ölçüde farklılık göstermemiştir (26). Diğer bir çalışmada, istatistiksel anlamlılık bildirilmemesine rağmen, kontrol grubuyla karşılaştırıldığında siyanokobalamin ve metilkobalamin gruplarında alfa çeşitliliğinin (Chao1, Shannon indeksi) daha düşük olduğu rapor edilmiştir (27). Kazlar üzerinde yapılan çalışmada yüksek, orta ve düşük dozda B_{12} takviyesine ek olarak yüksek ve düşük dozda folik asit takviyesi verilen iki grup karşılaştırılmıştır. B_{12} vitamininin 0,018 mg/kg dozu ile kıyaslandığında, düşük (0,009 mg/kg) ila yüksek (0,036 mg/kg) B_{12} vitamini dozları arasında Simpson ve Shannon endekslerine göre çeşitliliğin arttığı belirlenmiştir (28). Aynı çalışmalarda farelerdeki beta çeşitliliği de değerlendirilmiştir. Siyanokobalamin takviyesi

öncesinde ve sonrasında cins düzeyinde ve siyanokobalamin ile kontrol grupları arasında önemli ölçüde fark saptanmıştır (25). Bunun tersine, farelerde yapılan diğer çalışmada beta çeşitliliğinde B_{12} vitamini müdahalesiyle farklılık gözlenmemiştir (26). B_{12} vitamini ve folik asit alan kazlar arasında, beta çeşitlilikte temel koordinat analizinde (PCoA) ve aritmetik ortalamalı ağırlıksız çift grup yönteminde (UPGMA), orta dozda B_{12} vitamini alan grupların, gruplardan daha uzakta kümelendiği görülmüştür (28). Filum düzeyinde bakteri bolluğu değerlendirildiğinde, metilkobalamin ile karşılaştırıldığında siyanokobalamin alan farelerde Bacteroidetes ve Proteobacteria'nın göreceli bolluğunun daha yüksek, Firmicutesin ise daha düşük olduğu belirlenmiştir. Her iki kobalamin takviyesi alan grupta kontrol grubuyla karşılaştırıldığında daha düşük Bacteroidetes ve daha yüksek Firmicutes bolluğu gözlenmiştir (27).

Tablo 2. B 12 vitamini ile ikincil sonuçlar arasındaki ilişkiyi değerlendiren çalışmalar

İlk yazar, yıl	Karşılaştırmak	Alfa çeşitliliği	Beta çeşitliliği	Bakteri bolluğu
Wang, 2019	CC veya AC içeren peynir altı suyu proteini (AC + BL, CC + BL, AC + AL, CC + AL) ile tek başına peynir altı suyu proteini (AL, BL)	AC + BL ve CC + BL, tek başına BL'den daha yüksekAC + AL ve CC + AL, tek başına AL'dan farklı değildi	AL ve CC + BL diğerlerinden kümelenmiş	Bacteroidetes:Firmicutes oranı: anlamlı değilAile [2] : CC + BL vs. BL daha yüksek *Christensenellaceae* , *Prevotellaceae* , *Cariobacteriacese* , *Clostridiaceae* , *Chloroplast* , *Lactobacillaceae* , *Enterococcaceae* , *Staphylococcaeae* ; alt *Bacteroidaceae* , *Eubacteriaceae* , *Rikenellaceae* , *Porphyromonadaceae* , *Verrucomicrobiaceae* Aile [2] : CC + AL vs. AL yüksek *Enterococcaceae* , *Anearoplasmataceae* , *Bacteroidaceae* ; alt *Peptostreptococcaceae* , *Prevotellaceae* , *Coriobacteriaceae* , *Clostridiaceae* , *Streptococcaceae* , *Mogibacteriaceae* , *Enterobacteriaceae* Ailesi [2] : AC + BL ve BL yüksek *Erysipelotrichaceae* , *Enterobacteriaceae* ; alt *Lachnospiraceae* , *Bacteroidaceae* , *Eubacteriaceae* , *Rikensellaceae* , *Porphyromonadaceae* , *Verrucomibrobiaceae* Aile [2] : AC + AL ve AL yüksek *Leuconostocaceae* ; alt *Peptostreptococcaceae* , *Christensenellaceae* , *Prevotellaceae* , *Coriobacteriaceae* , *Clostridiaceae* , *Streptococcaceae* , *Mogibacteriaceae* , *Enterobacteriaceae*
	CC ve AC	CC, AC'ye kıyasla daha düşük çeşitliliğe sahipti		Bacteroidetes: Firmicutes oranı: anlamlı değil Aile [2] : Yüksek *Bacteroidiaceae* , *Eubacteriaceae* ; alt *Bifidobacteriaceae* , *Flavinobacteriaceae* , *Peptostreptococcaceae* , *Lactobacillaceae* , *Ruminococcaceae*
	CC + AL ve AC + AL	CC + AL, AC + AL'ye kıyasla daha yüksek çeşitliliğe sahipti		Bacteroidetes: Firmicutes oranı: anlamlı değil Aile [2] : Yüksek *Christensenellaceae* , *Enterococcaceae* , *Lachnospiraceae* , *Anaeroplasmataceae* , *Bacteroidiaceae* ; alt *Leuconostocaceae*
	CC + BL'ye karşı AC + BL	Önemli değil		Bacteroidetes: Firmicutes oranı: anlamlı değil Aile [2] : Yüksek *Prevotellaceae* , *Cariobacteriacese* , *Clostridiaceae* , *Chloroplast* , *Staphylococcaeae* , *Lactobacillaceae* , *Enterococcaceae* , *Lachnospiraceae* ; daha düşük *Enterobacteriaceae*

İlk yazar, yıl	Karşılaştırmak	Alfa çeşitliliği	Beta çeşitliliği	Bakteri bolluğu
Xu, 2018	CC vs. MC vs. kontrol	CC'ye karşı kontrol: daha düşük Shannon indeksi (yani daha yüksek çeşitlilik), Chao1 anlamlı değil MC'ye karşı CC ve kontrol: daha düşük Chao1 (yani daha düşük çeşitlilik) ve daha düşük Shannon indeksi (yani daha yüksek çeşitlilik)	Kontrol ve CC grupları kümelendi Tedaviye ve güne göre kümelenme, ancak 7. gündeki MC örnekleri daha değişkendi	Cins: MC ve CC, zamanla *Acinetobacter'i* artırdı ve *Bacteroides* , *Enterobacteriaceae* unc ve *Ruminococcaceae* unc'yi azalttı Cins: MC , kanonik uyum analizinde *Pseudomonas bakterileri ile pozitif korelasyon gösterdi Kontrol grubu aşağıdakilerle diferansiyel olarak zenginleştirildi: -Sıra: Bifidobacteriales, Bacteroidales, Clostridiales-* *Aile: Bifidobacteriaceae* , *Bacteroidaceae* , *Rikenellaceae* , *Lachnospiraceae* , *Ruminococcaceae* , *Sutterellaceae* - Cins: *Bifidobacterium* , *Bacteroides* , *Alistipes* , *Dorea* , *Eisenbergiella* , *Lachnospiraceae_unclassified* , *Ruminococcus2* , *Ruminococcaceae sınıflandırılmamış* CC aşağıdakilerle diferansiyel olarak zenginleştirilmiştir: -Sipariş: Fusobacteriales, Caulobacterales- Aile: *Fusobacteriaceae* , *Caulobacteraceae* - Cins: *Clostridium* kümesi *XIVb* , *Fusobacterium* , *Ruminococcus* , *Brevundimonas* MC aşağıdakilerle diferansiyel olarak zenginleştirilmiştir: -Ordu: Pseudomonadales- Aile: *Clostridiacaeae1* , *Clostridiales* ailesi *XI incertae sedis* , *Comamonadaceae* , *Moraxellaceae* - Cins: *Escherichia* , *Rhizobacter* , *Clostridium* , *Sedimentibacter* ve *Flavonifractor* , *Clostridium* , *Eubacteriaceae sınıflandırılmamış* , *Aceinetobacter* , *Moraxellaceae sınıflandırılmamış*
Zheng, 2021	Yüksek ve düşük CC takviyesi (CC-yüksek, CC-düşük) ve CC ile zenginleştirilmiş ıspanak (CCspinach-high, CCspinach-low) ile kontrol karşılaştırması		CC-düşük ve CCıspanak-yüksek, başlangıç seviyesinden ve diğer gruplardan uzakta kümelenmiş (kontrol, CC-yüksek ve CCıspanak-düşük)	Cins: CC-düşük ve kontrol: daha yüksek *Klebsiella*, Acinetobaacter; daha düşük *Comamonas*, Bacteroides, Escherichia-*Shigella* CC-yüksek vs. kontrol: daha yüksek *Klebsiella*; daha düşük *Bacteroides*, Escherichia-*Shigella* CC-yüksek vs. CC-düşük: daha yüksek *Comamonas*, daha düşük *Acinetobacter* CCspinach-düşük vs. kontrol: daha yüksek *Klebsiella* ve *Bacteroides*; kontrole kıyasla daha düşük. *Comamonas CCıspanak-yüksek: daha yüksek Acinetobacter*; daha düşük *Comamonas*, Klebsiella, Escherichia-*Shigella*, Bacteroides CCspinach-high vs. CCspinach-low: daha yüksek *Acinetobacter*; alt *Klebsiella*, Escheria-*Shigella*, Bacteroides

İlk yazar, yıl	Karşılaştırmak	Alfa çeşitliliği	Beta çeşitliliği	Bakteri bolluğu
	Grup içi değişiklikler	Alfa çeşitliliği (Shannon, Simpson) CC-düşük, CC-yüksek ve CCıspanak-yüksek grupta azaldı; CCıspanaklı düşük grup için arttı; kontrol grubunda değişiklik olmadı		Filum:Kontrol: Proteobakteriler, Firmicutes, Bacteroidetes'te değişiklik yokCC-düşük: Daha yüksek Proteobakteriler, daha düşük Firmicutes ve BacteroidetesCC-yüksek: Daha yüksek Proteobakteriler, daha düşük Firmicutes ve BacteroidetesCCspinach-low: Daha düşük Proteobacteria ve daha yüksek BacteroidetesCCspinach-high: Daha yüksek Proteobakteriler, daha düşük Firmicutes Genus :Kontrol: daha yüksek *Comamonas* , *Klebsiella* ; daha düşük *Escherichia-Shigella* CC-düşük: daha yüksek *Acinetobacter* ; daha düşük *Escherichia-Shigella* CC-yüksek: daha yüksek *Comamonas* , *Klebsiella* ; alt *Escherichia-Shigella* , *Bacteroides* CCıspanak-düşük: alt *Escherichia-Shigella* ; daha yüksek *Bacteroides* CCıspanak-yüksek: daha yüksek *Acinetobacter* ; alt *Escherichia-Shigella* , *Bacteroides*

Bağırsak mikrobiyotası bakterileri B_{12} vitamininin ya üreticisi ya da tüketicisidir. Üstelik B_{12} vitamininin bağırsaktan emilimi bağırsak mikrobiyotasından etkilenebilir. *L. reuteri* ve *Enterococcus faecium* gibi birçok bakterinin B_{12} vitamini üreticisi olduğu rapor edilmiştir (29). B_{12} vitamini üreten bakteri takviyesinin gastrointestinal kanalda B_{12} vitamini kullanımını artırabileceği varsayılmaktadır. Böyle bir varsayım, B_{12} vitamini eksikliği olan diyetlerle beslenen farelerde kanıtlanmıştır. B_{12} vitamini üreten bir suş olan *L. reuteri* CRL1098'in takviyesinin, B_{12} vitamini eksikliği belirtilerini önlediği, bu da bağırsak bakterilerinin B_{12} vitamini eksikliğinde terapötik etkisini olabileceğini ortaya koymuştur (30). Bununla birlikte, bakteriler gerekli taşıyıcıların bulunmadığı kolonda kolonileşirse bu faydalı etkiler sınırlı olabilir. B_{12} vitamini eksikliğine yönelik probiyotik tedavisi geliştirmek için bakteri kolonizasyonunun konumu dikkate alınmalıdır. Gastrointestinal sistemdeki mikrobiyotanın yaklaşık %80'inin B_{12} vitamini tüketicileri olduğu düşünülmektedir (31). Bu nedenle, bakterilerin aşırı çoğalması, konakçıları ile eksojen B_{12} vitamini ile rekabete girebilir ve ardından biyoyararlanımı azaltabilir. İnce bağırsakta bakteriyel aşırı çoğalmada, artan anaerobez nedeniyle B_{12} vitamini tüketimi, B_{12} vitamini eksikliği semptomlarının önemli bir nedeni olarak kabul edilmektedir. B_{12} vitamini tüketen bakterilerin bolluğunun azaltılması, B_{12} vitamini eksikliğine fayda sağlar. Örneğin, Lactobacillus'un günlük probiyotik tedavisi, hem bakteriyel aşırı çoğalma hem de B_{12} vitamini emilimi üzerinde faydalı bir etki göstermiştir. Dolayısıyla bu probiyotik tedavisinin, B_{12} vitamini tüketen bakterilerin aşırı çoğalmasını engelleyerek B_{12} vitamini eksikliğini iyileştirebileceği düşünülmektedir (32). B_{12} vitamininin üretimi veya tüketiminin yanı sıra bağırsak mikrobiyotası, emilimle ilişkili fizyolojik faktörler üzerinde etki yaparak B_{12} vitamininin biyoyararlanımını dolaylı olarak değiştirebilir. Asit salgısının veya enzim içeriğinin azalmasıyla ilişkili gastrointestinal hastalıklar, B_{12} vitamininin gıdalardan salınmasını veya B_{12} vitamininin içsel faktörlere çevrilmesini engelleyebilir. Anormal bağırsak geçirgenliği ile karakterize edilen İnflamatuar bağırsak hastalığında (IBD) B_{12} vitamini emiliminde azalma da gözlenir (33). Bir probiyotik olarak *Lacidofil* tedavisi, *H. pylori* ile enfekte olmuş Moğol gerbillerinde mide asidi salgısını önemli ölçüde iyileştirmiş ve bu da gıdalardan B_{12} vitamininin salınmasına yol açmıştır (34). Bazı bağırsak bakterileri ayrıca bağırsak geçirgenliğini normalleştirerek B_{12} vitamininin emilimini artırarak IBD üzerinde remisyon etkisi de göstermiştir. Ayrıca bağırsak mikrobiyotası ile konakçı arasındaki aşırı rekabet, B_{12} vitamininin biyoyararlılığına müdahale edebilir. Örneğin *Bacteroides thetaiotaomicron* , BtuG adı verilen, B_{12} vitamini taşınması için yüzeye maruz kalan temel bir lipoproteini eksprese eder. BtuG'nin daha yüksek bağlanma

afinitesi, B_{12} vitaminini içsel faktörlerden uzaklaştırabilir ve B_{12} vitamini emilimini azaltabilir (35). B_{12} vitamini, nükleotid sentezi, amino asit metabolizması, karbon ve nitrojen metabolizması ve ikincil metabolit sentezi için insan bağırsak mikroorganizmalarındaki çeşitli enzimlerin kritik bir kofaktörü olarak görev yapar. B_{12} vitamininin biyosentezi yaklaşık 30 enzim aracılı adımı içerir ve bakterilerin yalnızca küçük bir kısmı bu vitamini üretebilir. Bağırsak bakterilerinin çoğu, ileumdaki emilimden kaçan ve kalın bağırsağa ulaşan B_{12} vitaminini kullanır. B_{12} vitamininin bağırsak mikrobiyotasındaki rekabeti bunların büyümesini, kolonizasyonunu ve metabolik süreçlerini etkileyebilir (36). Kolon modeli üzerinde yapılan in vitro çalışma, B_{12} vitamini takviyesinin α çeşitliliği artırabileceğini, ancak sonuçların uygulanan kobalaminin formuna ve dozuna bağlı olduğunu öne sürülmüştür. Başka bir in vitro çalışmada, metilkobalamin takviyesi sonrasında α çeşitliliği azalırken, siyanokobalamin tedavi grubunda bu azalma gözlenmemiştir (37). Bir çalışmada, siyanokobalamin takviyesinin α çeşitliliğinde bir artışa neden olduğunu ve cins düzeyinde β çeşitliliğinde önemli bir farklılık ortaya çıkardığı öne sürülmüştür (38). Ancak bu sonucu desteklemeyen çalışmalarda mevcuttur (39). Farelerde yapılan çalışmalarda, B_{12} vitamini takviyesi ile göreceli bakteri bolluğu arasındaki ilişkiler de rapor edilmiştir (40). Metilkobalamin ile karşılaştırıldığında, siyanokobalamin tedavisinin farelerde daha yüksek Bacteroidetes ve *Proteobakteri* seviyeleri ve daha düşük Firmicutes seviyelerine yolaçtığı gözlenmiştir. İnsanlarda B_{12} vitamini alımı *Proteobakterilerin* ve *Verrucomicrobia'nın* oranını artırabilir ve Bacteroidetes'in bolluğunu azaltabilir. Ancak bazı klinik çalışmalarda, B_{12} vitamini alımının bakteri bolluğu üzerinde hiçbir etkisinin olmadığı da ileri sürülmektedir (41).

SONUÇ

B_{12} vitamini insanlar için gerekli mikro besin maddeleri olarak işlev görür. Çoklu diyet B_{12} vitamininin emilim süreci, genellikle ince bağırsakta meydana gelen birçok taşıyıcının yardımını gerektirir. Aynı zamanda bağırsak mikrobiyotası, bağırsaktaki B_{12} vitamini takviyesini değiştirmek için yalnızca üretici ve/veya tüketici olarak hareket etmez_fakat aynı zamanda gastrointestinal sistemin fizyolojik veya patolojik faktörlerini değiştirerek B_{12} vitamininin emilimini de etkiler. Çoklu enzimlerin kofaktörleri olan B_{12} vitamini takviyesi, bağırsak mikrobiyotasının çeşitliliğini, bolluğunu ve fonksiyonlarını değiştirebilir. B_{12} vitamini ile bağırsak mikrobiyotası arasındaki etkileşimi anlamak, B_{12} vitamini eksikliğini önlememize yardımcı olabilir ve daha da önemlisi probiyotiklerin insan sağlığı üzerindeki faydalı potansiyelini fark etmemizi sağlayabilir.

Kaynak

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TERMO-REAKTİF DİFÜZYON YÖNTEMİ İLE ALUMİNİD KAPLANMIŞ INCONEL 625 ALAŞIMINDA METALURJİK VE MEKANİK KARAKTERİZASYON

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Özet
Nikel esaslı süperalaşımlar, mükemmel korozyon direnci ve yüksek sıcaklıklarda gösterdiği mukavemetten dolayı birçok motor komponentinin imalatında tercihen kullanılmaktadır. Yüksek sıcaklıkta uzun sürede alaşımın yüzeyinde kimyasal bozunumun ve oksidasyonun ortaya çıkması alaşımın yapısal bütünlüğünü yitirerek erken ömürde hasarlanmasına neden olmaktadır. Geçmişten günümüze süperalaşımlara uygulanan yüzey işlemleri ile malzemenin oksidasyon direncinin arttırılması ve böylece malzemelerin daha uzun ömürde çalıştırılması mümkündür. Bu çalışmada, Inconel 625 alaşım yüzeyine 700°C sıcaklıkta farklı sürelerde (2, 4 ve 6 saat) termo-reaktif difüzyon kaplamalar yapılarak farklı kalınlıkta aluminid tabakalar elde edilmiştir. Proses sonrası aluminid kaplanmış süperalaşım yüzey ve kesitinde meydana gelen metalurjik oluşumlar taramalı elektron mikroskobu, enerji dağılım spektrometresi ve x-ışını difraktometresi ile karakterize edilmiştir. Metalurjik karakterizasyon çalışmaları; (i) proseslenen alaşım yüzeyinde çeşitli Ni-Al fazlarının (NiAl, Ni_2Al_3, $NiAl_3$) oluşabildiğini, (ii) artan proses süresi ile yüzeyde bu fazların daha yoğun bir dağılım gösterdiğini ve (iii) aluminid tabaka kalınlığını artan proses süresine bağlı olarak arttığını göstermiştir. Aluminid tabakası ile nikel esaslı alaşımına kıyasla yüzeyde daha yüksek bir sertlik değerine ulaşılmıştır. Yüzeyde sürekli, homojen kalınlıkta ve sert aluminid tabakasının başarılı bir şekilde oluşturulması alaşımın yüksek sıcaklık oksidasyonuna yönelik çalışmalara öncül data eldesini mümkün kılmıştır.
Anahtar Kelimeler: Inconel 625, termo-reaktif difüzyon kaplama, karakterizasyon.

METALLURGICAL AND MECHANICAL CHARACTERIZATION OF ALUMINIDE COATED INCONEL 625 ALLOY BY THERMO-REACTIVE DIFFUSION METHOD

Abstract
Nickel-based superalloys are preferably used in the manufacturing of many engine components due to their excellent corrosion resistance and strength at high temperatures. The occurrence of chemical decomposition and oxidation on the surface of the alloy at high temperatures over a long period of time causes the alloy to lose its structural integrity and be failed in early life. With the surface treatments applied to superalloys from past to present, it is possible to increase the oxidation resistance of the material and thus make the materials last longer. In this study, aluminide layers of different thicknesses are obtained by applying thermo-reactive diffusion coatings to the Inconel 625 alloy surface at 700°C for different periods of time (2, 4 and 6 h). The metallurgical formations occurring on the aluminide-coated superalloy surface and cross-section after the process are characterized by scanning electron microscopy, energy dispersion spectrometer and x-ray diffractometer. Metallurgical characterization studies show that (i) various Ni-Al phases (NiAl, Ni_2Al_3, $NiAl_3$) can form on the processed alloy surface, (ii) these phases show a denser distribution on the surface with increasing process time, and (iii) the aluminide layer thickness increases depending on the increasing process time. With the aluminide layer, a higher hardness value is reached on the surface compared to the nickel-based alloy. The successful formation of a continuous, homogeneous thick and hard aluminide layer on the surface made it possible to obtain preliminary data for studies on high temperature oxidation of the alloy.
Keywords: Inconel 625, thermo-reactive coating, characterization.

Giriş

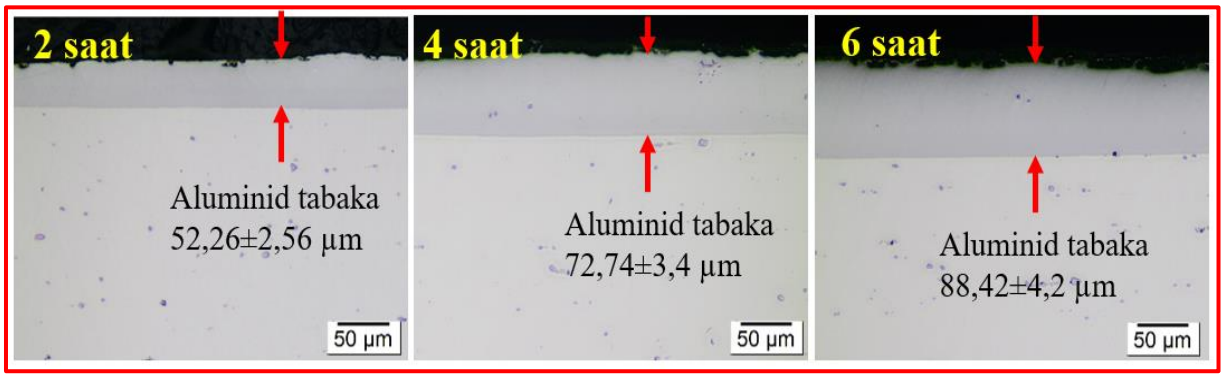
Geçmişten günümüze teknolojinin gelişimi ile yüksek sıcaklık malzemelerine ihtiyacın ortaya çıkması ile süperalaşımlar geliştirilmiştir. Türbin motorları, petro-kimya, ısı aktarım elemanları ve reaktörler söz konusu iken yüksek sıcaklık malzemeleri çoğunlukla kullanılmaktadır (Liu vd., 2023; De Oliveira vd., 2019). Kompozisyonel bir yaklaşımla süperalaşımları kobalt (Co), nikel (Ni) ve nikel-demir (Ni-Fe) esaslı olmak üzere üç ana gruba ayırmak mümkündür. Nikel esaslı süperalaşımların yapısı birçok alaşıma göre daha karmaşık olup, mikroyapısında gama prime (γ′), gama double prime (γ′′), eta (η), sigma (σ), mü (μ), R, Laves, TSP (topolojik sıkı paket) fazları ve çeşitli alaşım karbürleri bulunabilmektedir (Gencay, 2021; Campbell, 2006; Selvaraj vd., 2021).Çalışma koşullarında yüksek sıcaklığa maruz kalan malzemelerde zamanla oksidasyon, sülfürizasyon, sıcak korozyon, erozyonlu korozyon ve benzeri hasar mekanizmaları görülmektedir (Selvaraj vd., 2021, Jamnapara vd., 2016). Bu sebeple malzemelerin yüzey ve kimyasal özelliklerini geliştirmek için birçok konvansiyonel ve ileri yüzey modifikasyon yöntemleri geliştirilmiştir. Bu yöntemler arasında termo-reaktif difüzyon kaplama prosesi düşük maliyetle karmaşık geometrili parçaların kaplanmasına olanak sağlanmaktadır. Ayrıca bu yöntem ile kuvvetli adhezif kaplamalar elde edilebilmektedir (Adamniak vd., 2016; Tong vd., 2010). Termo-reaktif difüzyon kaplama yönteminde altlık malzemenin yüzeyine aluminid kaplanabilmekte ve özellikle nikel esaslı süperalaşımların yüzeylerinde aluminyumca zengin Ni-Al fazları (NiAl, Ni_2Al_3, $NiAl_3$) oluşmaktadır (Tong vd., 2010; Goward vd., 1988; Zielińska vd., 2011). Yapılan çalışmalar, nikel esaslı malzeme yüzeyinde oluşturulan aluminid tabakanın altlık malzemeye kıyasla yüksek sıcaklık oksidasyon direncini, aşınma direncini ve sertlik değerini arttırdığını göstermiştir (Atapek vd., 2023; Khalid vd., 2002; Bölükbaşı vd., 2023). Döleker ve arkadaşları, kutu sementasyon yöntemi ile 600°C ve 700°C sıcaklıkta, 3 ve 5 saat süre boyunca Inconel 718 altlık malzeme üzerine aluminid kaplama yaparak 700 °C sıcaklıkta ve 5 saat süre boyunca yapılan kaplama prosesi sonucunda altlık malzemenin sertlik değerini (260 HV) yüzeyde 900 HV seviyesine kadar arttırabilmiştir. Ayrıca aluminid kaplanmış numunenin işlem görmemiş numuneye kıyasla oksidasyon ve aşınma direncinin de eş zamanlı arttırılabildiği raporlanmıştır (Döleker vd., 2021).Bu çalışmada kutu sementasyon yöntemi ile nikel esaslı Inconel 625 alaşımı üzerine 700°C sıcaklıkta 2, 4 ve 6 saat boyunca termo-reaktif difüzyon kaplama gerçekleştirilmiştir. Proseslenen numunelerin kesit ve yüzeylerinde metalurjik analizler yapılarak yüzey sertliğinde prosese özgü değişimler izlenmiştir. Elde edilen bulgular homojen kaplamalar ile altlık malzemeye kıyasla daha sert tabakaların başarılı bir şekilde oluşabildiğini ortaya koymuştur.

Materyal ve Metod

Bu çalışmada, normalize edilmiş Inconel 625 alaşımına (21.24 Cr, 9.38 Mo, 3.56 Nb+Ta, ağ.-%) farklı sürelerde termo-reaktif difüzyon koşullarının sağlanması ile aluminid kaplama işlemi gerçekleştirilmiştir. Bu işlem için öncelikle, plaka halinde bulunan Inconel 625 alaşımından hassas kesme (Mikrotest Multicut Sense) ile 10x10x2 mm boyutlarında numuneler elde edilmiştir. Numuneler 320, 600, 1000 ve 2500, 4000 mesh'lik zımparalar ile kaba zımparalanmıştır. Sonrasında 3 µm ve 1 µm elmas solüsyon ile parlatma işlemi yapılarak yüzey pürüzlülüğü indirgenmiştir. Metalografik işlem sonrası numunelerin ağırlıkları hassas terazi ile tartılıp kaplama öncesi ve sonrası ağırlıklar takip edilmiştir. Aluminid kaplanma işleminde, aluminyum kaynağı olarak saf Al (40-45 µm), inert malzeme olarak alumina (< 1 µm) ve aktivatör olarak NH_4Cl tozları kullanılmıştır. Kaplama işleminde öncelikle toz karışımı (40 Al + 10 NH_4Cl + 50 Al_2O_3 ağ.-%) hazırlanmış olup mini rotor ile 2 saat mekanik olarak karıştırılmıştır. Toz karışımı hazırlandıktan sonra numuneler karışımın içine gömülerek 700°C sıcaklıkta 2, 4 ve 6 saat sürelerde proseslenmiştir. Yüzeyleri aluminid kaplanmış numunelerin yüzeyleri ve kesitleri, ışık mikroskobu (IM, Olympus BX41M-LED), taramaları elektron mikroskobu (SEM, Jeol JSM 6060), enerji dağılımlı x-ışın spektrometresi (EDS, IXRF) ve x-ışını difraktometresi (XRD, Rigaku Ultima+) ile karakterize edilmiştir. XRD analizi için Cu-K_α radyasyonu kullanılmış ve tarama hızı 1.0 °/dak. olarak seçilmiştir. Kaplamalar sonrasında yüzey sertliğinde oluşan değişim ise Vickers sertlik cihazı (EmcoTest Durascan-70 G5) kullanılarak 10 g yüklenme koşulunda takip edilmiştir.

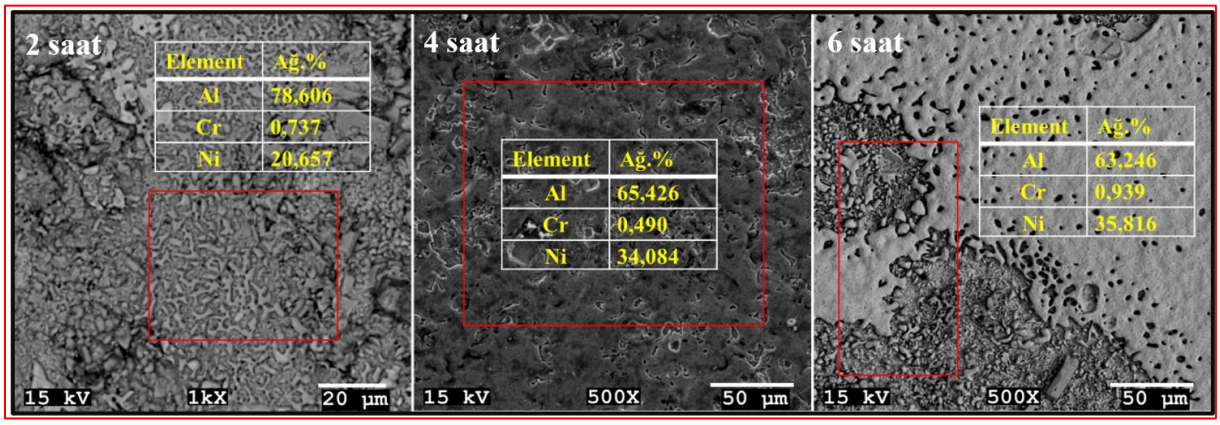
Bulgular ve Tartışma

Inconel 625 alaşımına 700°C sıcaklıkta 2, 4 ve 6 saat süreyle uygulanmış olan aluminid kaplama prosesi sonrası kaplama kesitleri IM ile incelenmiş ve tabaka kalınlıkları ölçülerek Şekil 1'de verilmiştir. Kaplama süresinin artışına bağlı olarak tabaka kalınlıkları artış göstermiş, 2 saat süreyle yapılan proses sonrası 52.26±2.56 µm kalınlık elde edilirken, 4 saat proseslenmiş numunede 72.74±3.4 µm kalınlık değerine ulaşılmıştır. 4 saat ve 6 saat süreyle yapılan prosesler karşılaştırıldığında sürenin artması ile kaplama kalınlığı 1.2 kat artarak 88.42±4.2 µm kalınlığa ulaşmıştır. Artan proses süresi ile aluminyumun yüzeyden içeri doğru sürekli difüzyonu tabaka kalınlığında izlenebilir bir artışa neden olmuştur. Numunelerin kesitleri incelendiğinde, termo-reaktif difüzyon sonrası yüzeyde elde edilen aluminid tabakanın homojen, sürekli olduğu görülmektedir. Ayrıca numune yüzeyinden içeriye doğru herhangi bir oksit varlığı da tespit edilmemiştir. Bu durumda iç oksidasyon olmaksızın prosesin gerçekleştiği kabul edilmektedir.



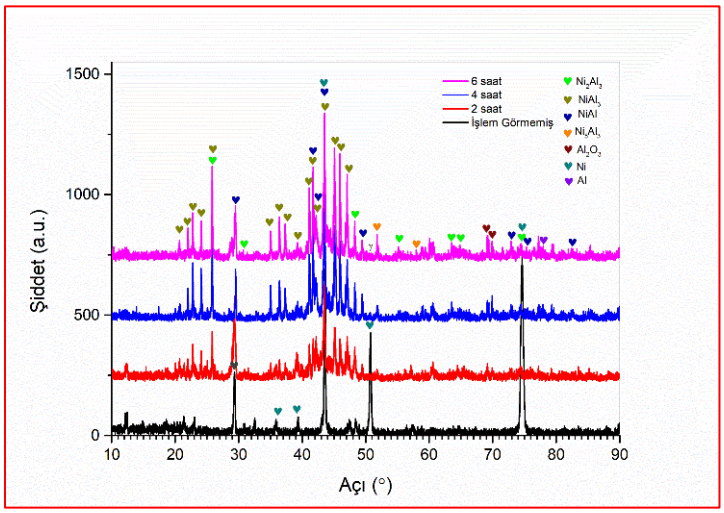
Şekil 1. Aluminid kaplama sonrası alaşımların kesitlerine ait IM görüntüleri.

Kaplama sonrası alaşım yüzeylerinde SEM-EDS analizleri yapılmıştır ve elde edilen bulgular Şekil 2'de verilmiştir. EDS analizleri yüzeyde aluminyum ve nikel elementlerince zengin bir tabaka varlığına işaret etmektedir. Proses süresinin 2 saatten 4 saate arttırılması ile aluminyumun sürekli içeri difüzyonunda yeralan boşyerlerin doldurulduğu ve böylece yüzeydeki aluminyum miktarının ağırlıkça % 78.6 seviyesinden % 65.42 seviyesine azalarak içeri difüzyonun süreçle azaldığı tespit edilmiştir. Bu azalma trendi 6 saatlik işlem sonrası yüzey karakterizasyonunda da izlenmiştir.



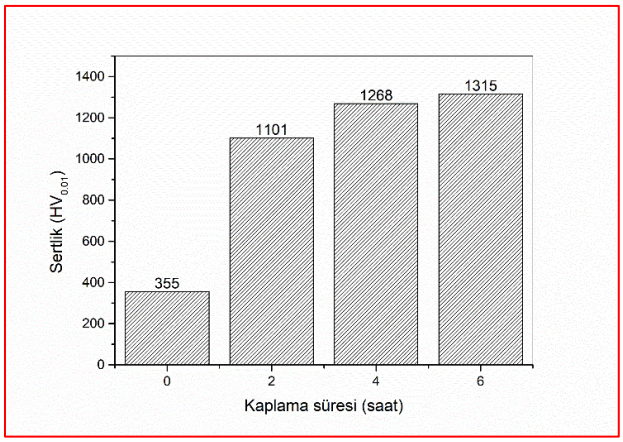
Şekil 2. Aluminid kaplama sonrası alaşımın kesitine ait SEM görüntüleri.

Kaplama prosesi sonrası yüzeyde oluşan fazlar XRD ile analiz edilerek elde edilen spektralar Şekil 3'te verilmiştir. Proses öncesi inceleme yapılan altlık malzemede sadece nikel katı ergiyine ait belirgin pikler görülmüştür. 700°C sıcaklıkta yapılan aluminid kaplama sonrası yapılan XRD incelemelerinde ise yüzeyde literatürle uyumlu Ni-Al (NiAl, $NiAl_3$, Ni_2Al_3, Ni_5Al_3) fazlarının oluştuğu ve sürenin artmasıyla beraber oluşan fazlara ait pik şiddetlerinin artış gösterdiği tespit edilmiştir (Atapek vd., 2023; Döleker vd., 2021). Ayrıca yüzeyde reaksiyona giremeyen Al_2O_3 toz varlığı da tespit edilmiştir.



Şekil 3. Aluminid kaplama sonrası alaşımın yüzeyine ait XRD datası.

Altık malzeme ve farklı sürelerde aluminid kaplanmış yüzeylerin sertlikleri ölçülerek elde edilen bulgular Şekil 4'te verilmiştir. Kaplama öncesi altlık malzemeye ait sertlik değeri 355±22 HV iken 6 saat sürelik kaplama sonrası sertlik değeri 1315±30 HV değerine ulaşmıştır. Atapek ve arkadaşları kaba ve ince taneli aluminyum partikülleri kullanarak kutu sementasyon yöntemi ile Inconel 625 altlık malzeme yüzeyinde aluminid tabaka elde etmiş ve kaplama sonrası numune yüzey sertliğini 1369 ± 13.81 $HV_{0.5}$ ölçmüştür (Atapek vd., 2023). Bu çalışmada da özellikle ince toz formu ile elde edilmiş kaplama sertlik değerine 6 saatlik bir prosesleme ile ulaşılabilmiştir.



Şekil 4. Kaplanmış yüzeylere ait sertlik değerleri.

Sonuç

Aluminid kaplama çalışmaları sonrasında yapılan karakterizasyon çalışmalarda; (i) yüzeyde aluminyumca zengin NiAl, $NiAl_3$, Ni_2Al_3 ve Ni_5Al_3 fazlarının oluştuğu, (ii) artan proses süresi ile kaplama kalınlığının arttığı tespit edilmiştir. Proses süresinin artması ile sertlik değerleri de artarak özellikle altık malzeme yüzey sertliğine kıyasla 6 saatlik bir prosesleme sonrasında

yüzey sertliği yaklaşık 4 kat arttırılarak 1315 HV sertlik değerine ulaşılmıştır. Elde edilen tüm bu bulgular yüzey modifikasyonu sonrası nikel esaslı Inconel 625 alaşımının kullanım alanına özgü bazı özelliklerinin izlenmesine katkı vermiştir.

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Ti6Al4V ALAŞIMININ TERMO-REAKTİF DİFÜZYON KAPLAMALARI İLE YÜZEY MODİFİKASYONU

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Özet
Düşük yoğunluğa, üstün korozyon direncine ve yüksek sıcaklık mekanik kararlılığına sahip Ti6Al4V alaşımı havacılık ve uzay endüstrisinde kullanılan bir alaşımdır. Ancak alaşımın yüksek sıcaklıkta uzun sürede oksidasyona maruz kalması ve yapısal bütünlüğünü kaybetmesi alaşımın uzun ömürde kullanımını sınırlamaktadır. Alaşım üzerine yüzey mühendisliği uygulamaları ile çalışma koşullarına karşılık uzun ömür kazanımı sağlanabilmektedir. Bu çalışmada, 700 °C sıcaklıkta termo-reaktif difüzyon kaplama ile Ti6Al4V alaşım yüzeyinde bir aluminid tabakasının oluşumu sağlanmış ve özellikle proses süresine bağlı olarak yüzey/yüzeyaltı metalurjik oluşumlar karakterize edilmiştir. Metalurjik karakterizasyon çalışmaları kaplama yapısında çeşitli Ti-Al fazlarının (TiAl, $TiAl_2$ ve $TiAl_3$) oluşabildiğine ve özellikle artan proses süresine bağlı olarak aluminid kaplama tabaka kalınlığında sürekli bir artışın meydana geldiğini ortaya koymuştur. Alaşım yüzeyinde yapılan sertlik taramaları ise çift faz (α+β) yapılı titanyum alaşımına kıyasla daha yüksek sertlik değerlerine ulaşılabildiğini göstermiştir. Yüzeyde sürekli, homojen kalınlıkta ve sert aluminid tabakasının başarılı bir şekilde oluşturulması alaşımın yüksek sıcaklık oksidasyonuna yönelik çalışmalara öncül data eldesini mümkün kılmıştır.
Anahtar Kelimeler: Ti6Al4V, aluminid kaplama, mikroyapı, karakterizasyon.

SURFACE MODIFICATION OF Ti6Al4V ALLOY BY THERMO-REACTIVE DIFFUSION COATINGS

Abstract
Ti6Al4V alloy, which has low density, superior corrosion resistance and high temperature mechanical stability, is an alloy used in the aviation and space industry. However, the alloy's exposure to oxidation at high temperatures over a long period of time and its loss of structural integrity limits the long-life use of the alloy. With surface engineering applications on the alloy, long life can be achieved in response to operating conditions. In this study, the formation of an aluminide layer on the Ti6Al4V alloy surface is achieved by thermo-reactive diffusion coating at 700 °C and the surface/subsurface metallurgical formations are characterized, especially depending on the process time. Metallurgical characterization studies have revealed that various Ti-Al phases (TiAl, $TiAl_2$ and $TiAl_3$) can be formed in the coating structure and there is a continuous increase in the aluminide coating layer thickness, especially due to increasing process time. Hardness scans performed on the alloy surface show that higher hardness values could be achieved compared to the dual phase ($\alpha+\beta$) titanium alloy. The successful formation of a continuous, homogeneous thick and hard aluminide layer on the surface made it possible to obtain preliminary data for studies on high temperature oxidation of the alloy.
Keywords: Ti6Al4V, aluminide coating, microstructure, characterization.

Giriş

Yüksek sürünme direnci, üstün korozyon dayanımı ve düşük yoğunluk özelliklerinden dolayı titanyum alaşımları havacılık ve uzay uygulamalarında tercih edilmektedir. Titanyum alaşımlarının kullanımının %50'sini oluşturan Ti6Al4V alaşımı metalurjik olarak bir α+β alaşımıdır (Liu vd., 2021). Sahip olduğu fazlar sebebiyle yüksek mukavemet, tokluk, üstün korozyon direnci, şekillendirilebilme ve iyi sürünme direnci sergilemektedir (Donachie vd., 2000). Bütün bu kombinasyonlara rağmen Ti6Al4V alaşımı 420°C çalışma sıcaklığına kadar kullanılabilmektedir. Yüksek sıcaklık uygulamalarında titanyumun oksijene karşı yüksek afinitesinden dolayı yüzeyde koruyucu olmayan gevrek oksit tabakası oluşmaktadır (Zhang vd., 2012; McKee vd., 1993; Wang vd., 2021). Bu da uzun vadede yapısal bütünlüğün bozulup alaşımın erken ömürde hasarlanmasına neden olmaktadır. Alaşımın yüzey işlemleri ile yüksek sıcaklık oksidasyon direncini geliştirerek servis ömrünün artırılması sağlanabilmektedir (McKee vd., 1993). Titanyum esaslı altlık malzeme yüzeyinde Al_2O_3, Cr_2O_3 ve SiO_2 gibi oksijen geçirgenliği düşük ince tabakaların oluşturulması ile malzemenin oksidasyon direncinin arttırılması mümkündür (McKee vd., 1993; Wang vd., 2021; Shafiri vd., 2019). Termal sprey, plazma sprey, sıcak daldırma, lazer kaplama ve kutu sementasyon yöntemleriyle yapılan yüzey modifikasyonları ile yüzeyde Ti-Al tabakası elde edilebilmektedir (Wang vd., 2021). Yüzey işlemleri arasında termo-reaktif difüzyon kaplama metodu pahalı ekipmanlara ihtiyaç duymadan kaplama ile altlık malzeme arayüzey bütünlüğünü sağlamasından dolayı tercih edilmektedir (Bianco vd., 1996). Bu tür bir yöntemin kullanımı ile özellikle titanyum alaşımı yüzeyine aluminid kaplamalarının yapılması ile alaşımın oksidasyon direncini önemli ölçüde arttırılabilmektedir (Ohnuma vd., 2000; Alam vd., 2009). Aluminyumun içeri difüzyonu sonrası numune yüzeyinde oluşan aluminid tabakada TiAl, $TiAl_2$, $TiAl_3$ ve Ti_3Al esaslı fazlar oluşmaktadır (Deinq vd., 2005). Termo-reaktif difüzyon kaplamada kullanılan toz karışımının içeriğine ve proses sıcaklığına/zamanına bağlı olarak yüzeyde değişken metalurjik yapıda ve kalınlıkta difüzyon tabakası elde edilmektedir. Xiang ve arkadaşları tarafından yapılan bir çalışmada, yüzeyde oluşturulan aluminyumca zengin γ-TiAl aluminid tabakasının yüzeyde oksidasyon koşullarında koruyucu bir tabaka olarak görev alan Al_2O_3 tabakası oluşturabildiği izlenmiştir (Xiang vd., 2002). Yener ve arkadaşları, Ti6Al4V alaşımı yüzeyine kutu sementasyon yöntemi ile aluminid kaplayarak homojen, yoğun, porozite içermeyen ve yüzeye iyi tutunmuş γ-TiAl tabakasının alaşım yüzeyinde kristallenmesini sağlayarak yüzeyde altlık malzemeye göre sertliğin (~650 HV) artabildiğini ortaya koymuştur (Yener vd., 2023). Bu çalışmada, Ti6Al4V alaşımının kutu sementasyon metodu kullanılarak termo-reaktif difüzyon

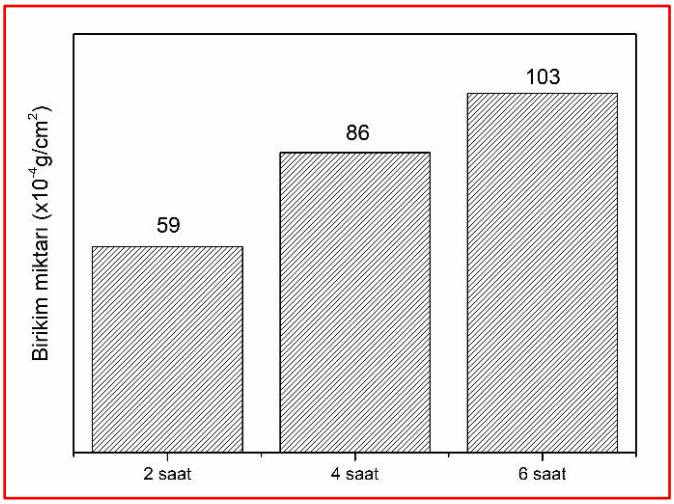
koşulları iletilerek yüzeyler aluminyum ile kaplanmıştır. Seçilen proseste sabit sıcaklıkta (700°C) değişken sürelere (2-6 saat) bağlı olarak elde edilen kaplanmanın metalurjik ve mekanik karakterizasyonu yapılmıştır.

Malzeme ve Yöntem

Döküm konumunda bulunan Ti6Al4V alaşımından (89.9Ti- 6.14Al-3.96 V, ağ.-%), hassas kesme cihazı (Mikrotest Multicut Sense) ile 10x10x10 mm boyutlarında numuneler alınmış ve yüzeyler metalografik olarak hazırlanmıştır. Metalografik hazırlık sürecinde numuneler 320, 600, 1000, 2500 ve 4000 mesh'lik SiC esaslı zımpara kağıtları ile zımparalanmış, 3µm ve 1µm elmas solüsyon ile parlatılmıştır. Metalografik işlem sonrası numunelerin ağırlıkları hassas terazi ile tartılarak kaplama öncesi ve sonrası ağırlıkları kayıt altına alınmıştır. Yüzeylerin aluminid kaplanmasında, aluminyum kaynağı olarak saf aluminyum tozu (40-45 µm), inert malzeme olarak alumina (< 1 µm) ve aktivatör olarak NH_4Cl tozları kullanılmıştır. Kaplama işleminde 40 Al + 10 NH_4Cl + 50 Al_2O_3 (ağ.-%) bileşimine sahip toz karışımı hazırlanarak tozların mini rotor ile 2 saat karıştırılması sağlanmıştır. Numuneler hazırlanan toz karışımı içerisine gömülerek 700°C sıcaklıkta, 2, 4 ve 6 saat süreyle aluminid kaplanmıştır. Kaplama işleminin ardından numunelerin yüzeylerinin karakterize edilmesi için ışık mikroskobu (IM, Olympus BX41M-LED), taramalı elektron mikroskobu (SEM, Jeol JSM 6060) ve enerji dağılımlı x-ışın spektrometresi (EDS, IXRF) kullanılmıştır. IM çalışmalarında, aydınlık alan kontrastı ile kaplama kalınlıkları çoklu olarak ölçülmüş olup, ortalama bir değer belirlenmiştir. Aluminid kaplamada oluşan fazların tayini X-ışın difraktometresi (XRD, Rigaku Ultima+) kullanılarak gerçekleştirilmiştir. XRD çalışmalarında Cu-K_α radyasyonu kullanılmış ve tarama hızı 1.0 °/dak. olarak seçilmiştir. Kaplama işlemleri sonrası numune yüzeylerine ait sertlik değerleri Vickers sertlik cihazı ile 10 g yük altında çoklu kez ölçülmüş ve ortalama değer hesaplanmıştır.

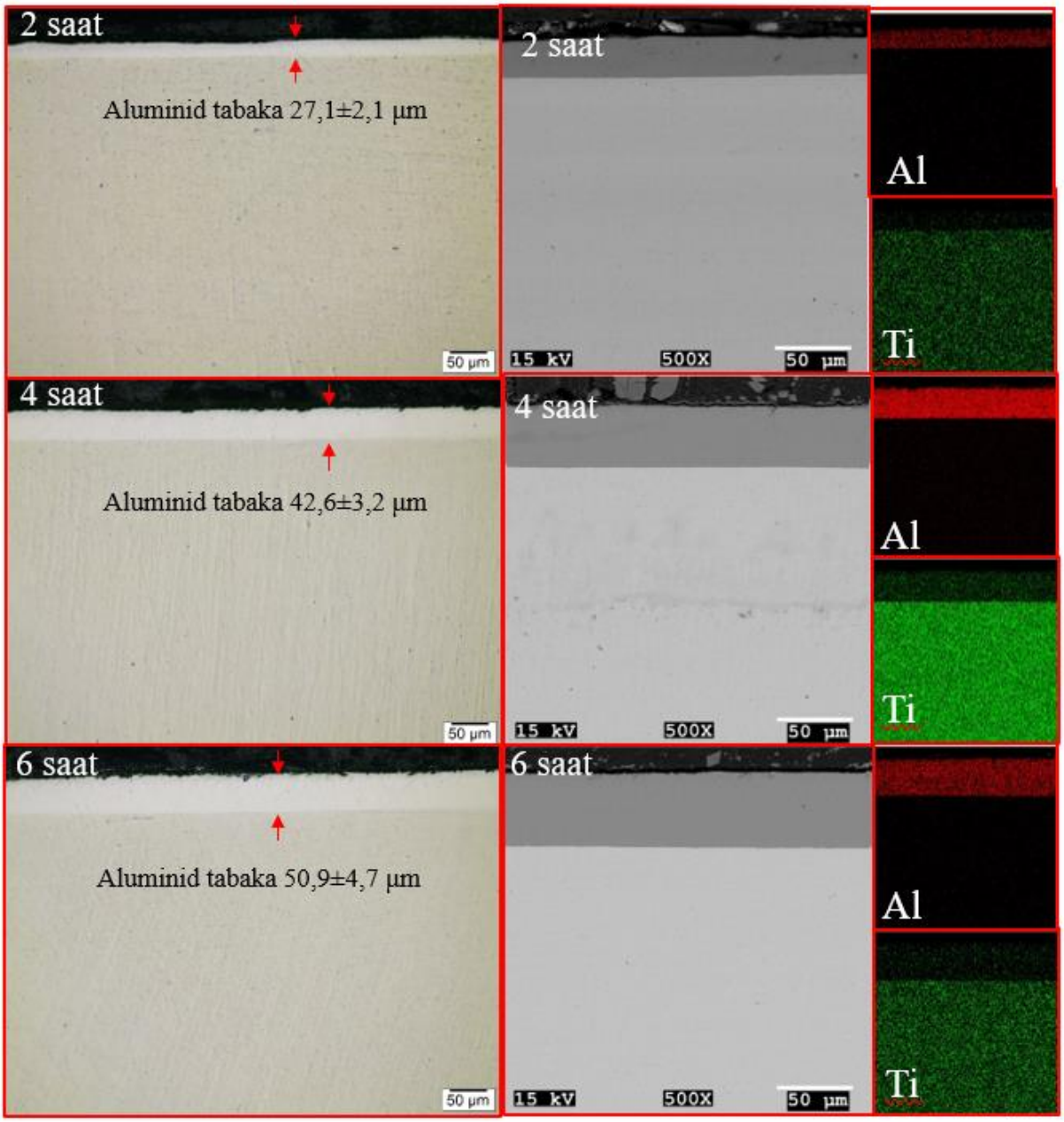
Bulgular ve Tartışma

700°C sıcaklıkta farklı sürelerde (2, 4 ve 6 saat) aluminid kaplanmış Ti6Al4V altlık malzemesinde birim alan başına birikim miktarı hesaplanmış ve elde edilen data Şekil 1'de verilmiştir. Aluminid kaplama süresi 2 saatten 4 saate çıkarıldığında yüzeydeki birikim miktarının $59x10^{-4}$ g/cm^2 değerinden ~1.5 kat artarak $86x10^{-4}$ g/cm^2 değerine yükseldiği ve kaplama süresinin 4 saatten 6 saate çıktığı proseste kaplama miktarının ~1.2 kat artarak $103x10^{-4}$ g/cm^2 değerine ulaştığı görülmüştür. Artan süre ile birlikte yüzeyden içeri doğru aluminyum difüzyonu artmakta ve böylece daha fazla birikim sağlanabilmiştir.



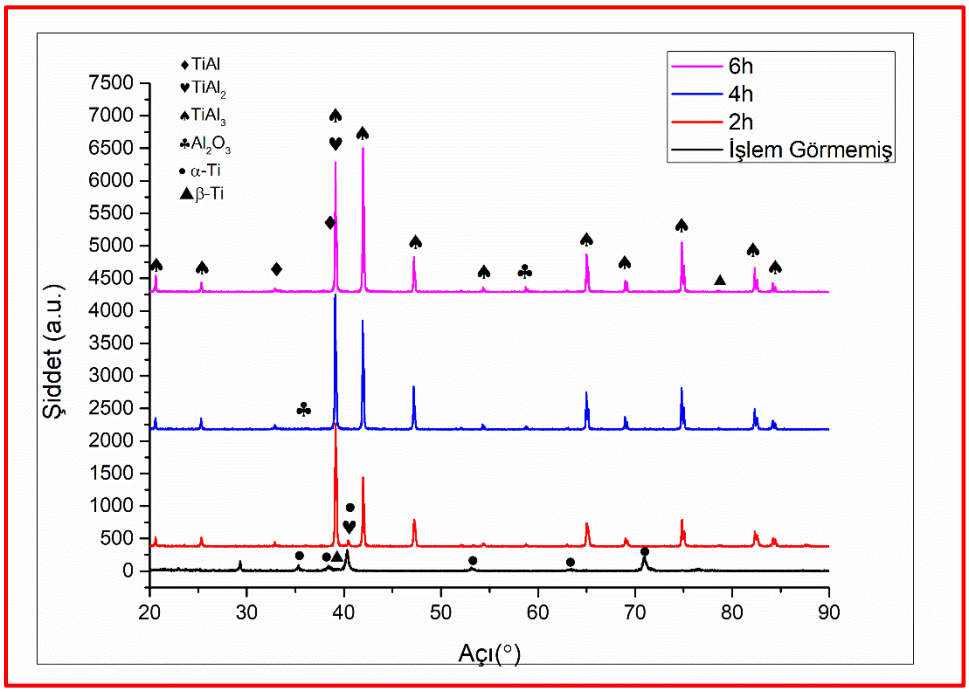
Şekil 1. Kaplama süresine bağlı olarak yüzeydeki birikim miktarının değişimi.

Farklı sürelerde termo-reaktif difüzyon kaplama uygulanmış atlık malzeme yüzeyinde oluşturulan aluminid tabaka kalınlığının zamana bağlı değişimini gösteren IM ve SEM kesit görüntüleri Şekil 2'de verilmiştir. Kaplama süresi 2 saatten 4 saate arttırılması ile aluminid tabaka kalınlığı 27.1±2.1 µm'den 42.6±3.2 µm değerine artarak 6 saatlik bir işlem ile tabaka kalınlığının 50.9±4.7 µm değerine ulaştığı tespit edilmiştir. Proses süresi arttıkça birikim miktarındaki artışa benzer bir trend ile kaplama kalınlığında zamanla artış izlenmiştir. SEM-EDS çalışmaları ile elde edilen kesit görüntüleri tüm prosesler ile alaşım yüzeylerinde alüminyumca zengin homojen ve sürekli bir kaplama tabakasının oluştuğunu göstermiştir (Şekil 2).



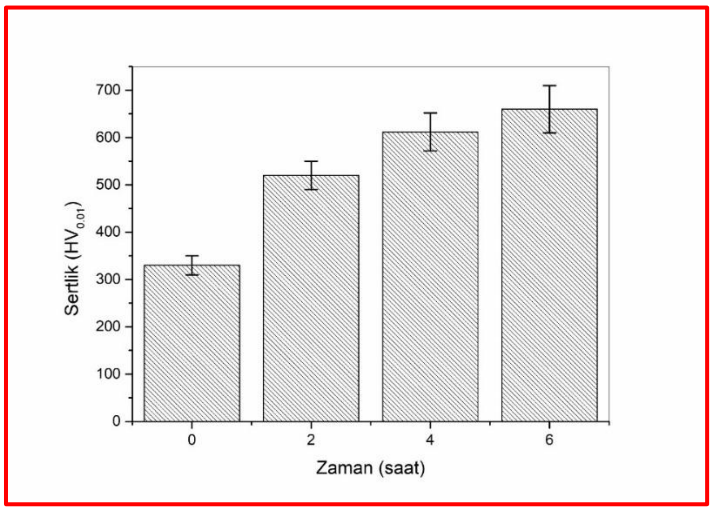
Şekil 2. Kaplama sonrası alaşımın kesitine ait IM ve SEM görüntüleri.

Aluminid kaplama sonrası alaşımın yüzeyinde oluşan fazlar XRD analizleri ile tespit edilmiştir. Şekil 3'te işlem görmemiş Ti6Al4V altlık malzemeye ait XRD spektraları incelendiğinde sadece α ve β fazlarının varlığı tespit edilmiştir. 700°C sıcaklıkta 2, 4 ve 6 saat boyunca termo-reaktif difüzyon kaplamalar sonrasında altlık malzeme yüzeylerinde TiAl, $TiAl_2$ ve $TiAl_3$ ve fazlarının oluşabildiği gözlenmiştir. Yüzeyde aynı zamanda karışım tozunun bir bileşeni olan ve reaksiyona giremeyen Al_2O_3 toz varlığı da izlenmiştir. kaplama süresinin artmasına bağlı olarak Ti-Al fazlarına ait pik şiddeti daha da artmıştır.



Şekil 3. Aluminid kaplama sonrası alaşımın yüzeyine ait XRD datası.

Aluminid kaplama işlemi uygulanmamış alaşımın ve farklı sürelerde kaplama işlemi uygulanmış alaşımların yüzeylerine ait sertlik değerleri Şekil 4'te verilmiştir. İşlem görmemiş alaşım 300±20 HV sertliğe sahipken yüzey işlemleri sonrasında proses süresinin fonksiyonu olarak alaşıma ait yüzey sertliğinde önemli bir artış tespit edilmiştir. Yapılan çalışmalar aluminid kaplama ile alaşım yüzeyinde oluşan TiAl, $TiAl_2$ ve $TiAl_3$ fazlarının yüzey sertlik artışında önemli bir etken olduğunu ortaya koymuştur (Yılmaz vd., 2022; Patel vd., 2020).



Şekil 4. Kaplanmış alaşımların yüzey sertlik datası.

Sonuç

Kaplamalar üzerine yapılan metalurjik ve mekanik karakterizasyon çalışmalar; (i) termo-reaktif difüzyon ile titanyum esaslı malzeme yüzeyinde alüminyumun içeri difüzyonu sağlanarak sürekli, homojen Ti-Al içerikli fazlarının (TiAl, $TiAl_2$ ve $TiAl_3$) başarılı bir şekilde oluşturulabildiğini, (ii) proses süresine bağlı olarak Ti-Al tabakasında sürekli bir artışın sağlanabildiği ve 6 saat prosesleme ile yüzeyde ~ 50 µm tabaka kalınlığına ulaşılabildiğini, (iii) kaplama ile birlikte altlık malzeme yüzeyinde 660 HV gibi bir yüksek sertlik değerine ulaşılabileceğini ve altlık malzemeye (300±20 HV) kıyasla yaklaşık 2 kat sertliğin arttırılabildiğini göstermiştir.

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PEYNİR ÜRETİMİNDE STARTER KÜLTÜR OLARAK KULLANILAN LAKTİK ASİT BAKTERİLERİ ÜZERİNE *Spirulina platensis*'in ETKİSİ

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Özet
Süt, düşük asitli ve yüksek su aktivitesine sahip bir gıda ürünüdür. Sütün raf ömrünü uzatmanın birçok yolu olup bunlardan birisi de peynir üretimidir. Peynir üretimi ısıtma (pastörizasyon), kültürleme, doğrudan asitleştirme, dehidrasyon, soğutma ve paketleme gibi çeşitli teknikler yardımıyla yapılmaktadır. Doğal peynirler, sütün pıhtılaşmasıyla, genellikle kimozinin pıhtılaştırıcı bir çözelti içindeki enzimatik etkisiyle veya bazı durumlarda laktik asit bakteri kültürlerinin etkisiyle veya doğrudan asit ilavesiyle kazeinlerin izoelektrik çökelmesi yoluyla üretilir. Peynirlerde genellikle *Lactococcus*, *Lactobacillus*, *Enterococcus*, *Streptococcus* ve *Leuconostoc* cinslerine ait Laktik asit bakterilerine (LAB) rastlanmaktadır. Son dönemlerde bir mikro alg olan *Spirulina platensis* (*S. platensis*) diyet takviyesi olarak yaygın bir şekilde kullanılmaktadır. Alglerin özellikle *S. platensis*'in gıda endüstrisindeki uygulamalarından biri biyoaktif bileşikler sağlamak için fermente süt ürünlerine eklenmesidir. Bu nedenle peynir gibi fermente ürünlerin zenginleştirilmesinde *S. platensis* kullanılması durumunda starter kültürlere herhangi bir antimikrobiyal etkisinin olup olmadığı sorgulanmaktadır. Bu çalışmada, laktik asit bakterilerinin büyümesini teşvik edici yanını gösteren çalışmaların aksine *S. platensis'in* kuru ve metanol ekstraktlarının farklı konsantrasyonlarının (2.5 mg/ml, 5 mg/ml, 7.5 mg/ml ve 10 mg/ml) peynir üretiminde starter kültür olarak kullanılan laktik asit bakterileri (*Lactococcus lactis* subsp. *cremoris, Lactococcus lactis* subsp. *lactis* -R-704) üzerine herhangi bir antimikrobiyal etkisinin olup olmadığının araştırılması amaçlanmıştır. Bu çalışmada kullanılan *S. platensis* Çukurova Üniversitesi Su Ürünleri fakültesinden kuru olarak sağlanırken, starter kültür suşları Ch. Hansen's firmasından temin edilmiştir. Antimikrobiyal etkinin incelenmesinde Agar Difüzyon yöntemi kullanılmıştır. *In vitro* koşullarda 5 tekrarlı gerçekleştirilmiş bu çalışmada, peynir starter bakterileri üzerine *S. platensis'*in tüm çalışılan konsantrasyonlarında herhangi bir antibakteriyel etki tespit edilememiştir.
Anahtar Kelimeler: Laktik asit bakterileri, *Spirulina platensis*, peynir, antimikrobiyal etki

EFFECT OF *Spırulina platensis* ON LACTIC ACID BACTERIA USED AS STARTER CULTURE IN CHEESE PRODUCTION

Abstract
Milk is a food product with low acidity and high water activity. There are many ways to extend the shelf life of milk, and one of them is cheese production. Cheese production is done with the help of various techniques such as heating (pasteurization), culturing, direct acidification, dehydration, cooling and packaging. Natural cheeses are produced by coagulation of milk, usually by the enzymatic action of chymosin in a coagulant solution, or in some cases by isoelectric precipitation of caseins by the action of lactic acid bacterial cultures or by direct addition of acid. Lactic acid bacteria (LAB) belonging to the genera *Lactococcus*, *Lactobacillus*, *Enterococcus*, *Streptococcus* and *Leuconostoc* are generally found in cheese. Recently, *Spirulina platensis* (*S. platensis*), a microalgae, has been widely used as a dietary supplement. One of the applications of algae, especially *S. platensis*, in the food industry is the addition to fermented dairy products to provide bioactive compounds. Therefore, it is questioned whether *S. platensis* has any antimicrobial effect on starter cultures when used in the enrichment of fermented products such as cheese. In this study, it was aimed to investigate whether different concentrations (2.5 mg/ml, 5 mg/ml, 7.5 mg/ml ve 10 mg/ml) of dry and methanol extracts of *S. platensis* have any antimicrobial effects on lactic acid bacteria used as starter culture (*Lactococcus lactis* subsp. *cremoris*, *Lactococcus lactis* subsp. *lactis* -R-704) in cheese production, contrary to studies showing its ability to promote the growth of lactic acid bacteria. While *S. platensis* used in this study was provided dry from Çukurova University Faculty of Fisheries, these strains used as starter cultures were obtained from Ch. Hansen's company. Agar Diffusion method was used to examine the antimicrobial effect. In this study, which was carried out with 5 replicates under *in vitro* conditions, no antibacterial effect was detected on cheese starter bacteria at all studied concentrations of *S. platensis*.
Keywords: Lactic acid bacteria, *Spirulina platensis*, cheese, antimicrobial effect

GİRİŞ

Milyonlarca insanın beslenme gereksinimlerini karşılamak için dünya çapında yaygın olarak tüketilen bir gıda olan süt, sağladığı önemli makro ve mikro besinler dolayısıyla oldukça önemlidir. Ayrıca, süt ve süt ürünleri, çeşitli gıda ürünlerinin üretiminde önemli bir bileşen olarak da kullanılmaktadır. Süt, protein, kalsiyum, fosfor, B vitaminleri ve diğer önemli besin öğelerini içermektedir (Park, 2009). Sütün raf ömrünü uzatmak için üretilen yoğurt, kefir ve peynir gibi fermente süt ürünleri binlerce yıldır tüketilmektedir. Fermente süt ürünleri, sütte bulunan doğal bakterilerin ve mayaların fermantasyon süreciyle oluşur (Zamfira vd., 2006; Visioli ve Strata, 2014). Bu süreç, sütteki karbonhidratların (genellikle laktoz) bakteriler veya mayalar tarafından fermantasyonu ve bunun sonucunda laktik asit gibi organik asitlerin oluşmasıyla gerçekleşir. Oluşan laktik asit, sütün pH'ını düşürerek asidik bir ortam yaratır (Zamfira vd., 2006). Asidik ortam, zararlı mikroorganizmaların büyümesini engellerken, üretilen laktik asit ve düşük pH, sütün dayanıklılığını artırır ve bozulmasını önler. Fermente sütlerde bulunan laktik asit bakterileri (LAB) çeşitli türlerden oluşur ve genellikle *Lactobacillus, Lactococcus, Leuconostoc, Pediococcus, Streptococcus* ve *Bifidobacterium* cinslerine ait bakterileri içerir. Bu bakterilerin her biri fermente süt ürünlerinin oluşumunda farklı roller üstlenir ve ürünlerin besleyici değerini artırırken, tat, koku ve doku özelliklerini belirleyebilirler. Fermentasyon sürecinde, laktik asit bakterilerinin metabolizması çeşitli aroma bileşenleri ve organik asitlerin oluşumuna yol açabilir. Bu bileşenler, fermente süt ürünlerinin karakteristik tat, koku ve dokusunu belirler. Bazı laktik asit bakterileri B vitaminleri gibi önemli besleyici bileşenleri de sentezleyebilir (Panesar, 2011).Süt, düşük asitli ve yüksek su aktivitesine sahip bir gıda ürünüdür. Sütün raf ömrünü uzatmanın birçok yolu olup bunlardan birisi de peynir üretimidir. Bir fermente süt ürünü olan peynir; Türk Gıda Kodeksi'nde "Hammaddenin uygun bir pıhtılaştırıcı kullanılarak pıhtılaştırılması ve pıhtıdan peyniraltı suyunun ayrılmasıyla ya da sütün permeatının ayrılmasından sonra pıhtılaştırılmasıyla elde edilen, farklı sertliklerde ve yağ içeriklerinde, salamura ile ya da kuru tuzlama ile tuzlanarak ya da tuzlanmadan, starter kültür kullanarak ya da kullanmadan, telemesi haşlanarak ya da haşlanmadan, çeşnili ya da çeşnisiz olarak, tekniğine uygun olarak üretilen, olgunlaştırılmadan ya da olgunlaştırıldıktan sonra tüketilen, çeşidine özgü karakteristik özellikleri gösteren süt ürünleri" şeklinde tanımlanmaktadır (Anonymous, 2015). Peynir birçok çeşidi olan ve en fazla tanınan süt ürünüdür. Dünyada 4000'den fazla, Türkiye'de 200'den fazla peynir çeşidi bulunmaktadır. Bu peynirlerin yapımında ortak işlemler olarak, süt temini, standardizasyon, pastörizasyon, starter kültür ilavesi, mayalama, oluşan pıhtının işlenmesi aşamalarını içerir.

Peynirler, sütün pıhtılaşmasıyla, genellikle kimozinin pıhtılaştırıcı bir çözelti içindeki enzimatik etkisiyle veya bazı durumlarda LAB kültürlerinin etkisiyle veya doğrudan asit ilavesiyle kazeinlerin izoelektrik çökelmesi yoluyla üretilir (Park, 2009). Peynirlerde genellikle *Lactococcus, Lactobacillus, Enterococcus, Streptococcus* ve *Leuconostoc* cinslerine ait LAB'lere rastlanır. Laktik asit bakterilerinin (LAB) mikrobiyal metabolizması, süt bileşenlerini, özellikle karbonhidratları ve proteinleri, diğer mikroorganizmaların büyümesi ve metabolizması için bir substrat olarak kullanılabilecek ikincil ürünlere dönüştürür (Tilocca vd, 2020). Peynir üretimi süt, peynir mayası ve bakteriler arasında karmaşık bir etkileşim içerir. Sütün bakteriyolojik kalitesi önemli ölçüde değiştiğinden, çoğu peynir pastörize süt kullanılarak yapılır. Bu pastörizasyon işlemi, spontan asitlenme sağlayabilen LAB dahil olmak üzere sütte bulunan patojen ve saprofit bakterilerin %99'undan fazlasını ortadan kaldırır. Bu nedenle istenilen özelliklere sahip bir peynir yapmak için süte starter kültürler eklenmektedir. Starter kültürü, peynir yapımının tüm aşamalarında ve olgunlaşma sürecinde çok önemli bir rol oynar (Høier vd, 2010). Fermantasyon süreçlerinde merkezi bir rol oynayan LAB'lar, fermente yiyecek ve içeceklerin üretiminde uzun ve güvenli üretim ve tüketim geçmişine sahiptir. Peynir üretimi sırasında starter kültür olarak kullanılan laktik asit bakterileri laktozu laktik aside metabolize edebilmekte, olgunlaşma sırasında peynir lezzetinin gelişmesine katkıda bulunmakta ve oluşturdukları metabolitleri ile istenmeyen mikroorganizmaların inhibisyonunu sağlamaktadır. Başta laktik asit olmak üzere organik asitlerin üretimi yoluyla hammaddenin hızla asitlenmesine neden olurlar. Ayrıca, asetik asit, etanol, aroma bileşikleri, bakteriyosinler, ekzopolisakkaritler ve çeşitli enzimlerin LAB tarafından üretimi önemlidir. Bu şekilde fermente ürünün raf ömrünü ve mikrobiyal güvenliğini arttırır, dokuyu iyileştirir ve son ürünün hoş duyusal profiline katkıda bulunurlar (Leroy ve Vuyst, 2004). Peynir yapımı için başlangıç kültürünün iki ana işlevi vardır: Peynir yapımı sırasında asit üretmek ve peynirin olgunlaşmasına yardımcı olmaktır. Kültürlerin ürettiği asit, peynir yapımında önemli bir adım olan asitle pıhtılaşmış peynirlerde süt pıhtılaşmasına yol açar. Peynir mayası ise pıhtılaşmış peynirlerde asit gelişimi ile pıhtılaşmayı hızlandırır. Birçok peynirin üretimi, asitlik gelişimi *Lactococcus lactis* alt türleri *lactis* ve *cremoris*'e bağlıdır.Ticari starter kültürlerinde esas olarak *Lactococcus, Lactobacillus, Streptococcus* ve *Bifidobacterium* suşları kullanılmaktadır. İyi asit üretici oldukları için en yaygın kullanılan mezofilik starter kültür *lactis* ve *cremoris* alt türlerini içeren *Lactococcus lactis*'tir. Karışık mezofilik kültürler genellikle %90 asit üreticisi ve %10 aroma üreticisidir. *Lactococcus lactis* subsp. *lactis* ve *L. lactis* subsp. *cremoris* süt endüstrisinde büyük öneme sahiptir (Başaran vd, 2001).

Lactococcus cinsinin üyeleri Gram pozitif koklar, büyüme koşullarına bağlı olarak oval görünebilen ve tipik olarak 0.5-1.5 µm boyutlarındadır. Spor oluşturmayan, hareketli olmayan ve fakültatif anaerob bakterilerdir. Laktokok türleri çiftler veya kısa zincirler halinde büyümektedir ve streptokok cinsinin birçok üyesinden farklı olarak bu organizmalar uzun zincirler halinde gelişmezler. Laktokoklar, pH 6.3-6.9 değerleri arasında ve optimum sıcaklık genellikle 30 °C'ye yakın olsa da 12 ila 40 °C arasında büyüyebilmektedir. *L. lactis* subsp. *cremoris* lezzet bileşiği olarak taze peynir üretiminde esastır. *L. lactis* subsp. *lactis* ve *L. lactis* subsp. *cremoris* kombinasyonunun, beyaz salamura peynirdeki lezzet ve aroma söz konusu olduğunda en iyi kombinasyon olduğu kabul edilmektedir. Yumuşak, olgunlaşmış, kaşar ve taze peynirler gibi peynir çeşitlerinde kullanılmaktadır. Karışık laktokok kültürü (*L. lactis* subsp. *lactis* ve *L. lactis* subsp. *cremoris*) kullanılarak yapılan pıhtısı haşlanmamış beyaz salamura peynirlerde (Türk beyaz peyniri, feta, teleme vb.) olgunlaşma, mezofilik ve termofilik karışımı kültürlerle (*L. lactis* subsp. *lactis* ve *Streptococcus thermophilus*) yapılan peynirlerden daha hızlı gelişmektedir. *L. lactis* subsp. *lactis* ve *L. lactis* subsp. *cremoris* yüksek tuz konsantrasyonlarına tolerans göstermemekte ve genellikle %6.5 'in üzerinde büyüyememektedir (Ivy ve Wiedmann, 2014; Büyükyörük, 2007). Laktik aside ilaveten, termofilik starter kültürler karakteristik olarak asetaldehit üretir. Peynir yapımında zaman zaman peynirin türüne göre özel işlevi olan ikincil kültürler kullanılır. Örneğin, *Propionibacterium freudenreichii* subsp. *shermanii* İsviçre peyniri çeşitlerinde peynirin (gözlerin) iç kısmında büyük delikler oluşturarak CO_2 üretir. Diğer kültürler olgunlaşmaya yardımcı olarak kullanılır. Başlangıç kültürlerine ilave olarak eklenirler. Bu bağlamda, peynir olgunlaşması sırasında büyüyen ve olgunlaşma enzimleri üreten bazı *Lactobacilli* ve *Pediococci* bakterileri de kullanılır. Sonuç olarak, bir peynirin temel karakteri starter türü, bileşimi, büyümesi ve metabolik özelliklerine göre yönetilir (Ivy ve Wiedmann, 2014).Fermente süt ürünlerine mikroalglerin eklenmesi, biyoaktif bileşiklerin sağlanmasını hedefleyen daha sağlıklı süt ürünleri oluşturmanın bir aracı olarak benimsenmektedir. Bu amaçla, *Arthrospira* (*Spirullina*) spp. ve *Chlorella vulgaris* gibi mikroalg türleri, fermente gıda takviyesi için yaygın olarak kullanılan iki ana türdür. Mikroalgler, mikroskobik canlılar olup çapı 2 µm'den küçük, siyanobakteriler (*Chloroxybacteria*) gibi prokaryot veya yeşil algler (*Chlorophyta*) gibi ökaryotik olabilmektedir (Sasa vd, 2020). Yaklaşık 50.000 türe sahip fotosentez yapabilen, tatlı ve tuzlu su ortamlarında yaşayabilen canlılar olup, hücre yapılarına, pigmentlerine ve yaşam döngülerine göre farklılık göstermektedir. Yeşil algler (*Chlorophyceae*), mavi-yeşil algler (*cyanopyta*), diatomlar (*Bacillariophyceae*) en önemli

mikroalglerdendir (Suna, 2020). Mikroalg zengin bir karbon kaynağıdır ve bu biyoyakıtlarda, sağlık takviyelerinde, ilaçlarda ve kozmetiklerde kullanılabilmektedir (Alam vd, 2020). Mikroalgler, protein, karbonhidrat (özellikle β glukan), lipit, esansiyel amino asit, çoklu doymamış yağ asitleri, vitamin, mineral ve kalorisiz diyet lifi gibi yüksek besin değerli bileşenleri sentezleme yetenekleri ile bilinmektedir (Sasa vd, 2020). Bunların nispi bileşimi türlere ve büyüme koşullarına bağlıdır. Kuru biyokütle ağırlıklarına göre ise %9-50 protein ve %7-50 karbonhidrat, %7-50 yağ içerebilmektedir. En önemli mikroalg türleri *Isochrysis, Dunaliella, Chaetoceros, Chlorella* ve *Spirulina*'dır (Nale, 2021). *Chlorella vulgaris, Arthrospira platensis, Haematococcus pluvialis* ve *Dunaliella salina* gibi bazı mikroalgler esas olarak gıda, yem ve nutrasötik sektörlerinde pazarlanmaktadır. Protein, karotenoidler, özellikle omega-6 ve omega-3 lipitleri üretme potansiyellerine dayanarak, hayvan yemi ve su ürünleri yetiştiriciliği, protein ve kozmetik gibi birçok pazarda yer alabilirler (Molino vd, 2018). *C. vulgaris* ve *A. platensis* gibi türler, US FDA (Food and Drug Administration) ve EFSA (European Food Safety Authority) tarafından güvenli olarak kabul edilmiştir. *C. vulgaris* ve *A. platensis*, vitamin, esansiyel amino asit ve çoklu doymamış yağ asitleri içeriği nedeniyle nutrasötik sektörde en yaygın olarak bilinen ve kullanılan mikroalglerdir. Ayrıca sakız, şeker ve bazı ürünlerde boya maddesi olarak kullanılmaktadır. *Spiruluna* piyasada hap, tablet, kapsül, toz ve jel formlarında bulunduğu gibi *Spiruluna* sirkesi, sandoloz sakızı olarak da ticari olarak satışa sunulmaktadır. Aynı zamanda *S. platensis*'in unlu mamuller, süt ürünleri, emülsiyon et ürünleri ve tatlılar gibi gıda sanayinin birçok dalında kullanılma potansiyeli de mevcuttur (Güler vd, 2021). Bunların yanı sıra Kozmetik sektöründe yaygın olarak kullanılan mikroalgler'den *C. vulgaris*, yaşlanma karşıtı özelliklere sahip bir ajan olarak kolajen sentezi için kullanılırken, karotenoid içerikleri nedeniyle renklendirici maddeler olarak ve UV koruması için *D. salina* ve *H. pluvialis* tercih edilmektedir (Molino vd, 2018).Uzun yıllardır bir mikro alg olan *Spirulina platensis* (*S. platensis*) diyet takviyesi olarak yaygın bir şekilde kullanılmaktadır (Kapoor ve Mehta, 1993). *S. platensis*, filamentli bir siyanobakteridir ve çok hücreli ipliksi yapısı ile bilinmektedir. Bu organizmanın özelliklerinden biri de art arda sıralanmış silindirik trikomların heliks şeklinde dizilmesidir. *S. platensis*, yüksek oranda vitamin, mineral ve diğer besin bileşenlerini sağlamaktadır. Bu organizma, insanlarda metabolik aktiviteyi artırıcı etkilerinin yanı sıra, yüksek oranda protein içeriğine sahiptir ve yapısındaki proteinlerin %95'i sindirilebilir özelliktedir ve özellikle lizin, valin ve izolösin gibi esansiyel amino asitleri içerir (Suna, 2020; Akça, 2020). *Spirulina*, toksisite riski taşımayan ve anemi, tümör büyümesi ve yetersiz beslenme gibi durumlarda mükemmel bir gıda kaynağı

olarak da değerlendirilmektedir (Saranraj ve Sivasakthi, 2014). Son zamanlarda, *Spirulina*'nın terapötik etkileri daha fazla önem kazanmıştır. Özellikle ağır metallerin neden olduğu kolesterol ve nefrotoksisitenin azaltılması, antikanser özellikleri, radyasyona karşı koruma sağlama ve bağışıklık sisteminin güçlendirilmesi gibi yönleri üzerinde araştırmalar yoğunlaşmıştır. Bununla birlikte, *Spirulina*'nın antiviral, antibakteriyel, antifungal ve antiparaziter aktiviteler gibi çeşitli biyolojik fonksiyonlara da sahip olduğu belirtilmektedir (El-Baz vd., 2013). Tüm bu yararlı etkilerinden dolayı gıda endüstrisinde de değerlendirilmesi mümkün olabilmekte ve farklı ürün gruplarına yönelik çalışmalar sürdürülmektedir.*S. platensis*'in gıda endüstrisindeki uygulamalarından biri olarak, biyoaktif bileşikler sağlamak amacıyla peynir gibi fermente ürünlerin zenginleştirilmesinde kullanılması söz konusu olabilmektedir. Bu durumda starter kültürlerin *S. platensis*'in antimikrobiyal etkisine karşın nasıl bir tavır gösterdikleri sorgulanması gereken bir husus olarak ön plana çıkmaktadır.Bu çalışmada, laktik asit bakterilerinin (LAB) büyümesini teşvik eden etkilerinin aksine, *Spirulina platensis*'in kuru ve metanol ekstraktlarının farklı konsantrasyonlarının (2.5 mg/ml, 5 mg/ml, 7.5 mg/ml ve 10 mg/ml) peynir üretiminde kullanılan starter kültürler (*Lactococcus lactis subsp. cremoris, Lactococcus lactis subsp. lactis* -R-704) üzerindeki antimikrobiyal etkisinin araştırılması amaçlanmıştır.

1. ARAŞTIRMA ve BULGULAR

1.1. MATERYAL

Bu çalışmada kullanılan *Spirulina platensis*, Çukurova Üniversitesi Su Ürünleri Fakültesi'nden kuru olarak sağlanırken, starter kültür olarak kullanılan *Lactococcus lactis subsp. cremoris, Lactococcus lactis subsp. lactis* -R-704 suşları Ch. Hansen's firmasından temin edilmiştir. Ayrıca, çalışmada pozitif kontrol olarak kullanılan antibakteriyel kanamisin Çukurova Üniversitesi Gıda Mühendisliği bölümü mikrobiyoloji laboratuvarından temin edilmiştir.

1.2. YÖNTEM

Spirulina platensis'in kuru formu ve metanol ekstraktının 4 farklı konsantrasyonu (2.5 mg/ml, 5 mg/ml, 7.5 mg/ml ve 10 mg/ml) *L. lactis subsp. cremoris* ve *L. lactis subsp. lactis* üzerindeki antimikrobiyal etkisinin araştırılmasında kullanılmış ve kuyucuk agar difüzyon yöntemi ile çalışılmıştır.

1.2.1. Starter Kültürün Laktik Asit Bakterilerinin Aktive Edilmesi

Lactococcus lactis subsp. *cremoris* ve *Lactococcus lactis* subsp. *lactis* (R-704) suşları 121ºC'de 15 dakika sterilize edilen Tryptic Soy Broth besiyerine steril koşullarda ilave edilmiş ve 48 saat 30ºC'de inkübe edilmiştir.

1.2.2. Spirulina platensis Preparatlarının ve Ekstraklarının Hazırlanması

Spirulina platensis'in farklı konsantrasyonları (2.5 mg/ml, 5 mg/ml, 7.5 mg/ml ve 10 mg/ml) %75 metanol içinde çözülmüş ve oda sıcaklığında karanlık ortamda 24 saat bekletilmiştir. Elde edilen preparatların (metanol + *S. platensis*) pH değerleri saptanmıştır. 7 g kurutulmuş *S. platensis* 105 ml çözücü (%85 metanol) içinde karıştırılarak oda sıcaklığında 5 saat bekletilmiş ve 15 dakika sonikasyon işlemi uygulanarak hazırlanmıştır. Daha sonra Whatman filtre kağıdından süzülmüştür. Solüsyon içerisindeki çözücü, basınç altında Rotary Evaporatör ile buharlaştırılmış ve elde edilen kalıntı (ham ekstrakt) hava geçirmez şişelerde -20° C'de saklanmıştır. Elde edilen ekstraktlar (2.5 mg/ml, 5 mg/ml, 7.5 mg/ml ve 10 mg/ml) farklı konsantrasyonlarda metanol içinde çözülmüştür ve pH değerleri ölçülerek kullanılmıştır.

Agar Difüzyon Yöntemi ile *Spirulina platensis*'in Lactococcus lactis ssp. *lactis* ve Lactococcus lactis ssp. *cremoris* Üzerine Etkinliğinin İncelenmesi

M17 Agar besiyeri kalınlığı 4mm olacak şekilde 90 mm çaplı plastik petrilerde hazırlanmıştır. Daha sonra canlandırılan starter kültürlerden 0.5 McFarland'a (yaklaşık 10^8 süspansiyon/ml) ayarlanmış bakteri süspansiyonlarından 100 µL petriye eklenmiş ve yayma ekim yöntemi ile ekimleri yapılmıştır. Agar yüzeyi kuruduktan sonra hazırlanmış petrilere 3 kuyucuk olacak şekilde agar delici (corkborer) ile 6 mm çaplı standart kuyucuklar açılmıştır. Her bir kuyucuğa 50 µl steril su (Negatif kontrol), antibakteriyel (0/015mg/ml kanamycin;Pozitif kontrol) ve *S. platensis*'in hem metanol solüsyonu hem de kuru formundaki farklı konsantrasyonda hazırlanmış preparatları koyulmuştur. Daha sonra ekim yapılan petriler aerobik koşullar altında 48 saat boyunca 37 ° C'de inkübe edilmiştir.

BULGULAR

Araştırmada kullanılan *S. platensis* kuru ve metanol ekstrakt çözeltilerinin dört farklı konsantrasyonda, test mikroorganizması olarak kullanılan laktik asit bakterileri (*L. lactis subsp. cremoris* ve *L. lactis subsp. lactis)* üzerine antimikrobiyal etkisinin 5 tekerrürlü çalışmasının ortalama sonuçları Çizelge 1 ve 2'de verilmiştir.

Çizelge 1. S. platensis'in kuru formunun L. lactis subsp. cremoris ve L. lactis subsp. lactis üzerine etkisinin 5 tekerrürlü çalışmasının ortalama sonuçları

	***S. platensis* Konsantrasyonu**					
Test mikroorganizması olarak kullanılan LAB	2.5mg/ml	5mg/ml	7.5mg/ml	10mg/ml	**Kanamisin (15 mg/ml)**	**Steril Su**
	Zon çapları (mm)					
L. lactis subsp. cremoris* ve *L. lactis subsp. lactis	--	--	--	--	23.00 mm	--

Çizelge 2. S. platensis'in metanol ekstraktının L. Lactis subsp. cremoris ve L. Lactis subsp. lactis üzerine etkisinin 5 tekerrürlü çalışmasının ortalama sonuçları

1	***S. platensis* Konsantrasyonu**					
Test mikroorganizması olarak kullanılan LAB	2.5mg/ml	5mg/ml	7.5mg/ml	10mg/ml	**Kanamisin (15 mg/ml)**	**Steril Su**
	Zon çapları (mm)					
L. lactis subsp. cremoris* ve *L. lactis subsp. lactis	--	--	--	--	22.20 mm	--

Çalışmanın *in vitro* koşullarda gerçekleştirilen 5 tekrarı sonucunda, *S. platensis*'in kuru formu ve metanol ekstraktının incelenen tüm konsantrasyonlarında peynir starter bakterileri üzerinde herhangi bir antibakteriyel etkisi görülmemiştir.Danielsen ve Wind (2003) *Lactobacillus* spp. türlerinin çeşitli antimikrobiyal ajanlara karşı duyarlılık düzeylerini belirlemek için yaptıkları çalışmada, bazı *Lactobacillus* suşlarının basitrasin, sefoksitin, siprofloksasin, fusidik asit, kanamisin, gentamisin, metronidazol, nitrofurantoin, norfloksasin, streptomisin, sülfadiazin, teikoplanin, trimetoprim/sülfametoksazol ve vankomisine karşı yüksek doğal dirence sahip olduğunu göstermişlerdir.

Kumar vd. (2011) tarafından yapılan çalışmada, *S. platensis*'in metanol ve aseton ekstraktlarının *Staphylococcus aureus* ve *Salmonella* Typhimurium'a karşı antibakteriyel etkisi incelenmiştir.

Çalışma sonunda, farklı konsantrasyonlarda (250 ppm'den 7000 ppm'e kadar) çalışılan ekstraktların bakterilerin üremesini inhibe ettiğini göstermişler. Ayrıca, *S. platensis* ekstraktlarının antibakteriyel ajan olarak kullanılabilecek aktif maddeleri ve kimyasal bileşimini belirlemek amacıyla gaz kromatografi kütle spektrometresi (GC-MS) kullanarak yaptıkları analizlerde, mevcut maksimum bileşik miktarının %42.11'lik oranda Eikosan adlı bir yağ asidi olduğu belirlenmiş ve bu yağ asidinin de antibakteriyel aktiviteden sorumlu olduğu tespit edilmiştir. Mazinani vd. (2015) tarafından yapılan çalışmada, soğutulmuş depolama sırasında *Lactobacillus acidophilus* içeren peynir üzerinde toz halindeki *S. platensis*'in etkisi incelenmiştir. Çalışma sonunda, peynirlerin depolanması sırasında *S. platensis*'in *L. acidophilus*'un gelişimini stimüle ettiği gösterilmiştir.Abd El-Monem vd. (2018) tarafında yapılan çalışmada, *S. platensis*'in antimikrobiyal aktivitesi %70'lik metanol, etanol ve aseton içerisinde farklı pH değerlerinde (8.0, 9.0, 10.0, 11.0 ve 12.0) hazırlanarak bazı patojen bakterilere karşı test edilmiştir. Çalışmanın sonuçlarına göre, *Staphylococcus aureus* NCTC-7447'nin maksimum inhibisyonu aseton ekstraktında pH 8 ve 10'da gözlenirken, *E. coli* NCTC-10418 için pH 8'de olduğu gösterilmiştir. Metanol ekstresi *S. aureus* NCTC-7447 üzerine pH 8'de maksimum 20.0 mm inhibisyon gösterirken, pH 8'de etanol ekstresi ile 17.00 mm olarak rapor edilmiştir.

SONUÇ

Yapılan çalışmalara bakıldığında; *Spirulina platensis*'in farklı miktarlarda çeşitli alkol ekstraktları ve pH'larda patojen bazı bakteriler üzerine antibakteriyel etkileri gösterilmiş fakat starter kültür üzerine etkileri ya kültür bakterilerini stimüle ettiği ya da herhangi bir pozitif ve negatif etkiyle karşılaşılmadıkları şeklinde sonuçlarla karşılaşılmıştır. Bu çalışmada, kuru formda *S. platensis* ile metanol ekstraktlarının çalışılan tüm konsantrasyonlarında test edilen peynir starterleri üzerinde etkili bir antibakteriyel aktivite göstermediği belirlenmiştir. Dolayısıyla, özellikle mikroalglerden biri olan *S. platensis*'in, fermente süt ürünlerinde biyoaktif bileşikler sağlamak amacıyla kullanılabileceği görülmüştür.

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BİR CATERİNG FİRMASINDAKİ ÇALIŞANLARIN EL HİJYENİ AÇISINDAN DEĞERLENDİRİLMESİ

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Özet

El hijyeni, özellikle gıda sektöründe faaliyet gösteren firmalar için hayati bir öneme sahiptir. Bu sektörde çalışanların el hijyeninin yetersiz olması, potansiyel gıda kaynaklı hastalıkların yayılmasına ve müşteri güveninin zedelenmesine neden olabilir. Günümüzde gelişmiş endüstrilerden biri olan catering sektörü ve bu firmaların sunduğu yemek hizmetinin geniş kitlelere ulaşması, gıda hijyeninin özenle ele alınmasını gerektirmektedir. Ancak, tüketici sayısının arttığı ve servis süresinin kısıtlı olduğu durumlarda, catering firmaları gıda hijyenini göz ardı edebilmektedir. Her ne kadar catering çalışanları, gıda hijyeni konusunda uzmanlardan eğitim almış olsalar da catering sektöründeki gıda zehirlenmesi vakalarının çoğu personelin el hijyeni hataları ile ilişkilendirilmektedir. Bu çalışmada, Adana'da faaliyet gösteren bir catering firmasının çalışanlarının el hijyeni uygulamaları değerlendirilmiştir. Bu değerlendirmede, catering çalışanlarının eldivenli ve çıplak ellerinden alınan örneklerin mikrobiyal florası incelenmiştir. Bu amaçla, çalışmada, rastgele seçilen 2 catering çalışanının eldivenli ve çıplak ellerinden sürüntü yöntemiyle örnekler alınmıştır. Bu örnekler, toplam aerobik mezofilik bakteri yükü, koliform ve *E. coli* ile *Salmonella* spp., *Staphylococcus aureus* ve *Listeria* spp. açısından değerlendirilmiştir. Sonuç olarak, eldivenli elin aerobik mezofilik bakteri yükü ($82x10^4$ kob/cm^2), çıplak elin aerobik mezofilik bakteri yükünden ($50x10^3$ kob/cm^2) daha yüksek bulunmuştur. Koliform ve *E. coli* açısından incelendiğinde, eldivenli elin yüksek kontaminasyon gösterdiği (>1100 EMS/cm^2), çıplak elin ise düşük kontaminasyonda olduğu (<3 EMS/cm^2) belirlenmiştir. Örneklerin hiçbirinde *Salmonella* spp., *Staphylococcus aureus* ve *Listeria* spp. izole edilememiştir. Catering sektöründe çalışanların el hijyeninin değerlendirildiği bu çalışmada el hijyenindeki yetersizliğin, beklenenin aksine özellikle eldivenli ellerde daha belirgin olduğu görülmüş, bu da hijyen açısından eldiven kullanımının daha dikkat edilmesi gereken bir husus olduğunu göstermiştir. Sonuç olarak, eldiven kullanımı

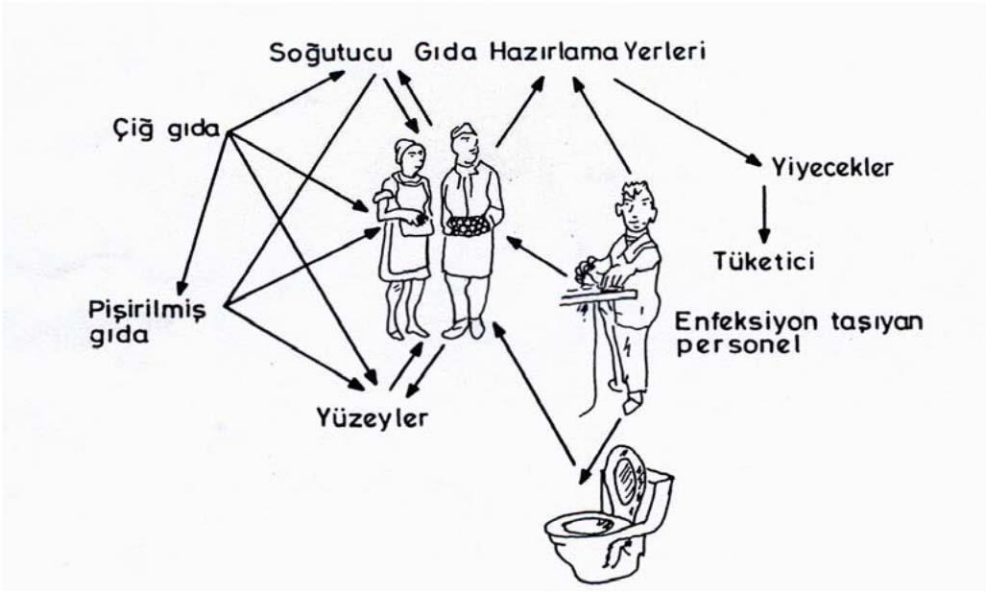
kontrol edilmediği takdirde potansiyel mikrobiyal kontaminasyon riskinin daha da artması muhtemel görünmektedir.
Anahtar Kelimeler: El hijyeni, Catering sektörü, Gıda güvenliği, Mikrobiyal kontaminasyon, *E. coli*

EVALUATION OF EMPLOYEES IN A CATERING COMPANY IN TERMS OF HAND HYGIENE

Abstract
Hand hygiene is of vital importance, especially for companies operating in the food industry. Inadequate hand hygiene of employees in this sector can lead to the spread of potential foodborne diseases and damage customer confidence. The catering industry, which is one of the developed industries today, and the fact that the food services offered by these industries reach large masses requires that food hygiene be handled carefully. However, in cases where the number of consumers increases and service time is limited, catering industries could ignore food hygiene. Even though catering employees receive training in food hygiene from hygiene experts, most cases of food poisoning in the catering sector are associated with personal hand hygiene errors. In this study, hand hygiene practices of employees of a catering company operating in Adana were evaluated. In this evaluation, the microbial flora of samples taken from the gloved and bare hands of catering employees were examined. For this purpose, in the study, samples were taken by swab method from the gloved and bare hands of 2 randomly selected catering employees. These samples were evaluated for total aerobic mesophilic bacterial load, coliform and *E. coli*, as well as *Salmonella* spp., *Staphylococcus aureus* and *Listeria* spp. As a result, the microbial load of gloved hands ($82x10^4$ cfu/cm^2) was found to be higher than that of bare hands ($50x10^3$ cfu/cm^2). When examined for coliforms and *E. coli*, it was determined that gloved hands showed high contamination (>1100 MPN/cm^2), while bare hands had low contamination (<3 MPN/cm^2). *Salmonella* spp, *Staphylococcus aureus and Listeria* spp could not be isolated in any of the samples. In this study evaluating hand hygiene among personnel in the catering industry, it was observed that inadequacies in hand hygiene were more pronounced, contrary to expectations, particularly in gloved hands. This indicates that the use of gloves requires more attention in terms of hygiene. Consequently, in the absence of controlled glove usage, the potential risk of microbial contamination is likely to increase further.
Keywords: Hand hygiene, Catering industry, Food safety, Microbial contamination, *E. coli*

GİRİŞ

Sanayileşme ile beraber ev dışında yemek yeme zorunluluğu son yıllarda artış göstermektedir. Artan taleple birlikte, toplu yiyecek hizmeti veren "catering" işletmelerinin sayısı ve verdikleri hizmet alanı da genişlemektedir (Bilgin ve Erkan, 2008). Köken itibari ile yabancı bir sözcük olan "catering", yiyecek içecek hazırlama ve sunumu anlamına gelmektedir. Türk Dil Kurumu Yabancı Kelimeler Kurulu'nun "catering" sözcüğüne önerdiği Türkçe karşılık ise "yemek hizmeti'dir. Catering işletmeleri, sosyal amaçlı (evlilik törenleri, yıl dönümleri, doğum günleri, mezuniyet partileri gibi), iş amaçlı (toplantı ve kongreler, açılış törenleri ve kokteyller gibi) organizasyonları, endüstriyel tesisler, okul, hastane ve ulaşım birimlerinde talebe bağlı olarak toplu yemek hizmeti sunan ve ziyafet organizasyonlarını düzenleyen işletmelerdir (Altun Karadeniz ve Çetin, 2007). Dünyada catering sisteminin kökü milattan 4 bin yıl öncesine, Çin'e kadar uzanmaktadır. Catering sisteminin, Çin'in yanı sıra Antik Roma, Yunanistan ve Mısır'da da askerler için ve ticaret yollarında kullanıldığı görülmektedir. Orta Çağ'da catering sadece askerler ve ticaretle uğraşanlar için değil ayrıca maddi yönden varlıklı insanlar için eğlence sektöründe de kullanılmaya başlanmıştır. Almanya'nın belirli kurallar koyarak oluşturduğu catering sistemi 14. ve 15. Yüzyıllarda tüm Avrupa'da popülerleşmeye başlamıştır (Burgess, 2013). Ülkemizde ise hazır yemek sektörü ilk kez Osmanlı saray mutfaklarından yeniçeri ocağına devşirilmiştir. Son 20 yılda önce fabrika ve işyerlerine, sonra yemek sektörüne geçiş yapmıştır. 1960'lı yıllarda büyük şehirlerdeki fabrikaların yemekhane kurması, 1970-80'lerde tabldot firmalarının açılması ve 1990'larda yabancı sermaye yatırımlarıyla büyüyen hazır yemek sektörü, ülke ekonomisi ve turizmi açısından büyük bir öneme sahip olmuştur (Öndoğan, 2010). Tüketicinin sağlığının korunması açısından, çok sayıda insanın beslenme ihtiyacının karşılandığı toplu beslenme sistemleri hijyenik olmak zorundadır (Dündar vd., 2000). Gıda hijyeninin amacı gıdaların kalitesini olumsuz yönde etkileyecek faktörlerin ortadan kaldırılması ya da en aza indirilmesidir (Elverir ve Gönülalan, 2010). Gıda, üretimden tüketiciye ulaşana kadar olan süreçte, çeşitli kaynaklardan bulaşan mikroorganizmalarla kirlenebilmekte ve uygun koşullarda bu mikroorganizmalar hızla çoğalarak duyusal kalitenin bozulmasına, ekonomik kayıplara ve gıda kaynaklı hastalıkların ortaya çıkmasına neden olabilmektedir. Bulaşma kaynakları arasında, gıdaların işlenmesinde kullanılan kesme tahtaları, dilimleyici, karıştırıcı ve öğütücüler, işletme suyu, ortam havası, uygun olmayan koşullarda bekletilen çöpler, haşereler, kemiriciler ve hayvanların yer aldığı birçok faktör yer almaktadır (Bilici, 2008). Mikroorganizmaların gıdalara bulaşma yolları Şekil 1'de gösterilmiştir.



Şekil 9. Mikroorganizmaların Gıdalara Bulaşma Yolları (Van Schothorst, 1999).

Bulaşı kaynaklarının en tehlikeli olanları patojen mikroorganizmalardır. Patojenler, gıdalara bulaştıktan sonraki uygun koşul ve sürelerde üreyerek ya da gıdada çoğalmadan bulunmaları halinde bile hastalık yapmaktadırlar (Bilici, 2008). *Salmonella, E. coli, L. monocytogenes* ve *Staphylococcus aureus* gibi bakteriler en sık karşılaşılan gıda zehirlenmesine neden olan bakteriler arasında yer alırlar (Anonymous, 2011-a). Mikroorganizmaların kontaminasyonu ve yayılması ile bunların olumsuz etkilerinin önlenmesinde temizlik ve dezenfeksiyonun büyük bir rolü bulunmaktadır (Şener ve Temiz, 2004). Temizlik, bir yüzey üzerinde mekanik ya da kimyasal etki gösteren ve estetik yönden görünümü bozan her türlü kirin ortadan uzaklaştırılmasıdır (Bilici, 2008). Dezenfeksiyon ise; temizlik aşamasından sonra ortamdaki ürüne kontaminasyon kaynağı olabilecek mikroorganizmaların tümünün öldürülmesi ya da en düşük düzeye indirilmesidir. Bu işlemde kullanılan maddelere dezenfektan denilmektedir (Anonymous, 2011-b). Mutfak, araç-gereç ve çalışma yüzeyleri yeterli derecede temiz olmadığında, gıdalar patojenlerle tekrar kontamine olabilmektedir. Riski minimuma indirmek için yüksek riskli gruplardaki araç-gereç (yiyeceklerle direk teması olan araç-gereç ve yüzeyler) ve çalışma yüzeylerinin temizliğinde sıcak su, deterjan ve dezenfektanların kullanılması gerekirken, düşük riskli gruplardaki (yiyeceklerle direk temas etmeyen duvar, raf vb. yüzeyler) araç-gereç ve yüzey temizliğinde ise sıcak su ve deterjan kullanılması yeterli olabilmektedir (Göbel, 2008). Ama bazı işletmelerde gıda ile temas eden yüksek riskli araç-gereç ve yüksek riskli yüzey temizliğinde genellikle düşük riskli gruplardaki araç-gereç ve yüzey temizliğinde kullanılan sıvı deterjanların kullanıldığı saptanmıştır (Çalışkan, 2006, Çelik ve Var, 2017).

Hatalı dezenfeksiyonun ve birçok gıda zehirlenmesinin ana nedeni, personelin dikkatsizliği ve bu konuda bilgi yetersizliğidir (Demirel, 2009). Hijyen uygulamaları konusundaki eğitimler; gıda bulaşmalarının önlenmesi için personelin gıda işletmelerindeki rolünün önemini anlamaları ve sorumluluklarının farkına varmaları açısından son derece önemlidir (Akbulut, 2010). İnsanın boğaz, burun, el, deri, bağırsak ve dışkısı bakterilerle yüklüdür (Bilici vd. 2006). Bu kaynağın bulaşma aracı olan en önemli organı ellerdir. El temizliği kişisel hijyenin en önemli adımlarından birisi olup, bulaşmış ellerle gıdaların ve servis malzemesinin kirletilmesi, gıda zehirlenmelerinin en önemli nedenini oluşturmaktadır (Demirel, 2009).Gıda kaynaklı hastalıkların bulaşmasında en fazla katkıda bulunan faktörler; çıplak elle temas, işleme ve hazırlama ekipmanlarının yetersiz temizlenmesi, enfekte veya asemptomatik kişiler tarafından gıdaların işlenmesidir. Gıdaların ellerle kontaminasyonu, salgın araştırmalarında belirlenen en önemli faktördür (CDC, 2006). Ellerde çok sayıda bulunabilen düşük enfektif dozlara sahip gıda kaynaklı patojenler gıdalara ve gıda dışındaki temas yüzeylerine kolayca aktarılabilmektedir (Todd vd., 2008a; Todd vd., 2008b, Todd vd., 2010). Eller kontamine veya kirli olduğunda, geçici patojenlerin elden tüketime hazır gıdalara bulaşmasını önlemek için etkili el hijyeni uygulamalarının yeterli olmayacağı Amerika Birleşik Devletleri Gıda ve İlaç Dairesi tarafından bildirilmektedir (FDA, 2017). Özellikle tüketime hazır gıdalara çıplak elle temasın önlenmesi ve bu gıda maddelerini kullanırken uygun mutfak eşyaları, bezler, tek kullanımlık eldivenler veya maşa gibi ekipmanların kullanılması gerektiği önerilmektedir (FDA, 2017). Gıda işletmelerinde eldiven kullanılmasının amacı, gıdanın fiziksel, kimyasal ve mikrobiyolojik kontaminasyonunu en aza indirmektir (Green vd., 2007). Çalışanlar eğitilmediğinde ve eldiven kullanımı uygun şekilde denetlenmediğinde hem gıda çalışanları hem de gıda güvenliği yöneticileri için yanlış bir güvenlik hissi sunmakta ve çapraz kontaminasyona yol açarak daha yüksek riskli durumlara neden olmaktadır (Todd vd., 2010; Valero vd., 2016). Gıda işletmelerinde el yıkama ve eldiven kullanımının yaygınlığı üzerine yapılan araştırmalarda, el hijyeni uygulamalarının gerektiği kadar sık gerçekleşmediği bildirilmektedir. Örneğin, personellerin gerektiğinde ellerini yıkamadıkları ve/veya gerektiğinde eldiven giymedikleri, çiğ ete dokunduktan sonra her zaman ellerini yıkamadıkları ve çiğ ete dokunduktan sonra her zaman eldivenlerini değiştirmedikleri saptanmıştır (Clayton vd. 2002; Green ve Selman, 2005). Uygun eldiven kullanımı, patojenlerin elden gıdaya transferini azalttığı, ancak eldiven kullanımının yanlış bir hijyen hissi yaratarak daha az el yıkama uygulamalarına yol açabildiği de bildirilmiştir (Green vd., 2007).

Bu çalışma; Adana'da catering hizmeti veren bir firmanın, halk sağlığını tehdit eden gıda kaynaklı mikroorganizmalara karşı, çalışan personelin el hijyeni uygulamalarını incelemek amacıyla kurgulanmıştır.

2. ARAŞTIRMA ve BULGULAR

2.1. MATERYAL

Bu çalışmada, Adana'da faaliyet gösteren bir catering firmasının çalışanlarının el hijyeni uygulamalarını değerlendirmek amacıyla, rastgele seçilen 2 catering çalışanının eldivenli ve çıplak ellerinden sürüntü yöntemiyle alınan örnekler materyali oluşturmuştur.

2.2. YÖNTEM

2.2.1. Çalışanların Ellerinden Sürüntü Yöntemiyle Numune Alınması

Bu çalışmada catering firmasından rastgele seçilen 2 personelin eldivenli ve çıplak elinden örnek almak için sürüntü yöntemi kullanılmıştır. Bu yöntemde, steril eküvyon çubuğu aseptik koşullarda tüpünden çıkarılarak uçtaki pamuk kısma değişik eğimler verdirilerek çalışanların eldivenli ve eldivensiz ellerine kuvvetlice bastırılmıştır. Bu sayede ellerdeki mikroorganizmaların pamuk ucunun tamamına geçmesi sağlanmıştır. Eküvyon çubuğu daha sonra hiçbir yere temas ettirilmeden içinde 5 ml dilüsyon sıvısı içeren tüpe yerleştirilerek tüp hızla laboratuvara ekim için götürülmüştür. Daha sonra aranan toplam aerobik mezofilik bakteri için Nutrient Agar, *E. coli* ve Koliform için Fluorocult® Lauryl Sulfate Broth, *Salmonella* spp. için Selenite Cystine Broth, Rappaport Vassiliadis Broth, Hektoen Enteric Agar, Xylose Lysine Deoxycholate Agar, *Staphylococcus aureus* için Egg Yolk Tellurite Emulsion içeren Baird Parker Agar, *Listeria* spp. için Buffered Listeria Enrichment Broth ve Palcam Agar besiyerleri kullanılarak ekim işlemleri gerçekleştirilmiştir (Anonymous, 2011-c).

2.3. BULGULAR

Rastgele seçilen 2 çalışanın eldivenli ve çıplak ellerinden sürüntü yöntemiyle alınan örnekler, toplam aerobik mezofilik bakteri yükü, koliform ve *E. coli* ile *Salmonella* spp., *Staphylococcus aureus* ve *Listeria* spp. açısından değerlendirilmiştir. Sonuç olarak, örneklerin hiçbirinde *Salmonella* spp., *Staphylococcus aureus* ve *Listeria* spp. izole edilememiştir.Aerobik mezofilik bakteri yükü açısından değerlendirildiğinde, iki çalışanın eldivenli elinin aerobik mezofilik bakteri yükünün ortalaması ($82x10^4$ kob/cm^2), çıplak elin aerobik mezofilik bakteri yükünün ortalamasından ($50x10^3$ kob/cm^2) daha yüksek bulunmuştur (Çizelge 1).Koliform ve *E. coli* açısından incelendiğinde, eldivenli ellerin yüksek kontaminasyon gösterdiği (>1100 EMS/cm^2), çıplak ellerin ise düşük kontaminasyonda olduğu (<3 EMS/cm^2) belirlenmiştir (Çizelge 1).

Çizelge 1. Sürüntü yöntemiyle iki çalışanın elinden alınan örneklerin sonuçlarının ortalamaları

	Alınan Örnekler	
Çalışılan Mikroorganizmalar	**Eldivenli ellerden alınan örneklerdeki sonuçlar**	**Çıplak ellerden alınan örneklerdeki sonuçlar**
Toplam Aerobik Mezofilik Bakteri (kob/cm^2)	82x10^4	50x10^3
Koliform (EMS/cm^2)	>1100	< 3
E. coli (EMS /cm^2)	>1100	< 3
Salmonella spp.	*TE	*TE
Staphylococcus aureus (kob/cm^2)	*TE	*TE
Listeria spp.	*TE	*TE

* TE: Tespit Edilemedi

Gıda güvenliği, tüketicilerin sağlığına zarar verebilecek tehlikelerin gıdalardan uzaklaştırılması ve çapraz bulaşmanın önlenmesi açısından kritik öneme sahiptir. Bu nedenle işletmelerde uygulanan hijyen gerekliliklerinin sorgulanması olası riskleri ortaya koyabilecektir. Hijyen gerekliliklerinden en önemlilerden birisi de personel ve daha da önemlisi el hijyenidir. El hijyeninde dikkat edilmesi gereken koşullardan biri ellerin uygun yöntemle yıkanmasıysa diğeri de yıkamanın yetersiz kalabileceği durumlarda eldiven kullanımıdır. Ancak yapılan çalışmalar eldiven kullanımındaki hataların gıda güvenliğini daha çok tehdit edebildiğini göstermektedir. Valero vd. (2016), bu konuyla ilgili yaptıkları çalışmada eldiven kullanmamanın, eldivenlerin düzensiz değişimi ve yanlış kullanımının çapraz kontaminasyonu artırabileceğini ve gıda zehirlenmesinin ana nedenlerinden biri olabileceğini bildirmişlerdir.Erdoğan ve Pamuk (2020) tarafından yapılan bir çalışmada, gıda endüstrisinde çalışanların eldivensiz elleri ve yüzeylerde yapılan mikrobiyolojik analizler, *Staphylococcus* spp. ve *Enterobacteriaceae* bakterileri ile kontaminasyonun yaygın olduğunu göstermektedir. İzolat sayıları dikkate alındığında, %52 oranda en yüksek kontaminasyonun gıda çalışanlarının ellerine ait olduğu tespit edilmiştir.

Eldiven kullanımının etkinliğini artırmak için eldiven değişiminden önce ve sonra ellerin yıkanmasının önemi de vurgulanmaktadır (Michaels vd., 2004). Yapılan bir çalışmada, Paulson (1996), eldiven takmadan önce eller yıkanmadığında *E. coli* sayısının arttığını (1 ve 3 saat sonra belirlendiğinde), ancak eller eldiven giymeden önce yıkandığında ise, 3 saatlik devamlı eldiven kullanımından sonra, mikroorganizma sayısında anlamlı bir artış olmadığını gözlemlemiştir.

Bu nedenle eldiven kullanımında, eldivenleri çıkardıktan sonra ve her eldiven değişiminde eldiven giymeden önce el yıkama işleminin gerçekleştirilmesi gerektiği vurgulanmaktadır. Eldiven kullanımında eldivenlerin bütünlüğünün korunması gerekliliği de oldukça önemlidir. Yapay tırnaklar ve takılar gibi faktörlerin eldivenlerin bütünlüğünü bozabileceği eldivenlerin yırtılmasına veya delinmesine yol açabileceği ve kontaminasyon kaynağı olabileceği belirtilmektedir (Gürel ve Taşçı, 2020). Tırnaklar ile ilgili yapılan bir çalışmada Dagnew vd. (2013), tırnaklarda antibiyotiklere dirençli *S. aureus* (%16) ve koagülaz negatif stafilokoklar (%33) tespit etmişler. Valero vd. (2016) yaptıkları çalışmada, eldivenlerin düzenli olarak değiştirilmesi gerektiğini ve kirli veya deforme olmuş eldivenlerin çıplak ellerden daha fazla kontaminasyon riski taşıdığını belirtmişlerdir.Perez-Rodriguez vd. (2006) yaptığı bir çalışmada, farklı gıdaların işlenmesi sırasında uzun süreli aynı eldiveni kullanmanın patojenlerin transfer riskini artırdığı bulunmuştur. Özellikle, *L. monocytogenes* gibi patojenlerin çiğ tavuktan pişmiş ete aktarılma riskinin bu şekilde arttığı tespit edilmiştir. Ancak, eldivenlerin düzenli olarak değiştirilmesinin ve kullanımının doğru şekilde yapılmasının bu riski azaltabileceği vurgulanmıştır.Birçok eldiven materyali aşırı nem birikmesine yol açmaktadır ve uzun süreli eldiven kullanımı da deride nem ve sıcaklık artışına neden olmaktadır. Bunun sonucu olarak da tırnakların içerisinde mikroorganizmaların birikmesine yol açarak mikrobiyal çoğalmayı teşvik edebileceği ve bu durumun çapraz kontaminasyon riskini artırabileceği vurgulanmaktadır. Bu durum aynı zamanda eldiven değiştirme işlemi sırasında da sorun yaratabilecek ve yine çapraz kontaminasyon riski söz konusu olabilecektir (Gürel ve Taşçı, 2020). Aynı zamanda eldiven kullanımının yanlış bir güvenlik duygusu yaratması ve çalışanların yeterince eğitilmemesi çapraz kontaminasyona sebep olabilecek daha yüksek riskli durumlara da yol açabilecektir (Todd vd., 2010).Bizim çalışmamızda da iki çalışanın elleri aerobik mezofilik bakteri, *E. coli* ve koliform bakteri açısından değerlendirildiğinde eldivenli ellerin yüksek kontaminasyon gösterdiği, çıplak ellerin ise düşük kontaminasyonda olduğu belirlenmiştir. Bu bağlamda, eldiven kullanımının gıda güvenliği üzerindeki etkilerini artırmak için çalışanların eldiven kullanımı konusunda yeterince eğitilmeleri ve bu önlemlerin doğru şekilde uygulanması, çapraz kontaminasyon riskini en aza indirmek için kritik öneme sahiptir.

3. SONUÇ

Catering sektöründe çalışanların el hijyeninin değerlendirildiği bu çalışmada el hijyenindeki yetersizliğin, beklenenin aksine özellikle eldivenli ellerde daha belirgin olduğu görülmüş, bu da eldiven kullanımına daha dikkat edilmesi gereken bir husus olduğunu göstermiştir. Sonuç olarak, eldiven kullanımı kontrol edilmediği takdirde potansiyel mikrobiyal kontaminasyon

riskinin artmasına neden olabilecektir. Bir üretim yerinde her türlü hijyen gereklilikleri yerine getirilse bile bir personeldeki hijyen eksikliği üretimi riske sokabilecektir. Bu açıdan araştırma yapılan catering firmasında gıda kaynaklı halk sağlığını tehdit eden mikrobiyal kontaminasyon riski değerlendirildiğinde, özellikle el hijyeni açısından işletmenin yetersiz olduğu gözlenmiştir.

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DİJİTAL İNSAN KAYNAKLARI YÖNETİMİ VE DİJİTAL PAZARLAMA YÖNETİMİ; YENİLİKÇİ İŞ BİRLİĞİ

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Özet
İşletmeler, dijitalleşmeden oldukça fazla etkilenmektedir ve bu etkiler bir işletmedeki iç ve dış paydaşların dahil olduğu tüm süreçler ile doğrudan ilişkilidir (Bajer vd., 2017). Dijitalleşmenin, müşterilerin satın alma davranışları (Kaya ve Okur, 2021), işletmelerin müşteri tercihleri, iş performansları üzerindeki etkileri (Uzkurt vd. 2022) ve işletmelerin iç süreçleri ve davranışları özellikle finansal açıdan nasıl etkilediği araştırılırken, insan kaynakları ile ilgili süreçlerin dijitalleşmesi ve bunun dijital pazarlama yönetimi ile olan ilişkisi çok fazla incelenmemiştir. İşletmelerin, dijitalleşmenin tüm kazanımlarından en iyi biçimde faydalanabilmeleri için tüm fonksiyonlarının bütünsel olarak dijitalleşmesi gerekmektedir. Pazarlamanın tarihsel gelişiminde müşteri odaklılığın modern dönemde oluşmaya başladığı görülmektedir. Modern pazarlama döneminde dijitalleşme ekonomik yapı üzerinde doğrudan etkiliyken, pazarlama üzerinde dolaylı olarak etkili olmuştur. Fakat internet teknolojilerinin gelişmesiyle günümüz dünyasında dijitalleşmenin doğrudan pazarlama üzerinde de etkili olduğu görülmektedir (Şengül, 2019). Dijital pazarlama literatürü incelendiğinde dijital pazarlama kanallarının müşteri ilişkileri, halkla ilişkiler ve insan kaynakları gibi departmanlarda kullanımının işletmeye sağlanacak toplam faydayı arttıracağı yönünde yaklaşımlar göze çarpmaktadır (Rocha vd., 2013). Dijital pazarlama tekniklerinin insan kaynakları alanında kullanımı, işe alım fonksiyonunda eylem alanının genişlemesine ve farklı kanalların kullanılmasına, dış müşteri ve iç müşteri etkileşiminin dijital kanallar aracılığıyla artmasına, çalışan performans ölçümünde daha etkin ve objektif dijital teknolojilerin kullanılmasına, marka yönetimi teknikleriyle işveren markası kavramının oluşturulmasına olanak tanımıştır (Mihalcea, 2017). Müşteri odaklı yaklaşımın içsel pazarlama anlayışı ile örgüt içinde benimsenmesi örgütsel bağlılık üzerinde olumlu katkılar sağlamıştır (Collins ve Payne, 1991). Bu bağlamda bu araştırmanın amacı dijitalleşmenin pazarlama yönetimi ve insan kaynakları yönetimi üzerindeki etkisini yenilikçi ve bütünsel bir yaklaşımla ele alarak literature teorik bir katkı sağlamaktır.
Anahtar Kelimeler: dijital pazarlama yönetimi, dijital insan kaynakları yönetimi, dijital dönüşüm

DIGITAL HUMAN RESOURCES MANAGEMENT AND DIGITAL MARKETING MANAGEMENT; INNOVATIVE COOPERATION

Abstract
Businesses are highly affected by digitalization, and these effects are directly related to all processes involving internal and external stakeholders in a business (Bajer, 2017). While investigating how digitalization affects customers' purchasing behavior (Kaya and Okur, 2021), businesses' customer preferences, its effects on business performance (Uzkurt vd., 2022), and how it affects an organization's internal processes and behaviors, especially financially, human resources The digitalization of processes related to digital marketing and its relationship with digital marketing management have not been examined much. To make the most of all the gains of digitalization, businesses must start dealing with the holistic digitalization of the entire business. It is seen that customer focus, one of the most important issues in the historical development of marketing, began to emerge in the modern period. In the modern marketing era, while digitalization has a direct impact on the economic structure, it has an indirect impact on marketing. However, with the development of internet technologies, it is seen that digitalization is also effective on direct marketing in today's world (Şengül, 2019). When the digital marketing literature is examined, approaches stand out that the use of digital marketing channels in departments such as customer relations, public relations and human resources will increase the total benefit to the business (Rocha et al., 2013). The use of digital marketing techniques in the field of human resources has enabled the expansion of the field of action and the use of different channels in the recruitment function, the increase of external and internal customer interaction through digital channels, the use of more effective and objective digital technologies in employee performance measurement, and the creation of the employer brand concept with brand management techniques. (Mihalcea, 2017). Adoption of the customer-oriented approach within the organization with the internal marketing approach has made positive contributions to organizational commitment (Collins and Payne, 1991). In this context, the aim of this research is to make a theoretical contribution to the literature by addressing the impact of digitalization on marketing management and human resources management with an innovative and holistic approach.
Keywords: digital marketing management, digital human resources management, digital transformation

GİRİŞ

İşletmelerin dijitalleşmesi, günümüz rekabetçi iş ortamında avantaj sağlamak ve başarılı olabilmeleri için kaçınılmaz bir gerekliliktir. Başka bir deyişle, günümüz işletmeleri için dijitalleşme bir seçenekten ziyade hayati bir gereklilik haline gelmiştir. Dijitalleşme, işletmelerin geleneksel iş modellerini, süreçlerini ve yönetim yaklaşımlarını dijital teknolojilerle dönüştürerek daha verimli, esnek ve müşteri odaklı bir yapıya geçiş yapmalarını ifade etmektedir. Özellikle günümüzde hızla değişen iş ortamlarında, dijitalleşme sayesinde işletmeler daha hızlı kararlar alabilir, müşteri taleplerine daha çabuk yanıt verebilir ve pazardaki trendlere daha çabuk adapte olabilirler. Ayrıca dijitalleşme, işletmelerin veri analitiği ve yapay zekâ gibi alanlardan da faydalanarak daha stratejik alanlarda bilgiye dayalı kararlar almasını sağlar. Bu nedenle, işletmelerin dijitalleşme sürecine yatırım yapmaları ve bu alanda sürekli olarak kendilerini güncellemeleri başarılı olabilmeleri için kritik önem kazanmaktadır. Dijitalleşme sürecinde işletmelerin önemli fonksiyonlarından olan pazarlama yönetimi ve insan kaynakları yönetimini bütünsel olarak ele alması gerekmektedir. Bu çalışmada bu iki fonksiyonunun dijitalleşmeden nasıl etkilendikleri ve yenilikçi, işbirlikçi yaklaşımları teorik olarak ele alınmıştır.

1. DİJİTAL İNSAN KAYNAKLARI YÖNETİMİ

İnsan kaynakları yönetimi, işletmelerin hedeflerine ulaşabilmesi için gerekli olan faaliyetleri gerçekleştirecek yeterli sayıda, kalifiye elemanın işe alımı, eğitimi, geliştirilmesi, motivasyonu ve değerlendirilmesi sürecidir (Aytaç, 1997). Başka bir tanıma göre, işletmeye çalışan tedariği sağlamasının (Bingöl, 2003) yanında işe alınan çalışanın eğitimi, geliştirilmesi, değerlendirilmesi ve işletmenin hedeflerine ulaşma doğrultusunda çalışanların yasalara da uyularak, etkin yönetilmesini sağlayan işlev ve çalışmaların tümüdür. Bu tanımlamalardan da anlaşılacağı üzere insan kaynakları yönetiminin başlıca fonksiyonu olarak işe alım gösterilirken, çalışanların değişen dünyaya uyum sağlayabilmeleri adına gerçekleştirilen diğer faaliyetler de insan kaynakları yönetiminin altında ele alınmaktadır. Dolayısıyla sürekli dijitalleşen ve teknolojinin önem kazandığı günümüz iş ortamında insan kaynaklarının dijitalleşmesi ve bu alana yatırım yapılması bir zorunluluk haline gelmiştir. İnsan kaynakları yönetiminin dijitalleşmesi süreci, adayın başvuru sürecinden başlamakta ve işletmedeki diğer çalışanların elde tutulmasına kadar giden birçok farklı alanda karşımıza çıkmaktadır. Özellikle de başvuran aday sayısının oldukça yüksek olduğu işletmelerde bu tür yeniliklerin kullanılması süreçlerin etkin ve verimli bir şekilde ilerlemesine katkı sağlamaktadır (Nivlouei, 2014). İnsan kaynakları yönetim süreçlerinin dijitalleştirilmesi, işletmelerin daha rekabetçi olmaları, çalışan

deneyimlerinin iyileştirilmesi ve işletme performansını artması beklenmektedir. Ancak bu süreçte güvenliğin ve gizliliğin korunması da önemlidir, bu yüzden dijitalleşme adımları dikkatlice planlanmalı ve uygulanmalıdır.

- Alım ve İşe Yerleştirme: Dijitalleşme, işe alım süreçlerini hızlandırır ve daha etkin hale getirir. Online başvuru formları, dijital CV değerlendirme sistemleri, video mülakatları gibi araçlar kullanılarak adaylar daha hızlı ve verimli bir şekilde değerlendirilebilir.
- Eğitim ve Gelişim: Dijital platformlar aracılığıyla çalışanlara çevrimiçi eğitimler sunulabilir. Bu eğitimler, çalışanların kariyerlerini geliştirmelerine ve yeni beceriler kazanmalarına olanak tanır.
- Performans Değerlendirme: Dijitalleşme, performans yönetimi süreçlerini otomatikleştirerek geri bildirimleri ve performans değerlendirmelerini daha objektif ve etkili hale getirir. Performans verileri, dijital platformlarda tutularak daha kolay erişilebilir hale gelir.
- Çalışan İlişkileri ve İletişim: İç iletişim araçları ve dijital platformlar, çalışanların birbirleriyle etkileşimini artırır ve şirket kültürünü güçlendirir. Ayrıca, uzaktan çalışma gibi esnek çalışma modellerini destekleyerek çalışan memnuniyetini artırabilir.
- İş Süreçlerinde Verimlilik: Otomatikleştirilmiş işlemler ve dijital platformlar, iş süreçlerinin daha verimli ve hatasız yürütülmesini sağlar. Bu da insan kaynakları departmanının daha stratejik görevlere odaklanmasına olanak tanır.

Elbette ki rekabet avantajı elde etmek isteyen işletmeler için yalnızca insan kaynakları yönetim alanının dijitalleşmesi yeterli olmayacaktır. İnsan kaynakları yönetimine ek olarak, işletmenin diğer fonksiyonlarının da özellikle pazarlama alanının bu değişime uyum sağlaması ve bu yönde stratejiler oluşturulması çok daha doğru olacaktır.

2. DİJİTAL PAZARLAMA YÖNETİMİ

Dijitalleşme, bilgi, belge ve dokümanların tümünün bilgi işlem teknolojileri kullanılarak dijital ortamlara aktarılması sürecini ifade eder. Bu yeni ortamlar, dijital olarak adlandırılır ve bilgilerin daha kolay erişilebilir ve işlenebilir hale gelmesini sağlar (Erkan, 2020). Teknolojinin hızla ilerlemesiyle birlikte dijitalleşme sürekli olarak artmaktadır. Bu dijital dönüşüm, işletmelerin pazarlama faaliyetleri aracılığıyla hedef kitlelerini etkileme ve onlara daha hızlı erişim sağlama kapasitesini artırmaktadır. Dijital pazarlama, işletmelerin belirledikleri hedeflerine internet, sosyal medya, web siteleri, e-postalar gibi iletişim araçlarını kullanarak ulaşmalarını sağlayan bir pazarlama stratejisidir (Karahasan, 2012). Çevrimiçi platformlarda

uygulanan dijital pazarlama işletmenin diğer fonksiyonlarıyla bütünsel olarak ele alındığında ilişki pazarlaması, işletme yönetimi ve insan kaynakları yönetimine katkı sağlamaktadır. Dijital pazarlama işletmelerle tüketicilerin etkileşimlerine de önemli katkılar sağlamıştır. Bunların en önemlileri şöyle sıralanabilir (Bala, 2018):

- İşletme ve müşteriler arası artık çift yönlü ilişki kurulabilmektedir.
- Müşterilerin 7/24 hizmet alabilme ve pek çok ürünü karşılaştırabilme imkanı bulunmaktadır.
- Tüketicilerin ürünlerle ilgili kendi aralarında çevrimiçi bilgi paylaşma imkanı bulunmaktadır.
- Tüketiciler ürünlere daha kolay ulaşmakta ve daha hızlı satın alabilmektedirler.

Pazarlamanın dijitalleşmeden yoğun şekilde etkilenmesi işletmelerde yeni çalışan rollerinin de ortaya çıkmasına neden olmaktadır. İçerik sorumlusu, veri bilimcisi, çok kanallı pazarlama sorumlusu bu rollerden sadece bir kaçıdır. Oluşan yeni roller, insan kaynakları yönetiminin işe alım, eğitim ve performans ölçümü gibi fonksiyonlarıyla da yakından ilgili olduğundan, insan kaynakları yönetiminin de dijitalleşmeye uyum sağlaması beklenmektedir. Dolayısıyla işletmelerin dijitalleşme fırsatlarından faydalanmak için tüm fonksiyonlarının özellikle pazarlama ve insan kaynakları fonksiyonlarının bütünsel olarak ele alınması bir zorunluluk haline gelmiştir (Çetin, 2018).

3. DİJİTAL İNSAN KAYNAKLARI YÖNETİMİ VE DİJİTAL PAZARLAMA YÖNETİMİ

Eskiden işletmeler rekabet avantajı sağlamak için belirli bir alanı dijitalleştirmeye odaklanabilirlerken, günümüzde bu durum değişmiştir. Artık işletmelerin sadece bir fonksiyonunun dijitalleştirilmesi yeterli değildir; tüm işletme fonksiyonlarının dijitalleştirilmesi gerekmektedir. Bunun başlıca sebepleri (Collins ve Payne, 1991).

- İşletme fonksiyonları arasında entegrasyon, verimlilik açısından kritiktir. Bir fonksiyon dijitalleştirilirken, diğerleriyle uyumlu olmalıdır. Tüm fonksiyonların dijitalleştirilmesi, süreçlerin daha iyi entegre edilmesine ve verimliliğin artmasına yardımcı olur.
- Veri Akışı ve Analitik Yetenekler: İşletmelerin başarısı giderek daha fazla veriye dayanmaktadır. Tüm fonksiyonların dijitalleştirilmesi, veri akışını sağlamakta ve işletmeye kritik kararlar için gerekli olan analitik yetenekleri sağlamaktadır.
- Operasyonel Esneklik ve Kriz Yönetimi: Dijitalleşmiş işletmeler, operasyonel esneklikleri sayesinde kriz zamanlarında daha iyi adapte olabilmektedirler. Uzaktan

çalışma, çevrimiçi satış ve diğer dijital süreçler, işletmelerin iş sürekliliğini sağlamalarına yardımcı olmaktadır.

- Müşteri Deneyimi ve Rekabet Gücü: Tüketici beklentileri hızla değişmekte ve müşteri deneyimi rekabet avantajı sağlamanın anahtarı haline gelmektedir. Sadece pazarlama veya satış değil, tüm işletme fonksiyonlarının dijitalleştirilmesi iç ve dış müşteri deneyimini geliştirmeye ve rekabet gücünü artırmaya yardımcı olmaktadır.

Dijital pazarlama stratejileri ve kanalları insan kaynakları yönetimi alanında da etkin araçlar olarak kullanılmaya başlanmıştır. Dijital pazarlama uygulamalarının insan kaynakları yönetiminde de kullanılabilmesi işe alım konusunda alanların genişlemesine, iç müşteri uygulamalarıyla çalışan bağlılıklarının ve performanslarının artmasına, iç ve dış müşteri etkileşiminin artmasına olanak sağlamıştır.

4. SONUÇ

İnternet teknolojilerinin gelişmesi ve kullanımının yaygınlaşması pek çok alanda etkili olduğu gibi pazarlama yönetimi ve insan kaynakları yönetimi alanında da etkili olmuştur. İşletmelerin sürdürülebilir rekabet avantajı sağlayabilmeleri için dijitalleşme stratejilerini pazarlama yönetimi ve insan kaynakları yönetimi alanında bütünsel olarak yürütmeleri gerekmektedir. Dijital pazarlama stratejilerinin insan kaynakları alanında da kullanılabilmesi, işe alım performans yönetimi, çalışan etkileşimi, dış müşteri etkileşimi ve iş veren markası yaratma gibi konularda etkinliğin ve verimliliğin artmasına olanak tanımıştır. Özellikle iç müşteri tarafından çalışılmak istenen bir işletme olmak, yüksek çalışan aidiyetlerinin yaratılması konusunda personel adaylarına doğru mesajı vermek konusunda da doğru dijital pazarlama stratejilerinin oluşturulması önem taşımaktadır. Bu çalışmanın amacı dijitalleşmenin pazarlama yönetimi ve insan kaynakları yönetimine etkisinde işbirlikçi bir yaklaşım olduğunu teorik olarak ortaya koymak ve bu alanda kısıtlı çalışma olduğundan literatüre katkı sağlayabilmektir.

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CNC PLAZMA HAVA İLE KESİM İŞLEMLERİNDE HIZ VE AMPER PARAMAETRELERİNİN BELİRLENMESİ

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Özet
Günümüz teknolojisinde imalatta düşük maliyet, hızlı üretim ve hassasiyet gibi faktörler göz önüne alınarak rekabet artmıştır. Bu teknolojiye ayak uydurmak için insan gücü ve üniversal tezgâhlardan uzaklaşılarak yerine bilgisayar kontrollü sistemler zorunlu hale gelmiştir. Cnc plazma tezgahları da bu teknolojide yer edinmiştir. Plazma kesim teknolojisi ile kesme işlemi yaparken kesim kalitesini maksimum seviyeye ulaştırmak için malzemenin kalınlığına göre uygun hız ve amper verilmesi gerekmektedir. Uygun amper ve hız verilmediğinde malzemenin arka yüzeyinde çapaklar meydana gelmekte ve istenilen ölçüde kesim elde edilememektedir. Bu çalışmada 1500x3000 mm kesme alanıne sahip 120 Amper güç kanağı kullanılarak hava ile 1-15 mm arasındaki malzemelerin istenilen ölçüde kesme işlemi için hız ve amper parametreleri oluşturulmuştur. Deneysel çalışmalar sonucunda malzemenin kalınlığı arttıkça kesme hızı azalırken kesme amperinin arttığı tespit edilmiştir.
Anahtar Kelimeler: Cnc Plazma Kesim, Kesme Amperi, Kesme Hızı

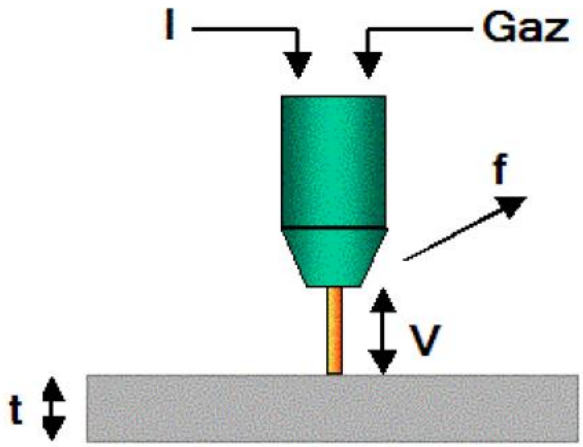
DETERMINATION OF SPEED AND AMPERAGE PARAMETERS IN CNC PLASMA AIR CUTTING PROCESSES

Abstract
In today's technology, competition in manufacturing has increased considering factors such as low cost, fast production and precision. In order to keep up with this technology, manpower and universal machines have been moved away from computer-controlled systems instead. Cnc plasma machines have also gained a place in this technology. When cutting with plasma cutting technology, the appropriate speed and amperage must be given according to the thickness of the material in order to maximize the cutting quality. When the appropriate amperage and speed are not given, burrs appear on the back surface of the material and the desired cut cannot be achieved. In this study, speed and amperage parameters were created for cutting materials between 1-15 mm with air to the desired size by using a 120 Ampere power supply with a cutting area of 1500x3000 mm. As a result of experimental studies, it was determined that as the thickness of the material increases, the cutting speed decreases and the cutting amperage increases.
Keywords: Cnc Plasma Cutting, Cutting Amperage, Cutting Speed

Giriş

Computer Numerical Control (CNC), basit Numerical Control (NC) fonksiyonlarını sağlayarak bünyesinde bilgisayar sistemi bulunduran, parça programlarının tanımlanarak malzemelerin işlenmesinde kullanılan mekanik bir sistemdir. CNC plazma teknolojisi ise üç eksende malzemeye temas etmeden belli bir yükseklikte gerçekleşen metal kesme işlemidir.CNC işleme; otomotiv, havacılık, inşaat ve tarım da dâhil olmak üzere çok çeşitli endüstrilere uygun olan otomobil çerçeveleri, cerrahi ekipmanlar, uçak motorları, dişliler, el ve bahçe gibi çeşitli ürünler üretebilen bir üretim sürecidir. Süreç, özel olarak tasarlanmış bir parça veya ürün üretmek için iş parçasından gerekli malzemeyi çıkaran, mekanik, kimyasal, elektrik ve termal süreçler de dâhil olmak üzere, birkaç farklı bilgisayar kontrollü işleme operasyonunu kapsar (Mamadjanov vd, 2021) Elektriksel olarak iletken hale gelen plazma, arkla ısıtılmış en azından kısmen iyonize olan bir gazdır. Plazma herhangi bir elektrik arkında oluşurken, plazma arkı bir torc sayesinde daraltılan bir yoğunlaşma etkisiyle oluşan patlamadır. Genel olarak malzemelerin kesiminde kullanılan geleneksel plazma sistemleri, yaygın olarak 20-150 mm kalınlık mesafesinde kesimi gerçekleştirmektedir. Günümüz hassas plazma sistemleri ise Hassas olarak kesim işlemini yerine getiren lazer kesim sistemleri, 1-12 mm kalınlığı mesafesindeki malzemeleri keserken; günümüzde kullanılan hassas plazma sistemleri lazer sistemlerine yaklaşık hassasiyette kesim yapabilme konusunda geliştirilmektedirler (Apay ve Egelioğlu, 2018).İmalat ve sanayide yaygın olarak kullanım alanına sahip olan plazma ile kesim, otomasyon uygunluğu ile üretim hattı sahasına, düşük maliyet ile verimli yatırım oranlarına, kesim hızının yüksek oluşu ve kesim kalitesinin sürekli olarak iyileştirilmesi ile olanaklar sunmaktadır. İş makineleri, gemi inşası, basınçlı kapların üretimi, vagon yapımı gibi imalat sektöründe yoğun olarak plazma kesim metodu ile karşılaşılmaktadır (Kutlu vd, 2005).Kesim işlemi yapılacak iş parçası üzerinde lokal bir bölgenin eritilerek yok edilmesi, daraltılarak yoğunlaştırılan bir ark sayesinde gerçekleştirilir. Buna plazma arkı ile kesim işlemi adı verilir. Torc ağzından yüksek hızlarda çıkan iyonize gazlar tarafından yüksek sıcaklığa maruz kalmış ve hal değiştiren metal, kesim bölgesinden uzaklaştırılır. 10000 ve 14000 °C sıcaklıkta çalışan plazma arkı, iyonize hale gelen gazın dönüşümüdür (Karkın, 2006; Akşahin, 2009).Plazma ile kesmede önemli parametreler gaz, güç kaynağı ve kesme hızıdır. Şekil 1'de görüldüğü gibi torcun yüksekliği de önemlidir. Parametreler arasındaki ilişkiler kesmede elde edilecek kaliteyi tanımlar.

Gaz parametreleri; Plazma ile kesme işleminde 6-8 bar basıncında gaz kullanılmaktadır. Kesme işleminde kullanılan gazlar hava, karbon, hidrojen gibi gazlardır. Bu gazlara bağlı olarak kesme kalitesi değişim göstermektedir. (Kutlu, 2005)



Şekil 1. Plazma ile kesim parametreleri (Kutlu vd,2005)

Materyal ve Metot

Tokat Niksar sanayi bölgesinde 1500x3000 mm kesim alanına sahip üç eksenli CNC plazma kesim tezgâhı kullanılarak farklı kalınlıktaki metal malzemelerin kesim işleminde minimum deformeler ile yüksek kalitede işlenmesi için uygun hız ve amper parametreleri belirlenmeye çalışılmıştır. 1500x3000 mm işleme alanına sahip tezgâhlarda hava ile 15 mm kalınlığına kadar metal malzeme kesebilmesi için 120 amper güç kaynağı kullanmak gerekmektedir. Hız ve amper parametrelerinin belirlenmesinde kullanılan Şekil 2'deki CNC plazma kesim tezgâhı 120 amper güç kaynağına sahiptir.



Şekil 2. St37 malzemesinin kesim işleminde kullanılan CNC plazma tezgâhı

Hız ve amper ayarı kesimin kalitesini belirleyen en önemli parametrelerdir. CNC plazma kesim tezgâhlarının en zor kestiği form daire şeklindeki çizimlerdir. Farklı çaplarda daireler keserek uygun kesme hızı-amper ayarı parametresi elde edilmiştir. Şekil 3'te görüldüğü gibi malzemenin kalınlığına göre düzgün amper ve hız belirlenmemesinden dolayı hatalı kesim işlemi olmuştur. Şekil 4'teki uygulamada hız 750 mm/dk, amper ayarı 85 amper olarak verilmiştir.



Şekil 3. Hız ve amper ayarının hatalı belirlenmesi

CNC plazma kesim tezgâhının imalatından sonra farklı kalınlıklarda malzemeler kesilerek en düzgün kesim kalitesini elde edilebilecek parametreler Tablo 1'de verilmiştir. Kesim işlemi malzeme türüne göre örneğin çelik, alüminyum ve St37 gibi malzemeler de hız-amper ayarı değişkenlik göstermektedir. Endüstriyel uygulamalarda yaygın olarak St37 malzemesi kullanılmaktadır. Bu nedenle deneysel çalışmada St37 malzemesi kullanılarak kesme parametresi oluşturulmuştur.

Tablo 1 CNC Plazma kesim tezgâhının kesme parametresi

Malzeme Kalınlığı (mm)	Amper (A)	Kesme Hızı (mm/dk)
1-2	65	2700
2,5-3-4	75	2200
5-6-7	80	1600
8-9-10	90	1000
11-12-13	95	750
14-15	100	500

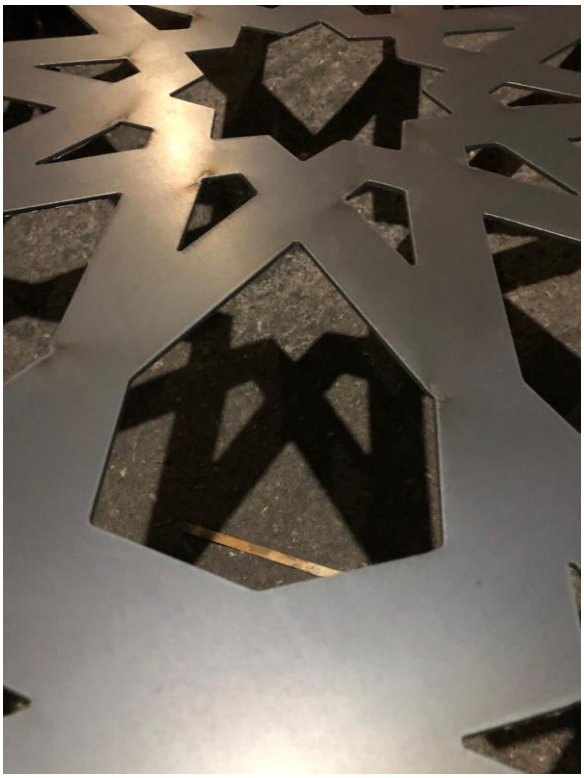
Kesimin kalitesi sadece malzeme türüne, ampere ve kesme hızına bağlı değildir. Kesim esnasında oluşan titreşimler de kesim kalitesini etkilemektedir. Bu titreşimleri en aza indirmek için kutu profil yerine alüminyum ağır sigma profil kullanılmıştır. 15 mm kalınlığındaki parametre kullanılarak Şekil 4'teki kesim elde edilmiştir. Kesim işlemi tamamlandıktan sonra kesilen malzemenin ön ve arka yüzeyi kumpas ile ölçülmüştür. Ön yüzeyinde kesim istenilen ölçüdedir ancak arka yüzeyin ölçülerinin 1,5 mm az olduğu tespit edilmiştir.



Şekil 4. Hız ve amper ayarının doğru belirlenmesi

Bulgular ve Tartışma

CNC plazma kesim tezgâhında farklı kalınlığa sahip ve kullanım alanları farklı olan malzemeler kesilerek sonuçları gözlemlenmiştir. CNC plazma kesim tezgâhlarında görülen en büyük hatalardan biri de kesilen malzemenin arka yüzeyinde çapak oluşmasıdır. Kesim işlemi sonrasında 2-15 mm kalınlığa sahip malzemelerin arka yüzeylerinde çapak oluşumu olmadığı tespit edilmiştir.Kesilen malzemeler 65 amper ve 2700 mm/dk'da kesilmiştir. Malzemelerin kesme işlemini yaparken, kesim kalitesini ölçmek için basınç ayarları değiştirilmiştir. Şekil 5'te görüldüğü gibi lazer kesime yakın çapaksız temiz bir kesim elde edilmiştir.



Şekil 5. 2 mm kalınlığındaki St37 malzemenin kesim işlemi

4 mm kalınlığındaki St37 malzemesinden kesilen iş parçası Şekil 6'da verilmiştir. Kesilen iş parçası, 75 amper ve 2200 mm/dk'da kesilmiştir. Kesim esnasında malzemenin ısınmasından dolayı sacda esnemeler meydana gelmiştir. Bu esnemelerden kaynaklı, malzemenin arka yüzeyinde az miktarda çapak kaldığı gözlemlenmiştir.



Şekil 6. 4 mm kalınlığındaki St37 malzemenin kesim işlemi

5 mm kalınlığındaki St37 malzemesinden kesilen iş parçası Şekil 7'de verilmiştir. Seçilen iş parçası, 80 amper ve 1600 mm/dk'da kesilmiştir. Kesim herhangi bir hata olmadan başarılı bir şekilde tamamlanmıştır.



Şekil 7. 5 mm kalınlığındaki St37 malzemenin kesim işlemi

6 mm kalınlığındaki St37 malzemesinden kesilen iş parçası Şekil 8'de verilmiştir. Şekil 8'de verilen iş parçası, 80 amper ve 1600 mm/dk'da kesilmiştir. Kesme işlemi sonucunda, malzeme kumpas ile ölçüldüğünde arka yüzeyinde istenilen ölçüden 0,5 mm az olduğu tespit edilmiştir.



Şekil 8. 6 mm kalınlığındaki St37 malzemenin kesim işlemi

8 mm kalınlığındaki St37 malzemesinden kesilen iş parçası Şekil 9'da verilmiştir. Şekil 9'da verilen iş parçası, 90 amper ve 1000 mm/dk'da kesilmiştir. Kesme işlemi sonucunda, malzeme kumpas ile ölçüldüğünde arka yüzeyinde istenilen ölçüden 1 mm az olduğu tespit edilmiştir.



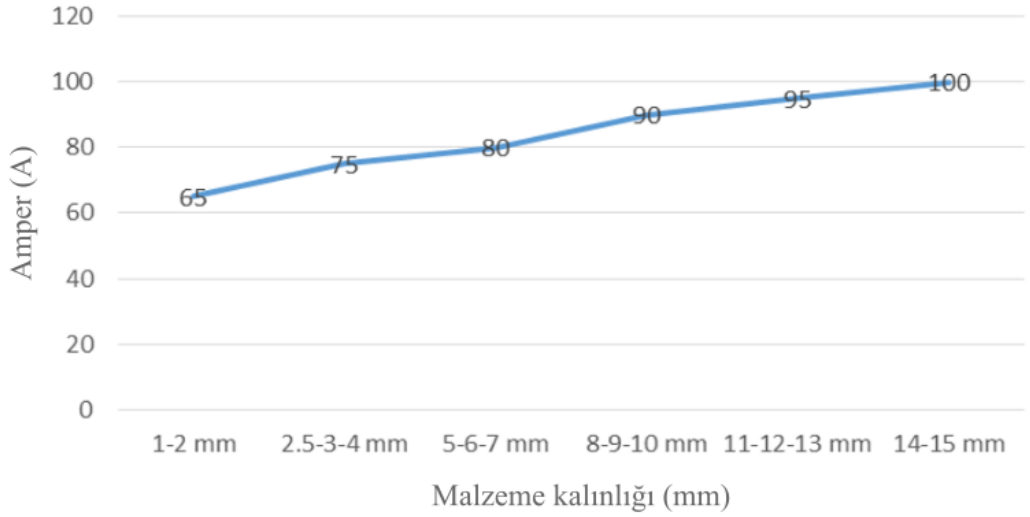
Şekil 9. 8 mm kalınlığındaki St37 malzemenin kesim işlemi

10 mm kalınlığındaki St37 malzemesinden kesilen iş parçası Şekil 10'da verilmiştir. Şekil 10'da verilen iş parçası, 90 amper ve 1000 mm/dk'da kesilmiştir. Torcun kesime başladığı yerde iz kaldığı tespit edilmiştir.

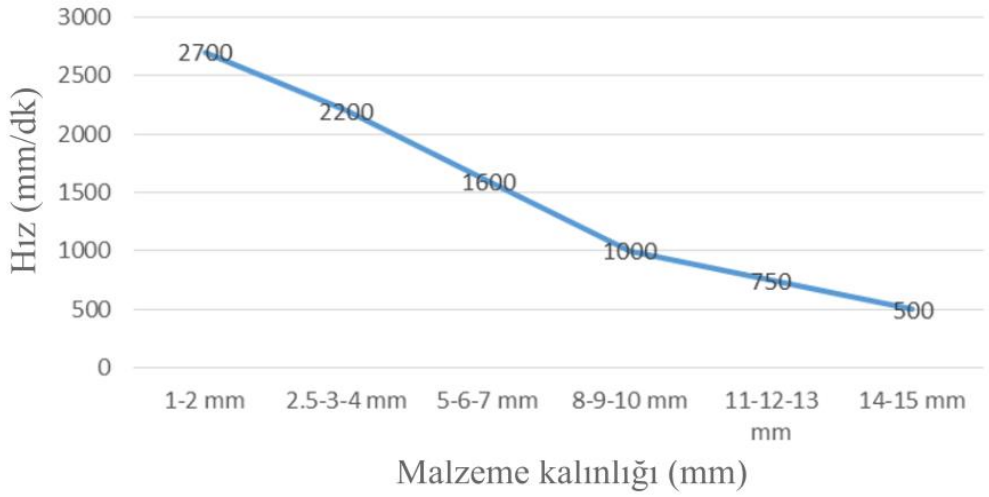


Şekil 10. 10 mm kalınlığındaki St37 malzemenin kesim işlemi

Deneysel çalışmalar sonucunda malzemenin kalınlığı arttıkça plazmadaki güç kaynağı amperin arttığı elde edilmiştir. Şekil 11'de görüldüğü gibi amper değerleri 60-100 amper arasında değişim göstermektedir. Dolayısıyla malzeme kalınlığı ile amper arasında doğru orantılı bir ilişki vardır.



Şekil 11. Malzeme kalınlığı-amper ilişkisi Elde edilen diğer bir deneysel sonuçta ise malzeme kalınlığı arttıkça kesme hızının azaldığı tespit edilmiştir. Şekil 12'de görüldüğü gibi hız değerleri 500-2700 mm/dk arasında değişim göstermektedir. Sonuç olarak malzeme kalınlığı ile hız arasında ters orantılı bir ilişki vardır.



Şekil 12. Malzeme kalınlığı-hız ilişkisi

Sonuç ve Öneriler

Sonuç olarak malzeme kalınlığına bağlı olarak amper miktarı arttıkça kesme hızının azaldığı gözlemlenmiştir.1-5 mm kalınlık arasında kesilen St37 malzemelerde kesimler istenilen ölçü ve kalitede gerçekleştirilmiştir. 6 mm kalınlığındaki St37 malzemenin kesme işlemi sonucunda, kumpas ile gerçekleştirilen ölçümler neticesinde arka yüzeyinde istenilen ölçüden yaklaşık olarak 0,5 mm daha az olduğu tespit edilmiştir. Aynı şekilde 8 mm, 10 mm ve 15 mm kalınlığındaki St37 malzemelerin kesme işlemi sonucunda, tekrar ölçümler yapıldığında

malzeme arka yüzeylerindeki ölçümlerin istenilen ölçüden sırasıyla 1 mm, 1,2 mm ve 1,5 mm daha olduğu gözlemlenmiştir Bulunan kesme hızı ve amper parametreleri, literatürde yapılan benzer çalışmalar ile uyumlu olduğu da tespit edilmiştir. Yapılan kesme işlemlerinde gaz olarak kuru hava kullanılmıştır. Hidrojen-argon veya Azot-Hava gibi karışım gazlar kullanılarak farklı değerler gözlemlenebilir. Belirlenen kesme hızı ve amper parametrelerinde kesilen farklı kalınlıktaki malzemelerin başka çalışmalarda yüzey pürüzlülük değerleri de çalışılabilir.

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DOĞAYLA ÖĞRENEN ÇOCUKLARIN BİYOMİMİKRİ İLE DESTEKLENMESİ

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Özet
Biyo; yaşam, doğa ya da hayat mimikri ise taklit kavramlarının birleşmesi ile elde edilen Biyomimikri, çocukların doğa ile bağlantı kurmasına katkı sağlamaktadır. Doğadan ilham alma, esinlenme anlamına gelen Biyomimikri kavramı farklı çalışma alanlarına katkı sağlamasının yanında çocuk ve doğa arasında köprü kurmaktadır. Dijitalleşen dünya gittikçe doğa yoksunluğuna sebep olmakta, modern yaşamın çıktıları çocukları doğal yaşamdan uzaklaştırmaktadır. Bu durumun bir sonucu olarak buluş yoluyla öğrenme, yaparak-yaşayarak öğrenme süreci olumsuz yönde etkilenen çocuklar, doğayla sınırlı etkileşimle gelişimlerini sürdürmektedirler. Rousaeau, Frobel, Dewey, Montessori'ye göre doğa çocuk için etkin bir öğrenme ortamı sunarak onu destekler. Çocuk için en basit ve en etkin kaynakları içinde barındıran doğa; çocukların becerilerini fark etmesini sağlayarak aktivite temelli uygulamaları gerçekleştirerek flora ve fauna türlerine ilişkin bilgi ve beceri edinmesine katkı sağlar. Ayrıca canlıları keşfetmesi, gözlem yapabilmesi, doğal çevre ile bağlantı kurması, doğadan ilham alması, farklı ürünler ortaya koyması, doğayı taklit etmesi, çıkarımlar yaparak gelişimlerinin desteklenmesi noktasında önemlidir. Çocuğun doğal öğrenme akışı içerisinde biyomimikri stratejisinin kavranılması güç olmakla birlikte eğitimcilerin bu alandaki yetkinliği, çocukların yaş ve gelişim düzeylerine uygun etkinliklerin hazırlanması, uygulanması kavramın anlaşılmasını kolaylaştıracaktır. Bu gerekçeler ışığında derleme niteliğinde olan çalışmamızda biyomimikri stratejisini konu alan etkinlik örneklerine yer verilecektir.
Anahtar Kelime: Biyomimikri, Doğa, Çocuk Gelişimi

SUPPORTING CHILDREN LEARNING WITH NATURE WITH BIOMIMICRY

Abstract
Bio; life, nature or life mimicry, obtained by combining imitation concepts, Biomimicry contributes to the connection of children with nature. The concept of biomimicry, which means inspiration and inspiration from nature, contributes to different fields of study and builds a bridge between child and nature. The digitalizing world is increasingly causing nature deprivation, the outputs of modern life are distracting children from natural life. As a result of this situation, children who are adversely affected by the process of learning by invention, learning by doing and living, continue to develop with limited interaction with nature. According to Rousaeau, Frobel, Dewey, Montessori, nature supports it by providing an effective learning environment for the child. Nature, which contains the simplest and most effective resources for the child; it enables children to realize their skills and contributes to the knowledge and skills of the flora and fauna species by performing activity-based practices. In addition, it is important to explore living things, to be able to observe, to connect with the natural environment, to be inspired by nature, to produce different products, to imitate nature, to support their development by making inferences. While it is difficult to understand the biomimicry strategy in the natural learning flow of the child, the competence of educators in this field will facilitate the understanding of the concept of preparing and implementing activities appropriate to the age and development levels of children. In the light of these reasons, our work, which is a compilation, will include examples of activities related to biomimicry strategy.
Keyword: Biomimicry, Nature, Child Development

GİRİŞ

Doğa, yüzyıllardır teknolojik gelişmelere ilham vererek hedeflenen amaçlar için taklit edilmiştir (Avcı, 2019). Doğa ile bütüncül bir iç içelik insanların yaşamını biçimlendirmiş, yeni ürünler, teknolojiler ortaya çıkarmasına da zemin hazırlamıştır. Böylece doğanın döngülerini ve sistemlerini merkeze alan aynı zamanda süreçleri, formlarını dikkate alarak doğanın kendi çözümlerini de gözlemleyen insanoğlu; doğanın sunduğu eşsiz olanaklardan beslenme fırsatı yakalamamıştır (Pekşen Akça& Arslan, 2022). Doğadaki canlılar karşılaştıkları problemlere ilişkin çeşitli çözümler üreterek pek çok bilim insanı ve tasarımcıya da ilham verip onları doğayı taklit etmeye yönlendirmiştir (Yıldız, 2012). Bu durum da yaşam, doğa, hayat anlamına gelen " biyo" ile taklit anlamına gelen "mimikri" kelimelerinin doğmasına (Shimomura, 2010) ve doğadan öğrenme hareketliliği olarak tanımlanan biyomimikri kavramını geliştirilmesine neden olmuştur (Van der Hout, 2016).Doğadan öğrenme çocuk için yaşamsal deneyimler sunarak onu biliş, duygusal gelişim olarak deneyimsel açıdan geliştirir ve öğrenmede entelektüel kökler oluşturarak, doğayı kapsamlı şekilde açıklamasını sağlar. Çocuk için harika bir deneyim sağlayan bu durum birkaç yineleme yoluyla daha nitelikli öğrenme deneyimlerine dönüşür. Kendi öğrenme kapasitesi ve hızı doğrultusunda öğrenmeyi gerçekleştiren, merak ettikleri konularda derinlemesine araştırma imkânı yakalayarak bilginin kalıcılığını arttıran çocuk öğrenme motivasyonunu da bu sayede artırır (Bakioğlu ve Karamustafaoğlu, 2020; Arslan, 2022).Çocukları, yenilikçi çözümler yaratmada doğadan ilham alan bir yaklaşım olan biyomimikri ile tanıştırmak, iş birliği ve problem çözmeye teşvik etmek adına önemlidir (Williams, Dolenc, Barber ve Lai,2016). Durum ve olayları somutlaştırarak deneyimleme fırsatı bulmasının sağlanması enek öğrenme olanakları sunulmasının yanında çocuğun çeşitli permütasyonları sınama fırsatı bulabilmesini de sağlar (Pekşen Akça, 2022). Dahası sanatsal açıdan da farklı bakış açıları geliştirerek görsel tasarım ürünlerine ilham vermek ve doğanın tamamlayıcılarını inceleme fırsatı yakalamak çocuk için destekleyicidir. Doğa güzel olduğu kadar işlevseldir, bu yönünün çocuklar tarafından keşfedilmesi, incelenmesi, yaşama dair bazı problemlere de çözümler bulmalarını da kolaylaştırır, çocuğu soru sormaya, araştırmaya, üretmeye, buluş yapmaya, ilgilerini ortaya koyabilme noktasında da destekler (Yıldırım, 2019).

Biyomimikri Etkinlik Örneği

Doğadan ilham alarak biyomimikri'yi eğitim stratejisi olarak kullanmak çocukların yeni tasarımsal fikirler ortaya koymaları, doğada yer alan farklı türlere ait detaylı bilgi edinmelerini sağlar. Okul dışı öğrenme ortamlarında saha gözlemi yapma fırsatı yakalayan çocuk doğanın problem durumlarına ilişkin buldukları çözümleri detaylandırarak hayal gücünü de besler.

Mevcut uygulama örnekleri okul dışı ortamlarda doğa ile bütünleşerek gerçekleştirilebileceği gibi sınıf ortamında da biyomimikri temelli uygulamalarının yapılması mümkündür. Aşağıda sınıf ortamında biyomimikri uygulama sürecine ilişkin bir etkinlik örneği sunulmuştur.

Süre: Zaman sınırlaması yoktur.

Etkinliğin Amacı:

- ✓ Çocukların doğanın kendi problem durumlarına ilişkin bulduğu çözüm yollarını gözlemleyerek bir nesne tasarlamasını sağlamak (şemdiye, gözlük vb.)
- ✓ Canlı organizmaları tasarım ilhamı olarak görebilmek,
- ✓ Problem durumlarına ilişkin birden fazla çözüm geliştirmelerini sağlamak,

Çocuklar için;

- ✓ Biyomimikri'yi örneklendirerek somutlaştırın
- ✓ Biyomimikri çalışmalarını konu alan fotoğraf ve video görsellerinden yararlanarak onlara örnekler gösterin
- ✓ Bir türün özelliklerinin, türün hayatta kalması için nasıl avantaj ve dezavantaj sağlayabileceğini hakkında bilgi verin.

Etkinlik: Çocukları küçük gruplar haline ayırın ve kara- deniz hayvanlarının yer aldığı afişleri sınıftaki masalar üzerinde bırakın. Bu afişlerde yer alan canlıları yakından gözlemleyebilmeleri için sınıf ortamına bunları getirin. Örneğin solucan, tırtıl, karınca, kelebek ya da hamsi, Japon balığı vb. gibi. Çocuklarla canlıları incelemesi ve kendi aralarında afişlerdeki görselleri ile farklılıkların ve benzerliklerinin olup olmadığı hakkında konuşmalarını sağlayın. Sonrasında bu canlıları konu alan bazı sorular sorarak süreci oyunla destekleyin. Örneğin ben hem bir fanusta hem de denizde yaşarım, yüzgeçlerim ve solungaçlarım vardır? Sizce ben bir solucan olabilir miyim? Çocukları bu süreçte gözlemleyin ve çocuklara ipuçları verin. Beklenmedik ifadeler olduğunda gerekli açıklamaları yaparak başka açıdan bir ilişki varsa çocuğun yakalamasını sağlayın. Çocuklara afişte/ortamda yer alan canlıları incelemeleri, doğaya nasıl bir katkı sağladıklarını düşünerek ilham aldıkları yönlerini belirtmelerini isteyin. Çocukları herhangi bir canlıyı yapı ve işlev olarak incelemesini, iki/üç boyutlu bir ürün ortaya koymaları noktasında destekleyin. Bunun için farklı özelliklerde boyalar, artık materyaller, 3D yazıcıları kullanabilirsiniz.

Etkinlik Çıktıları:

- ✓ Sizi şaşırtan söylemler oldu mu?

- ✓ Çocuklarla doğadan ilham almanın yararlarının neler olacağı hakkında düşünmelerini sağlayın?
- ✓ Bilim insanlarının doğadan ilham alarak tasarladıkları nesneler var mı?
- ✓ Doğanın bir ilham kaynağı olarak görülmesi bizim için neden önemlidir?

Değerlendirme: Çocuklar yaptıkları ürünleri ilişkin paylaşım yaparak doğadan ilham alarak hazırladıkları ürün ile organizma arasında nasıl bir bağ kurdular, tasarlamak istedikleri başka bir ürün var mı? Bu konu hakkında paylaşım yapılacaktır.

SONUÇ

Çocukların doğa ile doğrudan etkileşim içerisinde olmalarını sağlayacak biyomimikri etkinlikleri ile desteklenmeleri, eğlenceli bir öğrenme ortamı olmasının yanında farklı olay ve durumları deneyimleme olasılığı taşıdığı için çocuk için oldukça destekleyicidir. Doğanın işlevsel yönünün çocuklar tarafından keşfedilmesini, incelenmesini sağlayacak, çocuğun yaşama ilişkin problem durumlarına yönelik çözümler bulmasını kolaylaştıracak çalışmalarının yapılması çocuğun çeşitli konularda bilgi ve beceri edinmesi olanağı da yakalar.

Biyomimikri çocuklarda yirmi birinci yüzyıl becerilerinden; yaratıcılık, eleştirel düşünme, problem çözme ve işbirlikçi olmayı desteklemektedir (Williams, Dolenc, Barber ve Lai,2016). Bu nedenle biyomimikri kavramı eğitimin her aşamasına entegre edilerek çocuklara sunulabilir, bir eğitim stratejisine dönüştürülebilir. Çocukların yaş ve gelişim düzeylerine uygun etkinliklerin alan uzmanlarınca planlanması, bireysel ve grup olarak canlıları anlamaları kolaylaştırır. Doğanın zarafetinden esinlenen, doğa ile güçlü bir ilişki kuran ve buluş yoluyla öğrenme fırsatı yakalayan çocuk sunacaktır. Doğanın kendi döngüsünün gözlemlenmesi, bir atığın başka bir canlı için kaynak olduğunun keşfedilmesi, sürdürülebilirlik, verimlilik, dengeyi yeniden sağlayabilme gibi konularda çocukların bilgi ve becerileri geliştirmesini sağlayacaktır. Kısacası doğaya karşı duyarlılığı gelişmiş çocukların yetişmesine zemin hazırlayacaktır.

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BATMAN İLİ AÇIKTA SEBZE ÜRETİMİNİN EKONOMİK ANALİZİ

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Özet
Bu araştırmada, Batman ilinde açıkta üretilen sebze ürünlerinin 2022-2023 üretim dönemi ekonomik analizi gerçekleştirilmiştir. Araştırmada Tarım ve Orman Bakanlığı Batman İl Müdürlüğünün verilerinden yararlanılmıştır. Ekonomik analiz kapsamında sebze üretimine ilişkin yapılan üretim masrafları, elde edilen brüt üretim değerleri, brüt karlar, net karlar ve nispi karlar tespit edilmiştir. Araştırmadan elde edilen sonuçlarına göre ortalama reel üretim masrafının en yüksek sivri biber üretiminde (3646.83 TL/da), en düşük kavun üretiminde (427.54 TL/da) yapıldığı belirlenmiştir. Ortalama brüt kar dolmalık biber üretiminde 3528.17 TL/da, sivri biber üretiminde 2306.72 TL/da, domates üretiminde 1949.72 TL/da, hıyar üretiminde 3397.62 TL/da, kabak üretiminde 2481.17 TL/da, karpuz üretiminde 2072.12 TL/da, kavun üretiminde 986.27 TL/da, beyaz lahana üretiminde 1526.65 TL/da, marul üretiminde 1977.29 TL/da, patlıcan üretiminde 3327.68 TL/da olarak hesaplanmıştır. Ortalama net kar açısından en yüksek değerin patlıcan üretiminde (2813.48TL/da), en düşük değerin kavun üretiminde (888.92 TL/da) elde edildiği saptanmıştır. Batman ili açıkta sebze üretiminde nispi karlar incelendiğinde en yüksek nispi karın karpuz üretiminde (4.98), en düşük nispi karın ise domates üretiminde (1.33) olduğu bulunmuştur.
Anahtar Kelimeler: sebze üretimi, brüt kar, net kar, nispi kar, ekonomik analiz

ECONOMIC ANALYSIS OF OPEN VEGETABLE PRODUCTION IN BATMAN PROVINCE

Abstract
In this research, an economic analysis of openly produced vegetable products in Batman province was carried out for the 2022-2023 production period. In the research, data from Batman Provincial Directorate of the Ministry of Agriculture and Forestry was used. Within the scope of economic analysis, production costs related to vegetable production, gross production values obtained, gross profits, net profits and relative profits were determined. According to the results obtained from the research, it was determined that the average real production cost was highest in green pepper production (3646.83 TL/da) and lowest in melon production (427.54 TL/da). Average gross profit is 3528.17 TL/da in bell pepper production, 2306.72 TL/da in green pepper production, 1949.72 TL/da in tomato production, 3397.62 TL/da in cucumber production, 2481.17 TL/da in zucchini production, 2072.12 TL/da in watermelon production, 986.27 TL/da in melon production. TL/da is calculated as 1526.65 TL/da in white cabbage production, 1977.29 TL/da in lettuce production, and 3327.68 TL/da in eggplant production. It was determined that the highest value in terms of average net profit was obtained in eggplant production (2813.48 TL/da) and the lowest value in melon production (888.92 TL/da). When the relative profits in open field vegetable production in Batman province were examined, it was found that the highest relative profit was in watermelon production (4.98) and the lowest relative profit was in tomato production (1.33).
Keywords: vegetable production, gross profit, net profit, relative profit, economic analysis

GİRİŞ

Tarımda bitkisel üretim içerisinde önemli konumda bulunan sebzeler, bitkinin kendisinin veya meyvesinin pişmiş veya çiğ olarak tüketilebildiği gıda ürünleri olarak tanımlanmaktadır. Sebzeler insan ve hayvan beslenmesinde temel besin ürünleri olarak tüketilen kalori değeri yüksek gıdalardır. Bu nedenle Dünya çapında sebze üretimine önem verilmekte; ülkelerin ihracatında önemli bir yer almaktadır (Pirinç ve Akalp, 2023).Dengeli bir beslenme için vazgeçilmez bir gereklilik olan sebze üretiminde, kaynakların etkin kullanımının sağlanabilmesi hem tüketici hem üreticiler açısından önemlidir. Tarımsal verimliliği artırmak ve/veya girdi kullanımının optimizasyonu için kaynakların ne derece etkin kullanıldığının belirlenmesi gerekmektedir. Bu konuda yapılması gereken en önemli çalışmalardan biri ise, bölgelere göre üretim maliyetlerinin ve kârlılıklarının ortaya konulmasıdır (Hayran ve Gül, 2020). İşletmelerin üretimden sağlayacakları faydaya karşı oluşacak maliyetleri göz önünde bulundurmaları ve yönetim kararları alırken bu stratejik karşılaştırmaları hesaplamaları gerekmektedir. İşletmelerde etkin yönetimin sağlayabilmek için maliyetlerin doğru şekilde hesaplanmasına ihtiyaç duyulmaktadır (Bayramoğlu ve ark., 2021).Bugüne kadar birçok çalışmada ürünlerin maliyetleri hesaplanmıştır (Kadanalı ve ark., 2008; Bayraktar ve Saner, 2010; Engindeniz ve ark., 2010; Ağır ve Saner, 2014; Semerci ve Çelik, 2019; Örük ve Engindeniz, 2019). Literatürde ürünlerin üretim maliyetleri sıklıkla hesaplanmış olup üretim maliyetleri girdi maliyetleri ile ilişkili olarak sürekli değişmektedir. Bu nedenle çalışmaların zaman içinde tekrarlanarak tarımsal üretim maliyetlerinin hesaplanmasına ihtiyaç duyulmaktadır. Bu çalışmada Batman'da yaygın olarak üretimi yapılan biber (dolmalık), biber (sivri), domates, hıyar, kabak, karpuz, kavun, lahana, marul, patlıcanın üretim maliyetleri hesaplanmıştır.

2.MATERYAL VE YÖNTEM

Çalışmanın materyalini ikincil nitelikli veriler oluşturmaktadır. Çalışmada Batman Tarım ve Orman İl Müdürlüğü Brifing Raporları, konu ile ilgili daha önce yapılmış tez, makale, kongre bildirileri, Türkiye İstatistik Kurumu (TÜİK) tarafından yayınlanmış kaynaklar ve istatistiksel kayıtlardan yararlanılmıştır.Çalışmada sebze üretim faaliyetinin karlılık durumunu ortaya koyabilmek için brüt kar, net kar ve nispi kar analizi yapılmıştır. Brüt karın hesaplanmasında, brüt üretim değerinden değişken masraflar çıkartılmıştır. Net karın hesaplanmasında brüt üretim değerinden üretim masrafları (değişken masraflar + sabit masraflar) çıkartılmıştır. Nispi kar ise brüt üretim değerinin üretim masraflarına bölünmesiyle hesaplanmıştır.

Çalışmada değişken masraflar: materyal masraflarını oluşturan fide/ tohum, gübre, zirai mücadele ilaççı, elektrik (sulama) masrafları, işgücü masrafları ve diğer masraflar ile döner sermaye faiz karşılığından oluşmaktadır. Çalışmada sabit masraflar ise arazi kirası ve yönetim payından oluşmaktadır. Genel yönetim giderleri toplam değişken masrafların %3'ü olarak hesaplanmıştır.

3.ARAŞTIRMA BULGULARI

Batman ilinde üretimi yapılan sebzelerin 2013 yılı itibariyle ekilen alan miktarları incelendiğinde, en yüksek ekilen alan büyüklüğü ve üretim miktarının karpuz ürününe ait olduğu belirlenmiştir. Karpuzun yıllar itibariyle ekilen alan miktarında meydana gelen değişim incelendiğinde ekilen alan miktarının 2019 yılından 2023 yılana gelindiğinde artış gösterdiği, 11690 da'dan 12224 da'a ulaştığı ortaya çıkmıştır. Ekilen alan miktarının artış gösteriyor olmasına karşın üretim miktarının azaldığı 26184 tondan 24562 tona gerilediği belirlenmiştir.

2023 yılı itibariyle ekilen alan miktarı bakımından ikinci sırada yer alan ürün 8437 da ile kavun olurken, onu sırasıyla 4800 da alan ile domates, 1830 da ile hıyar, 1152 da ile patlıcan, 973 da ile biber (dolmalık), 695 da ile biber (sivri), 450 da ile marul, 400 da ile kabak, 300 da ile lahana izlemektedir (Çizelge 1).2023 yılı itibarıyla Batman ili sebze üretim miktarı bakımından ikinci sırada yer alan ürün 18750 ton ile domates olurken, onu sırasıyla 15726 ton ile hıyar, 8864 ton ile kavun, 5115 ton ile patlıcan, 3259 ton ile biber (dolmalık), 1689 ton ile biber (sivri), 1600 ton ile kabak, 1350 ton ile marul, 900 ton ile lahana izlemektedir (Çizelge 1).

Türkiye genelinde 2019 yılından 2023 yılına gelindiğinde biber ve lahana ekim alanlarının azalırken üretim miktarının arttığı, domates, hıyar, karpuz, kavun, marul, patlıcan ekim alanlarının ve üretim miktarlarının azaldığı, kabak üretim alanlarının ve üretim miktarının arttığı belirlenmiştir (Çizelge 1).

Çizelge 1: 2023 Yılı Batman İli ve Türkiye'de Biber (Dolmalık), Biber (Sivri), Domates, Hıyar, Kabak, Karpuz, Kavun, Lahana, Marul, Patlıcan Ekim Alanı (da) ve Üretim Miktarları (ton)

Ürünler	Yıl	Batman				Türkiye				Pay(%)
		Ekilen Alan	İndeks (2019=100)	Üretim Miktarı	İndeks (2019=100)	Ekilen Alan	İndeks (2019=100)	Üretim Miktarı	İndeks (2019=100)	
Biber (Dolmalık)	2019	730	100.00	2047	100.00	122952	100.00	371918	100.00	0.55
	2020	678	92.88	2096	102.39	122523	99.65	389957	104.85	0.54
	2021	876	120.00	2823	137.91	123388	100.35	420918	113.17	0.67
	2022	870	119.18	2832	138.35	116672	94.89	404459	108.75	0.70
	2023	973	133.29	3259	159.21	114197	92.88	395441	106.32	0.82
Biber (Sivri)	2019	735	100.00	1701	100.00	277642	100.00	902203	100.00	0.19
	2020	675	91.84	1624	95.47	265863	95.76	838890	92.98	0.19
	2021	675	91.84	1625	95.53	277868	100.08	1064633	118.00	0.15
	2022	668	90.88	1602	94.18	261893	94.33	979180	108.53	0.16
	2023	695	94.56	1689	99.29	251672	90.65	939178	104.10	0.18
Domates (Sofralık)	2019	4270	100.00	10570	100.00	1191772	100.00	8836055	100.00	0.12
	2020	4900	114.75	17776	168.17	1116588	93.69	8656435	97.97	0.21
	2021	4440	103.98	16579	156.85	1070081	89.79	8580522	97.11	0.19
	2022	4570	107.03	17125	162.02	984391	82.60	7954856	90.03	0.22
	2023	4800	112.41	18750	177.39	958116	80.39	7749152	87.70	0.24
Hıyar (Sofralık)	2019	2780	100.00	11653	100.00	289287	100.00	1748157	100.00	0.67
	2020	2230	80.22	14280	122.54	260482	90.04	1678341	96.01	0.85
	2021	2050	73.74	13596	116.67	259301	89.63	1696520	97.05	0.80
	2022	1870	67.27	14281	122.55	258960	89.52	1690523	96.70	0.84
	2023	1830	65.83	15276	131.09	239349	82.74	1562058	89.35	0.98
Kabak (Sakız)	2019	380	100.00	1520	100.00	96716	100.00	447830	100.00	0.34
	2020	380	100.00	1576	103.68	99746	103.13	547208	122.19	0.29
	2021	380	100.00	1520	100.00	104968	108.53	609622	136.13	0.25
	2022	450	118.42	1800	118.42	104323	107.87	590362	131.83	0.30
	2023	400	105.26	1600	105.26	98816	102.17	573617	128.09	0.28
Karpuz	2019	11690	100.00	26184	100.00	833657	100.00	3870515	100.00	0.68
	2020	10202	87.27	24919	95.17	740345	88.81	3491554	90.21	0.71
	2021	10838	92.71	19629	74.97	729485	87.50	3468717	89.62	0.57
	2022	11436	97.83	25637	97.91	690207	82.79	3394783	87.71	0.76
	2023	12224	104.57	24562	93.81	640700	76.85	3147921	81.33	0.78
Kavun	2019	5393	100.00	7741	100.00	721758	100.00	1777059	100.00	0.44
	2020	6670	123.68	8422	108.80	690904	95.73	1724856	97.06	0.49
	2021	6321	117.21	5355	69.18	668753	92.66	1638638	92.21	0.33
	2022	10168	188.54	12117	156.53	627243	86.90	1587230	89.32	0.76
	2023	8437	156.44	8864	114.51	548123	75.94	1403214	78.96	0.63
Lahana (Beyaz)	2019	350	100.00	1400	100.00	137114	100.00	567622	100.00	0.25
	2020	350	100.00	1050	75.00	136400	99.48	594143	104.67	0.18
	2021	350	100.00	1050	75.00	132115	96.35	597910	105.34	0.18
	2022	300	85.71	900	64.29	125985	91.88	666959	117.50	0.13

	2023	300	85.71	900	64.29	129855	94.71	695472	122.52	0.13
Marul (Göbekli)	2019	380	100.00	1520	100.00	91439	100.00	215728	100.00	0.70
	2020	380	100.00	1140	75.00	93874	102.66	225639	104.59	0.51
	2021	380	100.00	1140	75.00	83576	91.40	212091	98.31	0.54
	2022	400	105.26	1200	78.95	80148	87.65	204422	94.76	0.59
	2023	450	118.42	1350	88.82	83260	91.06	211660	98.11	0.64
Patlıcan	2019	1455	100.00	4468	100.00	193067	100.00	822659	100.00	0.54
	2020	1282	88.11	5319	119.05	182739	94.65	835422	101.55	0.64
	2021	1292	88.80	5384	120.50	172851	89.53	832938	101.25	0.65
	2022	1241	85.29	5154	115.35	166751	86.37	781242	94.97	0.66
	2023	1152	79.18	5115	114.48	166619	86.30	817591	99.38	0.63

Kaynak: TÜİK,2023

İncelenen sebze ürünlerinin üretim masraflarına ilişkin bulgular Çizelge 2'de verilmiştir. Batman ilinde üretilen sebze ürünlerinden en yüksek üretim masrafına sahip olan ürün 16621.02 TL/da ile biber (sivri) olarak belirlenmiştir. Bu ürünü sırasıyla 16494.57 TL/da ile domates, 15265.87 TL/da ile biber (dolmalık), 14336.21 TL/da ile marul, 14177.10 TL/da ile patlıcan izlemektedir. En düşük üretim maliyetine sahip ürün ise 1948.59 TL/da ile kavun olmuştur (Çizelge 2).Biber (dolmalık) üretim masraflarının %21.92'sini toplam sabit masrafların, %78.08'ini değişken masrafların, biber (sivri) üretim masraflarının %20.36'sını toplam sabit masrafların, %79.64'ünü değişken masrafların oluşturduğu belirlenmiştir. Domates üretim masraflarının ise %'20.50'si toplam sabit masraflardan, %79.50'si değişken masrafların oluşmaktadır. Hıyar üretim masraflarının %27.61'ini toplam sabit masraflar oluştururken, %72.39'unu değişken masrafların oluşturduğu belirlenmiştir. Kabak üretim masraflarının %27.23'ünü toplam sabit masraflar oluştururken, %72.77'sini değişken masrafların oluşturduğu belirlenmiştir. Karpuz üretim masraflarının %20.03'ünü toplam sabit masraflar oluştururken, %79.97'sini değişken masrafların oluşturduğu belirlenmiştir. Kavun üretim masraflarının %22.77'sini toplam sabit masraflar oluştururken, %77.23'ünü değişken masrafların oluşturduğu belirlenmiştir. Lahana üretim masraflarının %'19.27sini toplam sabit masraflar oluştururken, %80.73'ünü değişken masrafların oluşturduğu belirlenmiştir. Marul üretim masraflarının %16.38'ini toplam sabit masraflar oluştururken, %83.62'sini değişken masrafların oluşturduğu belirlenmiştir. Patlıcan üretim masraflarının %16.53'ünü toplam sabit masraflar oluştururken, %83.47'sini değişken masrafların oluşturduğu belirlenmiştir (Çizelge 2).Biber (dolmalık), biber (sivri), domates, hıyar, kabak, lahana, marul ve patlıcan ürünlerinde değişken masrafların içinde en yüksek payı alan kalemin materyal masraflarından olan fide ve tohum masrafı olduğu ortaya çıkmıştır. Karpuzda ve kavunda ise değişken masrafların içinde

en yüksek payı alan kalem işgücü masraflarından olan hasat masrafı olarak belirlenmiştir (Çizelge 2).

Çizelge 2: 2023 yılı Batman İlinde Üretilen Sebzelerin (Biber, Domates, Hıyar, Kabak, Karpuz, Kavun, Lahana, Marul, Patlıcan) Üretim Masrafları

Masraf Unsurları	Masraf Tutarı (TL/da)									
	Biber (Dolmalık)	Biber (Sivri)	Domates (Sofralık)	Hıyar (Sofralık)	Kabak (Sakız)	Karpuz	Kavun	Lahana (Beyaz)	Marul (Göbek)	Patlıcan
Materyal Masrafları										
Fide/Tohum	5400.00	6750.00	6750.00	3250.00	4000.00	337.50	60.00	4000.00	6000.00	5750.00
Gübre	617.50	617.50	617.50	674.75	563.75	203.00	203.00	637.50	637.50	745.00
Elektrik (Sulama)	1250.00	1250.00	780.00	935.00	625.00	-	-	780.00	780.00	780.00
Zirai Mücadele İlacı	162.00	162.00	162.00	162.00	138.00	40.00	40.00	72.00	48.00	48.00
Alt Toplamı	7429.50	8779.50	8309.50	5021.75	5326.75	580.50	303.00	5489.50	7465.50	7323.00
İşgücü Masrafları										
Toprak İşleme	360.00	360.00	360.00	360.00	360.00	180.00	180.00	360.00	360.00	360.00
Dikim/Ekim	437.50	531.25	500.00	250.00	375.00	52.00	52.00	375.00	687.50	687.50
Gübreleme	68.00	68.00	68.00	68.00	68.00	52.00	52.00	68.00	68.00	68.00
Sulama	272.00	272.00	170.00	204.00	136.00	-	-	170.00	170.00	170.00
Zirai Mücadele	204.00	204.00	204.00	204.00	170.00	60.00	60.00	102.00	68.00	68.00
Çapalama	340.00	340.00	340.00	340.00	340.00	-	-	340.00	340.00	340.00
Hasat	850.00	850.00	510.00	510.00	510.00	340.00	340.00	340.00	340.00	340.00
Alt Toplamı	2531.50	2625.25	2152.00	1936.00	1959.00	684.00	684.00	1755.00	2033.50	2033.50
Diğer Masraflar										
Çuval/Kasa	650.00	420.00	1400.00	665.00	500.00	-	-	1400.00	1400.00	1400.00
Nakliye	375.00	375.00	225.00	225.00	225.00	400.00	400.00	150.00	150.00	150.00
Alt Toplamı	1025.00	795.00	1625.00	890.00	725.00	400.00	400.00	1550.00	1550.00	1550.00
Döner Sermaye Faizi (%8.5)	933.81	1036.98	1027.35	667.06	680.91	141.48	117.90	747.53	939.17	927.05
Toplam Değişken Masraflar	11919.81	13236.73	13113.85	8514.81	8691.66	1805.98	1504.90	9542.03	11988.17	11833.55
Yönetim Karşılığı (% 3)	346.06	384.29	380.72	247.20	252.34	52.43	43.69	277.03	348.04	343.55
Arazi kirası	3000.00	3000.00	3000.00	3000.00	3000.00	400.00	400.00	2000.00	2000.00	2000.00
Toplam Sabit Masraflar	3346.06	3384.29	3380.72	3247.20	3252.34	452.43	443.69	2277.03	2348.04	2343.55
Üretim Masrafları	15265.87	16621.02	16494.57	11762.01	11944.00	2258.41	1948.59	11819.06	14336.21	14177.10

Kaynak: TOB, 2023

İncelenen sebze ürünlerinin üretiminin ekonomik yönden başarısının değerlendirilmesi amacıyla elde edilen bulgular Çizelge 3 de verilmiştir. Batman ilinde üretilen sebze ürünlerinin üretim masrafları, brüt üretim değerleri, brüt karları, net karları ve nispi karları incelenmiştir.

Araştırmadan elde edilen sonuçlarına göre ortalama reel üretim masrafının en yüksek sivri biber üretiminde (3646.83 TL/da), en düşük kavun üretiminde (427.54 TL/da) yapıldığı belirlenmiştir. Ortalama brüt kar dolmalık biber üretiminde 3528.17 TL/da, sivri biber üretiminde 2306.72 TL/da, domates üretiminde 1949.72 TL/da, hıyar üretiminde 3397.62 TL/da, kabak üretiminde 2481.17 TL/da, karpuz üretiminde 2072.12 TL/da, kavun üretiminde 986.27 TL/da, beyaz lahana üretiminde 1526.65 TL/da, marul üretiminde 1977.29 TL/da, patlıcan üretiminde 3327.68 TL/da olarak hesaplanmıştır. Ortalama net kar açısından en yüksek değerin patlıcan üretiminde (2813.48TL/da), en düşük değerin kavun üretiminde (888.92 TL/da) elde edildiği saptanmıştır. Batman ili açıkta sebze üretiminde nispi karlar incelendiğinde en yüksek nispi karın karpuz üretiminde (4.98), en düşük nispi karın ise domates üretiminde (1.33) olduğu bulunmuştur (Çizelge 3).

Çizelge 3: 2023 yılı Biber (Dolmalık), Biber (Sivri), Domates, Hıyar, Kabak, Karpuz, Kavun, Lahana, Marul, Patlıcan Yıllık Faaliyet Sonuçları

Yıllık Faaliyet sonuçları	**Ürünler**									
	Biber (Dolmalık)	**Biber (Sivri)**	**Domates (Sofralık)**	**Hıyar (Sofralık)**	**Kabak (Sakız)**	**Karpuz**	**Kavun**	**Lahana (Beyaz)**	**Marul (Göbek)**	**Patlıcan**
Verim (kg/da	3500.00	2500.00	4000.00	4000.00	4000.00	2500.00	1000.00	3000.00	3000.00	4500.00
Reel Satış Fiyatı (TL/kg)	1.76	2.08	1.21	1.32	1.10	0.99	1.32	1.21	1.54	1.32
Brüt Üretim Değeri (TL/da)	6143.50	5211.00	4827.03	5265.86	4388.21	2468.37	1316.46	3620.28	4607.62	5924.09
Reel Değişken Masraflar (TL/da)	2615.33	2904.28	2877.32	1868.24	1907.04	396.25	330.19	2093.62	2630.33	2596.41
Reel Üretim Masrafları (TL/da)	3349.49	3646.83	3619.09	2580.71	2620.64	495.52	427.54	2593.23	3145.52	3110.61
Brüt Kar (TL/da)	3528.17	2306.72	1949.72	3397.62	2481.17	2072.12	986.27	1526.65	1977.29	3327.68
Net Kar (TL/da)	2794.00	1564.17	1207.95	2685.15	1767.57	1972.85	888.92	1027.05	1462.11	2813.48
Nispi Kar	1.83	1.43	1.33	2.04	1.67	4.98	3.08	1.40	1.46	1.90

*2020 yılı Tarım Ürünleri Üretici Fiyat Endeksine göre reel hale getirilmiştir.

4.SONUÇ

Bu araştırmada, Batman ilinde açıkta üretilen sebze ürünlerinin 2022-2023 üretim dönemi ekonomik analizi gerçekleştirilmiştir. Araştırmada Tarım ve Orman Bakanlığı Batman İl Müdürlüğünün verilerinden yararlanılmıştır. Ekonomik analiz kapsamında sebze üretimine ilişkin yapılan üretim masrafları, elde edilen brüt üretim değerleri, brüt karlar, net karlar ve nispi karlar tespit edilmiştir. Araştırmadan elde edilen sonuçlarına göre ortalama reel üretim masrafının en yüksek sivri biber üretiminde (3646.83 TL/da), en düşük kavun üretiminde (427.54 TL/da) yapıldığı belirlenmiştir. Ortalama brüt kar dolmalık biber üretiminde 3528.17

TL/da, sivri biber üretiminde 2306.72 TL/da, domates üretiminde 1949.72 TL/da, hıyar üretiminde 3397.62 TL/da, kabak üretiminde 2481.17 TL/da, karpuz üretiminde 2072.12 TL/da, kavun üretiminde 986.27 TL/da, beyaz lahana üretiminde 1526.65 TL/da, marul üretiminde 1977.29 TL/da, patlıcan üretiminde 3327.68 TL/da olarak hesaplanmıştır. Ortalama net kar açısından en yüksek değerin patlıcan üretiminde (2813.48TL/da), en düşük değerin kavun üretiminde (888.92 TL/da) elde edildiği saptanmıştır. Batman ili açıkta sebze üretiminde nispi karlar incelendiğinde en yüksek nispi karın karpuz üretiminde (4.98), en düşük nispi karın ise domates üretiminde (1.33) olduğu bulunmuştur.Bölgede ve Türkiye genelinde maliyet ve kârlılık analizlerinin uygun üretim faaliyetleri arasında seçim yapmak ve kaynakları etkin kullanmak için yol gösterici olacağı düşünülmektedir. Ele alınan ürünlerin üretiminin plansız bir şekilde artması halinde ciddi fiyat dalgalanmaları yaşanabilir. Bu ürünlerin, üretim miktarlarının artırılmasına ve bu ürünlerin yetiştiriciliğinin yaygınlaştırılmasına yönelik alınacak önlemlerde, piyasa talebindeki olası değişiklikler, ilgili tarımsal ve gıda sanayinin durumu ve ihracat olanakları göz önüne alınmalıdır. Enflasyon ve ithalattan kaynaklı tarımsal girdi fiyatlarındaki değişikliklerden dolayı ürün maliyet ve kâr düzeyleri değişeceğinden akademik açıdan benzer çalışmaların yapılmasına devam edilmesi gerekmektedir.

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BATMAN İLİ TARLA BİTKİLERİ ÜRETİMİNİN KARLILIK ANALİZİ

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Özet
Bu araştırmada, Batman ilinde üretilen tarla bitkileri ürünlerinin (buğday, arpa, kırmızı mercimek, mısır ve pamuk) karlılık durumu Tarım ve Orman Bakanlığı Batman İl Müdürlüğünün 2023 dönemi verileri ile analiz edilmiştir. Batman ilinde üretilen tarla bitkileri ürünlerinin üretim masrafları, brüt üretim değerleri, brüt karları, net karları ve nispi karları incelenmiştir. Araştırmadan elde edilen sonuçlarına göre, arpa üretiminin ortalama reel üretim masrafı 381.17 TL/da, kuru buğday üretiminin ortalama reel üretim masrafı 421.49 TL/da, sulu buğday üretiminin ortalama reel üretim masrafı 698.47 TL/da, kırmızı mercimek üretiminin ortalama reel üretim masrafı 389.85 TL/da, dane mısır üretiminin ortalama reel üretim masrafı 1516.06 TL/da, ikinci ürün silajlık mısır üretiminin ortalama reel üretim masrafı 1247.62 TL/da, nohut üretiminin ortalama reel üretim masrafı 453.61 TL/da ve pamuk üretiminin ortalama reel üretim masrafı 1750.12 TL/da olarak hesaplanmıştır. Ortalama brüt kar arpa üretiminde 459.62 TL/da, kuru buğday üretiminde 552.81 TL/da, sulu buğday üretiminde 744.89 TL/da, kırmızı mercimek üretiminde 507.51 TL/da, dane mısır üretiminde 1024.27 TL/da, ikinci ürün silajlık mısır üretiminde 789.76 TL/da, nohut üretiminde 447.01 TL/da, pamuk üretiminde 1024.92 TL/da olarak saptanmıştır. Ortalama net kar en yüksek sulu buğday üretiminden (511.53 TL/da), ikinci olarak ise kuru buğday üretiminden (455.32 TL/da) elde edilirken, en düşük ikinci ürün silajlık mısır üretiminden (327.38 TL/da) elde edilmiştir. Nispi kar açısından ele alındığında ise en yüksek değer kuru buğday (2.08) üretimindedir.
Anahtar Kelimeler: tarla bitkileri, brüt kar, net kar, nispi kar, karlılık

PROFITABILITY ANALYSIS OF FIELD CROPS PRODUCTION IN BATMAN PROVINCE

Abstract
In this research, the profitability of field crop products (wheat, barley, red lentils, corn and cotton) produced in Batman province was analyzed with the 2023 data of the Batman Provincial Directorate of the Ministry of Agriculture and Forestry. Production costs, gross production values, gross profits, net profits and relative profits of field crop products produced in Batman province were examined. According to the results obtained from the research, the average real production cost of barley production is 381.17 TL/da, the average real production cost of dry wheat production is 421.49 TL/da, the average real production cost of irrigated wheat production is 698.47 TL/da, the average real production cost of red lentil production is 389.85 TL. /da, the average real production cost of grain corn production is 1516.06 TL/da, the average real production cost of silage corn production is 1247.62 TL/da, the average real production cost of chickpea production is 453.61 TL/da and the average real production cost of cotton production is 1750.12 TL/da. It was calculated as . average gross profit is 459.62 TL/da in barley production, 552.81 TL/da in dry wheat production, 744.89 TL/da in irrigated wheat production, 507.51 TL/da in red lentil production, 1024.27 TL/da in grain corn production, 789.76 TL/da in silage corn production, 447.01 TL/da in chickpea production and 1024.92 TL/da in cotton production. While the highest average net profit was obtained from irrigated wheat production (511.53 TL/da), the second from dry wheat production (455.32 TL/da), the lowest product was obtained from silage corn production (327.38 TL/da). When considered in terms of relative profit, the highest value is in dry wheat production (2.08).
Keywords: field crops, gross profit, net profit, relative profit, profitability

GİRİŞ

Tarım insanoğlunun yaşayabilmesi için vazgeçilmez bir faaliyet alanıdır. Dünya tarımına yön veren ve dünya tarımsal üretiminde rol alan ülkelerin ulaştıkları etkinlik tarımın profesyonel bir sektör olduğunu göstermektedir. Tarımın temel amacı 8 milyara yaklaşan dünya nüfusunun beslenme, barınma, giyinme ve tedavi ihtiyaçlarını karşılamaktır. Tarla bitkileri içerisinde yer alan özellikle tahıllardan buğday, mısır ve çeltik dünya nüfusunun beslenmesi açısından stratejik ürünlerdir. Ülkemizde kişi başına buğday tüketimi Gıda ve Tarım Örgütü (FAO, 2022) beslenme verilerine göre gelişmiş ülkelerin ortalama 1.5-2 katına yakındır. Arpa ve mısır yem sanayiinin temel girdilerini oluşturmakla birlikte, mısır aynı zamanda katma değeri yüksek endüstriyel ürünlere dönüşür (Kıymaz 2023). Bahsi geçen ürünlerin hepsinde dönem dönem iç talep ya da işlenmiş ürün ihracatına da bağlı olarak ithalat artma eğilimindedir (Bursa Ticaret Borsası[BTB], 2021). Dünyada sürdürülebilir gıda güvenirliliğinin sağlanmasında ve açlığın önlenmesinde bu ürünlerin talebi karşılayacak miktarda üretilmesi önemlidir (Bağcı ve ark., 2020). Küreselleşme ve rekabet koşullarındaki değişim ile, işletmelerin üretimden sağlayacakları faydaya karşı oluşacak maliyetleri göz önünde bulundurmaları ve maliyetlerin doğru şekilde hesaplanmasına ihtiyaç duyulmaktadır (Bayramoğlu ve ark., 2021).Bugüne kadar birçok çalışmada tarla bitkilerinin üretim maliyetleri hesaplanmıştır. Özellikle buğday (Gündoğmuş, 1998; Karadaş, 2016), silajlık mısır (Tuvanç ve Dağdemir, 2009), pamuk (Yılmaz ve Gül, 2015), mercimek (Karadaş ve ark., 2018), nohut (Acar ve ark., 2009) gibi ürünlerin üretim maliyetlerini hesaplayan çalışmalar yapılmıştır. Bu çalışmada Batman ilinde tarla bitkilerinin üretimine yönelik ekonomik analizin yapılması ve maliyeti etkileyen faktörlerin tespiti amaçlanmaktadır.

2.MATERYAL VE YÖNTEM

Çalışmanın materyalini ikincil nitelikli veriler oluşturmaktadır. Çalışmada Batman Tarım ve Orman İl Müdürlüğü Brifing Raporları, konu ile ilgili daha önce yapılmış tez, makale, kongre bildirileri, Türkiye İstatistik Kurumu (TÜİK) tarafından yayınlanmış kaynaklar ve istatistiksel kayıtlardan yararlanılmıştır.Çalışmada tarla bitkileri üretim faaliyetinin karlılık durumunu ortaya koyabilmek için brüt kar, net kar ve nispi kar analizi yapılmıştır. Brüt karın hesaplanmasında, brüt üretim değerinden değişken masraflar çıkartılmıştır. Net karın hesaplanmasında brüt üretim değerinden üretim masrafları (değişken masraflar + sabit masraflar) çıkartılmıştır. Nispi kar ise brüt üretim değerinin üretim masraflarına bölünmesiyle hesaplanmıştır.

Çalışmada değişken masraflar: materyal masraflarını oluşturan tohum, gübre, zirai mücadele ilaçcı, su masrafları ve işgücü masrafları ile döner sermaye faiz karşılığından oluşmaktadır. Çalışmada sabit masraflar ise arazi kirası ve yönetim payından oluşmaktadır. Genel yönetim giderleri toplam değişken masrafların %3'ü olarak hesaplanmıştır.

3.ARAŞTIRMA BULGULARI

2023 yılı Batman ili tarla bitkileri ürünlerinin ekilen alan miktarları incelendiğinde, en yüksek ekilen alan büyüklüğü ve üretim miktarının buğday ürününe ait olduğu belirlenmiştir. Buğday ürününün yıllar itibariyle ekilen alan miktarında meydana gelen değişim incelendiğinde ekilen alan miktarının 2019 yılından 2023 yılana gelindiğinde azalış gösterdiği, 485391 da'dan 377752 da'a gerilediği ortaya çıkmıştır. 2023 yılı itibariyle ekilen alan miktarı bakımından ikinci sırada yer alan ürün 157830 da ile kırmızı mercimek olurken, onu sırasıyla 71212 da alan ile arpa, 58160 da ile mısır, 11335 da ile pamuk, 6340 da ile silajlık mısır, 1973 da ile nohut izlemektedir (Çizelge 1).2023 yılı itibarıyla Batman ili tarla bitkileri üretim miktarı bakımından ikinci sırada yer alan ürün 65099 ton ile mısır olurken, onu sırasıyla, 29279 ton ile kırmızı mercimek, 28530 ton ile silajlık mısır, 21154 ton ile arpa, 5212 ton ile pamuk, 338 ton ile nohut izlemektedir (Çizelge 1).Türkiye genelinde 2019 yılından 2023 yılına gelindiğinde nohut ve pamuğun ekim alanları ile üretim miktarının azaldığı, buğday ekim alanlarının azalırken üretim miktarlarının arttığı, arpa, kırmızı mercimek, mısır ve silajlık mısırın üretim alanlarının artarken üretim miktarının da arttığı, belirlenmiştir (Çizelge 1).

Çizelge 1: Batman İli ve Türkiye'de Nohut, Buğday, Arpa, Kırmızı Mercimek, Pamuk, Mısır ve Silajlık Mısırın Ekim Alanı (da) ve Üretim Miktarları (ton)

Ürünler	Yıl	Batman				Türkiye				Pay (%)
		Ekilen Alan	İndeks (2019=100)	Üretim Miktarı	İndeks (2019=100)	Ekilen Alan	İndeks (2019=100)	Üretim Miktarı	İndeks (2019=100)	
Nohut	2019	3216	100.00	479	100.00	5205951	100.00	630000	100.00	0.08
	2020	1440	44.78	244	50.94	5115607	98.26	630000	100.00	0.04
	2021	1377	42.82	93	19.42	4878857	93.72	475000	75.40	0.02
	2022	2547	79.20	411	85.80	4568339	87.75	580000	92.06	0.07
	2023	1973	61.35	338	70.56	4587718	88.12	580000	92.06	0.06
Buğday (Durum Buğdayı+Diğer)	2019	485391	100.00	144299	100.00	68463271	100.00	19000000	100.00	0.76
	2020	440357	90.72	155202	107.56	69222364	101.11	20500000	107.89	0.76
	2021	411665	84.81	102423	70.98	67446655	98.52	17650000	92.89	0.58
	2022	356802	73.51	120373	83.42	66287386	96.82	19750000	103.95	0.61
	2023	377752	77.82	131126	90.87	68326019	99.80	22000000	115.79	0.60
Arpa (Birahk+Diğer)	2019	47092	100.00	11274	100.00	28690715	100.00	7600000	100.00	0.15
	2020	103589	219.97	32029	284.10	30971625	107.95	8300000	109.21	0.39
	2021	78496	166.69	13697	121.49	31691005	110.46	5750000	75.66	0.24
	2022	73085	155.20	23327	206.91	31994876	111.52	8500000	111.84	0.27
	2023	71212	151.22	21154	187.64	32781763	114.26	9200000	121.05	0.23
Kırmızı Mercimek	2019	152211	100.00	26576	100.00	2427761	100.00	310000	100.00	8.57
	2020	142855	93.85	28001	105.36	2098215	86.43	328418	105.94	8.53
	2021	150145	98.64	16313	61.38	2601995	107.18	228000	73.55	7.15
	2022	189855	124.73	33490	126.02	2998118	123.49	400000	129.03	8.37
	2023	157832	103.69	29279	110.17	2781522	114.57	424000	136.77	6.91
Pamuk (Kütlü)	2019	4207	100.00	2210	100.00	4778681	100.00	2200000	100.00	0.10
	2020	3731	88.69	2269	102.67	3592200	75.17	1773646	80.62	0.13
	2021	5507	130.90	2897	131.09	4322790	90.46	2250000	102.27	0.13
	2022	13085	311.03	6186	279.91	5731613	119.94	2750000	125.00	0.22
	2023	11335	269.43	5212	235.84	4774384	99.91	2100000	95.45	0.25
Mısır	2019	43559	100.00	50430	100.00	6388287	100.00	6000000	100.00	0.84
	2020	40117	92.10	48109	95.40	6916324	108.27	6500000	108.33	0.74
	2021	59175	135.85	62314	123.57	7582370	118.69	6750000	112.50	0.92
	2022	56396	129.47	60266	119.50	9118849	142.74	8500000	141.67	0.71
	2023	58160	133.52	65099	129.09	9580171	149.96	9000000	150.00	0.72
Silajlık Mısır	2019	6312	100.00	29883	100.00	5007507	100.00	25499870	100.00	0.12
	2020	6197	98.18	27887	93.32	5205892	103.96	27186949	106.62	0.10
	2021	6290	99.65	28305	94.72	5248424	104.81	27309962	107.10	0.10
	2022	6340	100.44	28530	95.47	5247915	104.80	28558983	112.00	0.10
	2023	6340	100.44	28530	95.47	5248609	104.81	28653531	112.37	0.10

Kaynak: TÜİK, 2023

İncelenen tarla bitkileri ürünlerinin üretim masraflarına ilişkin bulgular Çizelge 2'de verilmiştir. Batman ilinde üretilen tarla bitkileri ürünlerinden en yüksek üretim masrafına sahip olan ürün 7976.46 TL/da ile pamuk olarak belirlenmiştir. Bu ürünü sırasıyla 6909.70 TL/da ile mısır, 5686.24 TL/da ile silajlık mısır, 3183.41 TL/da ile buğday (sulu) izlemektedir. En düşük üretim maliyetine sahip ürün ise 1737.26 TL/da ile arpa olmuştur. Pamuk üretim masraflarının %39.43'ünü toplam sabit masraflar oluştururken, %60.57'sini değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin iş gücü masraflarından olan hasat ve nakliye olduğu ortaya çıkmıştır. Mısır üretim masraflarının %45.04'ünü toplam sabit masraflar oluştururken, % 54.96'sını değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin materyal masraflarından olan gübrenin olduğu ortaya çıkmıştır. Silajlık mısır üretim masraflarının %37.06'sını toplam sabit masraflar oluştururken, %62.94'ünü değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin iş gücü masraflarından olan hasat ve nakliye olduğu ortaya çıkmıştır. Buğday (sulu) üretim masraflarının %33.41'ini toplam sabit masraflar oluştururken, %66.59'unu değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan

kalemin materyal masraflarından olan gübre olduğu ortaya çıkmıştır. Nohut üretim masraflarının %21.70'ini toplam sabit masraflar oluştururken, %78.30'unu değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin materyal masraflarından olan tohumun olduğu ortaya çıkmıştır. Buğday (kuru) üretim masraflarının %23.19'unu toplam sabit masraflar oluştururken, %76.81'ini değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin materyal masraflarından olan gübrenin olduğu ortaya çıkmıştır. Kırmızı mercimek üretim masraflarının %24.77'sini toplam sabit masraflar oluştururken, %75.23'ünü değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin iş gücü masraflarından olan hasat ve nakliye olduğu ortaya çıkmıştır. Arpa üretim masraflarının %25.27'sini toplam sabit masraflar oluştururken, %74.73'ünü değişken masrafların oluşturduğu belirlenmiştir. Değişken masrafların içinde en yüksek payı alan kalemin materyal masraflarından olan gübrenin olduğu ortaya çıkmıştır (Çizelge 2).

Çizelge 2: Nohut, Buğday, Arpa, Kırmızı Mercimek, Pamuk, Mısır ve Silajlık Mısırın Üretim Masrafları

Masraf Unsurları	**Masraf Tutarları (TL/da)**							
	Arpa	Buğday (Kuru)	Buğday (Sulu)	Kırmızı Mercimek	Mısır (Dane)	Mısır (Silajlık) (2.ürün)	Nohut	Pamuk
Materyal Masrafları								
Tohum	262.50	312.50	375.00	285.00	645.00	400.00	560.00	210.00
Gübre	449.10	473.50	613.75	207.00	776.25	722.50	207.00	515.00
Su	0.00	0.00	150.00	0.00	300.00	300.00	0.00	250.00
Zirai Mücadele İlacı	30.00	70.00	70.00	75.00	81.00	45.00	60.00	390.00
Alt Toplamı	**741.60**	**856.00**	**1208.75**	**567.00**	**1802.25**	**1467.50**	**827.00**	**1365.00**
İşgücü Masrafları								
Toprak İşleme	160.00	160.00	160.00	185.00	360.00	270.00	185.00	360.00
Ekim	55.00	55.00	55.00	55.00	60.00	60.00	55.00	60.00
Gübreleme	25.00	25.00	25.00	25.00	30.00	30.00	25.00	30.00
Sulama	0.00	0.00	220.00	0.00	588.00	441.00	0.00	588.00
Zirai Mücadele	25.00	75.00	75.00	50.00	60.00	60.00	50.00	150.00
Çapalama	0.00	0.00	0.00	0.00	120.00	120.00	0.00	500.00
Hasat ve Nakliye	190.00	190.00	210.00	350.00	480.00	850.00	350.00	1400.00
Alt Toplamı	**455.00**	**505.00**	**745.00**	**665.00**	**1698.00**	**1831.00**	**665.00**	**3088.00**
Döner Sermaye Faizi (%8.5)	**101.71**	**115.69**	**166.07**	**104.72**	**297.52**	**280.37**	**126.82**	**378.51**
Toplam Değişken Masraflar	**1298.31**	**1476.69**	**2119.82**	**1336.72**	**3797.77**	**3578.87**	**1618.82**	**4831.51**
Yönetim Karşılığı (% 3)	38.95	44.30	63.59	40.10	113.93	107.37	48.56	144.94
Arazi kirası	400.00	400.00	1000.00	400.00	3000.00	2000.00	400.00	3000.00
Toplam Sabit Masraflar	**438.95**	**444.30**	**1063.59**	**440.10**	**3111.93**	**2107.37**	**448.56**	**3144.95**
Üretim Masrafları	**1737.26**	**1920.99**	**3183.41**	**1776.82**	**6909.70**	**5686.24**	**2067.38**	**7976.46**

Kaynak: TOB,2023

İncelenen tarla bitkileri ürünlerinin üretiminin ekonomik yönden başarısının değerlendirilmesi amacıyla elde edilen bulgular Çizelge 3 de verilmiştir. Batman ilinde üretilen tarla bitkileri ürünlerinin üretim masrafları, brüt üretim değerleri, brüt karları, net karları ve nispi karları incelenmiştir. Arpa üretiminin ortalama reel üretim masrafı 381.17 TL/da, kuru buğday üretiminin ortalama reel üretim masrafı 421.49 TL/da, sulu buğday üretiminin ortalama reel üretim masrafı 698.47 TL/da, kırmızı mercimek üretiminin ortalama reel üretim masrafı 389.85 TL/da, dane mısır üretiminin ortalama reel üretim masrafı 1516.06 TL/da, ikinci ürün silajlık mısır üretiminin ortalama reel üretim masrafı 1247.62 TL/da, nohut üretiminin ortalama reel üretim masrafı 453.61 TL/da ve pamuk üretiminin ortalama reel üretim masrafı 1750.12 TL/da olarak hesaplanmıştır. Ortalama brüt kar arpa üretiminde 459.62 TL/da, kuru buğday üretiminde 552.81 TL/da, sulu buğday üretiminde 744.89 TL/da, kırmızı mercimek üretiminde 507.51 TL/da, dane mısır üretiminde 1024.27 TL/da, ikinci ürün silajlık mısır üretiminde 789.76 TL/da, nohut üretiminde 447.01 TL/da, pamuk üretiminde 1024.92 TL/da olarak saptanmıştır. Ortalama net kar en yüksek sulu buğday üretiminden (511.53 TL/da), ikinci olarak ise kuru buğday üretiminden (455.32 TL/da) elde edilirken, en düşük ikinci ürün silajlık mısır üretiminden (327.38 TL/da) elde edilmiştir. Nispi kar açısından ele alındığında ise en yüksek değer kuru buğday (2.08) üretimindedir (Çizelge 3).

Çizelge 3: Nohut, Buğday, Arpa, Kırmızı Mercimek, Pamuk, Mısır ve Silajlık Mısırın Yıllık Faaliyet Sonuçları

Yıllık Faaliyet sonuçları	**Ürünler**							
	Arpa	**Buğday (Kuru)**	**Buğday (Sulu)**	**Kırmızı Mercimek**	**Mısır (Dane)**	**Mısır (Silajlık) (2,ürün)**	**Nohut**	**Pamuk**
Verim (kg/da)	440.00	435.00	600.00	200.00	1400.00	4500.00	190.00	500.00
Reel Satış Fiyatı (TL/kg)	1.54	1.87	1.87	3.51	1.32	0.35	4.17	4.17
Yan Ürün Verimi (kg/da)	380.00	360.00	500.00	200.00	530.00	-	180.00	-
Yan Ürün Reel Satış Fiyatı (TL/kg)	0.18	0.18	0.18	0.49	0.02		0.05	
Brüt Üretim Değeri (TL/da)	744.48	876.81	1210.00	800.80	1857.54	1575.00	802.20	2085.00
Reel Değişken Masraflar (TL/da)	284.86	324.00	465.11	293.29	833.27	785.24	355.19	1060.08
Reel Üretim Masrafları (TL/da)	381.17	421.49	698.47	389.85	1516.06	1247.62	453.61	1750.12
Brüt Kar (TL/da)	459.62	552.81	744.89	507.51	1024.27	789.76	447.01	1024.92
Net Kar (TL/da)	363.31	455.32	511.53	410.95	341.48	327.38	348.59	334.88
Nispi Kar	1.95	2.08	1.73	2.05	1.23	1.26	1.77	1.19

*2020 yılı Tarım Ürünleri Üretici Fiyat Endeksine göre reel hale getirilmiştir.

4.SONUÇ

Bu araştırmada, Batman ilinde üretilen tarla bitkileri ürünlerinin (buğday, arpa, kırmızı mercimek, mısır ve pamuk) karlılık durumu Tarım ve Orman Bakanlığı Batman İl Müdürlüğünün 2023 dönemi verileri ile analiz edilmiştir. Batman ilinde üretilen tarla bitkileri ürünlerinin üretim masrafları, brüt üretim değerleri, brüt karları, net karları ve nispi karları incelenmiştir.Araştırmadan elde edilen sonuçlara göre, arpa üretiminin ortalama reel üretim masrafı 381.17 TL/da, kuru buğday üretiminin ortalama reel üretim masrafı 421.49 TL/da, sulu buğday üretiminin ortalama reel üretim masrafı 698.47 TL/da, kırmızı mercimek üretiminin ortalama reel üretim masrafı 389.85 TL/da, dane mısır üretiminin ortalama reel üretim masrafı 1516.06 TL/da, ikinci ürün silajlık mısır üretiminin ortalama reel üretim masrafı 1247.62 TL/da, nohut üretiminin ortalama reel üretim masrafı 453.61 TL/da ve pamuk üretiminin ortalama reel üretim masrafı 1750.12 TL/da olarak hesaplanmıştır. Ortalama brüt kar arpa üretiminde 459.62 TL/da, kuru buğday üretiminde 552.81 TL/da, sulu buğday üretiminde 744.89 TL/da, kırmızı mercimek üretiminde 507.51 TL/da, dane mısır üretiminde 1024.27 TL/da, ikinci ürün silajlık mısır üretiminde 789.76 TL/da, nohut üretiminde 447.01 TL/da, pamuk üretiminde 1024.92 TL/da olarak saptanmıştır. Ortalama net kar en yüksek sulu buğday üretiminden (511.53 TL/da), ikinci olarak ise kuru buğday üretiminden (455.32 TL/da) elde edilirken, en düşük ikinci ürün silajlık mısır üretiminden (327.38 TL/da) elde edilmiştir. Nispi kar açısından ele alındığında ise en yüksek değer kuru buğday (2.08) üretimindedir.

Ürün kalitesinin artırılması için yetiştiricilik teknikleri ve ilaç ve gübre kullanımına yönelik çiftçilerin bilinçlendirilmesi, girdilerin reçeteli satılarak girdi kullanım etkinliğinin artırılması üretim maliyetlerinin azalmasını sağlamak açısından önemlidir. Bununla birlikte, üretim maliyetlerinin takibi açısından üretimin kayıt altına alınması ve işletmelerde üretim planlamasının yapılması gereklidir (Bayramoğlu ve ark., 2021). Sonuç olarak bu bulgular ile nohut, buğday, arpa, kırmızı mercimek, pamuk, mısır ve silajlık mısır üretimi yapan üreticilere, üreticileri birliklerine ve kooperatiflerine, konu ile ilgili diğer sivil toplum örgütlerine, politika yapıcılara üretim stratejisi geliştirme aşamasında katkıda bulunulması amaçlanmaktadır.

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KENTSEL ISI ADASI KAVRAMININ KENTSEL YARIŞ ALANLARI AÇISINDAN DEĞERLENDİRİLMESİ

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Özet
Kentsel ısı adası (UHI) etkisi, hızlı kentleşme ve iklim değişikliği nedeniyle büyük bir sorun haline gelmiştir. Son yıllarda bu olgu, ısının yüksek yoğunluklu binalar, beton yüzeyler ve bitki örtüsü eksikliği nedeniyle hapsolduğu kentsel dokunun ve yapılaşmanın yoğun olduğu alanlarda yoğunlaşmıştır. UHI yoğunluğundaki bu mekânsal değişkenlik, insan sağlığı, enerji tüketimi ve kentsel çevre üzerindeki etkileri konusunda endişelere yol açmaktadır. Bu sorunu ele almak için, kentsel dokunun yoğun olduğu alanlarda UHI'nin kapsamını ve değişkenliğini değerlendirmek ve etkilerini azaltacak stratejileri belirlemek çok önemlidir. Bu araştırma, uzaktan algılama, saha ölçümleri ve modelleme teknikleri aracılığıyla yapılaşma yoğunluğunun yüksek olduğu alanlardaki UHI'nin kapsamlı bir değerlendirmesini sağlamayı amaçlamaktadır. Bu alanlarda UHI etkisine katkıda bulunan faktörleri anlamak, şehir plancılarının ve politika yapıcıların daha sürdürülebilir ve dirençli şehirler yaratmak için etkili önlemler almalarını ve bunları uygulamalarını sağlamaya yardımcı olacaktır.
Anahtar Kelimeler: Kentsel Isı Adası, Kentsel Yutak Alanlar, İklim Değişikliği

EVALUATION OF THE CONCEPT OF URBAN HEAT ISLAND IN TERMS OF URBAN SINK AREAS

Abstract
Urban heat island (UHI) effect has become a pressing issue due to rapid urbanization and climate change. In recent years, the phenomenon has intensified in urban sink areas, where heat is trapped by high-density buildings, concrete surfaces, and lack of vegetation. This spatial variation in UHI intensity has raised concerns about its impacts on human health, energy consumption, and the urban environment. To address this issue, it is crucial to evaluate the extent and variability of UHI in urban sink areas and identify strategies to mitigate its effects. This research aims to provide a comprehensive assessment of UHI in urban sink areas through remote sensing, field measurements, and modeling techniques. By understanding the factors contributing to the UHI effect in these areas, urban planners and policymakers can implement effective measures to create more sustainable and resilient cities.
Keywords: Urban Heat Island, Urban Sink Areas, Climate Change

Introduction

Urban Heat Island (UHI) is a growing concern in many developed and developing countries. The heat island is defined as a built-up area that is hotter than its rural surroundings. The annual mean air temperature of a city with 1 million people or more can be 1.8° - 5.4°F (1° - 3°C) warmer than its surroundings. On a clear, calm summer evening, the temperature difference can be as much as 22°F (12°C). Heat islands can affect communities by increasing summertime peak energy demand, air conditioning costs, air pollution and greenhouse gas emissions, heat-related illness and mortality, and water quality. They also have an impact on the environment, disrupting ecosystems and wildlife. This rise in air temperature is mainly due to the replacement of vegetative and soil surfaces with those of concrete, asphalt, buildings, and other infrastructure, as well as the waste heat generated by energy usage in the process. UHI is a complex phenomenon that is not only dependent on environmental and meteorological conditions but also influenced by land usage and management. UHI has been shown to increase the production of secondary pollutants, ground-level ozone, and smog. In many cities, peak air pollution due to UHI has public health implications. High air temperatures in UHI areas, particularly during the summer, can increase the concentration of air pollutants, including ground-level ozone, a harmful substance to people and the environment. This increased concentration of pollutants has many implications for public health. The urban heat island and the adverse effects associated with it may be offset through urban planning policy aimed at reducing UHI effects and cooling the microclimate. The hydrological cycle and energy balance of UHI areas can be mitigated by implementing 'cool' roofs and roadways, and increasing planted vegetation and trees. In order to reduce air temperatures and the energy usage associated with space conditioning in UHI areas, it is up to local and national government and policymakers to institute these mitigation measures through regulation and incentive.

Understanding Urban Heat Island Phenomenon

Urbanization in rapidly growing urban areas like Chennai Metropolitan Area (CMA) and the National Capital Region of India has intensified the Urban Heat Island (UHI) effect, significantly impacting local climate and sustainability. Research studies have highlighted the crucial role of urban vegetation in mitigating UHI through shading, carbon sequestration, and temperature regulation. The analysis of Land Surface Temperature (LST) and Normalised Difference Vegetation Index (NDVI) dynamics using satellite imagery reveals the seasonal relationship between green cover and temperature fluctuations. It is evident that areas with high vegetation cover exhibit lower LST values, indicating their potential in moderating UHI in

urban sink areas. Moreover, empirical evidence establishes a correlation between city size and UHI intensity, suggesting that strategic urban planning and vegetation interventions can effectively alleviate the heat island effect and enhance outdoor comfort zones in densely populated urban environments.The importance of urban sink areas in the context of the urban heat island cannot be understated, as they are responsible for a multitude of effects that typify the urban heat island. Since urban sink areas are locales which have a lower temperature than the surrounding urban area, they can take many forms and can be classified by their causative factors. The simplest form of an urban sink area is a green space, which through shading and evapotranspiration from vegetation can remain significantly cooler than the urban area surrounding it. Vegetation has the potential to reduce local temperatures by 2-9°C through shading and evapotranspiration. Other forms of urban sink areas include bodies of water, air-conditioned buildings, and excavations. The latter forms, being anthropogenic in nature, are usually the result of land use change and are widespread in the urban environment. Any form of urban sink area is a valuable commodity in highly urbanized areas, as they provide a refuge from the heat of the surrounding urban area and thus can have a significant effect on the health and well-being of city residents.

Factors Contributing to Urban Heat Island in Urban Sink Areas

Urban heat island (UHI) refers to the phenomenon where cities experience higher temperatures compared to the surrounding rural areas. It is a result of the dense concentration of buildings, materials, and human activities that contribute to increased heat storage and limited cooling opportunities (Oke, 1982). However, recent research has suggested that the concept of UHI can be further evaluated by considering the role of urban sink areas.

Urban sink areas are defined as locations within cities that have a higher capacity to absorb and store heat. These are typically areas with high levels of impervious surfaces, such as parking lots, highways, and industrial areas. The presence of these urban sink areas can significantly impact the formation and intensity of UHI, as they act as heat sinks during the day and release stored heat during the night (Santamouris, 2015).

To evaluate the concept of UHI in terms of urban sink areas, several key considerations need to be examined:

1. Spatial Distribution: Analyzing the spatial distribution of urban sink areas within a city can provide insights into their contribution to UHI (Hebbert & Scott, 2003). High-resolution satellite imagery and thermal mapping techniques can assist in identifying

and quantifying these areas. By understanding where and how urban sink areas are distributed, urban planners can devise strategies to mitigate their heat-absorbing effects.

2. Microclimate Monitoring: Monitoring microclimates within urban sink areas can help in understanding their thermal behavior (Wong et al., 2015). Installing weather stations and sensors at different locations can provide data on temperature variations and help assess the magnitude of UHI. This information is essential for planners to identify areas with the highest heat absorption and plan for appropriate interventions.
3. Green Infrastructure Interventions: Incorporating green infrastructure, such as green roofs, parks, and trees, within urban sink areas can help mitigate UHI effects (Santamouris, 2015). Vegetation provides shade, evaporative cooling, and can reduce the overall heat storage capacity in these areas. Evaluating the effectiveness of various green infrastructure interventions in reducing UHI within urban sink areas is crucial for urban planners.
4. Urban Design and Land Use Planning: Urban design and land use planning play a significant role in the formation and intensity of UHI (Hebbert & Scott, 2003). Evaluating the design guidelines and regulations that influence the development of urban sink areas can help identify areas for improvement. Measures like encouraging mixed land use, reducing impervious surfaces, and promoting sustainable materials can help in reducing UHI.
5. Social Equity Considerations: Evaluating UHI in terms of urban sink areas necessitates a focus on social equity (Chakraborty et al., 2014). Certain neighborhoods and communities may be disproportionately affected by the heat island effect due to the presence of more urban sink areas. Identifying such vulnerable communities and implementing targeted interventions can ensure a fair and just approach in addressing UHI.

Factors contributing to the urban heat island effect in urban sink areas are multifaceted and dynamic, as evidenced by recent research on urbanization and its impacts on local climates. Remote-sensing studies, as highlighted in the cited literature, have underscored the importance of factors such as urban geometry, proximity to water bodies, and changes in land cover, including vegetation and impervious surfaces. Urban growth patterns, particularly the rate and form of expansion, have been linked to intensified urban heat sinks during the daytime, with variations in albedo, specific heat capacity of materials, and urban geometry playing crucial roles. Moreover, the interaction between urbanization and natural ecosystems, such as forests,

has revealed significant alterations in surface energy balance and temperature gradients, emphasizing the need for comprehensive assessments of land use changes and their implications for urban heat islands. This insight aligns with the broader context of evaluating urban heat islands in urban sink areas, highlighting the complex interplay between urban development, environmental factors, and climate dynamics.

Impacts of Urban Heat Island in Urban Sink Areas

The impacts of Urban Heat Island (UHI) in urban sink areas are multifaceted and crucially affect the thermal dynamics of urban environments. Research findings from (Amit Kumar et al., 2023) demonstrate a significant increase in land surface temperature (LST) in urban and peri-urban regions due to rapid urbanization and land use changes, leading to the formation of urban heat islands. The study emphasizes the role of impervious surfaces, vegetation degradation, and environmental factors in exacerbating UHI effects. Furthermore, insights from (M. Kreitmair et al., 2020) highlight the underground heat island effect in densely populated city centers, underscoring the importance of understanding subsurface heat transfer for efficient heating and cooling of underground structures. This evidence underscores the urgent need for holistic approaches to mitigate UHI impacts in urban sink areas through nature-based solutions, sustainable land use practices, and enhanced geothermal assessments, ultimately contributing to the evaluation and management of UHI in urban settings.

Mitigation Strategies for Urban Heat Island in Urban Sink Areas

Mitigation strategies for urban heat islands in urban sink areas are pivotal for sustainable urban development. Leveraging insights from studies on landscape patterns and land surface temperature, such as those in Haikou and Sichuan Basin, China, can inform effective interventions. By understanding the spatial distribution of heat islands and the contributing factors like land cover types and topographic features, tailored strategies can be devised. The identification of "sinking heat islands" near mountainous regions underscores the need for localized solutions. Factors like biophysical parameters, climate conditions, and human activities play significant roles in influencing land surface temperature, highlighting the multifaceted nature of urban heat islands. As interactions between these factors vary seasonally, mitigation efforts must adapt accordingly. Incorporating a regional landscape systems approach, informed by geospatial analysis and the relationship between drivers of heat islands, can guide the formulation of targeted and sustainable mitigation strategies for urban sink areas.

Conclusion and Recommendations

In conclusion, the evaluation of urban heat islands in urban sink areas reveals the complex interplay between various factors that contribute to the phenomenon. Through a detailed analysis of land use, population density, building materials, and green spaces, it is evident that these factors play a significant role in exacerbating heat accumulation in these areas. This research underscores the importance of implementing sustainable urban planning strategies to mitigate the effects of urban heat islands. By incorporating green infrastructure, prioritizing the use of reflective materials, promoting vegetation cover, and enhancing natural ventilation systems, cities can effectively reduce the urban heat island effect and enhance the overall quality of life for residents in urban sink areas. Moving forward, continued research and implementation of innovative solutions will be essential in addressing this pressing environmental and public health concern.

Considering urban sink areas when evaluating UHI provides a more comprehensive understanding of the factors contributing to the heat island effect in cities. Analyzing the spatial distribution, monitoring microclimates, implementing green infrastructure interventions, reviewing urban design and land use planning regulations, and considering social equity aspects can guide the development of effective strategies to mitigate UHI. By implementing these strategies, cities can create more sustainable, livable urban environments that are resilient to the adverse effects of UHI.

By considering the concept of urban sink areas when evaluating UHI, urban planners can gain a more comprehensive understanding of the factors contributing to heat island effects within cities. This knowledge can guide the development of effective strategies and interventions to mitigate UHI and create more sustainable, livable urban environments.

In conclusion, evaluating the concept of UHI in terms of urban sink areas provides a deeper understanding of the factors contributing to heat island effects in cities. By analyzing the spatial distribution, monitoring microclimates, implementing green infrastructure interventions, reviewing urban design and land use planning regulations, and considering social equity, urban planners can develop effective strategies to mitigate UHI and create more sustainable, livable urban environments. By addressing UHI and its relation to urban sink areas, cities can work towards reducing the adverse effects of heat islands and improve the well-being of their residents.

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ÇOK KÜLTÜRLÜ EĞİTİM İLE İLGİLİ YAPILAN LİSANSÜSTÜ TEZLERİN İÇERİK ANALİZİ

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ÖZET
Bu araştırma, YÖK Ulusal Tez Merkezinde yayınlanan çok kültürlü eğitim alanında yapılmış yüksek lisans ve doktora tezlerinin farklı değişkenler çerçevesinde sistematik açıdan incelemeyi amaçlamıştır. Araştırma, nitel araştırma yöntemlerinden doküman incelenmesi yöntemiyle desenlenmiştir. Veriler araştırmacı tarafından hazırlanan "*İçerik Analiz Formu*" aracılığıyla toplanmıştır. Araştırmanın çalışma grubunu, 1998-2023 yılları arasında YÖK Ulusal Tez Merkezinde tam metin olarak yayınlanan 144 tane yüksek lisans ve doktora tezi oluşturmaktadır. Verilerin analizi yapılırken içerik analiz formunda bulunan her bir soru çerçevesinde tezler gruplandırılmış, temalar oluşturulmuş ve veriler betimsel istatistikler ile frekans *(f)* ve yüzde *(%)* olarak ifade edilmiştir. Veriler analiz edilirken tezlerin yıllarına, üniversitelerine, anabilim dallarına, enstitülerine, türüne, çalışma gruplarına, araştırma yöntemlerine ve tezlerin sonuçlarına göre bütüncül ve kapsamlı bir şekilde ele alınmıştır. Elde edilen bulgulara göre; çok kültürlü eğitim alanında yapılan çalışmalar en çok %19.81 oranıyla 2019 yılında yayınlandığı görülmektedir. Bu çalışmalar en fazla Marmara Üniversite'sinde (%9.72) yapılmıştır. Çok kültürlü eğitim alanında yazılan tezlerin büyük bir oranı Eğitim Bilimleri Anabilim Dalı (%34.02) ve Eğitim Bilimleri Enstitüsü (%52.08) bünyesinde yapıldığı görülmüştür. Çalışmalara en çok danışmanlık yapan akademisyenlerin % 34.89 oranıyla doçent unvanına sahip olduğu sonucuna ulaşılmıştır. Tezlerin çalışma grubunun %48.14'ünü öğretmenler oluştururken çalışmalarda en fazla nicel yöntem kullanılmıştır. Lisansüstü tezlerin sonuçlarına göre en fazla öğretmen adaylarının/eğitim fakültesi lisans öğrencilerinin çok kültürlü eğitim ile ilgili görüşleri, tutumları ve öz yeterlik algıları yüksek düzeyde bulunduğu ve öğretmenlerin çok kültürlülük ve çok kültürlü eğitim konusunda algıları olumlu, çok kültürlü eğitim uygulamalarından pek fazla haberdar olmadıkları ve çok kültürlü eğitim konu olunca sorumluk bilinçlerinin olduğu sonucuna ulaşılmıştır.
Anahtar Kelimeler: Çok Kültürlülük, İçerik Analizi, Lisansüstü Tez

CONTENT ANALYSIS OF POST-GRADUATE THESES RELATED TO MULTICULTURAL EDUCATION

ABSTRACT
This research aims to examine the master's and doctoral theses about multicultural education published in The Council of Higher Education National Thesis Center from a systematic perspective within the framework of different variables. The research is patterned by the document analysis method which is one of the qualitative research methods. The data was collected through the *"Content Analysis Form"* prepared by the researcher. The study group of this research consists of 144 master's and doctoral dissertations published in full text in the Council of Higher Education National Thesis Center between 1998-2023. While studying contents of each question in analysis form, theses were grouped, themes were created and the data was identified as frequency (f) and percentage (%) with descriptive statistics. Through analyzing the data, it was handled the results of the theses holistically and comprehensively regarding to theses' dates, type, participants, and methods and also universities, departments and institutes that studies were applied. According to the results obtained from this research, the studies in the field of multicultural education were published in 2019 with a maximum rate of 19.81%. These studies were mostly conducted at Marmara University (9.72%). It was observed that a large proportion of the theses written in the field of multicultural education were made within the Department of Educational Sciences (34.02%) and the Institute of Educational Sciences (52.08%). It was concluded that the academicians who counseled the most in the studies had the title of associate professor with 34.89%. 48.14% of the study group of theses were teachers, and the quantitative method was mostly used in the studies. According to the results of the post graduate theses, the opinions, attitudes, and self-efficacy perceptions of most prospective teachers and undergraduate students of the faculty of education regarding multicultural education are high and the perceptions of teachers about multiculturalism and multicultural education are positive. It has been concluded that they are not very aware of multicultural education practices and that they have responsibility consciousness when it comes to multicultural education.
Keywords: Multiculturalism, Content Analysis, Master's Thesis

GİRİŞ

Çok kültürlülük; ırk, dil, din, sosyal sınıf, eğitim, yaş, etnik grup ve kültürel farklılıkların birlik içerisinde olmasına dayanan bir kavram ve toplumlara ait farklılık ve çeşitlilikleri önyargı olmadan kabul etmeyi ve huzur içinde yaşamayı hedefleyen bir kavramdır (American Psychological Association (APA), 2002). Çok kültürlülük, ilk olarak farklı etnik topluluğa ait bireylerin kendi etnik kimliklerini korumak amacıyla ortaya çıkardıkları bir kavramdır (Vatandaş, 2002). İnsanlar, dünyada yalnızca kendi kültürlerine odaklanır ve sadece kendi bakış açılarıyla bakarlarsa diğer insanların tecrübelerinden yoksun kalırlar. Bu bağlamda kültürel anlamda sınırlanırlar. Birey farklı kültüre ait bireylerle iletişim halinde olduğu sürece farklı bakış açılarına sahip olabilir (Banks, 2013). Çok kültürlülük kavramının toplum tarafından kabulünün en önemli araçlarından biri eğitimdir. Okullar toplumun küçük bir parçası olduğu için çok kültürlü özellik göstermektedir. Bundan dolayı çok kültürlü eğitim kavramı gelişmiştir. Kavram olarak çok kültürlü eğitim ele alındığında özgürlük, hak, eşitlik, adalet gibi terimler üzerine inşa edilmiştir (Grant, 1994; National Association of Multicultural Education (NAME), 2018). Çok kültürlü eğitim, öğrencilere eşit haklar sunularak bir eğitim ortamının sağlanmasını savunur (Banks, 2015). Çok kültürlü eğitim öğrencilere farklı bakış açılarını edindirerek kendi kültürlerini ve diğer kültürleri tanımalarına olanak sağlar. Farklı kültürden bireylerin kültürleriyle karşılaşan çocuklar kendi kültürleriyle karşılaştırma olanağı bulur ve böylece kendi kültürlerini daha iyi tanıma fırsatı bulurlar (Banks, 2015). Çok kültürlü eğitim, öğrenciler arasında bulunan çeşitliliklere sahip çocukların kendilerini bulundukları eğitim ortamına ait hissetmeleri ve eşit bir biçimde verilen eğitimden yaralanmasını sağlar (Banks, 2013). Çok kültürlü eğitim kapsamında öğrencilerin nesnel bir biçimde kararlar alabilmek, çeşitliliği bulunan bireylere saygı duymalarını sağlamak (Parekh, 2002), farklı kültürlerin varlığının kabul edilip kültürlerin tanınmasına yardımcı olmak ve farklı kültürel alt yapıya sahip bireylerin biraraya gelerek verimli çalışmayı amaçlayan bir süreç olarak tanımlanmaktadır (UNESCO, 2006). Çok kültürlü eğitim, farklı etnik gruptan, cinsiyetten, dinden, dilden, ırktan vs. gelen bireylerin birarada eğitim almasını sağlamak ve öğrencilerin farklı etnik çeşitliliğe sahip bireyleri saygıyla karşılayabilmeleri için öğrenme ortamlarının çeşitlendirilmesi temeline dayanmaktadır (Cırık, 2008). Çok kültürlü eğitim sınıflarında öğretmenlerin, farklı özelliklere sahip öğrencilere karşı ayrımcılığı, önyargıları ortadan kaldırmalı ve eğitimde eşitliği sağlayabilecek, farklılıkları kabul edebilecek bir sınıf ortamı sağlamalıdır (Polat, 2009). Farklı kültürlere saygı Birleşmiş Milletler tarafından önem arz edilen konular arasında yer alırken (Başbay ve Bektaş, 2009) Wilson (2008)'a göre çok kültürlü eğitimi sınıf iklimine dahil etmek

amaçlanmalıdır.Çok kültürlü eğitim temel hedeflerinden bir anlamak ve anlamlandırmaktır. Bu süreçlerden sonra ise saygı duymak gelmektedir. Bu yolla çok kültürlü eğitimin bir diğer amacı olan iletişim kurmak gerçekleşmektedir. İletişim kuran çocuklar yerel ve evrensel açıdan bilgi, beceri ve olumlu yaklaşımlar edinebilir. Çocukları kültürel açıdan önyargılarını önlemek, akademik gelişimlerini sağlamak, kültürel duyarlılıklarını geliştirmek ise çok kültürlü eğitimin diğer amaçlarından biridir (Bozkurt & Alcı, 2013). Dunn (1997) ve Gay (1994) ise çok kültürlü eğitimin amaçlarını şu şekilde ortaya koymuştur; tutum ve değerleri görünür hale getirme, temel olan yeteneklerin edindirilmesi, çok kültürlü okur-yazarlığın geliştirilmesi, eğitim noktasında eşitliği sağlanmasıdır.Çok kültürlü eğitimin amaçları beraberinde çok kültürlü eğitimin boyutlarını da getirmektedir. Çok kültürlü eğitimi uygulama, çok kültürlü eğitimi iyi hale getirme açısından uygulayıcılar çok kültürlü eğitimin boyutlarını kendilerini yol gösterici olarak kabul etmektedir (Banks, 2019). Parks (1999)'a göre çok kültürlü eğitimin boyutları şu şekildedir; ahlak eğitimi, barış eğitimi, akran arası çatışmaları çözme, karakter eğitimi, hizmet öğretimi, eleştirel düşünme, küresel eğitim ve duygusal zekâ eğitimidir. Ahlak eğitimi; herkese saygılı olmayı savunur. Barış eğitimi; insanlar arasında oluşan ayrıştırmacılığın/ayrımcılığın önlenmesini savunur. Akran arası çatışmaları çözme; açık veya örtük olarak yapılan ırkçılığı önler. Karakter eğitimi; iyi insan olmayı öğütler. Hizmet öğretimi; farklılıklara sahip bireylerin uyumunu sağlar. Eleştirel düşünme; farklı bakış açıların kabul edilmesini savunur. Küresel eğitim; ırkçılığı sorun olarak görür. Duygusal zekâ eğitimi; farklı kültüre ait bireyin korku veya üzüntüsünün kontrolünü sağlar. Eğitim bu boyutlarını edindirme ve farklı bakış açılarını edindirme noktasında okullar devreye girmektedir (Toprak, 2008).

Erdem (2017) ele aldığı çalışmasında eğitim ve öğretim sürecinde en önemli sorun olarak dilin görüldüğünü, öğretmenlerin farklı dilleri konuşan/milletten olan çocuklar için içerik düzenlemesi yapmadığı ve öğrencileri değerlendirirken nesnel bir biçimde değerlendirme sürecini tamamlamadıkları sonucuna ulaşmıştır.

Yıldırım & Muyo Yıldırım'ın Kosova'da 2019 yılında yapmış oldukları çalışmada öğretmenlerin çok kültürlü eğitim uygulamalarının farklı değişkenlere göre durumları incelenmiştir. Araştırmanın sonucuna göre ise seviye, anadil ve branşın öğretmenlerin uygulamaları üzerinde etkili olduklarını ortaya koymuştur.Ng, Chai, Chan & Chung'un 2021 yılında yapmış oldukları çalışmaya göre azınlık okul öncesi kurumlarında görev yapan öğretmenlerin kültürel olarak duyarlı bir öğretim sağlayıp sağlayamadıklarını ortaya koymayı amaçlamıştır. Azınlık okullarında görev yapan öğretmenlerin öğretim yöntemlerini uyarlama noktasında yeterli oldukları ancak çok kültürlü eğitim programları tasarlama ve materyalleri

eğitim sürecine dahil etme noktasında yetersiz kaldıkları sonucuna ulaşılmıştır.Çok kültürlülük bağlamında alanyazın incelendiğinde çok kültürlülüğün bireyler üzerindeki ve eğitim üzerindeki önemi ele alınmıştır. Bu açıdan bakıldığından çok kültürlülüğün bireylerin topluma uyum sürecinde ne denli önemli olduğu sonucuna varılabilir. Bunu bireylere anlatmanın en etkili yollarından biri olan eğitim devreye girmektedir. Eğitim yoluyla bireyler toplumda farklılıklara ve çeşitliliklere sahip bireylere karşı nasıl davranacaklarını, ön yargısız nasıl kabul edebileceklerini vs. öğrenirler ve farklılıklara sahip bireylerin birarada bulunduğu okullar da bunları öğretmek için en uygun ortam olarak görülebilir. Bu doğrultuda yapılan çalışmalar incelendiğinde; yurtdışı çalışmalarında genellikle öğretmen ve öğretmen adaylarıyla ilgili yapılan çalışmalar yoğunluk göstermekte (Kaya & Söyleme, 2014; Taştekin, Bozkurt-Yükçü, İzoğlu, Güngör, Işık-Uslu & Demircioğlu, 2016; Aslan, 2017; Aslan & Kozikoğlu, 2017; Sezer & Kahraman, 2017; Kervan, 2017; Güngör, Buyruk & Özdemir; 2018; Kimzan & Arıkan, 2018; Ateş, 2021; Çoban, Güney Karaman & Doğan, 2010; Demircioğlu & Özdemir, 2014; Engin & Genç, 2015; Polat, 2009; Kimzan & Arıkan, 2018; Tortop, 2014; Yıldırım, 2022). Ders kitaplarıyla/doküman incelemesi ile ilgili yapılan çalışmalara (Bektaş, 2023a; Bektaş, 2023b, Doğan, 2019) ve öğrencilerle ilgili yapılan çalışmalara da az da olsa yer verilmiştir (Şimşek, 2022). Öte yandan çok kültürlülük bağlamında yurt dışında yapılan çalışmalar da oldukça fazlalık göstermektedir. Bu çalışmalar uygulamaya yönelik, öğretmenlere yönelik, öğrencilere yönelik, doküman incelemesine yönelik çalışmalardan oluşmaktadır (Samuels, 1994; Jae-Kyung, 2000; Walters, 2007; Yenlin Miranda, 2008; Park, 2010; Phoon, Abdullah & Abdullah, 2013; Bartelo, 2014; Park, 2014; Huh, Choi & Jun, 2015; Vittrup, 2016; Guo, 2017; Abdullah & Abdullah, 2018; Aragona-Young & Sawyer, 2018; Pourdavood & Yan, 2020; Zain, Basir & Mustafa, 2020; Ng, Chai, Chan & Chung, 2021). Ancak yapılan literatür taraması neticesinde çok kültürlü eğitim ile ilgili yapılan lisansüstü tezlerin içerik analizini ortaya koyan herhangi bir çalışmaya yer verilmediği görülmüştür. Bu açıdan çok kültürlü eğitimle ilgili çalışmaların sınırlı sayıda olması, alana katkı sağlaması, ailelere, eğitimcilere, öğrencilere vs. katkı sağlaması konusunda 144 lisansüstü tezin toplu bir biçimde tek bir çalışmanın çatısı altında sunulması noktasında önem taşımaktadır. Ayrıca çok kültürlü eğitim ile ilgili yapılan lisansüstü tezlerin içerik analizi noktasında ilk çalışma olması da çalışmanın önemini ortaya koymaktadır.

AMAÇ

Bu çalışma, eğitim ve öğretim konusunda çok kültürlü/çokkültürlülüğü ele alan Yüksek Öğretim Kurumu Ulusal Tez Merkezinde indekslenen yüksek lisans ve doktora tezlerinin farklı değişkenler açısından sistemli bir şekilde incelenmesi amaçlanmıştır.

YÖNTEM

Bu araştırmada çok kültürlü/çokkültürlü eğitim ile ilgili yapılan lisansüstü tezler incelenirken nitel araştırma yöntemleri kullanılmıştır. Nitel çalışmalar, araştırmacıya direkt olarak veri kaynağına erişebilme imkânı sunar. Durum ve olayların ayrıntılı bir şekilde anlaşılmasını sağlayacak betimlemeler yaparak elde edilen bilgiler ışığında genellemeler yapılmasını sağlar (Büyüköztürk, 2023). Bu araştırma, nitel araştırma yöntemlerinden doküman incelemesi yöntemiyle desenlenmiştir. Nitel araştırma modeli olarak verilerin elde edilerek yorumlanması aşamasında doküman incelemesi yöntemi kullanılmıştır. Doküman incelemesi yönteminde basılı ve web tabanlı bilgilerin sistematik bir biçimde ele alınmasıdır (Bowen, 2009). Bu araştırmada incelemesi yapılan dokümanlar çok kültürlü/çokkültürlü eğitim kapsamında yapılan yüksek lisans ve doktora tezleridir.

Evren ve Örneklem

Çalışmada lisansüstü tezlerin elde edilmesinde "YÖK Ulusal Tez Merkezi" kullanılmıştır. Araştırma 1998-2023 tarihleri arasında çok kültürlü/çokkültürlü eğitim konusunda eğitim bilimleri alanında yer alan 144 tane doktora ve yüksek lisans tezlerinden oluşmaktadır. Aralık 2023 tarihinde "çok kültürlü eğitim" ve "çokkültürlü eğitim" kavramına yönelik yapılan aramada "çok kültürlü eğitim" kelimesi taratılınca 113, "çokkültürlü eğitim" kelime taratılınca 202 tane doktora ve yüksek lisans tezine ulaşılmıştır. Konu alanı eğitim bilimleri dışında olan ve erişime kapalı olan tezler (Hamurabi Sözen, 2005; Kahyaoğlu, 1998; Öztürk, 1998; Altaş, 2001) araştırma kapsamı dışında bırakılmıştır. Geriye kalan 144 çalışma, eğitim bilimleri alanında ve erişime açık "çok kültürlü eğitim" ve "çokkültürlü eğitim" konularını kapsayan yüksek lisans ve doktora tezlerinden oluşmaktadır.

Verilerin Toplanması ve Analizi

Çalışmanın örneklemi dahiline 144 doktora ve yüksek lisans tezi dahil edilmiştir. Bu çalışmaların veri toplama sürecinde araştırmacılar tarafından geliştirilen "İçerik Analiz Formu" kullanılmıştır. İçerik analiz formu toplamda dokuz sorudan oluşmaktadır. Bu soruların her biri içerik analiz yönergesi için birer tema olarak ele alınmıştır. Çalışmaların geçerlik ve güvenirlikleri için üç hafta sonra tekrar "YÖK Ulusal Tez Merkezi"nden "çok kültürlü eğitim" ve "çokkültürlü eğitim" konuları taratılmış ve uzmanların görüşleri doğrultusunda içerik analiz formu için Miles & Huberman (1994)'nın uyuşum yüzdeliği (*görüş birliği/(görüş ayrılığı+görüş birliği)x100*)) formülü kullanılmıştır. Üç hafta sonra "YÖK Ulusal Tez Merkezi"nden "çok kültürlü eğitim" ve "çokkültürlü eğitim" konuları taratıldığında aynı sonuçlara ulaşılmıştır. Ayrıca içerik analiz formu için uyuşum yüzdeliğine bakıldığında %90

olarak hesaplanmıştır. Miles & Huberman (1994) uyuşum yüzdeliğinin %70'i geçmesi durumunda güvenilir olduğunu savunmuştur. İçerik analiz formu dahilinde hazırlanan sorular şunlardır:

1. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin yıllara göre dağılımı nasıldır?
2. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin yazarlarının üniversitelere göre dağılımı nasıldır?
3. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin enstitülerine göre dağılımı nasıldır?
4. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin anabilim dallarına göre dağılımı nasıldır?
5. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin tez türüne göre dağılımı nasıldır?
6. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin danışmanlarının unvanlarına göre dağılımı nasıldır?
7. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin çalışma grubuna göre dağılımı nasıldır?
8. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin araştırma yöntemine göre dağılımı nasıldır?
9. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin sonuçları nasıldır?

Verilerin Kodlanması ve Çözümlenmesi

Veriler, çok kültürlü/çokkültürlü eğitim ile ilgili yapılan 144 yüksek lisans ve doktora çalışmasının analiz formunda yer alan 10 soru çerçevesinde kodlanmıştır. Bu amaç doğrultusunda sorulan sorular "tema" ve "alt temalar" şeklinde belirlenmiş ve frekans ve yüzdelikleri hesaplanmıştır (Örneğin; 4. sorudaki "tema" için toplamda 6 "alt tema" belirlenmiştir). Kodlanan veriler betimsel istatistikler ile frekans *(f)* ve yüzde *(%)* şeklinde ifade edilmiştir.

ARAŞTIRMA VE BULGULAR

Yüksek Lisans ve Doktora Tezlerinin Yıllara Göre Dağılımı

Tablo 1'de doküman analizi yapılan 148 lisansüstü tezin yıllara göre dağılımları verilmiştir.

Tablo 1. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin yıllara göre dağılımı

Yayın Yılı	*f*	%
2023	10	6.75
2022	20	13.51
2021	16	10.81
2020	10	6.75
2019	28	18.91
2018	10	6.75
2017	8	5.4
2016	8	5.4
2015	5	3.37
2014	11	7.43
2013	9	6.08
2012	2	1.35
2011	1	.67
2010	1	.67
2009	2	1.35
2008	2	1.35
2006	1	.67
2005	1	.67
2001	1	.67
1998	2	1.35
Toplam	148	100

Tablo 1'de 148 çalışmanın yıllara göre dağılımı şu şekildedir; 1998 yılında 2 çalışma (% 1.35), 2001 yılında 1 çalışma (% 0.67), 2005 yılında 1 çalışma (% 0.67), 2006 yılında 1 çalışma (% 0.67), 2008 yılında 2 çalışma (% 1.35), 2009 yılında 2 çalışma (% 1.35), 2010 yılında 1 çalışma (% 0.67), 2011 yılında 1 çalışma (% 0.67), 2012 yılında 2 çalışma (% 1.35), 2013 yılında 9 çalışma (% 6.08), 2014 yılında 11 çalışma (% 7.43), 2015 yılında 5 çalışma (% 3.37), 2016 yılında 8 çalışma (% 5.4), 2017 yılında 8 çalışma (% 5.4), 2018 yılında 10 çalışma (% 6.75), 2019 yılında 28 çalışma (% 18.91), 2020 yılında 10 çalışma (% 6.75), 2021 yılında 16 çalışma (% 10.81), 2022 yılında 20 çalışma (% 13.51), 2023 yılında 10 çalışma (% 6.75) yapılmıştır. Elde edilen bulgular dahilinde çok kültürlü/çokkültürlü eğitim alanından en fazla 2019 (%18.91) ve 2022 (%13.51) yıllarında yüksek lisans ve doktora tezlerinin yazıldığı

görülmektedir. Bu çalışmalarda dördü erişime kapalıdır (Kahyaoğlu, 1998; Öztürk,1998; Altaş, 2001; Hamurabi Sözen, 2005).

Yüksek Lisans ve Doktora Tezlerinin Üniversitelere Göre Dağılımı

Tablo 2'de doküman analizi yapılan 144 lisansüstü tezin yazarların üniversitelerine göre dağılımları verilmiştir.

Tablo 2. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin yazarlarının üniversitelere göre dağılımı

Üniversitenin Adı	*f*	%	Üniversitenin Adı	*f*	%
Marmara Üniversitesi	14	9.72	Gaziantep Üniversitesi	3	2.08
Hacettepe Üniversitesi	8	5.55	Çağ Üniversitesi	2	1.38
Yıldız Teknik Üniversitesi	7	4.86	Necmettin Erbakan Üniversitesi	2	1.38
Abant İzzet Baysal Üniversitesi	6	4.16	İnönü Üniversitesi	2	1.38
Çukurova Üniversitesi	5	3.47	Bahçeşehir Üniversitesi	2	1.38
Trakya Üniversitesi	4	2.77	Gazi Osman Paşa Üniversitesi	2	1.38
Dokuz Eylül Üniversitesi	4	2.77	Balıkesir Üniversitesi	2	1.38
Van Yüzüncü Yıl Üniversitesi	4	2.77	İstanbul Üniversitesi- Cerrahpaşa Üniversitesi	2	1.38
Dumlupınar Üniversitesi	4	2.77	On Dokuz Mayıs Üniversitesi	2	1.38
Çanakkale On Sekiz Mart Üniversitesi	4	2.77	Gazi Üniversitesi	2	1.38
Akdeniz Üniversitesi	4	2.77	Boğaziçi Üniversitesi	2	1.38
Ege Üniversitesi	4	2.77	Fırat Üniversitesi	2	1.38
İstanbul Aydın Üniversitesi	3	2.08	Zonguldak Bülent Ecevit Üniversitesi	2	1.38
Ankara Üniversitesi	3	2.08	Kastamonu Üniversitesi	2	1.38
Uludağ Üniversitesi	3	2.08	Hacı Bektaş Veli Üniversitesi	2	1.38
Sakarya Üniversitesi	3	2.08	Erciyes Üniversitesi	2	1.38
Dicle Üniversitesi	3	2.08	Pamukkale Üniversitesi	2	1.38
Anadolu Üniversitesi	3	2.08	Diğer Üniversiteler	23	15.97

Tablo 2'de verilen 144 çalışmanın üniversitelere göre dağılımı şu şekildedir; Marmara Üniversitesi'nde 14 (%9.72), Hacette Üniversitesi'nde 8 (%5.5), Yıldız Teknik Üniversitesi'nde 7 (%4.86), Abant İzzet Baysal Üniversitesi'nde 6 (%4.16), Çukurova Üniversitesi'nde 5 (%3.47), Trakya Üniversitesi'nde 4 (%2.77), Dokuz Eylül Üniversitesi'nde 4 (%2.77), Van Yüzüncü Yıl Üniversitesi'nde 4 (%2.77), Dumlupınar Üniversitesi'nde 4 (%2.77), Çanakkale On Sekiz Mart Üniversitesi'nde 4 (%2.77), Akdeniz Üniversitesi'nde 4 (%2.77), Ege Üniversitesi'nde 4 (%2.77), İstanbul Aydın Üniversitesi'nde 3 (%2.08), Ankara

Üniversitesi'nde 3 (%2.08), Uludağ Üniversitesi'nde 3 (%2.08), Sakarya Üniversitesi'nde 3 (%2.08), Anadolu Üniversitesi'nde 3 (%2.08), Gaziantep Üniversitesi'nde 3 (%2.08), Çağ Üniversitesi'nde 2 (%1.38), Necmettin Erbakan Üniversitesi'nde 2 (%1.38), İnönü Üniversitesi'nde 2 (%1.38), Bahçeşehir Üniversitesi'nde 2 (%1.38), Gazi Osman Paşa Üniversitesi'nde 2 (%1.38), Balıkesir Üniversitesi'nde 2 (%1.38), İstanbul Üniversitesi-Cerrahpaşa Üniversitesi'nde 2 (%1.38), On Dokuz Mayıs Üniversitesi'nde 2 (%1.38), Gazi Üniversitesi'nde 2 (%1.38), Boğaziçi Üniversitesi'nde 2 (%1.38), Fırat Üniversitesi'nde 2 (%1.38), Zonguldak Bülent Ecevit Üniversitesi'nde 2 (%1.38), Kastamonu Üniversitesi'nde 2 (%1.38), Hacı Bektaş Veli Üniversitesi'nde 2 (%1.38), Erciyes Üniversitesi'nde 2 (%1.38), Pamukkale Üniversitesi'nde 2 (%1.38) ve diğer Üniversitelerde toplamda 23 (%15.97) lisansüstü tez yazılmıştır. Elde edilen bulgulara göre çok kültürlü/çokkültürlü eğitim konusunda en fazla lisansüstü tez Marmara (%9.72) ve Hacettepe (%5.5) üniversitelerinde yazılmıştır.

Yüksek Lisans ve Doktora Tezlerinin Enstitülerine Göre Dağılımı

Tablo 3'te doküman analizi yapılan 144 lisansüstü tezin enstitülerine göre dağılımları verilmiştir.

Tablo 3. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin enstitülerine göre dağılımı

Enstitüler	f	%
Eğitim Bilimleri Enstitüsü	75	52.08
Sosyal Bilimler Enstitüsü	52	36.11
Lisansüstü Enstitüsü	15	10.41
Sağlık Bilimleri Enstitüsü	1	.69
Yurtdışı Enstitüsü	1	.69
Toplam	144	100

Tablo 3'teki verilere göre çalışmaların enstitülere göre 75 (%52.08)'i Eğitim Bilimleri Enstitüsü'nde, 52 (%36.11)'si Sosyal Bilimler Enstitüsü'nde, 15(%10.41)'i Lisansüstü Enstitüsü'nde, 1(% 0.69)'i Sağlık Bilimleri Enstitüsü'nde ve 1 (% 0.67)'i de Yurtdışı Enstitüsü'nde yazılmıştır. Elde edilen bulgulara göre lisansüstü tezler en fazla Eğitim Bilimleri Enstitüleri (%52.08) kapsamında yazılmıştır.

Yüksek Lisans ve Doktora Tezlerinin Anabilim Dallarına Göre Dağılımı

Tablo 4'te doküman analizi yapılan 144 lisansüstü tezin anabilim dallarına göre dağılımları verilmiştir.

Tablo 4. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin anabilim dallarına göre dağılımı

Anabilim Dalı	***f***	***%***
Eğitim Bilimleri Anabilim Dalı	49	34.02
Türkçe ve Sosyal Bilimler Anabilim Dalı	19	13.19
İlköğretim Anabilim Dalı	17	11.8
Eğitim Programları ve Öğretimi Anabilim Dalı	8	5.55
Temel Eğitim Anabilim Dalı	7	4.86
Diğer	44	30.55
Toplam	144	100

Tablo 4'te çalışmaların anabilim dallarına göre dağılımı şu şekildedir; Eğitim Bilimleri Anabilim Dalı 49 (%34.02), Türkçe ve Sosyal Bilimler Anabilim Dalı 19 (%13.19), İlköğretim Anabilim Dalı 17 (%11.8), Eğitim Programları ve Öğretimi Anabilim Dalı 8 (%5.55), Temel Eğitim Anabilim Dalı 7 (%4.86) ve diğer anabilim dallarında 44 (%30.55) lisansüstü tez yayınlanmıştır. Bu bulgulara göre en fazla lisansüstü tez yayınlayan anabilim dalının Eğitim Bilimleri Anabilim Dalı (%34.02) olduğuna ulaşılmıştır.

Yüksek Lisans ve Doktora Tezlerinin Türüne Göre Dağılımı

Tablo 5'te doküman analizi yapılan 144 lisansüstü tezin türüne göre dağılımları verilmiştir.

Tablo 5. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin tez türüne göre dağılımı

Tez Türü	***f***	***%***
Yüksek Lisans	114	79,16
Doktora	30	20,83
Toplam	144	100

Tablo 5'te çalışmaların tez türlerinin dağılımına göre 114 (%79,16) yüksek lisans tezi ve 30 (%20.83) doktora tezi yayınlanmıştır. Verilere göre yüksek lisans tezlerinin oranı (%79.16) doktora tezlerinin oranından (%20.83) oldukça fazladır.

Yüksek Lisans ve Doktora Tezlerinin Danışman Unvanlarına Göre Dağılımı

Tablo 6'da doküman analizi yapılan 144 lisansüstü tezin danışman unvanlarına göre dağılımları verilmiştir.

Tablo 6. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin danışmanlarının unvanlarına göre dağılımı

Danışman Ünvanları	*f*	%
Profesör	47	31.54
Doçent	52	34.89
Doktor Öğretim Üyesi/ Yardımcı Doçent Doktor	49	32.88
Doktor	1	.67
Toplam	149	100

Tablo 6'ya göre tezlerin danışman unvanlarına göre dağılımı şu şekildedir; 47 (%31.54) profesör, 52 (%34.89) doçent, 49 (%32.88) doktor öğretim üyesi/yardımcı doçent ve 1 (% 0.67) doktor unvanına sahip danışmanın yer aldığı toplamda 144 tane lisansüstü tez yayınlanmıştır. Tezlerin frekans toplamının 149 olmasının sebebi ise bazı çalışmaların iki danışmana (Toprak, 2008; Sarıkaya Serdaroğlu, 2023; Arslan, 2014; Şahin Bektaş, 2022; Kılıçoğlu, 2014) sahip olmasından kaynaklanmaktadır.

Yüksek Lisans ve Doktora Tezlerinin Çalışma Grubuna Göre Dağılımı

Tablo 7'de doküman analizi yapılan 144 lisansüstü tezin çalışma grubuna göre dağılımları verilmiştir.

Tablo 7. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin çalışma grubuna göre dağılımı

Çalışma Grubu	*f*	%
Öğretmen	78	48.14
Öğretmen Adayı	26	16.04
Öğrenci	20	12.34
Ders Kitabı/Dokümantasyon	18	11.11
Öğretim Görevlisi/Elemanı	8	4.93
Okul Yöneticisi/Personeli	7	4.32
Diğer	5	3.08
Toplam	162	100

Tablo 7'de tezlerin çalışma gruplarına göre dağılımı şu şekildedir; 78 (%48.14) çalışmada öğretmene, 26 (%16.04) çalışmada öğretmen adayına, 20 (%12.34) çalışmada öğrenciye, 18 (%11.11) çalışmada ders kitabı/dokümantasyona, 8 (%4.93) çalışmada öğretim görevlisi/elemanına, 7 (%4.32) çalışmada okul yöneticisi/personeline ve 5 (%3.08) diğer (program, ebeveyn, farklı etnik grup katılımcıları) grubuna yer verilmiştir. Araştırmalarda

çalışma grubu olarak öğretmenlerin oran (%48.14) olarak en fazla tercih edildiği bulgular dahilinde elde edilmiştir.

Yüksek Lisans ve Doktora Tezlerinin Araştırma Yöntemine Göre Dağılımı

Tablo 8'de doküman analizi yapılan 144 lisansüstü tezin araştırma yöntemine göre dağılımları verilmiştir.

Tablo 8. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin araştırma yöntemine göre dağılımı

Araştırma Yöntemi	***f***	***%***
Nitel	46	31.94
Nicel	79	54.86
Karma	19	13.19
Toplam	144	100

Tablo 8'de tezlerin araştırma yöntemlerinin dağılımı incelendiğinde 46 (%31.94) nitel, 79 (%54.86) nicel ve 19 (%13.19) karma çalışmaya yer verilmiştir. Bu bulgulara göre lisansüstü tezlerin nicel (%54.86) çalışmalara en fazla yer verdiği görülmektedir.

Yüksek Lisans ve Doktora Tezlerinin Sonuçlarına Göre Dağılımı

Tablo 9'da doküman analizi yapılan 144 lisansüstü tezin sonuçlarına göre dağılımları verilmiştir.

Tablo 9. Çok kültürlü/çokkültürlü eğitimi konu alan tezlerin sonuçları

* Öğretmenlerin çok kültürlülük ve çok kültürlü eğitim konusunda algıları olumlu, çok kültürlü eğitim uygulamalarından pek fazla haberdar olmadıkları ve çok kültürlü eğitim konu olunca sorumluk bilinçlerinin olduğu sonucu elde edilmiştir (Karadeniz, 2019; Teymur, 2020; Sağlam, 2016; Kaya, 2013; Polat, 2013).

* Öğretmen adaylarının/eğitim fakültesi lisans öğrencilerinin çok kültürlü eğitim ile ilgili görüşleri, tutumları ve öz yeterlik algıları yüksek düzeyde bulunmuştur (Başarır, 2012; Moumin, 2019; Karadağ, 2019; Oğuz, 2016; Alanay, 2015).

* Okul öncesi öğretmenlerinin yeterlilik algılarına bakıldığında farklı değişkenler doğrultusunda (yaş, eğitim durumu, etnik köken, görev yaptığı okulun bulunduğu yerleşim yeri vs.) farklılıklar gösterdiği sonucuna varılmıştır (Çapçı, 2020; Kimzan, 2016; Acar Çiftçi, 2015; Polat, 2013).

* Öğretmenlerin farklı toplum anlayışını kabul etmektedir. Öğretmenlerin farklılıklara karşı faklı tutumları bulunmaktadır. Öğretmenler, öğretmenlik mesleğini yerine getiren bireylerin

önyargılı olduklarını ancak kendilerinin önyargılı olmadıklarını ifade etmektedirler (Esen, 2009; Teymur, 2020).

* sosyal bilgiler öğretmenlerinin çok kültürlülüğe ait olumlu görüşlere sahip olduğu, eğitim sisteminde çok kültürlülüğe ait eksiklerin olduğu sonucuna ulaşılmıştır (Çetinkaya, 2020; Ateş, 2017).

* Çok kültürlü yeterliliğin en önemli iki unsurunun motivasyon ve üst biliş olduğu ve çok kültürlü eğitim tutumlarının kişilik özellikleriyle ilişkili olduğu sonucuna ulaşılmıştır (ekinci, 2019; kaba, 2019).

* Öğretmenlerin çok kültürlülüğe ilişkin tutumları görev yaptıkları okulun türüne, sahip oldukları branşlara, cinsiyetlerine, kariyer basamaklarına göre farklılık göstermekte ayrıca çok kültürlü sınıf ortamlarında sınıf yönetim becerileri cinsiyete göre farklılık gösterirken mezuniyet durumu, kıdem yılı, ana dili, yaş gibi durumlara göre farklılık göstermemektedir ayrıca öğretmenlerin çok kültürlü eğitim ve çok kültürlülük kavramına ilişkin bilgi, tutum ve becerilerinin yüksek derecededir (Pınarcıoğlu, 2023; Sevilmiş, 2022; Kafa, 2022).

* Sosyal bilgiler ders kitapları incelendiğinde beş, altı ve yedinci sınıfların bazı ünitelerinde çok kültürlülük bağlamında kazanımlara yer verildiği ancak yeteri düzeyde çok kültürlüğe yer verilmediği ve sosyal bilgiler ders kitaplarında çok kültürlülüğün yansımalarına değinildiği sonucuna ulaşılmıştır (Bektaş, 2023a; Bektaş, 2023b, Doğan, 2019).

* Öğretmenlerin, farklı kültüre ait veliler ve çocuklarla iletişim problemi yaşaması, verdikleri eğitimin yeterince karşılıkları alamamaları, farklı kültüre sahip çocukların çatışmalar yaşadıkları ile ilgili problemler öğretmenlerin çok kültürlü eğitime olan görüşlerini olumsuz etkilemekte ve öğretmenlerin çok kültürlü eğitim algıları ve sınıf yönetim becerileri düşük düzeyde ve negatif yönlü bir ilişki içerisindedir (Yıldırım, 2022; Şahin Bektaş, 2022; Tanış, 2021).

* Psikolojik danışmanların Suriyeli bireyler ile kurulan ilişkinin/temasın miktar ve düzey olarak okul dışında düşük seviyede olduğu ve psikolojik danışanların çok kültürlülük algılarının yüksek olmasına rağmen Suriyeli bireyler hakkında pek bilgi sahip olmadığı ya da eksik ve yanlış bilgiye sahip oldukları sonucuna varılmıştır (Yalçın Güler, 2020; Polat, 2013).

* Göçmen çocuklarla çalışan öğretmenlerin çok kültürlülüğe ait tutumları, iş doyumları ve yaşam doyumları yüksektir (Duygu, 2023; Kervan, 2017).

* Sınıf öğretmenlerinin kültürel sermaye yeterlik düzeylerinin yüksek olduğu ve kültürel sermaye yeterlik düzeylerinin anne eğitim düzeyi, yaş ve meslekte geçirilen yıla göre anlamlı farklılık gösterdiği ve öz duyarlılıkla çok kültürlülük yeterlik algıları arasında pozitif bir ilişki bulunduğu sonucuna ulaşılmıştır (Güleç, 2019).

* Çok kültülrülük kavramının; zenginlik, çeşitlilik, süreklilik, hoşgörü, tahammül gibi kavramları çağrıştırdığı sonucuna ulaşılmıştır (Gholizadeh Avval, 2018).

* Çok kültürlü kişilik özelliklerinin çok kültürlü eğitime karşı olan tutumlarda herhangi bir belirleyicilik göstermediği sonucuna ulaşılmıştır (Özdemir, 2018).

* Farklılıklara saygı ve çok kültürlülük arasında olumlu ilişkiler bulunmaktadır. Açık görüşlülük, empati, esnekliğin arttığı durumlarda farklılıklara saygının da arttığı görülmüştür (Kacar, 2018).

* Öğretmen yetiştirme programlarında en fazla katıda bulunan dersin çok kültürlü eğitim uygulaması ile birleştirilmiş olan sınıf yönetimi dersi olduğu sonucu elde edilmiştir (Akcaoğlu, 2017).

* Okul öncesi öğretmenlerinin çok kültürlü kişilik özellikleri ve çok kültürlü eğitime olan tutumları okul öncesi öğretmen adaylarına göre daha yüksek düzeydedir (Bulut, 2015).

* Okul yöneticilerin ve öğretmenlerin çok kültürlü eğitime yönelik tutumlarının olumlu olduğu sonucu elde edilmiştir (Marangoz, 2014).

* Öğretmen ve öğrenci görüşlerinin incelendiği çalışmada vatandaşlık eğitiminin yetersiz kaldığı sonucuna ulaşılmıştır (Arslan, 2014).

* Türk ve yabancı öğrencilerin çok kültürlü eğitim ortamına bakışı olumludur (Demirel, 2014).

* Kültürel zekanın çok kültürlü eğitim üzerinde pek bir etkiye sahip olmadığı (Özer Koçak, 2020), bir diğer çalışma da ise kültürel zekâ ve çok kültürlü eğitim tutumu ve kültürler arası tutarlılık arasında pozitif bir ilişki olduğu sonucuna ulaşılmıştır (Uğur, 2019).

* Öğretmenlere göre kültürel konuların yüz yüze eğitimle iletilmesinin daha etkili olduğu ancak farklılıklara saygı ve çok kültürlülük uygulamalarının bazı noktalarda ilişkilendiremedikleri sonucuna varılmıştır (Ateş, 2021).

* Beden eğitimi öğretmenlerinin daha büyük yaş grubundaki bireylerle çalışanlar çok kültürlü farkındalık düzeyleri diğerlerine göre daha yüksek olduğu ve ayrıca öğretmenlerin öğrenim durumları yükseldikçe çokkültürlülük algı bilgi düzeylerinin arttığı sonucuna ulaşılmıştır (Alçin, 2021).

* Sosyal bilgiler öğretmenleri İngilizce öğretmenlerine göre daha yüksek çok kültürlü tutum sergilemektedir (Dağdemir, 2021).

* Okulun bulunduğu yer, fiziki şartları, sosyo-ekonomik durum ve verilen eğitimin kalitesinin çok kültürlü eğitimi etkilediği sonucuna ulaşılmıştır (Ekşi, 2020).

* Öğretmenler, çok kültürlü eğitime çok yönlü bir bakış açısı geliştirmesi ve evrensel değerleri ön planda tutması noktasında olumlu ancak suiistimale açık olması noktasında ise olumsuz bir bakış açısına sahiptir. Öğretmenlerin çok kültürlü eğitimde kullandıkları teknikler; münazara, altı şapkalı düşünme tekniği, örnek olaydır (Yıldırım, 2021).

* Öğretmenlerin kültürler arası duyarlılıklarının yüksek seviyede olduğu ve barışa yönelik tutumları arasında orta düzey pozitif bir ilişki olduğu sonucuna ulaşılmıştır (Gençtürk Erdem, 2022).

* Yetişkinler çok kültürlü eğitimi önemli ve avantajlı, eğitimciler ise çok kültürlü eğitim ortamını kültürel açıdan farklı insanların ve materyallerin birarada bulundurulmasıyla ilişkilendirmişlerdir (Elçiçek, 2022).

* Çalışmaya katılan bireylerin oyunun çok kültürlü eğitim ve çok kültürlü oyunun sahip olduğu olumlu kısımları dikkate aldıklarına ulaşılmıştır (Kurşun, 2023).

* Yabancı basım ders kitaplarını kullanan öğrencilerin yerli basım ders kitaplarını kullanan öğrencilere göre çok kültürlülük algılarının daha yüksek olduğu sonucuna ulaşılmıştır (Çarıkçı Kula, 2023).

* Fen bilimleri öğretmenlerinin büyük bir kısmının çok kültürlülük yeterlik algısına sahip olduğu yaş ve deneyim açısında büyük olanların ise diğer öğretmenlere oranla daha çok çok kültürlü eğitim algı ve yeterlik algısına sahiptir (Güner, 2023).

* Okul öncesi öğretmenlerinin çok kültürlü eğitim tutumlarına veya çocuk hakları hakkında sahip oldukları bilgi düzeyi; yaş, çalışma yılı, öğrenim düzeyi, çok kültürlü eğitim konusunda eğitim alıp almama gibi durumlara etki etmediği sonucuna ulaşılmıştır (kopuz yavuz, 2019).

* Yabancı öğrencilere Türkçe öğreten öğretim görevlilerinin çok kültürü eğitime yönelik tutumları mesleki kıdem, yaş ve eğitim düzeyine göre farklılık göstermemektedir (yılmaz, 2019).

* Tarih derslerinde katılımcılar kendi kültürlerine ait kimliklerin yeteri kadar yer bulmadığını, yer verilen bölümlerde ise ötekileştiren söylemlerin yer aldığı belirtilmiştir (Yazıcı, 2013).

* Okul öncesi eğitim sınıfındaki çocukların aile ortamında okul ortamına geçiş sürecinde kültürel etkileşimler ve unsurlar önemlidir (şimşek, 2022).

* Hizmet içi eğitim programının çok kültürlü eğitime karşı algıların ve mesleki yeterliliklerin arttırılması hakkında iyileştirilmeye ihtiyaç duymaktadır (durmuş, 2022).

* Sosyal empati becerisi, kültürler arası iletişim kaygısı ile öğretmenlerin çok kültürlü yeterlik algısı yordadığı sonucuna ulaşılmıştır (Akgül, 2022).

* Türkiye'de çok kültürlü eğitim ile ilgili çalışmalar dünyada yapılan çalışmalardan 29 yıl sonra yapıldığı, çok kültürlülükle ilgili yapılan çalışmaların konularının ise eğitim-öğretim, kültür, kimlik, öğretmen vb. dir (şangül, 2022).

* Öğretmenlerin çok kültürlü eğitim ortamlarını gözlemleyerek yeterliliklerini geliştirdikleri sonucuna ulaşılmıştır (başar, 2022).

* Öğretmenlerin sosyal adalete bağlı olarak öğretme yeterlikleri ve çok kültürlü öğretim yeterlilikleri arasında olumlu bir ilişki vardır (can, 2021).

* Öğretmenlerin çok kültürlü eğitime karşı tutumlarının ve empati düzeylerinin yüksek ve aralarında pozitif yönde düşük bir ilişki bulunmaktadır (Babur, 2021).

* İkili öğretmen modelinin kalabalık ve çok kültürlü sınıflarda uygulanabileceği ancak iki öğretmenin bir sınıfa girmesinin görüş ayrılıklarının olabileceği sonucunu da ortaya çıkarmaktadır (Altay, 2021).

* Çok kültürlü eğitimin amacı ülke genelinde birlik ve beraberliğini, düşünce ve ifade özgürlüğünü sağlamak, hoşgörü ve empati bilincini geliştirmek olarak öğretmen adayları tarafından aktarılmıştır (keçesi, 2019).

* Medya okuryazarlığı dersinin sosyal bilgiler öğretmen adaylarının çok kültürlü tutum geliştirmeye yönelik etkisine bakıldığında olumsuz yönde bir etki elde edilmiştir (Çelik, 2011). Sosyal bilgiler öğretmenlerinin bir kısmının çok kültürlülüğü tanımlayamamıştır (Yıldırım, 2019).

* Türkiye tarih öğretim programlarının içeriklerine bakıldığında çok kültürlülüğe yönelik meyilli olduğu sonucu elde edilmiştir (Çınar, 2010).

* Bireylerin kendi kültürel kimliklerine karşı olumlu tutumları arttıkça yabancı dil öğrenme noktasında tutumlarının azaldığı sonucuna ulaşılmıştır (Sökmen Ramos, 2019).

* Öğretmen adaylarının sosyal medya kullanımına göre çok kültürlü eğitime ilişkin görüşlerine bakıldığında; sosyal medya sitelerinin kullanım amacına, zaman geçirilen sosyal

medya grubuna, sosyal medya sitelerinde üye olunan kişi sayısına göre farklılık gösterdiği sonucuna ulaşılmıştır (Hark Söylemez, 2017).

* Türkiye ve Yunanistan'da yayınlanmış olan resimli çocuk kitaplarının çok kültürlülük açısından incelenmesine bakıldığında inanç boyutunun fantastik öğeler alt boyutunda benzer olduğu sonucu elde edilmiştir (Veli Amet, 2021).

* Okul ortamının sosyal ve duygusal becerilere etkisine bakıldığında yaş grubu ve kültürel farklılıkların yordayıcılığı dikkat çekmektedir (Hayır, 2023).

* din kültürü ve ahlak bilgisi dersleri çok kültürlülüğü ele bir ortamlarda etkili olabilmesi için öğretmenlerin dersi anlatış tarzı, tutum ve davranışları etkili olmaktadır (Doğru, 2022).

* Beden eğitimi öğretmen adaylarının çok kültürlü eğitime yönelik tutumlarının yüksek olduğu sonucuna ulaşılmıştır (ırmak, 2022).

* Sığınmacı öğrencileri tanımak amacıyla gelişi güzel bir yol izlendiği, eğitimde en önemli sorunun dil olduğu, öğretmenlerin bu durumlara karşı hazırlıksız olması, en çok kullanılan yöntemlerin düz anlatım ve akıllı tahtanın kullanılması ve sonuç olarak iki öğretmen yaklaşımına varılmıştır. Bunlardan ilki Türk öğrencilere odaklı anlatım ve tüm öğrencileri temel alarak yapılan anlatım şeklindedir (Yılmaz, 2023).

* Ders kitapların çok kültürlülük öğelerine yer verilmesine rağmen bu öğeler arasında bir dengenin olmayışı dikkat çekmektedir (Korkmaz, 2009).

* Kadın sınıf öğretmenlerinin erkek sınıf öğretmenlerine oranla çok kültürlü kişilik özelliklerinin farklılaşma gösterdiği, öğretmenlerin çok kültürlü kişilik özelliklerinin on sekiz yaşına kadar yaşadıkları yer ve baba eğitim düzeylerine bağlı olarak değişiklik göstermediği, anne eğitim düzeyinin çok kültürlü kişilik özellikleri üzerinde anlamlı bir farklılık olmadığı ancak çok kültürlü algıları üzerinde anlamlı bir farklılık olduğu sonucu elde edilmiştir. Öğretmenlerin kıdem yılları arttıkça çok kültürlü yeterlik algılarının azaldığı, sınıf öğretmenlerinin çok kültürlü yeterlilik algıları arttıkça çok kültürlü kişilik özelliklerinin de arttığı sonucuna ulaşılmıştır (Durşen Ünal, 2018).

* Okulda görev yapmakta olan psikolojik danışmanların kültüre duyarlı psikolojik danışma yeterlikleri, medeni durumları, cinsiyetleri, hayatlarının en fazla geçtiği mekan, görev süresi,, kültüre duyarlılık ile ilgili ders alması gibi değişkenlere göre anlamlı düşeyde bir farklılaşma görülmediği, ancak psikolojik danışma yeterlik algısı, farklı kültürlere ait danışanların sıklığı, öğrenim düzeyi ve bildikleri dil sayısına göre anlamlı bir düzeyde farklılaşmanın olduğu sonucuna ulaşılmıştır (Demir, 2016).

* Öğrencilerin çok kültürlü bir ortamda yapılan birebir ve ikili testlerin tercih etmesi konusunda yapılan çalışmaya göre bireysel farklılıkların temel olduğu sonucuna ulaşılmıştır (Öncel, 2016).

* Vatandaşlık ve demokrasi eğitimi ders kitabı ve ders programına katılan bireylerin kültürel farklılıkları tanıma ve tanıtma noktasında ihtiyaca cevapsız kaldıkları ve farklı kültüre ait bireylerin en fazla şikayetçi oldukları konunun önyargı olduğu sonucu elde edilmiştir (Yiğit, 2014).

* Okul yöneticileri öğretmenlere oranla kendi çok kültürlü yeterlilikleri hakkında daha olumlu görüş bildirmişlerdir. Küçük okulda çalışan okul yöneticilerinin çok kültürlü yeterlilik hakkında daha olumlu görüşler bildirmişleridir (Karadağ, 2015). Okul yöneticileri çok kültürlü kişilik özelliklere sahip olduğu ve çatışmadan kaçındıkları sonucuna ulaşılmıştır (Günçavdı Alabay, 2022).

* İlkokulda görev yapan öğretmenlerin çok kültürlülükle ilgili farkındalık düzeyleri genel olarak yüksek olduğu sonucuna ulaşılmıştır. Ayrıca bu öğretmenlerin çok kültürlülükle ilgili beceri, bilgi ve farkındalık alt boyutlarına göre değişkenler (cinsiyet, kıdem, öğrenim ve çalışılan okul) arasında anlamlı herhangi bir farklılık bulunmamıştır (Cırık, 2014).

* Lise öğretmenlerinin çok kültürlü yeterlilik algıları diğer kademelerdeki (ilkokul ve ortaokul) öğretmenlere göre daha yüksek olduğu sonucuna ulaşılmıştır. Ayrıca öğretmenlerin demokratik tutum ve çok kültürlü yeterlilik algıları arasında pozitif bir ilişki bulunmuştur (Bulut, 2014).

* Öğretmen adaylarının çok kültürlü bir eğitim sınıfında ders verme noktasında hazırbulunuşluk seviyesi olarak orta düzeyde yer aldıkları sonucuna ulaşılmıştır. Bu hazırbulunuşluk seviyelerinin ise çok kültürlülük konusunda dersler almak, göçmen veya göçmen kökenli olmak ve öğretmen yetiştirme programına göre farklılıklar göstermektedir (Subaşı, 2013).

* İlköğretim öğretmenlerinin çok kültürlü eğitim tutumları orta ve kişilik özellikleri yüksek düzeydedir (Gürel, 2013).

Tablo 9'da tezlerin sonuçlarına yer verilmiştir. Buna göre lisansüstü tezlerin sonuçlarına göre en çok ulaşılan sonuçlar şu şekildedir; öğretmenlerin çok kültürlülük ve çok kültürlü eğitim konusunda algıları olumlu, çok kültürlü eğitim uygulamalarından pek fazla haberdar olmadıkları ve çok kültürlü eğitim konu olunca sorumluluk bilinçlerinin olduğu sonucu elde edilmiştir. Diğer sonuçlara bakıldığında öğretmen adaylarının/eğitim fakültesi lisans öğrencilerinin çok kültürlü eğitim ile ilgili görüşleri, tutumları ve öz yeterlik algıları yüksek

düzeyde bulunmuştur. Okul öncesi öğretmenlerinin yeterlilik algılarına bakıldığında farklı değişkenler doğrultusunda (yaş, eğitim durumu, etnik köken, görev yaptığı okulun bulunduğu yerleşim yeri vs.) farklılıklar gösterdiği sonucuna varılmıştır. Öğretmenlerin farklı toplum anlayışını kabul etmekte ve farklılıklara karşı faklı tutumları bulunmaktadır. Öğretmenler, öğretmenlik mesleğini yerine getiren bireylerin önyargılı olduklarını ancak kendilerinin önyargılı olmadıklarını ifade etmektedirler. Sosyal bilgiler öğretmenlerinin çok kültürlülüğe ait olumlu görüşlere sahip olduğu, eğitim sisteminde çok kültürlülüğe ait eksiklerin olduğu sonucuna ulaşılmıştır. Çok kültürlü yeterliliğin en önemli iki unsurunun motivasyon ve üst biliş olduğu ve çok kültürlü eğitim tutumlarının kişilik özellikleriyle ilişkili olduğu sonucuna ulaşılmıştır. Öğretmenlerin çok kültürlülüğe ilişkin tutumları görev yaptıkları okulun türüne, sahip oldukları branşlara, cinsiyetlerine, kariyer basamaklarına göre farklılık göstermekte ayrıca çok kültürlü sınıf ortamlarında sınıf yönetim becerileri cinsiyete göre farklılık gösterirken mezuniyet durumu, kıdem yılı, ana dili, yaş gibi durumlara göre farklılık göstermemektedir ayrıca öğretmenlerin çok kültürlü eğitim ve çok kültürlülük kavramına ilişkin bilgi, tutum ve becerilerinin yüksek derecededir. Sosyal bilgiler ders kitapları incelendiğinde beş, altı ve yedinci sınıfların bazı ünitelerinde çok kültürlülük bağlamında kazanımlara yer verildiği ancak yeteri düzeyde çok kültürlüğe yer verilmediği ve sosyal bilgiler ders kitaplarında çok kültürlülüğün yansımalarına değinildiği sonucuna ulaşılmıştır. Öğretmenlerin, farklı kültüre ait veliler ve çocuklarla iletişim problemi yaşaması, verdikleri eğitimin yeterince karşılıklarını alamamaları, farklı kültüre sahip çocukların çatışmalar yaşadıkları ile ilgili problemler öğretmenlerin çok kültürlü eğitime olan görüşlerini olumsuz etkilemekte ve öğretmenlerin çok kültürlü eğitim algıları ve sınıf yönetim becerileri düşük düzeyde ve negatif yönlü bir ilişki içerisinde olduğu görülmektedir. Psikolojik danışmanların Suriyeli bireyler ile kurulan ilişkinin/temasın miktar ve düzey olarak okul dışında düşük seviyede olduğu ve psikolojik danışanların çok kültürlülük algılarının yüksek olmasına rağmen Suriyeli bireyler hakkında pek bilgiye sahip olmadığı ya da eksik ve yanlış bilgiye sahip oldukları sonucuna varılmıştır. Göçmen çocuklarla çalışan öğretmenlerin çok kültürlülüğe ait tutumları, iş doyumları ve yaşam doyumlarının yüksek olduğu, sınıf öğretmenlerinin kültürel sermaye yeterlik düzeylerinin yüksek olduğu ve kültürel sermaye yeterlik düzeylerinin anne eğitim düzeyi, yaş ve meslekte geçirilen yıla göre anlamlı farklılık gösterdiği ve öz duyarlılıkla çok kültürlülük yeterlik algıları arasında pozitif bir ilişki bulunduğu sonucuna ulaşılmıştır. Çok kültülrülük kavramının; zenginlik, çeşitlilik, süreklilik, hoşgörü, tahammül gibi kavramları çağrıştırdığı sonucuna ulaşılmıştır. Çok kültürlü kişilik özelliklerinin çok kültürlü eğitime karşı

olan tutumlarda herhangi bir belirleyicilik göstermediği sonucuna ulaşılmıştır. Farklılıklara saygı ve çok kültürlülük arasında olumlu ilişkiler bulunmaktadır. Açık görüşlülük, empati, esnekliğin arttığı durumlarda farklılıklara saygının da arttığı görülmüştür. Öğretmen yetiştirme programlarında en fazla katıda bulunan dersin çok kültürlü eğitim uygulaması ile birleştirilmiş olan sınıf yönetimi dersi olduğu sonucu elde edilmiştir. Okul öncesi öğretmenlerinin çok kültürlü kişilik özellikleri ve çok kültürlü eğitime olan tutumları okul öncesi öğretmen adaylarına göre daha yüksek düzeydedir. Okul yöneticilerinin ve öğretmenlerin çok kültürlü eğitime yönelik tutumlarının olumlu olduğu sonucu elde edilmiştir. Öğretmen ve öğrenci görüşlerinin incelendiği çalışmada vatandaşlık eğitiminin yetersiz kaldığı sonucuna ulaşılmıştır. Türk ve yabancı öğrencilerin çok kültürlü eğitim ortamına bakışının olumlu olduğu ve kültürel zekanın çok kültürlü eğitim üzerinde pek bir etkiye sahip olmadığı, bir diğer çalışma da ise kültürel zekâ ve çok kültürlü eğitim tutumu ve kültürler arası tutarlılık arasında pozitif bir ilişki olduğu sonucuna ulaşılmıştır. Öğretmenlere göre kültürel konuların yüz yüze eğitimle iletilmesinin daha etkili olduğu ancak farklılıklara saygı ve çok kültürlülük uygulamalarının bazı noktalarda ilişkilendiremedikleri sonucuna varılmıştır. Beden eğitimi öğretmenlerinin daha büyük yaş grubundaki bireylerle çalışanlar çok kültürlü farkındalık düzeyleri diğerlerine göre daha yüksek olduğu ve ayrıca öğretmenlerin öğrenim durumları yükseldikçe çok kültürlülük algı bilgi düzeylerinin arttığı sonucuna ulaşılmıştır. Sosyal bilgiler öğretmenleri İngilizce öğretmenlerine göre daha yüksek çok kültürlü tutum sergilemektedir. Okulun bulunduğu yer, fiziki şartları, sosyo-ekonomik durum ve verilen eğitimin kalitesinin çok kültürlü eğitimi etkilediği sonucuna ulaşılmıştır.

SONUÇ

Bu çalışmada çok kültürlü eğitim ile ilgili yapılan lisansüstü tezler incelenmiştir. Yapılan araştırma kapsamında ele alınan sonuçlar tartışılmış ve sunulmuştur.

Çok kültürlü eğitim alanında yapılmış olan çalışmalarda yıllara göre dağılım incelendiğinde; 1998 yılında 2 tez, 2001 yılında 1 tez, 2005 yılında 1 tez, 2006 yılında 1 tez, 2008 yılında 2 tez, 2009 yılında 2 tez, 2010 yılında 1 tez, 2011 yılında 1 tez, 2012 yılında 2 tez, 2013 yılında 9 tez, 2014 yılında 11 tez, 2015 yılında 5 tez, 2016 yılında 8 tez, 2017 yılında 8 tez, 2018 yılında 10 tez, 2019 yılında 28 tez, 2020 yılında 10 tez, 2021 yılında 16 tez, 2022 yılında 20 tez ve 2023 yılında 10 tez yayınlanmıştır. Hazırlanmış olan tezlerin yıllara göre dağılımı incelendiğinde yıllar arasında dalgalanmaların olduğu görülmektedir. Ancak son yıllarda yazılmış olan tezlerin sayısında bir artış olduğu ve çok kültürlü eğitim konusunda son yıllarda verilen önemin arttığı yorumu yapılabilir.

Çok kültürlü eğitim alanında yapılmış olan çalışmaların yazarlarının üniversitelerine göre dağılımı incelendiğinde; Marmara Üniversitesi'nde 14 tez, Hacette Üniversitesi'nde 8 tez, Yıldız Teknik Üniversitesi'nde 7 tez, Abant İzzet Baysal Üniversitesi'nde 6 tez, Çukurova Üniversitesi'nde 5 tez, Trakya Üniversitesi'nde 4 tez, Dokuz Eylül Üniversitesi'nde 4 tez, Van Yüzüncü Yıl Üniversitesi'nde 4 tez, Dumlupınar Üniversitesi'nde 4 tez, Çanakkale On Sekiz Mart Üniversitesi'nde 4 tez, Akdeniz Üniversitesi'nde 4 tez, Ege Üniversitesi'nde 4 tez, İstanbul Aydın Üniversitesi'nde 3 tez, Ankara Üniversitesi'nde 3 tez, Uludağ Üniversitesi'nde 3 tez, Sakarya Üniversitesi'nde 3 tez, Anadolu Üniversitesi'nde 3 tez, Gaziantep Üniversitesi'nde 3 tez, Çağ Üniversitesi'nde 2 tez, Necmettin Erbakan Üniversitesi'nde 2 tez, İnönü Üniversitesi'nde 2 tez, Bahçeşehir Üniversitesi'nde 2 tez, Gazi Osman Paşa Üniversitesi'nde 2 tez, Balıkesir Üniversitesi'nde 2 tez, İstanbul Üniversitesi-Cerrahpaşa Üniversitesi'nde 2 tez, On Dokuz Mayıs Üniversitesi'nde 2 tez, Gazi Üniversitesi'nde 2 tez, Boğaziçi Üniversitesi'nde 2 tez, Fırat Üniversitesi'nde 2 tez, Zonguldak Bülent Ecevit Üniversitesi'nde 2 tez, Kastamonu Üniversitesi'nde 2 tez, Hacı Bektaş Veli Üniversitesi'nde 2 tez, Erciyes Üniversitesi'nde 2 tez, Pamukkale Üniversitesi'nde 2 tez ve diğer üniversitelerde toplamda 23 lisansüstü tez yazılmıştır. Elde edilen bulgulara göre çok kültürlü/çokkültürlü eğitim konusunda en fazla lisansüstü tez Marmara (%9.72) ve Hacettepe (%5.5) üniversitelerinde yazılmıştır. Öte yandan birçok üniversitenin farklı sayılarda çok kültürlü eğitim alanında tez hazırlamış olduğunu ve birçok üniversitenin çok kültürlü eğitim konusuna önem verdiği yorumu yapılabilir.

Çok kültürlü eğitim alanında yazılmış olan tezlerin enstitülerine göre dağılımına bakıldığında; 75 tezin Eğitim Bilimleri Enstitüsü'nde, 52 tezin Sosyal Bilimler Enstitüsü'nde, 15 tezin Lisansüstü Enstitüsü'nde, 1 tezin Sağlık Bilimleri Enstitüsü'nde ve 1 tezin de Yurtdışı Enstitüsü'nde yazıldığı sonucu elde edilmiştir. Elde edilen bulgulara göre lisansüstü tezler en fazla Eğitim Bilimleri Enstitüleri (%52.08) kapsamında yazılmıştır. Bunun sebebi olarak konu alanının eğitim olarak sınırlandırılmış olması yorumu yapılabilir. Çok kültürlü eğitim alanında yazılmış olan tezlerin anabilim dallarına göre dağılımına bakıldığında; Eğitim Bilimleri Anabilim Dalı 49 tez, Türkçe ve Sosyal Bilimler Anabilim Dalı 19 tez, İlköğretim Anabilim Dalı 17 tez, Eğitim Programları ve Öğretimi Anabilim Dalı 8 tez, Temel Eğitim Anabilim Dalı 7 tez ve diğer anabilim dallarında 44 lisansüstü tez yayınlanmıştır. Bu bulgulara göre en fazla lisansüstü tez yayınlayan anabilim dalının Eğitim Bilimleri Anabilim Dalı (%34.02) olduğuna ve farklı anabilim dallarına eğitimlerini tamamlamış lisansüstü öğrencilerinin çok kültürlü eğitim konularına önem verdiği yorumu yapılabilir. Çok kültürlü eğitim alanında yazılmış olan

tezlerin tez türlerine göre dağılımına bakıldığında; 114 yüksek lisans tezi ve 30 doktora tezi yayınlanmıştır. Verilere göre yüksek lisans tezlerinin oranı (%79.16) doktora tezlerinin oranından (%20.83) oldukça fazla olduğu sonucuna ulaşılmıştır. bu sonuca göre yüksek lisans programlarının doktora programlarından sayıca fazla olması, doktora programlarının yeterli olmayışı, yüksek lisans öğrencilerinin doktora öğrencilerine oranla çok kültürlü eğitime ilgisinin daha yüksek olabileceği yorumları yapılabilir.Çok kültürlü eğitim alanında yazılmış olan tezlerin danışmanlarının unvanlarına göre dağılımına bakıldığında; 47 profesör, 52 doçent, 49 doktor öğretim üyesi/yardımcı doçent ve 1 doktor unvanına sahip danışmanın yer aldığı toplamda 144 tane lisansüstü tez yayınlanmıştır. Tezlerin frekans toplamının 149 olmasının sebebi ise bazı çalışmaların iki danışmana (Toprak, 2008; Sarıkaya Serdaroğlu, 2023; Arslan, 2014; Şahin Bektaş, 2022; Kılıçoğlu, 2014) sahip olmasından kaynaklanmaktadır. Ayrıca farklı unvanlara sahip akademisyenlerin veya bu akademisyenlerinin öğrencilerinin çok kültürlü eğitim konusuna önem verdikleri/ilgi duydukları yorumu yapılabilir. Çok kültürlü eğitim alanında yazılmış olan tezlerin çalışma gruplarına göre dağılımına bakıldığında; 78 çalışmada öğretmene, 26 çalışmada öğretmen adayına, 20 çalışmada öğrenciye, 18 çalışmada ders kitabı/dokümantasyona, 8 çalışmada öğretim görevlisi/elemanına, 7 çalışmada okul yöneticisi/personeline ve 5 diğer (program, ebeveyn, farklı etnik grup katılımcıları) grubuna yer verilmiştir. Araştırmalarda çalışma grubu olarak öğretmenlerin oran (%48.14) olarak en fazla tercih edildiği sonucu elde edilmiştir. Çalışmalarda en fazla öğretmenlere yer verilmesinin sebebinin kolay ulaşılabilir olması, çok kültürlülük konusuna olumlu algılara sahip olmaları (Karadeniz, 2019; Teymur, 2020; Sağlam, 2016; Kaya, 2013; Polat, 2013) yorumları yapılabilir.Çok kültürlü eğitim alanında yazılmış olan tezlerin araştırma yöntemlerine göre dağılımına bakıldığında; 46 çalışma nitel, 79 çalışma nicel ve 19 çalışma karma yöntemle hazırlanmıştır. Karma ve nitel çalışmaların sayılarının artması durumda çok kültürlü eğitim ile ilgili farklı verilere ve sonuçlara ulaşılabilir.Çok kültürlü eğitim alanında yazılmış olan tezlerin sonuçları incelendiğinde en çok ulaşılan sonuçlar şu şekildedir; öğretmenlerin çok kültürlülük ve çok kültürlü eğitim konusunda algıları olumlu, çok kültürlü eğitim uygulamalarından pek fazla haberdar olmadıkları ve çok kültürlü eğitim konu olunca sorumluluk bilinçlerinin olduğu, öğretmen adaylarının/eğitim fakültesi lisans öğrencilerinin çok kültürlü eğitim ile ilgili görüşleri, tutumları ve öz yeterlik algıları yüksek düzeyde olduğu ve okul öncesi öğretmenlerinin yeterlilik algılarına bakıldığında farklı değişkenler doğrultusunda (yaş, eğitim durumu, etnik köken, görev yaptığı okulun bulunduğu yerleşim yeri vs.) farklılıklar gösterdiği sonucuna varılmıştır.

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BUĞDAY ÜRETİMİNİN YAPISAL ANALİZİ: TÜRKİYE ÖRNEĞİ

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Özet
Buğday Türkiye'de birçok çiftçinin gelir kaynağı olup yoğun olarak üretilmektedir. Ayrıca temel gıda maddesi olması buğdayın önemini daha da artırmaktadır. Bu çalışmada, buğdayın dünya ve Türkiye'de ekim alanı, üretimi ve dış ticaretinin gelişiminin ortaya konulması amaçlanmıştır. Ayrıca Türkiye'de farklı illerde buğday üretiminin ekonomik analizinin yapıldığı çalışmalardan faydalanarak buğday üreten işletmelerin bazı teknik ve ekonomik özellikleri incelenmiştir. Çalışmanın ana materyalini ilgili istatistikler (Türkiye İstatistik Kurumu, Birleşmiş Milletler Gıda ve Tarım Örgütü) ve literatürde konuyla ilgili yapılmış olan ulusal ve uluslararası bilimsel çalışmalar oluşturmuştur. Dünya ve Türkiye'de buğday üretimindeki ve dış ticaretindeki gelişmeler basit ve zincirleme indeks hesabı yapılarak yıllar itibariyle değişimleri incelenmiştir. İncelenen çalışmalarda buğday üretiminde sabit masrafların oranı ortalama %25,80 ve değişen masrafların oranı ortalama %74,11 olarak tespit edilmiştir. Buğday üretiminde nispi kâr ise 1,28 olarak belirlenmiştir. Yani işletmeler 1 birimlik masraf karşılığında 1,28 birimlik gelir elde etmekte olup bunun 0,28 birimi kârdır. İşletmelerin ortalama işletme arazisi genişlikleri 244,7 dekar, buğday ekim alanlarının ortalama genişliği 124,2 dekar, buğday verimi ise 351,76 kg/da olarak tespit edilmiştir. 2022 yılı itibariyle Türkiye buğday üretiminde dünyada 12. sırada yer almaktadır. Buğday ihracatında dünyada 30. sırada, buğday ithalatında ise 3. sırada yer almaktadır. Türkiye hem miktar bakımından hem değer bakımından buğday dış ticaretinde açık vermektedir. Buğday dış ticaret açığı 8 milyon 512 bin ton ve 3 milyar 187 milyon dolardır. Türkiye önemli bir buğday ithalatçısı ülke olmakla birlikte ithal edilen buğdayı tarıma dayalı sanayi kollarında (un sanayi, makarna sanayi vb.) işleyerek katma değer kazandırmakta ve ihraç etmektedir. Her ne kadar ithal edilen buğday tarıma dayalı sanayinde kullanılsa da Türkiye'de yıllar itibariyle buğday ekim alanlarının azalması ve dış ticaret açığının artması üzerinde durulması gereken önemli bir konudur.
Anahtar Kelimeler: Buğday, Türkiye, Yapısal Analiz, Nispi kâr, Masraf

STRUCTURAL ANALYSIS OF WHEAT PRODUCTION: Türkiye EXAMPLE

Abstract
Wheat is the source of income for numerous farmers in Türkiye and is produced in large areas. In addition, the fact that it is a staple food increases the importance of wheat even more. This study aimed to reveal the development of wheat cultivation areas, production, and foreign trade in the world and Türkiye. In addition, some technical and economic characteristics of wheat-producing farms were examined by utilizing the studies in which economic analysis of wheat production in different provinces in Türkiye. The main material of the study consisted of relevant statistics (Turkish Statistical Institute, Food and Agriculture Organization of the United Nations) and national and international scientific studies in the literature. Wheat production and foreign trade developments in the world and Türkiye were analyzed using simple and chain indexes. In the analyzed studies, the ratio of fixed costs in wheat production was 25.80%, and the ratio of variable costs was 74.11 % on average. The relative profit in wheat production was determined as 1.28. In other words, farms earn 1.28 units of income for 1 unit of expenditure, of which 0.28 units is profit. The average size of the farms was 244.7 decares, the average size of the wheat cultivation area was 124.2 decares, and the wheat yield was 351.76 kg/da. As of 2022, Türkiye ranked 12th in the world in wheat production. It ranks 30th globally in wheat exports and 3rd in wheat imports. Türkiye has a wheat foreign trade deficit in terms of quantity and value. The wheat foreign trade deficit was 8 million 512 thousand tons and 3 billion 187 million dollars. Although Türkiye is an important wheat-importing country, it processes the imported wheat in agriculture-based industries (flour industry, pasta industry, etc.) and exports it. Although imported wheat is used in agriculture-based industries, the decrease in wheat cultivation areas and the increase in the foreign trade deficit in Türkiye over the years are important issues that should be emphasized.
Keywords: Wheat, Türkiye, Structural analysis, Relative profit, Cost

Giriş

Toplumların yaşamlarının devamı için önemli bir gıda maddesi olan buğday üretimden tüketime kadar tüm aşamalarda ekonominin önemli bir konusudur (Önkal, 1991). Öyle ki buğday üreminin azalması tarım sektörünün büyümesini azaltacak ve ülkelerin gıda güvenliğini etkileyecektir (Chandio vd. 2021). Üretimdeki arz ve tüketimdeki talep değişmeleri gıdada kendine yeterlilik kavramını ön plana çıkarmaktadır. Türkiye 2000'li yılların başından beri buğday ithalatının artmasına karşın buğday üretiminde kendine yeterlilik ortalaması 101,26'dır. Türkiye ithal ettiği buğdayı un sanayi, makarna sanayi vb. gibi sanayi kollarında işleyerek ürüne katma değer kazandırmakta ve ihracat geliri elde etmektedir. Bu sayede tarıma dayalı sanayi işletmelerinin atıl durumda bekleyen kapasite kullanım oranları da artmaktadır.Türkiye'de toplam işlenen tarım arazilerinin %28,54'ünde, toplam tahıl ekim alanlarının ise %40,89'unda buğday üretilmektedir (TÜİK, 2024a). Bu bakımdan birçok çiftçinin temel gelir kaynağı buğdaydır.Bu çalışmada, dünya ve Türkiye'de buğday ekim alanları ve üretimindeki gelişmeler, dış ticaretteki durum değerlendirilmeye çalışılmıştır. Dünyada buğday üretiminin ülkelere göre, Türkiye'de ise illere göre dağılımı incelenmiştir. Dünya buğday üretimi ve dış ticaretinde Türkiye'nin yeri ve önemi ortaya konulmuştur. Ayrıca Türkiye'nin farklı illerinde buğday üretiminin ekonomik analizini ele alan çalışmalarından yararlanılarak buğday üreten işletmelerin bazı özellikleri incelenmiştir.

Materyal ve Metot

Çalışmanın ana materyalini ikincil veriler oluşturmaktadır. İkincil veriler; Türkiye İstatistik Kurumu (TÜİK), Birleşmiş Milletler Gıda ve Tarım Örgütü (FAO), ulusal ve uluslararası literatürdeki konuyla ilgili bilimsel yayınlardan elde edilmiştir. Dünya ve Türkiye'de buğday üretimine ilişkin verilere basit ve zincirleme indeks hesabı yapılarak yıllar itibariyle değişim incelenmiştir. İndeks hesabında temel amaç nispi artış veya azalışları ortaya koymaktır. Basit indekste her yıl temel alınan yıla oranlanarak hesaplanırken, zincirleme indekste her yıl bir önceki yıla oranlanarak hesaplanmaktadır.

Araştırma Bulguları ve Tartışma

Dünya buğday ekim alanı 2000-2022 yılları arasında 213-220 milyon hektar arasında değişmektedir. 2000-2004 yılları ortalamasında 213 milyon 536 bin hektar olan buğday ekim alanı 2022 yılında %2,63 artarak 219 milyon 154 bin hektara çıkmıştır. Aynı tarihler itibariyle dünya buğday üretimi ise 590-810 milyon ton arasında değişmektedir. 2000-2004 yılları ortalamasına göre 590 milyon 516 bin ton olan buğday üretimi %36,90 artarak 2022 yılında 808 milyon 442 bin tona yükselmiştir. Bir önceki döneme göre üretimdeki değişim

incelendiğinde en fazla artış %8,96 ile 2015-2019 yılları ortalamasında gerçekleşmiştir. Dünya buğday ekim alanlarında çok fazla bir değişim olmamasına rağmen üretim miktarı her geçen yıl artmaktadır. Dünya buğday verimi 2000-2004 yılları ortalamasında hektara 2.764 kg iken 2022 yılında %33,44 artarak hektara 3.689 kg olarak gerçekleşmiştir (Çizelge 1). Dünya buğday verimi incelenen yıllar itibariyle artış eğilimindedir. Dünya buğday ekim alanlarının çok fazla değişmemesine karşın üretim miktarının artmasının sebebi olarak verimdeki artışlar gösterilebilir.

Çizelge 1. Dünya buğday üretiminin gelişimi (FAO, 2024a)

Yıllar	Ekim Alanı			Üretim Miktarı			Verim		
	Bin hektar	Basit indeks	Zincirleme indeks	Bin ton	Basit indeks	Zincirleme indeks	Kg/ha	Basit indeks	Zincirleme indeks
2000-2004	213.536	100,00		590.516	100,00		2.764	100,00	
2005-2009	219.404	102,75	102,75	642.386	108,78	108,78	2.927	105,86	105,86
2010-2014	218.327	102,24	99,51	690.072	116,86	107,42	3.160	114,31	107,98
2015-2019	217.984	102,08	99,84	751.917	127,33	108,96	3.450	124,80	109,18
2020	217.888	102,04	99,96	757.023	128,20	100,68	3.474	125,68	100,70
2021	220.425	103,23	101,16	772.779	130,87	102,08	3.506	126,82	100,91
2022	219.154	102,63	99,42	808.442	136,90	104,61	3.689	133,44	105,22

Dünya buğday üretim miktarı bakımından %17,04'lük pay ile Çin ilk sırada yer almaktadır. Çin'i sırasıyla %13,33'lük pay ile Hindistan, %12,89'luk pay ile Rusya takip etmektedir. Bu üç ülke dünya buğday üretiminin %43,26'sını oluşturmaktadır. Türkiye'nin payı ise %2,44 olup dünya buğday üreminde 12. sırada yer almaktadır. İncelenen yıllar itibariyle Türkiye'nin dünya buğday üretimi içerisindeki payının azaldığı tespit edilmiştir (Çizelge 2).

Çizelge 2. Dünya önde gelen buğday üreticisi ülkelerin buğday üretimlerinin gelişimi (FAO, 2024a)

Ülkeler	2000-2004	2005-2009	2010-2014	2015-2019	2020	2021	2022
	Bin ton						
Çin	92.448	108.558	120.350	133.038	134.250	136.946	137.720
Hindistan	71.347	74.610	90.384	96.159	107.861	109.587	107.742
Rusya	42.316	53.483	49.454	73.545	85.896	76.061	104.234
ABD	55.969	58.132	57.882	53.987	49.751	44.804	44.902
Avustralya	21.486	18.573	25.462	23.275	14.480	31.923	36.237
Fransa	35.601	36.471	37.938	37.355	30.181	36.559	34.632
Kanada	22.194	25.335	28.573	31.037	35.437	22.422	34.335
Pakistan	19.402	22.235	24.438	25.364	25.248	27.464	26.209
Almanya	21.993	23.626	24.356	23.764	22.172	21.459	22.587
Arjantin	14.832	13.704	11.418	16.324	19.777	17.644	22.150
Ukrayna	16.210	18.671	20.266	26.373	24.912	32.183	20.729
Türkiye	19.900	19.425	20.525	20.740	20.500	17.650	19.750
Diğer ülkeler	156.817	169.564	179.028	190.958	186.558	198.077	197.213
Dünya	590.516	642.386	690.072	751.917	757.023	772.779	808.442
	Pay (%)						
Çin	15,66	16,90	17,44	17,69	17,73	17,72	17,04
Hindistan	12,08	11,61	13,10	12,79	14,25	14,18	13,33
Rusya	7,17	8,33	7,17	9,78	11,35	9,84	12,89
ABD	9,48	9,05	8,39	7,18	6,57	5,80	5,55
Avustralya	3,64	2,89	3,69	3,10	1,91	4,13	4,48
Fransa	6,03	5,68	5,50	4,97	3,99	4,73	4,28
Kanada	3,76	3,94	4,14	4,13	4,68	2,90	4,25
Pakistan	3,29	3,46	3,54	3,37	3,34	3,55	3,24
Almanya	3,72	3,68	3,53	3,16	2,93	2,78	2,79
Arjantin	2,51	2,13	1,65	2,17	2,61	2,28	2,74
Ukrayna	2,75	2,91	2,94	3,51	3,29	4,16	2,56
Türkiye	3,37	3,02	2,97	2,76	2,71	2,28	2,44
Diğer ülkeler	26,56	26,40	25,94	25,40	24,64	25,63	24,39
Dünya	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Dünya buğday ihracat miktarı 2000-2004 yılları ortalamasına göre 115 milyon 955 bin ton iken yaklaşık %61 artış göstererek 2022 yılında 186 milyon 680 bin ton olarak gerçekleşmiştir. 2022 yılında dünya buğday ihracatının %15,42'sini Avustralya, %11,21'ini ABD, %10,79'unu Fransa, %9,94'ünü Kanada ve %9,55'ini Rusya gerçekleştirmiştir. Türkiye'nin payı ise %0,21 olup dünya buğday ihracatında 30. sırada yer almaktadır (Çizelge 3).

Çizelge 3. Ülkelere göre buğday ihracatı (FAO, 2024b)

Ülkeler	2000-2004	2005-2009	2010-2014	2015-2019	2020	2021	2022
	Bin ton						
Avustralya	15.184	11.784	18.673	15.426	10.400	25.563	28.781
ABD	26.974	27.108	29.007	24.435	26.132	24.014	20.918
Fransa	15.718	16.031	19.587	18.457	19.793	16.091	20.152
Kanada	15.091	17.007	19.319	22.106	26.111	21.546	18.548
Rusya	4.915	12.602	15.812	31.085	37.267	27.366	17.829
Arjantin	9.401	8.733	5.631	9.989	10.197	9.485	12.938
Ukrayna	2.963	6.426	7.077	17.017	18.056	19.395	11.223
Hindistan	2.647	159	3.108	272	929	6.091	6.799
Kazakistan	3.948	4.090	4.930	4.783	5.199	5.748	6.346
Almanya	4.910	6.421	8.252	7.931	9.259	7.100	6.222
Türkiye	588	268	328	68	125	265	395
Diğer ülkeler	13.616	19.305	27.386	35.379	35.108	37.380	36.529
Dünya	115.955	129.934	159.108	186.949	198.574	200.044	186.680
	Pay (%)						
Avustralya	13,09	9,07	11,74	8,25	5,24	12,78	15,42
ABD	23,26	20,86	18,23	13,07	13,16	12,00	11,21
Fransa	13,56	12,34	12,31	9,87	9,97	8,04	10,79
Kanada	13,01	13,09	12,14	11,82	13,15	10,77	9,94
Rusya	4,24	9,70	9,94	16,63	18,77	13,68	9,55
Arjantin	8,11	6,72	3,54	5,34	5,14	4,74	6,93
Ukrayna	2,55	4,95	4,45	9,10	9,09	9,70	6,01
Hindistan	2,28	0,12	1,95	0,15	0,47	3,04	3,64
Kazakistan	3,40	3,15	3,10	2,56	2,62	2,87	3,40
Almanya	4,23	4,94	5,19	4,24	4,66	3,55	3,33
Türkiye	0,51	0,21	0,21	0,04	0,06	0,13	0,21
Diğer ülkeler	11,74	14,86	17,21	18,92	17,68	18,69	19,57
Dünya	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Dünya buğday ithalat miktarı 2000-2004 yılları ortalamasına göre 115 milyon 560 bin ton iken yaklaşık %60 artış göstererek 2022 yılında 184 milyon 800 bin ton olarak gerçekleşmiştir. 2022 yılında dünya buğday ithalatının %5,34'ünü Çin, %5,12'sini Endonezya, %4,82'sini Türkiye, %4,33'ünü Mısır ve %3,80'ini Cezayir gerçekleştirmiştir. Türkiye'nin dünya buğday ithalatındaki payı %0,92 ile %5,10 arasında değişmekte olup 3. sırada yer almaktadır. İncelenen dönemler itibariyle Türkiye'nin buğday ithalatı yaklaşık 8,4 kat artmıştır (Çizelge 4). Türkiye'de ithal edilen buğday, buğday unu olarak işlenip katma değer kazandırılarak ihraç edilmektedir (Karlı vd. 2022). Bu sebeple Türkiye önemli bir buğday ithalatçısıdır.

Çizelge 4. Ülkelere göre buğday ithalatı (FAO, 2024b)

Ülkeler	2000-2004	2005-2009	2010-2014	2015-2019	2020	2021	2022
	Bin ton						
Çin	1.966	1.021	2.927	3.345	8.152	9.711	9.873
Endonezya	3.732	4.563	6.167	9.901	10.300	11.481	9.459
Türkiye	1.062	1.925	4.073	5.871	9.659	8.877	8.907
Mısır	4.662	7.876	10.654	11.538	8.969	6.641	8.010
Cezayir	5.224	5.542	6.516	8.008	7.054	8.029	7.017
İtalya	7.114	6.419	6.845	7.432	7.994	7.298	6.917
Filipinler	2.711	2.275	2.595	5.471	6.150	6.029	6.251
Fas	2.984	2.923	3.778	4.171	5.522	4.669	6.008
Brezilya	6.514	5.927	6.340	6.290	6.160	6.225	5.717
Japonya	5.595	5.314	5.924	5.533	5.374	5.126	5.346
Diğer ülkeler	73.996	85.487	102.932	115.738	113.909	122.868	111.293
Dünya	115.560	129.271	158.751	183.299	189.243	196.957	184.798
	Pay (%)						
Çin	1,70	0,79	1,84	1,82	4,31	4,93	5,34
Endonezya	3,23	3,53	3,88	5,40	5,44	5,83	5,12
Türkiye	0,92	1,49	2,57	3,20	5,10	4,51	4,82
Mısır	4,03	6,09	6,71	6,29	4,74	3,37	4,33
Cezayir	4,52	4,29	4,10	4,37	3,73	4,08	3,80
İtalya	6,16	4,97	4,31	4,05	4,22	3,71	3,74
Filipinler	2,35	1,76	1,63	2,98	3,25	3,06	3,38
Fas	2,58	2,26	2,38	2,28	2,92	2,37	3,25
Brezilya	5,64	4,58	3,99	3,43	3,26	3,16	3,09
Japonya	4,84	4,11	3,73	3,02	2,84	2,60	2,89
Diğer ülkeler	64,03	66,13	64,84	63,14	60,19	62,38	60,22
Dünya	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Türkiye'de 2000-2004 yılları ortalaması 9 milyon 290 bin hektar olan buğday ekim alanı %26,45 azalarak 2023 yılında 6 milyon 833 bin hektara gerilemiştir. İncelenen yıllar itibariyle 2023 yılı hariç azalan bir seyir izlemiştir. 2023 yılında bir önceki yıla göre %3,08 artış göstermiştir. Buğday üretim miktarı ise incelenen yıllarda 17,5 milyon ton ile 22 milyon ton arasında değişmiştir. 2000-2004 yılları ortalamasında 19 milyon 900 bin ton olan buğday üretimi 2023 yılında %10,55 artarak 22 milyona yükselmiştir. Aynı dönemde buğday verimi ise %50,34 artarak 2.142 kg/ha'dan 3.220 kg/ha'a yükselmiştir (Çizelge 5). Türkiye'de buğday ekim alanlarında azalan, üretim miktarında dalgalı artan, verimde ise mutlak artan bir seyir olduğunu söylemek mümkündür.

Çizelge 5. Türkiye buğday üretiminin gelişimi (TÜİK, 2024a)

Yıllar	Ekim Alanı			Üretim Miktarı			Verim		
	Bin hektar	Basit indeks	Zincirleme indeks	Bin ton	Basit indeks	Zincirleme indeks	Kg/ha	Basit indeks	Zincirleme indeks
2000-2004	9.290	100,00	-	19.900	100,00	-	2.142	100,00	-
2005-2009	8.406	90,48	90,48	19.425	97,61	97,61	2.310	107,86	107,86
2010-2014	7.884	84,87	93,80	20.525	103,14	105,66	2.605	121,64	112,77
2015-2019	7.471	80,42	94,76	20.740	104,22	101,05	2.775	129,58	106,53
2020	6.922	74,51	92,66	20.500	103,02	98,84	2.961	138,27	106,71
2021	6.745	72,60	97,43	17.650	88,69	86,10	2.617	122,18	88,36
2022	6.629	71,35	98,28	19.750	99,25	111,90	2.979	139,11	113,85
2023	6.833	73,55	103,08	22.000	110,55	111,39	3.220	150,34	108,07

Türkiye'de 2023 yılında Trabzon ve Rize hariç diğer illerin tamamında buğday üretimi yapılmıştır. 2023 yılında buğday üretim ekim alanları bakımından Konya 5 milyon 967 bin dekar ve %8,73'lük pay ile birinci sırada, Ankara 3 milyon 758 bin dekar ve %5,50'lik pay ile ikinci sırada, Şanlıurfa 3 milyon 165 bin dekar ve %4,63'lük pay ile üçüncü sırada, Yozgat 2 milyon 994 bin dekar ve %4,38'lik pay ile dördüncü sırada ve Diyarbakır 1 milyon 960 bin dekar ve %4,00'lük pay ile beşinci sırada yer almaktadır (Çizelge 6).

Çizelge 6. İllere göre buğday ekim alanlarının gelişimi (TÜİK, 2024a)

İller	2005-2009	2010-2014	2015-2019	2020	2021	2022	2023
	Bin dekar						
Konya	6.613	6.891	7.027	6.203	5.801	5.794	5.967
Ankara	4.851	4.360	4.530	3.612	3.704	3.667	3.758
Şanlıurfa	3.296	3.414	2.871	4.044	3.097	2.922	3.165
Yozgat	3.361	3.419	3.127	2.630	2.762	2.884	2.994
Diyarbakır	3.017	3.677	3.413	2.707	2.910	2.765	2.734
Sivas	3.085	2.792	2.752	2.389	2.371	2.390	2.462
Tekirdağ	1.734	1.651	1.893	1.966	1.924	1.928	1.960
Mardin	1.261	1.769	1.867	1.719	1.829	1.892	1.951
Kayseri	1.831	1.539	1.655	1.848	1.646	1.681	1.875
Çorum	2.588	2.238	2.126	1.864	1.771	1.827	1.775
Diğer iller	52.417	47.092	43.445	40.242	39.630	38.536	39.683
Türkiye	84.055	78.842	74.707	69.222	67.447	66.287	68.326
	Pay (%)						
Konya	7,87	8,74	9,41	8,96	8,60	8,74	8,73
Ankara	5,77	5,53	6,06	5,22	5,49	5,53	5,50
Şanlıurfa	3,92	4,33	3,84	5,84	4,59	4,41	4,63
Yozgat	4,00	4,34	4,19	3,80	4,10	4,35	4,38
Diyarbakır	3,59	4,66	4,57	3,91	4,31	4,17	4,00
Sivas	3,67	3,54	3,68	3,45	3,52	3,61	3,60
Tekirdağ	2,06	2,09	2,53	2,84	2,85	2,91	2,87
Mardin	1,50	2,24	2,50	2,48	2,71	2,85	2,86
Kayseri	2,18	1,95	2,22	2,67	2,44	2,54	2,74
Çorum	3,08	2,84	2,85	2,69	2,63	2,76	2,60
Diğer iller	62,36	59,73	58,15	58,13	58,76	58,14	58,08
Türkiye	100,00	100,00	100,00	100,00	100,00	100,00	100,00

2023 yılında buğday üretim miktarı bakımından Konya 2 milyon 240 bin ton ve %10,18'lik pay ile birinci sırada, Şanlıurfa 1 milyon 718 bin ton ve %7,81'lik pay ile ikinci sırada, Ankara 1 milyon 102 bin ton ve %5,01'lik pay ile üçüncü sırada, Diyarbakır 982 bin ton ve %4,46'lık pay ile dördüncü sırada ve Yozgat 951 bin ton ve %4,32'lik pay ile beşinci sırada yer almaktadır (Çizelge 7).

Çizelge 7. İllere göre buğday üretim miktarının gelişimi (TÜİK, 2024a)

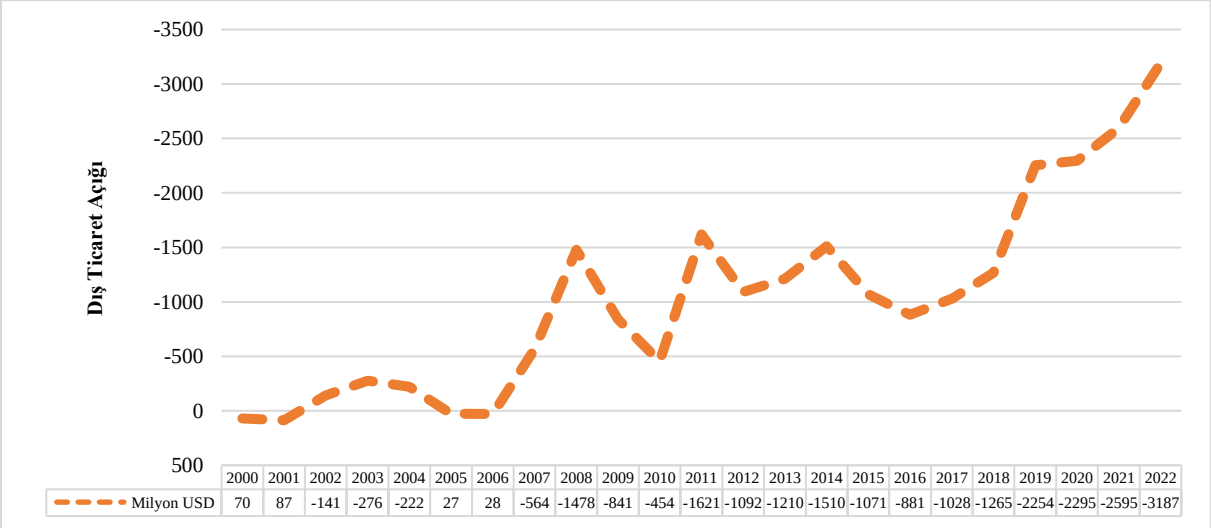
İller	2005-2009	2010-2014	2015-2019	2020	2021	2022	2023
	Bin ton						
Konya	1.349	1.946	2.143	1.921	1.580	1.930	2.240
Şanlıurfa	915	1.043	918	1.539	1.183	1.008	1.718
Ankara	965	1.015	1.119	975	610	896	1.102
Diyarbakır	706	1.102	1.108	1.008	578	799	982
Yozgat	700	782	698	607	437	669	951
Mardin	338	660	709	725	680	744	758
Edirne	640	574	499	478	641	523	724
Tekirdağ	699	650	789	770	1.027	812	688
Eskişehir	374	428	533	464	394	453	607
Sivas	500	588	615	586	392	586	604
Diğer iller	12.240	11.736	11.609	11.429	10.128	11.330	11.626
Toplam	19.425	20.525	20.740	20.500	17.650	19.750	22.000
	Pay (%)						
Konya	6,94	9,48	10,33	9,37	8,95	9,77	10,18
Şanlıurfa	4,71	5,08	4,42	7,51	6,70	5,10	7,81
Ankara	4,97	4,95	5,39	4,75	3,45	4,54	5,01
Diyarbakır	3,64	5,37	5,34	4,91	3,28	4,05	4,46
Yozgat	3,60	3,81	3,36	2,96	2,48	3,39	4,32
Mardin	1,74	3,22	3,42	3,53	3,85	3,77	3,45
Edirne	3,29	2,80	2,41	2,33	3,63	2,65	3,29
Tekirdağ	3,60	3,17	3,81	3,76	5,82	4,11	3,13
Eskişehir	1,92	2,09	2,57	2,26	2,23	2,29	2,76
Sivas	2,57	2,87	2,97	2,86	2,22	2,97	2,75
Diğer iller	63,01	57,18	55,97	55,75	57,39	57,37	52,85
Toplam	100,00	100,00	100,00	100,00	100,00	100,00	100,00

Türkiye'nin buğday ihracatı 2000-2004 yılları ortalamasına göre 588 bin ton ve 68 milyon dolar olup 2022 yılında ihracat miktarı %32,78 azalarak 395 bin tona, ihracat değeri ise %148,32 artarak 169 milyon dolara yükselmiştir. Aynı tarihler itibariyle buğday ithalat miktarı 8,38 kat artarak 1 milyon 62 bin tondan, 8 milyon 907 bin tona yükselmiştir. İthalat değeri ise 20,42 kat artarak 164 milyon dolardan, 3 milyar 356 milyon dolara yükselmiştir. Dış ticaret dengesinde ise Türkiye hem miktar bakımından hem değer bakımından açık vermektedir. Buğday dış ticaret açığı miktar bakımından 17,94 kat artarak 474 bin tondan 8 milyon 512 bin tona, değer bakımından ise 33,06 kat artarak 96 milyon dolardan 3 milyar 187 milyon dolara çıkmıştır (Çizelge 8). İncelenen dönemler itibariyle Türkiye'nin net buğday ithalatçısı olduğu söylenebilir.

Çizelge 8. Türkiye'de buğday dış ticaretinin gelişimi (FAO, 2024b)

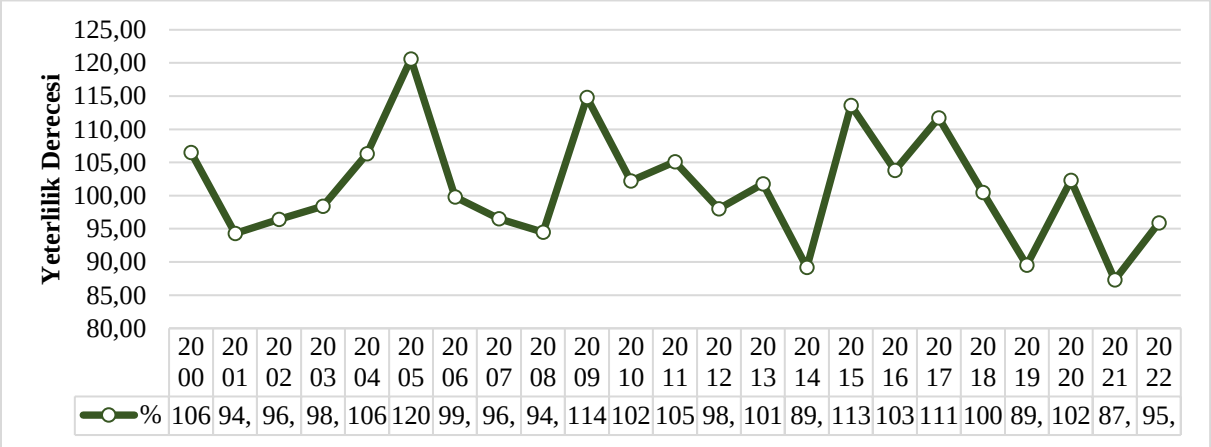
Dış Ticaret	2000-2004	2005-2009	2010-2014	2015-2019	2020	2021	2022
	(Bin ton)						
İhracat Miktarı (1)	588	268	328	68	125	265	395
İthalat Miktarı (2)	1.062	1.925	4.073	5.871	9.659	8.877	8.907
Denge (1-2)	-474	-1.656	-3.745	-5.802	-9.535	-8.613	-8.512
	(Milyon USD)						
İhracat Değeri (3)	68	41	71	26	39	98	169
İthalat Değeri (4)	164	607	1.248	1.326	2.335	2.693	3.356
Denge (3-4)	-96	-565	-1.177	-1.300	-2.295	-2.595	-3.187
	Basit indeks (2000-2004=100)						
İhracat Miktarı (1)	100,00	45,62	55,74	11,65	21,19	44,98	67,22
İthalat Miktarı (2)	100,00	181,14	383,37	552,54	909,12	835,53	838,36
Denge (1-2)	100,00	349,14	789,55	1.223,10	2.009,90	1.815,60	1.794,37
İhracat Değeri (3)	100,00	60,52	103,84	38,52	58,10	143,53	248,32
İthalat Değeri (4)	100,00	369,03	759,14	806,79	1.420,23	1.638,10	2.041,65
Denge (3-4)	100,00	586,53	1.221,14	1.348,43	2.380,56	2.691,80	3.305,98

Türkiye'nin buğday dış ticaret açığı yıllar itibariyle artmaktadır. Türkiye incelenen 2000-2022 yılları arasında; 2000 yılında 70 milyon dolar, 2001 yılında 87 milyon dolar, 2005 yılında 27 milyon dolar ve 2006 yılında 28 milyon dolar dış ticaret fazlası vermiştir. Diğer yıllarda ise buğday dış ticaretinde açık vermiştir (Şekil 1).



Şekil 1. Türkiye'nin buğday dış ticaret açığı (FAO, 2024b)

Türkiye'de buğday üretiminde kendine yeterlilik derecesi 2000-2022 yılları arasında %87,30 ile %120,60 arasında değişmekte olup ortalama %101,26'dır. 2000 yılında buğdayda kendine yeterlilik derecesi %106,50 iken 2022 yılında %9,95 azalarak %95,90 olarak gerçekleşmiştir (Şekil 2).



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
%	106	94,	96,	98,	106	120	99,	96,	94,	114	102	105	98,	101	89,	113	103	111	100	89,	102	87,	95,

Şekil 2. Türkiye'nin buğday üretiminde kendine yeterlilik derecesi (TÜİK, 2024b)

Türkiye'de farklı illerde yapılmış çalışmaların sonuçlarına göre buğday üreten işletmelerin ortalama işletme büyüklükleri genellikle 100 dekar ve üzeridir. Ortalama işletme büyüklüğü en fazla olan il 482,5 dekar ile Edirne olurken bunu sırasıyla 382,5 dekar ile Erzurum, 289,1 dekar ile Adana takip etmektedir. Buğday ekim alanları ise yaklaşık 45 dekar ile 288 dekar arasında değişmekte olup en fazla buğday ekim alanı 288,5 dekar ile Erzurum ilindedir. Buğday ekim alanlarının toplam işletme arazileri içerisindeki payları ise Erzurum'da %75,42, Adana'da %66,86 ve Haymana'da %58,64'tür. İncelenen 9 farklı bölgenin ortalamasına göre işletme büyüklükleri 244,7 dekar, buğday ekim alanları 124,2 dekar, payı ise %50,78 olarak tespit edilmiştir (Çizelge 9).

Çizelge 9. Türkiye'de buğday işletmelerinin büyüklükleri

Yapılan çalışmalar	İşletme büyüklüğü (da) (A)	Buğday ekim alanı (da) (B)	Buğday ekiminin payı (%) (A/B)
Adana[1]	289,1	193,3	66,86
Burdur[2]	79,4	43,4	54,66
Cihanbeyli[3]	231,3	144,9	62,66
Edirne[4]	452,5	53,2	11,75
Erzurum[5]	382,5	288,5	75,42
Haymana[6]	222,9	130,7	58,64
Isparta[2]	108,9	46,3	42,52
Konya[7]	206,1	103,9	50,41
Trakya[8]	229,5	114,0	49,67
Ortalama	244,7	124,2	50,78

1. Alemdar vd., 2014; 2. Gül vd., 2015; 3. Güldal, 2016; 4. Aydın vd., 2022; 5. Birinci ve Küçük, 2004; 6. Taşcı ve Oğuz, 2014; 7. Arısoy, 2004; 8. Erdem, 2012.

Araştırmaların farklı yıllarda yapılması sebebi ile buğday üretiminin maliyet ve kârlılık göstergeleri oransal olarak incelenmiştir. İncelenen çalışmalarda buğday üretiminde sabit masrafların oranı %11,92 ile %43,91 arasında değişmekte olup ortalama %25,80 olarak belirlenmiştir. Değişen masraflar ise %56,09 ile %88,08 arasında değişmekte olup ortalama %74,11 olarak tespit edilmiştir. Buğday üretiminde nispi kâr Ağrı'da 0,88, Erzurum'da 0,81'dir. Bu illerdeki işletmeler buğday üretimi için yaptıkları masrafları dahi karşılayamamakta olup zarar etmektedirler. Kırıkkale'nin Çelebi ilçesinde yapılan çalışmada buğday üretimi için nispi kâr 1,97 olarak hesaplanmış olup en kârlı bölge olmuştur. Genel olarak ise buğday üretimde nispi kâr 1,28 olarak belirlenmiş ve buğday üretiminden elde edilen gelirin masrafları karşıladığı ve işletmelerin kâr ettikleri tespit edilmiştir. Araştırmalarda buğday verimi ise dekara 102,22 kg ile 506,29 kg arasında değişmekte olup ortalama 351,76 kg olarak belirlenmiştir (Çizelge 10).

Çizelge 10. Buğday üretiminin masraf ve kârlılık durumu

Yapılan çalışmalar	Değişen masraf (%)	Sabit masraf (%)	Nispi kâr	Verim (kg/da)
Adana[1]	65,21	34,79	1,19	506,29
Ağrı[2]	88,08	11,92	0,88	102,22
Cihanbeyli[3]	78,87	21,13	1,29	404,13
Çelebi[4]	78.34	21.66	1.97	301.61
Erzurum[5]	84,11	15,18	0,81	375,54
Haymana[6]	69,39	30,60	1,46	351,10
Konya[7]	56,09	43,91	1,31	349,00
Zile[8]	72,78	27,22	1,29	424,22
Ortalama	74,11	25,80	1,28	351,76

1. Alemdar vd., 2014; 2. Karadaş, 2016; 3. Güldal, 2016; 4. Mercan, 2023; 5. Birinci ve Küçük, 2004; 6. Taşcı ve Oğuz, 2014; 7. Arısoy, 2004; 8. Bayramoğlu vd., 2005.

Sonuç ve Öneriler

Bu çalışmada dünyada ve Türkiye'deki buğday üretimi ve dış ticaretinin seyri, Türkiye'deki buğday üretiminin yapısal analizi üzerine bir inceleme yapılmıştır. Buğday üretimi Türkiye'nin tarım sektöründe ve ülke ekonomisi için önemli bir yere sahiptir. Bu öneme rağmen buğday üretiminde nispi kârın düşük olması, dış ticaretteki dengesizlikler ve verim düşüklüğü gibi faktörler işletmelerin karşılaştıkları zorluklardır. Türkiye, dünya buğday üretim sıralamasında yüksek bir konumda olmasına rağmen, dış ticaret açığının sürekli artması ve ekim alanlarının daralması, buğday üretiminin geleceği için endişe vericidir. Bu nedenle, buğday ekim alanlarını, üretimini ve verimini artıracak destekleme politikalarına ve buğday üretimindeki yapısal sorunlara çözüm bulmaya odaklanılması gerekmektedir. Ayrıca, tarıma dayalı sanayi kollarında işlenen buğdayın katma değerinin artırılarak ihraç edilmesi, sektörün sürdürülebilirliği açısından önemlidir.

Kaynaklar

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HEAVY METALS POLLUTED SOIL TREATMENT BY PHYTOREMEDIATION IN VIETNAM – A REVIEW

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Abstract
Heavy metals play an essential role in living organisms because they participate in the structure of enzymes, proteins, biochemical processes, etc. However, many heavy metals are toxic to human health and the environment, with different levels of impact depending on the type of heavy metal. Four heavy metals have the most significant effect on living organisms: As (in the form of organic As), Hg (in the form of Methylmercury), Pb (Pb^{2+}), and Cd (Cd^{2+}). The effects of heavy metals on human health often manifest through the accumulation of heavy metals in food, mainly from crop products. Plants are intermediaries that absorb, accumulate, and transport heavy metals from soil, water, and air to human and animal bodies. Therefore, to minimize the effects of heavy metals on human and animal health, pay attention to the existence and absorption of heavy metals in the soil and the ability of plants to absorb heavy metals, especially in areas at risk of heavy metal pollution. Using plants to treat pollution in general and heavy metals, in particular, is commonly called "Phytoremediation." Phytoremediation is one of the methods many countries choose to treat heavy metal contamination in soil because of its high feasibility, financial savings, and environmental landscape improvement. As a developing country, Vietnam has limited financial resources for ecological restoration, so phytoremediation is an entirely suitable choice. Studies in Vietnam show that *Lantana camara L.*, *Vetiveria zizanioides*, *Pteris vittata*, *Pityrogramma calomelanos*, and *Eleusine indica* are lead (Pb) hyperaccumulators. Arsenic (As) can be effectively treated by *Pteris vittata*, *Eleusine indica*, and *Bidens pilosa L*. Plants that have sound potential at absorbing Cadmium (Cd) include *Solanum nigrum L.*, *Helianthus annuus*, *Phragmites Australis* and *Eleusine indica*. *Pteris vittata*, *Jussiaea fissendocarpa Haines*, and *Saccharum Arundinaceum* can accumulate high Zinc (Zn) levels in their biomass. In Vietnam, *Vetiveria zizanioides*, *Phragmites Australis*, and other plants of the *Polypodiaceae* family are commonly researched and applied to treat heavy metals in soil. In addition, some scientists also focus on researching native plant species that grow on lands with high heavy metal content to find more plant species that super absorb heavy metals. However, studies on treating plant biomass after using them to absorb heavy metals have not received much attention. Therefore, scientists in Vietnam need to focus on researching this issue in the future to support phytoremediation technology better.
Keywords: heavy metals, hyperaccumulator, phytoremediation, polluted soil.

INTRODUCTION

Soil is a non-renewable natural resource that plays a significant role in all human activities. When soil is polluted, the ecosystem is damaged and causes many severe diseases in humans and animals through the food chain. In industrialization and modernization, there are more and more factories and areas. Concentrated industries were built and put into operation, creating a volume of industrial products accounting for a high proportion of the entire product of the national economy. Besides, industrial production also causes many adverse effects on the environment, especially the soil environment. Not only Vietnam but also countries worldwide are facing enormous challenges with the problem of soil environmental pollution because it threatens the habitat of many types of organisms (Hoang, 2021).One of the leading agents that pollute the soil environment that scientists are concerned about is heavy metals. Heavy metal elements in the soil environment exist in many different forms. Existence forms of heavy metals depend on environmental conditions in the soil and soil properties. Heavy metals play an essential role in living organisms because they participate in the structure of enzymes, proteins, biochemical processes, etc. However, many heavy metals are toxic to human health and the environment, with different levels of impact depending on the type of heavy metal. Many causes of soil heavy metal pollution include industrial waste, battery industry, mining activities, mechanical engineering, traffic, precipitation, domestic waste, and fertilizers (Khoa et al., 2012). Studies conducted in Vietnam have shown that heavy metal pollution occurs in most types of soil, such as urban soil (Binh et al., 2020), soil in craft villages (Pho et al., 2022), agricultural land (Huong et al., 2012; Na and Bai, 2019; Na et al., 2023; Tuyen, 2024), landfill soil (Ha, 2018; Thang and Viet, 2022), industrial park soil (Binh and Hoang, 2020), mineral mining areas (Hoai and Khanh, 2021).Biological systems require the presence of certain metals, including Cu and Zn, which have a specific concentration range and become hazardous at higher levels (Garbisu and Alkorta, 2003). Four heavy metals have the most significant effect on living organisms: As (in the form of organic As), Hg (in the form of Methylmercury), Pb (Pb^{2+}), and Cd (Cd^{2+}) (Sharma and Agrawal, 2005). The effected of heavy metals to human health is often manifest through the accumulation of heavy metals in food, mainly from crop products. Treatment is necessary for soil concentrations of heavy metals that have surpassed safe limits (Baker et al., 1994). Various approaches, such as chemical, physical, and biological, accomplish soil remediation. While chemical treatments utilize powerful acids and chelators to cleanse polluted soils, physical treatments entail removal from contaminated places (soil excavation), deep burial (landfilling), and capping. Plants are intermediaries that absorb,

accumulate, and transport heavy metals from soil, water, and air to human and animal bodies (Zwolak et al., 2019). Therefore, to minimize the effects of heavy metals on human and animal health, pay attention to the existence and absorption of heavy metals in the soil and the ability of plants to absorb heavy metals, especially in areas at risk of heavy metal pollution. Using plants to treat pollution in general and heavy metals, in particular, is commonly called "*Phytoremediation*." Phytoremediation is one of the methods many countries choose to treat heavy metal contamination in soil because of its high feasibility, financial efficiency, and environmental landscape improvement (Ansari et al., 2016). Finding suitable plant species has been the focus of numerous research efforts in Vietnam on applying plants to treat heavy metals on various soil types. This review article summarizes recent research and applications related to phytoremediation of heavy metal-contaminated soils in Vietnam, including the investigation and selection of plant species that hyperaccumulating arsenic (As), cadmium (Cd), lead (Pb), and zinc (Zn); introducing plant species commonly used to treat heavy metals in soil; Survey and evaluate the ability of native plant species to treat with heavy metals-contaminated soil increases efficiency and reduces processing costs; presenting methods for treating plant biomass after adsorbing heavy metals.

2. RESEARCH RESULTS ON THE ABILITY OF PLANTS TO HYPERACCUMULATE SOME HEAVY METALS IN SOIL.

Hyperaccumulation is the uptake, translocation, and accumulation of heavy metals at concentrations higher than the surroundings in different plant parts (Maestri et al., 2010). Three primary characteristics set hyperaccumulators apart from non-hyperaccumulating plants and are necessary for hyperaccumulation: 1) a significantly higher capacity to absorb heavy metals from the soil, 2) improved metal ion translocation from the root to the shoot, and 3) a significantly higher capability to detoxify and sequester incredibly enormous levels of heavy metals in the shoots (Rascio and Navari-Izzo, 2011). Plants that are hyperaccumulators can accumulate heavy metals in their aboveground organs at concentrations that are 100 – 1000 times higher than those of nonhyperaccumulators, all without showing any overt signs of cytotoxicity (Jabeen et al., 2009; Grobelak et al., 2010; Rascio and Navari-Izzo, 2011). This review paper will discuss four typical soil metals-Cd, As, Pb, and Zn-that plants in Vietnam hyperaccumulate.

2.1 Lead (Pb)

Hanh and Zarli (2007) conducted experimental planting of *Lantana camara L.* on soil samples taken at some locations at risk of Pb pollution in Ho Chi Minh City. The results showed that,

when growing *Lantana camara L.* in control soil without Pb, the Pb content in the roots was only 0.4 $mg.kg^{-1}$; But when the Pb content in the soil increases to 1×10^3 $mg.kg^{-1}$, plants can absorb up to 0.4×10^3 $mg.kg^{-1}$ of Pb on a dry weight basis without harm to growth and development. When growing plants in a soil environment that is periodically treated every two weeks, each time with a Pb content of 1×10^3 $mg.kg^{-1}$, after seven times of treatment, the accumulated Pb content in the soil is up to 7×10^3 $mg.kg^{-1}$, plants can accumulate up to 1.7×10^3 $mg.kg^{-1}$ of Pb in roots, without significant growth differences compared to plants grown in Pb-free environments. *Lantana camara L.* can increase from an initial dry weight of 7.87 g; after 105 days of planting, the dry biomass rises about 15 times. *Lantana camara L.* can absorb up to 1% of Pb, on a dry weight basis, in its root system. This physiological characteristic makes it possible for the plant to be used as a plant to decontaminate Pb in soil.Research results of Phuong et al. (2023) showed that Vetiver grass (*Vetiveria zizanioides*) can grow in Pb-contaminated farmland. With a Pb content in the soil of about 2,500 $mg.kg^{-1}$, after three months from planting, the ability to accumulate Pb in the leaves and roots of Vetiver plants reaches the highest threshold (corresponding to 908.83 $mg.kg^{-1}$). At the same time, the ability of Vetiver grass to remove Pb from the soil is also the highest (14.23 $mg.kg^{-1}$). According to Son et al. (2018), when growing Vetiver grass on soil around the lead and zinc mine with an initial Pb content of 1,670 $mg.kg^{-1}$, the accumulation in their leaves and roots reached 641.41 $mg.kg^{-1}$ after three months of the experiment. However, this accumulation ability gradually decreases after three months of planting. Studies show that the ability to accumulate in the roots of Vetiver grass is many times higher than in its leaves and that the Pb accumulation rate in biomass accounts for 36 – 38% of the Pb content in the soil.

Two species of *Polypodiaceae* family, including *Pityrogramma calomelanos L.* and *Pteris vittata*, are also plants that can grow well on soils with high Pb content (<1,000 $mg.kg^{-1}$). After 45 days of planting, *Pityrogramma calomelanos L.* absorbed and accumulated the highest Pb content in the stem of 1,342 $mg.kg^{-1}$ and in the roots of 1,956 $mg.kg^{-1}$ (Dung et al., 2022), Meanwhile, *Pteris vittata*, accumulates the highest Pb content of 147.34 $mg.kg^{-1}$ in shoots and 3,267.86 $mg.kg^{-1}$ in roots (Tua et al., 2011).*Eleusine indica* is also highly appreciated by scientists for its ability to accumulate Pb. According to Phuong et al. (2018), the Pb content in soil is about 1,500 – 3,000 $mg.kg^{-1}$, and the ability to accumulate Pb in stems and leaves reaches 149.25 to 189.60 $mg.kg^{-1}$ and in roots reaches 1,332.65 to 2,754.6 $mg.kg^{-1}$, the ability of plants to remove Pb from soil is high, reaching 14.01 - 14.36 $mg.tree^{-1}$ after three months of

experimental planting. During the same period of experimental planting, research by Son et al. (2018) showed that the accumulated Pb content in roots was 121.08 $mg.kg^{-1}$, the accumulated Pb content in leaf stems was 17.97 $mg.kg^{-1}$ with the initial Pb content in soil being 1,671.01 $mg.kg^{-1}$. Research results show that *Eleusine indica* can achieve a high cumulative effect after three months (90 days) of planting. Pb accumulation in roots is always much higher than in stems and leaves.

Table 1. Pb concentration in soil (before the experiment) and in plant biomass (after the experiment)

Plant	Pb Concentration ($mg.kg^{-1}$)				References
	Soil	Shoots	Roots	Biomass	
Lantana camara	7×10^3	-	1.7×10^3	-	Hanh et al., 2007
Vetiveria zizanioides	2500	-	-	908.83	Phuong et al., 2023
	1,670	-	-	641.41	Son et al., 2018
Pityrogramma calomelanos	< 1,000	1,342	1,956	3,298	Dung et al., 2022
Pteris vittata	< 1,000	147.34	3,267.86	3,415.2	Tua et al., 2011
Eleusine indica	1,500–3,000	149.25–189.6	1,332.65–2,754.6	1,481.9–2,994.2	Phuong et al., 2018
	1,671.01	17.97	121.08	139.05	Son et al., 2018

2.2 Arsenic (As)

Studies on As accumulation in plants in Vietnam generally recognize that two fern species, *Pityrogramma calomelanos*, and *Pteris vittata L.*, are hyperaccumulators of As, in which *Pteris vittata* has a higher ability to accumulate As than *Pityrogramma calomelanos*. In the study of Anh (2016), *Pteris vittata* contains more than 0.1% in the aboveground part of the plant. After 16 weeks of growing Pteris vittata on soil with an initial As content of 1,420 $mg.kg^{-1}$, the accumulated As content in the biomass of *Pteris vittata* reached 4,789 $mg.kg^{-1}$ in shoot and 818.9 $mg.kg^{-1}$ in the roots. Anh et al. (2010) studied the effects of nitrogen (N) and phosphorus (P) on the ability to grow and accumulate As of *Pteris vittata*. This study also showed that the concentration accumulated in the aboveground part of *Pteris vittata* is always much higher than in the roots. This is a massive advantage of this fern when applied to environmental treatment. The ability to grow and accumulate As of *Pteris vittata* is positively influenced by the P and N content added to the experiment. The growth and As accumulation of *Pteris vittata* is highest when N is added at 100 ppm – 200 ppm and P is added at a concentration of 800 ppm. When

growing both of these fern species on As-polluted soil with the addition of organic and inorganic fertilizers, their ability to accumulate As will increase from 2 times (*Pityrogramma calomelanos*) to 6 times (*Pteris vittata*) (Anh, 2014).A study by Nghiem et al. (2016) showed that *Bidens pilosa L* grew usually, and yield did not change much when increasing As in soil from 0 ppm to 500 ppm. But when it reached 1,000 ppm, productivity showed signs of decreasing. The As content in the roots of *Bidens pilosa L* also increased as the As concentration in the soil increased and reached a maximum of 240.70 $mg.kg^{-1}$ biomass at 3,000 ppm As. However, at 3,000 ppm, some *Bidens pilosa L* died, growth ability is much poorer, and the total amount of As absorbed by the plant will certainly be low. Ha et al. (2019) also concluded that *Bidens pilosa L.* has excellent potential in phytostabilizing As and heavy metal-contaminated mined soils due to its significant contribution to reducing As content in soil by accumulating in their biomass. *Eleusine indica L*. is also a plant that absorbs As well when the accumulated content in the shoot is 499 $mg.kg^{-1}$ and in the root is 791.8 $mg.kg^{-1}$ after 16 weeks of planting in soil with an initial As content of 1,420 $mg.kg^{-1}$ (Anh, 2016).

In addition to the above plants, some plants in nature also have the potential to accumulate As in biomass, such as *Phragmites australis* (Linh and Canh, 2018), *Vetiveria zizanioides* (Danh et al., 2012).

Table 2. As concentration in soil (before the experiment) and in plant biomass (after the experiment)

Plant	As Concentration ($mg.kg^{-1}$)				References
	Soil	Shoots	Roots	Biomass	
Bidens pilosa	240.70	-	-	3,000	Nghiem et al., 2016
Pteris vittata	1,420	4,789	818.9	5,607.9	Anh, 2016
Eleusine indica	1,420	499	791.8	1,290.8	Anh, 2014 Anh, 2016

Cadmium (Cd)

Research results of some authors also concluded that *Solanum nigrum L.* is a plant species that hyperaccumulators Cd (Phuong et al., 2016; Hung, 2016; Hung et al., 2018). *S. nigrum* grows, develops, and produces suitable biomass in normal farming conditions. This is an advantage of choosing this object when using plants to treat polluted soil. *S. nigrum* can live and grow in soil contaminated with Cd from 0 – 200 $mg.kg^{-1}$, in soil contaminated with Cd from 10 – 25 $mg.kg^{-1}$, growing *S. nigrum* effectively treats the highest Cd storage. Aboveground biomass

(stems, leaves, flowers, shoots) accumulates more Cd than belowground biomass (roots). The total Cd content can accumulate up to 914.2 $mg.kg^{-1}$ (dry biomass) (Hung, 2016). In an experiment by Phuong et al. (2016), with a Cd content in the soil of about 50 $mg.kg^{-1}$, the biomass of the tree reaches 22.30 $mg.tree^{-1}$, the accumulated Cd content in the leaf stem is 152.52 $mg.kg^{-1}$, in the roots, is 745.45 $mg.kg^{-1}$ and the highest ability to remove Cd from the soil, reaching 5.21 $mg.tree^{-1}$.*Helianthus annuus* is evaluated for its potential to control the spread of Cd in the ecosystem as a plant that can survive in high metal concentrations. Many scientific reports show that *H. annuus* can absorb and accumulate heavy metals in roots but rarely in shoots and branches (Saxena et al., 1999; Lin et al., 1999; Lin et al., 2003). Research by Thao and Hien (2017) pointed out that the range of Cd concentration in soil reaching the threshold of 50 $mg.kg^{-1}$) can be considered a reference value for devising a metal detoxification strategy in polluted areas.*Phragmites australis* is also a species that accumulates high Cd in its biomass. *P. australis* can absorb and accumulate Cd in stems and leaves more than in roots (Minh and Hai, 2016; Linh and Canh, 2018). The accumulated Cd content in P. australıs after eight months of planting increased 41.17 times compared to the initial content. Research by Van et al. (2013) showed that *P. Australis* can grow well on polluted soils after ore mining, with the highest Cd content in the soil up to 37.14 $mg.kg^{-1}$The highest accumulated Cd content was 33.38 $mg.kg^{-1}$ in roots and 8.89 $mg.kg^{-1}$ in shoots.*Eleusine indica L.* can grow and develop in Cd-polluted farmland. With a Cd content in soil of about 50 – 200 $mg.kg^{-1}$, the accumulated Cd content in the leaf stem of *E. indica* reaches 75.61 $mg.kg^{-1}$ to 195.21 $mg.kg^{-1}$, and in the roots of *E. indica* reached 365.09 $mg.kg^{-1}$ to 482.08 $mg.kg^{-1}$. The ability of plants to remove Cd from the soil is relatively high, reaching 2,883 – 2,973 $mg.tree^{-1}$ (Phuong et al., 2018). If appropriate N, P, and K are supplemented, after 16 weeks of planting, E.indica can absorb Cd with a content of 41.2 $mg.kg^{-1}$ in shoots and 160.7 $mg.kg^{-1}$ in roots from soil containing the initial Cd content is 200 $mg.kg^{-1}$ (Anh, 2016).

Table 3. Cd concentration in soil (before the experiment) and in plant biomass (after the experiment)

Plant	Cd Concentration (mg.kg^{-1})				References
	Soil	Shoots	Roots	Biomass	
Solanum nigrum	50	152.52	745.45	897.97	Phuong et al., 2016
	50			914.2	Hung, 2016
Phragmites australis	37,14	8,89	33,38	42,27	Van et al., 2013
Eleusine indica	50-200	75.61 - 195.21	365.09 - 482.08	440.7 – 677.29	Phuong et al., 2018
	200	41.2	160.7	201.9	Anh, 2016

2.4 Zinc (Zn)

Pteris vittata's ability to accumulate Zn in the stems and roots of the plant increases when the Zn content in the soil increases. However, the increase is not linearly proportional to the Zn concentration in the soil. When the Zn concentration in the soil rises from 300 – 1,500 mg.kg^{-1}, the plant's ability to accumulate Zn only increases from 345.46 – 580.09 mg.kg^{-1} for the stem and from 3,430.70 – 5,380.17 mg.kg^{-1} for the stem and roots. Like with the Pb tolerance experiment, when considering the Zn accumulation rate between the roots and shoots of *Pteris vittata* in the experimental concentrations, this number does not fluctuate much (in the range of 8.5 – 10.5). This proves that the Zn concentration in the soil does not significantly affect the ratio of Zn concentration in parts of *Pteris vittata*. Thus, *Pteris vittata* can withstand Zn concentrations up to 1500 mg.kg^{-1} in soil. However, the best tolerance and removal of Zn is at a concentration of 300 mg.kg^{-1} (Tua et al., 2011). After growing *Pteris vittata* for 16 weeks on soil (with an initial Zn content of 3,267 mg.kg^{-1}) taken from mining sites, analysis results showed that *Pteris vittata* can accumulate Zn about 810.2 mg.kg^{-1} in shoots and 1,298.8 mg.kg^{-1} in roots (Anh, 2016).*Jussiaea fissendocarpa haines* have been proven by many domestic and foreign authors to have the capacity to accumulate great quantities of heavy metals in the body. However, combining microbial strains can help increase the heavy metal content accumulated in plant parts, shortening the pollution treatment time (Hung et al.,2010). The absorption of heavy metals (Cu, Zn, Pb) of *J.F.haines* plants in the roots increased with the amount of inoculant applied to the soil and was significantly higher than the control. In the formula of fertilizing inoculant/kg dry soil, the highest absorption of heavy metals was 124.51 mg.kg^{-1} Zn; 41.44 mg.kg^{-1} Pb; 20.57 mg.kg^{-1} Cu, respectively (Hung et al., 2010). Research

by Kieu et al. (2011) also showed that growing *J.F.haines* in soil supplemented with microbial strains will increase the efficiency of Zn accumulation in biomass by 2.5 times compared to without supplemented with microbial strains (increased from 44.9 $mg.kg^{-1}$ to 113.18 $mg.kg^{-1}$).*Saccharum arundinaceum*: The amount of Zn accumulated in the tree after planting is higher than that of the original tree. After four months of planting, the accumulated Zn content in some plants was 30.3 $mg.kg^{-1}$ (in stems and leaves) and 50.39 $mg.kg^{-1}$ (in roots). The Zn content in *S.arundinaceum* roots is absorbed 1.66 times more than in the leaves. After eight months of planting *S.arundinaceum*, the Zn content accumulated in plants is very high: Zn content in leaves and stems is 79.87 $mg.kg^{-1}$. Accumulation in roots is 111.44 $mg.kg^{-1}$. The Zn content in *S.arundinaceum* roots is absorbed 1.4 times more than in the leaves (Hoa et al., 2022).

Table 3. Zn concentration in soil (before the experiment) and in plant biomass (after the experiment)

Plant	Zn Concentration ($mg.kg^{-1}$)				References
	Soil	Shoots	Roots	Biomass	
Pteris vittata	300 - 1,500	345.46 - 580.09	3,430.7 – 5,380.2	3,776.2 – 5,960.3	Tua, et al., 2011
	3,267	810.2	1,298.8	2,109	Anh, 2016
Jussiaea fissendocarpa haines	108.32	-	-	124.51	Hung, et al., 2010
Saccharum arundinaceum	150	79.87	111.44	191,31	Hoa et al., 2022

3. SURVEY OF NATIVE PLANT SPECIES CAPABLE OF ACCUMULATING SOIL HEAVY METALS

Related to this content, in Vietnam, there have been studies on surveying, screening, and evaluating the ability of native plants to accumulate and process heavy metals in soil. These species live on soil contaminated with very high levels of heavy metals.

Hung and Tra (2021) focused on screening native plant species with the ability to absorb the heavy metal Chromium (Cr) to treat contaminated soil in Long Khanh City, Dong Nai province. Forty-eight plant species with their outer morphology specific to heavy metal hyper-accumulators were collected. After examining scientific names and making a checklist of plant species, the results presented that there were 16 orders, 21 families, and 37 genera capable of accumulating heavy metals. Among them, four plant species survived in Cr-contaminated soil

from 150 – 350 mg.kg^{-1} dried soil, concluding: (1) *Cyperus rotundus L.*, (2) *Cynodon dactylon (L) Pers.*, (3) *Amaranthus spinosus L.*, and (4) *Solanum nigrum L.*

The results of the assessment of Lead (Pb) accumulation in native plants growing on coal mine sites in Northeastern Vietnam showed that all three species of plants could grow and well-develop in the environment with the concentrations of Pb. The average Pb accumulated was the highest in *Lantana camara* at 3.38 mg.kg^{-1}, followed by *Eleusine indica* and *Aglaonema muntifolium* at 1.67 mg.kg^{-1} and 1.37 mg.kg^{-1}, respectively. Based on the enrichment coefficients for stem, leaves and root values, the plant was separated into two groups, including hyperaccumulator (*A.muntifolium*) and photo stabilizer (*L.camara* and *E.indica*) (Dung et al., 2022). Fifteen native plant species grow in a Pb recycling zone of Dong Mai village, Hung Yen province, Vietnam. *Hymenachne acutigluma (Steud.) Gilliland*, a potential hyperaccumulator of Pb (1,160 mg.kg^{-1}-DW), is considered the best candidate for phytoremediation of Pb-contaminated soil (Ha et al., 2019). Ha et al. (2019) evaluated the phytoextraction and phytostabilization potential, two standard techniques of phytoremediation, of 21 plant species growing logically at the largest tungsten (W) mine in Vietnam–the second largest production of W in the world. The results indicated that hyperaccumulation levels (mg.kg^{-1}-DW) were obtained for only As in *Pityrogramma calomelanos* (2400) and *Pteris vittata L.* (1860). Based on the recorded hyperaccumulation levels, translocation and accumulation factors, biomass, and fast growth of these plants, *P. calomelanos* and *P. vittata* were considered promising native plants for the phytoextraction of As contaminated soils. *Bidens pilosa L.* also has excellent potential for phytostabilization of mining soils contaminated with As and heavy metals.The research of Hung et al. (2018) was conducted for two years in northern Tan Uyen, Binh Duong province, Vietnam, to screen native plant species capable of absorbing the heavy metal Cd. The results showed that only 9 per 52 plant species studied were able to live in soil contaminated with Cd with concentrations from 25 to 50 mg.kg^{-1}, of which *Solanum nigrum L.* and *Physalis angulata*, BF above 10, were considered to be Cd super accumulation.Anh et al. (2011) determined the heavy metal uptake into shoots and roots of 33 indigenous plant species in Thai Nguyen Province, Vietnam. Two species of the plants investigated, *Pteris vittata L.* and *Pityrogramma calomelanos L.* were hyperaccumulators, containing more than 0.1% heavy metals in their shoots. *Eleusine indica L.*, *Cynodon dactylon L.*, *Cyperus rotundus L.*, and *Equisetum ramosissimum*accumulate very high Pb (0.15–0.65%) and Zn (0.22–1.56%) concentration in their roots.

4. TREATMENT OF PLANT BIOMASS AFTER THEIR HEAVY METAL ABSORPTION

Recently, many research projects worldwide have been treating or utilizing accumulated plant biomass rich in metals, such as Keller et al. (2005) investigated whether thermal treatment could be a practicable option for evaporatively separating metals from the plant residues. This study uses a laboratory reactor scale designed to simulate the volatilization performance of heavy metals in a grate furnace. Hao et al. (2018) reported a greener and more effective process of hydrothermal change of rice straw (Cd low accumulated crop) and *Elsholtzia splendens* (Cu accumulated plant) to improve the metals and simultaneously produce biofuel for harmless treatment and resource reuse. In the research of Zhi et al. (2020), for the initial time, a mesoporous carbon-supported nano CdS (CdS@C) photocatalyst was gained by in situ upcycling of Cd-enriched *Sedum plumbizincicola* biomass through a mixture of pyrolysis carbonization and hydrothermal reaction. In the study of Haiwei et al. (2022), $CaO/Ca(ClO)_2$ was used to promotion As retrieval in hydrothermal liquefaction of As-enriched *Pteris vittata L.* Anaerobic digestion (AD) approach a guarantee to covert phytoremediation biomass into renewable energy (biogass) and control soil contamination. Accumulation of heavy metals in digestive substrates affects the enzymatic activities of methanogenic bacteria in AD (Aman et al., 2022). In general, research worldwide focuses mainly on treating hyperaccumulated plant biomass, recovering heavy metals, and recycling biomass to create fuel. The thermal method is commonly used to treat heavy metal hyperaccumulator plant biomass.However, The number of studies on treating plant biomass after heavy metal absorption is still minimal. In 2014, Minh and Hai studied the treatment of fern and vetiver biomass adsorbing heavy metals (Pb, Cd, As) after planting on post-mining land using the ashing method. Fresh biomass of Ferns and Vetiver is collected and dried, and after ashing, it is further treated with lime to reduce the content of mobile heavy metals. Research results show that after ashing the tree, biomass decreased significantly, only 5–6% compared to the original. Using lime mixed with ash for two months has dramatically reduced the amount of mobile heavy metals in the soil. The total heavy metals content in the ash before and after the experiment did not change much. However, the mobile heavy metals content in the ash after treatment with lime has changed clearly. This is very meaningful in limiting the harmful effects of heavy metals in soil.

5. CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Research related to the field of plant application for heavy metal treatment in Vietnam has produced several valuable results, including:

1. Researching about Hyperaccumulators:

- Pb: *Lantana camara L.*, *Vetiveria zizanioides*, *Pityrogramma calomelanos*, *Pteris vittata*, and *Eleusine indica*
- As: *Pteris vittata*, *Eleusine indica*, and *Bidens pilosa L.*
- Cd: *Solanum nigrum L.*, *Helianthus annuus*, *Phragmites Australis* and *Eleusine indica*.
- Zn: *Pteris vittata*, *Jussiaea fissendocarpa Haines*, and *Saccharum Arundinaceum* .

2. In Vietnam, *Vetiveria zizanioides*, *Phragmites Australis*, and other plants of the *Polypodiaceae* family are commonly researched and applied to treat heavy metals in soil

3. Some scientists also research native plant species that grow on lands with high heavy metal content to find more plant species that super absorb heavy metals.

4. The number of studies on treating plant biomass after heavy metal absorption is still very limited in Vietnam.

5.1 Recommendation:

- Scientists in Vietnam need to focus on researching this issue in the future to support phytoremediation technology better.
- The above research is mainly carried out in the laboratory. Therefore, in the future, it is necessary to turn these research results into applied research.

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DERİN ÖĞRENME METODU YARDIMIYLA ENGİNARIN (Cynara scolymus) FİDE ÜZERİNDE BELİRLENMESİ

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Özet
Derin öğrenme, günümüzde birçok alanda kullanılan etkili bir yapay zeka yöntemidir. Büyük veri setleri ve karmaşık problemlerle başa çıkmak için ideal olan derin öğrenme yöntemi görüntü işleme, tıp, tarım gibi çeşitli alanlarda kullanılmaktadır. *Tarımsal alanda derin öğrenme uygulamalarını günümüzde popüler hale gelmiştir. Bu uygulamalardan bazıları bitki algılama,nesne tanıma,rekolte tahmini,hastalık kontrolü,akıllı sulama sistemleridir.*Çalışma için seçilen enginarın hasadında işçilik maliyetleri büyük bir sorundur. Enginarın tüm yetiştirme sürecince ve hasadında insan gücü büyük bir yer tutmaktadır. İşçilik maliyetinin azaltılması enginar üretim sürecine doğrudan katkıda bulunacaktır. Bu çalışmanın amacı, derin öğrenme yöntemi kullanılarak enginarın baş büyüklüğü yardım ile fide üzerinde belirlenmesidir. Enginar hasadı, bitkinin doğru zamanda ve doğru şekilde toplanmasıyla gerçekleştirilir.Baş büyüklüğü enginar hasadını belirleyici en önemli faktördür. Bu nedenle enginar hasadının zamanında ve etkin bir şekilde gerçekleştirilmesi amacıyla, Özellikle YOLOv8l (large) modeli, yüksek F1 skoru ve mAP@0.5:0.95 değerleri ile diğer algortimalardan daha iyi bir performans göstermiştir. Bu bulgular, YOLOv8l'nin, nesne tespiti için gelişmiş bir seçenek olarak, gerçek zamanlı robotik hasat uygulamalarında tercih edilebileceği anlaşılmıştır. YOLOv8l (large) modelinin sağladığı avantajlar çiftçilerin enginar hasadı sürecini optimize etmelerine, verimliliği artırmalarına ve kaynakları daha etkin bir şekilde kullanmalarına yardımcı olacaktır.
Anahtar Kelimeler: Derin öğremme,tanımlama,enginar,YOLO

IDENTIFICATION OF ARTICHOKE (Cynara scolymus) ON SEEDLINGS WITH THE HELP OF DEEP LEARNING METHOD

Abstract
Deep learning is an effective artificial intelligence method used in many fields today. Ideal for dealing with large data sets and complex problems, deep learning is used in various fields such as image processing, medicine, agriculture, etc. Deep learning applications in agriculture have become popular today. Some of these applications are plant detection, object recognition, yield prediction, disease control, intelligent irrigation systems, etc. Labor costs are a major problem in harvesting the artichoke selected for the study. Manpower plays a major role in the entire growing process and harvesting of artichokes. Reducing the labor cost will directly contribute to the artichoke production process. The aim of this study is to determine the head size of artichoke on seedlings using deep learning method. Artichoke harvesting is realized by collecting the plant at the right time and in the right way, and head size is the most important factor determining the artichoke harvest. According to the results of the comparative analysis, the YOLOv8 algorithm has better object detection performance compared to YOLOv7. In particular, the YOLOv8l (large) model outperformed the other algorithms with high F1 scores and mAP@0.5:0.95 values. These findings suggest that YOLOv8l (large) can be preferred in real-time robotic harvesting applications as an advanced option for object detection. The advantages of the YOLOv8l (large) model will help farmers to optimize the artichoke harvesting process, increase efficiency and use resources more effectively.
Keywords: Deep learning, identification, artichoke, YOLO

Giriş

Derin öğrenme, yapay sinir ağları kullanarak karmaşık ve soyut verileri anlamlandırma ve örüntülerini çıkarma sürecidir. Bu yöntem, makine öğrenmesinin bir alt dalıdır.Geleneksel makine öğrenmesi yöntemlerinde, verilerin elle seçilmiş bir dizi öznitelik veya nitelik ile temsil edilmesi gerekmektedir. Ancak derin öğrenme yaklaşımında ise, algoritma, girdi verilerini otomatik olarak analiz ederek önemli özellikleri kendisi belirler.Derin öğrenme algoritmaları genellikle çok katmanlı sinir ağı mimarilerinden oluşur. Bu katmanlar arasında birbirleriyle bağlantılı olan yapay sinir hücreleri yer alır ve bu hücrelerden her biri girdi sinyallerini işleyerek çıktı üretir.Derin öğrenmenin uygulama alanları oldukça geniş kapsamlıdır. Görüntü tanıma, doğal dil işleme, ses tanıma ve oyun stratejisi gibi pek çok alanda kullanılabilir. Derin öğrenme teknolojisi kullanarak yüz tanıma sistemleri geliştirilebilir veya anlamını anlayabilen konuşan robotlar oluşturulabilir.YOLOv8, YOLO (You Only Look Once) nesne algılama algoritmaları serisinde önemli bir gelişmedir. Orijinal YOLO'dan YOLOv8, YOLO-NAS ve dönüştürücülü YOLO'ya doğru bir evrimi temsil etmektedir. YOLOv8 çeşitli alanlarda uygulanarak çok yönlülüğünü ve etkinliğini ortaya koymuştur.*YOLOv8, kendi başına bir derin öğrenme modelidir ve çeşitli yapay sinir ağı katmanlarından oluşur. Girdi olarak RGB görüntülerini alır ve bu görüntüler üzerinde tespit etmek istediğimiz nesneleri bulmaya çalışır. Derin öğrenme alanında YOLOv8 gibi modeller, nesne algılama problemini çözmek için yaygın olarak kullanılır. Bu modeller, otonom araçlar, güvenlik sistemleri, video analizi gibi birçok alanda kullanılabilir ve insanları ya da diğer nesneleri algılamak için büyük bir potansiyele sahiptir.Bu nedenle birçok alanda kullanılmaktadır.*Pediatrik bilek travması X-ışını görüntülerinde kırık tespiti Ju ve ark.(2023), çelik yüzey kusur tespiti (Xie ve ark., 2024), otomotiv ABS fren ana silindiri kusur tespiti (Liu ve ark., 2024), termal görüntülemeye dayalı cerrahi kesi iyileşme değerlendirmesi, düşük irtifa hava görüntülerinde nesne tespiti (Zhao ve ark., 2024) ve rüzgar türbini kanadı kusurlarının tespitinde (Yang ve ark., 2024) kullanılmıştır. Ayrıca YOLOv8, çöp sınıflandırma ve algılama, uzaktan algılama görüntülerinden kırsal yerleşim alanı çıkarma (Rui ve ark., 2023), izolatör hedef tespiti (Hu ve ark., 2023) ve manyetik rezonans anjiyografide beyin arteriyovenöz malformasyon tespiti gibi uygulamalarda kullanılmıştır. Algoritmanın yetenekleri, veri toplama ve analiz için araçlar ve paketler geliştirilerek genişletilmiş, böylece çeşitli araştırma ve pratik bağlamlarda daha erişilebilir ve uygulanabilir hale getirilmiştir.Derin öğrenme, tarımsal hasatta çeşitli uygulamalarda kullanılan etkili bir yapay zeka yöntemidir. Özellikle bitki stres fenotipleme, bitki hastalıklarının sınıflandırılması ve tarımsal üretimde verimliliğin arttırılması gibi alanlarda

derin öğrenme yöntemleri başarıyla kullanılmaktadır. Singh ve ark.(2018) bitki stres fenotipleme konusunda derin öğrenme araçlarının diğer mevcut tekniklere göre karar doğruluğu, veri boyutu gereksinimi ve çeşitli senaryolardaki uygulanabilirlik açısından karşılaştırmalı bir değerlendirmesini sunmuşlardır. Derin öğrenme ayrıca hyperspectral görüntü sınıflandırması gibi tarımsal uygulamalarda da kullanılmaktadır. Fırat ve ark.(2022) hyperspectral görüntü sınıflandırması için derin öğrenmeye dayalı bir mimari önermişlerdir. Bu tür uygulamalar, tarımsal alanlarda bitki örtüsü analizi ve tarım alanlarının izlenmesi için önemli bir araç haline gelmektedir. Ayrıca, tarımsal üretimde makine öğrenimi ve derin öğrenme tekniklerinin kullanımı, örneğin bitki hastalıklarının tespiti, mahsul verimliliğinin arttırılması ve tarımsal üretim süreçlerinin otomasyonu gibi konularda mavi yaban mersini meyvelerinin hasat edilebilirlik ve verimle ilişkilendirilen özelliklerinin belirlenmesi için derin öğrenme görüntü segmentasyonu ve çıkarma yöntemlerini kullanmıştır (Ni ve ark.,2020). Kim ve ark.(2021) otonom bir biçerdöver için zayıf denetimli mahsul alanı segmentasyonu konusunda çalışmış ve modelin küçük veri ölçeği ile kolayca uygulanabilir olduğunu göstermiştir. Li ve ark.(2023) yaptıkları çalışmada yüksek kaliteli çay toplama robotu için derin öğrenme ile tanımlama sistemi gerçekleştirmişlerdir. Gentilhomme ve ark.(2023) derin öğrenme yardımıyla asma için akıllı budama sistemi üzerine çalışmışlardır. Bir başka çalışmada Patil ve ark.(2023) füzyon derin öğrenme ile hasat öncesi ve sonrası üzüm kalite tahmini yapmışlardır. Pandey ve ark.(2023) 'de derin öğrenme yardımıyla pamukta yaprak hastalıklarının sınıflandırmasını gerçekleştirmişlerdir. Sekharamantry ve ark.(2023) derin öğrenme modeli olan YOLOv5 ile ağaç üstünde elma tespitini yapmışlardır. Ceyhan ve ark.(2022) görüntü tabanlı derin öğrenme ile buğday çeşitlerinin sınıflandırılması gerçekleştirmişlerdir. Zhang ve ark.(2022) domates hasat robotu için YOLOv5 derin öğrenme modeli geliştirmişlerdir. Bai ve ark.(2022) otomatik robotik hasat için makine öğrenimi destekli görüntü analizi kullanarak kümelenmiş domates tespiti ve toplama noktası konumu seçimi çalışması yapmışlardır.Badeka ve ark.(2023) hassas bağcılık için derin öğrenme yaklaşım için YOLOv7 ile üzüm olgunluğunun değerlendirilmesi gerçekleştirmişlerdir. Bu çalışmalar, tarımsal hasat süreçlerinde verimliliği artırmak ve ürün kalitesini iyileştirmek için derin öğrenme yöntemlerinin potansiyelini ortaya koymaktadır. Bu bağlamda, derin öğrenme yöntemlerinin tarımsal hasatta kullanımı, bitki hastalıklarının tespiti, bitki stres fenotipleme, mahsul sınıflandırması ve tarımsal verimlilik analizi gibi alanlarda önemli bir araştırma ve uygulama alanı oluşturmaktadır. Bu tekniklerin tarımsal üretimdeki rolü, gelecekteki tarımsal

uygulamaların geliştirilmesinde ve tarımsal verimliliğin artırılmasında önemli bir rol oynayacaktır.

2.Materyal ve Yöntem

2.1.Materyal

Enginar (Cynara scolymus) potansiyel sağlık faydaları ve besin değeri ile bilinen bir bitkidir. Araştırmalar enginar yaprağı ekstraktlarının anti-mikrobiyal, anti-alerjik, anti-enflamatuar ve antikanser etkiler gösteren dikafeoilkinik asitler, klorojenik asit, luteolin glukozit ve apigenin glukozit gibi antioksidan fenolik bileşikler içerdiğini göstermiştir (Tang ve ark., 2017). Ayrıca enginar brakteleri diyet lifi, fenolik içerik ve antioksidan aktivite açısından zengindir, bu da onları gıda ürünlerinde değerli bir fonksiyonel bileşen haline getirir (Dadalı, 2023). Enginarın karaciğer hasarına karşı potansiyel koruyucu etkileri ve kolesterol biyosentezi üzerindeki inhibitör etkileri vardır. (Gebhardt, 2002). Bu bulgular ışığında enginarın sağlığı geliştirici çeşitli özelliklere sahip fonksiyonel bir gıdadır.

Enginar hasadı, enginar üretiminin çok önemli bir yönüdür. Çok yıllık bitkilerin en yoğun üretimi Mart-Nisan ayları arasında gerçekleşir ve bu dönem enginar hasadı için en uygun dönemdir (Smith ve ark., 2008). Hasat zamanının seçimi enginarın polifenol profilini önemli ölçüde etkilemektedir ve bu da hasat zamanının istenen polifenol içeriğine sahip enginar elde etmek için gerekli olduğunu göstermektedir (Pandino ve ark., 2013). Organik ve geleneksel olarak yetiştirilen enginarların karşılaştırıldığı bir çalışmada, enginarın organik yetiştiricilik için en uygun bitkilerden biri olduğu tespit edilmiş, bu da organik yöntemlerin enginar hasadı için etkili bir şekilde kullanılabileceğini düşündürmüştür (Yıldırım ve ark., 2020). Enginar çeşitlerinin farklı gübre rejimlerine ve gibberellik asit uygulaması gibi uygulamalara verdiği nutrasötik tepkinin hasadın kalitesini ve verimini etkileyebileceğini göstermiştir (Lombardo ve ark., 2015; Lombardo ve ark., 2022). İstenen kalite ve verim için enginar hasadını optimize etmek amacıyla hasat zamanlamasının, yetiştirme yöntemlerinin ve uygulamaların dikkate alınması gerekmektedir.

2.2.Yöntem

Veri Setinin Hazırlanması:

Enginar bitkisinin veri setinin hazırlanmasında Tekirdağ Naip Köyü üretici tarlarında çekilmiş hasat fotoğrafları ve videoları kullanılmıştır. Şekil 1'de örnek fotoğraflar verilmiştir. Eğitim seti ve test seti için 150 adet enginar bitkisi görseli çalışmada kullanılmıştır.Her bir fide üzerinde birden fazla enginar bulunmaktadır.Şekil 1'de veri setinde kullanılan görsellere örnek gösterilmiştir.




Şekil 1. Naip Köyü üretici tarlasından alınmış görüntüler

Etiketleme ve Eğitim Seti

Bir nesne tespiti modelinin, bir veri seti üzerinde eğitim gerçekleştirebilmesi için, tespit edilmesi hedeflenen nesnelerin eğitileceği veri setinde etiketlenmiş/ imzalanmış olması gerekmektedir. Bu sebeple eğitim seti için 100 görselin her birinde enginar görüntüsünü içeren kısımların sınırlayıcı kutu alanı ile işaretlenmesi yapılmıştır. 50 görsel ise test setinde kullanılmıştır.Görsel etiketlemesi yapmak için, açık kaynak topluluklarında çok sayıda program, internet sitesi ve yardımcı araç bulunmaktadır. Şekil 2 ‘de etiketleme ekranı görüntüsü gösterilmiştir.




Şekil 2. Etiketleme ekranı

Bu araçlardan bir tanesi ise, nesne tespiti projelerinde sıklıkla kullanılan, popüler bir web sitesi olan Roboflow’dur. Roboflow, ham görüntüleri özel olarak eğitilmiş bir bilgisayar görme modeline dönüştürmek ve onu uygulamalarda kullanmak üzere dağıtmak için gereken tüm araçları sağlayan; görüntüler üzerinde alan seçimleri, işaretlemeleri ve sınıf etiketlemeleri yapılmasını sağlayan bir web sitesidir. Bu işaretleme ve etiketleme işlemi, sitenin sahip olduğu grafiksel kullanıcı arayüzü aracılığıyla kolaylıkla yapılmaktadır.

Eğitim Model Seçimi

Yapmış olduğumuz projede, CNN yöntemiyle geliştirilmiş YOLO model ailesinin açık kaynak olarak geliştirilen en son versiyonu olan YOLOv8 tercih edilmiştir. RCNN benzeri iki aşamalı ağ kullanan modellere göre oldukça avantaja sahip olan YOLO model ailesinin YOLOv8 modeli, kendisinden önce geliştirilmiş sürümlere doğruluk değerleri ve hız oranı açısından avantaj sağladığı için tercih edilmiştir.

Enginarın fide üzerinde tespiti yapacak olan modelin eğitiminin başlatılması için, YOLOv8 modelinin bilgisayardaki konumuna gidilerek Python çalıştırıcı editör açıldı. Ana dizinde bulunan ve YOLOv8 eğitimini sağlayan train.py programı, çalıştırılmak üzere kontrol edildi. Bu Python programının çalıştırılması, çeşitli parametreler ile özelleştirilebilmektedir.

Çalışma dahilinde, enginar için aşağıda yazılı olan kod içerisindeki parametreler ve düzenlemeler tercih edildi.

- **!yolo task=detect mode=train model=yolov8n.pt data={dataset.location}/data.yaml epochs=80 imgsz=640 plots=True**
- **!yolo task=detect mode=train model=yolov8s.pt data={dataset.location}/data.yaml epochs=80 imgsz=640 plots=True**
- **!yolo task=detect mode=train model=yolov8m.pt data={dataset.location}/data.yaml epochs=80 imgsz=640 plots=True**
- **!yolo task=detect mode=train model=yolov8l.pt data={dataset.location}/data.yaml epochs=80 imgsz=640 plots=True**

task: Eğitimin hangi görevi gerçekleştireceğini belirler. “detect” nesne tespiti görevini ifade eder.

mode: Modelin eğitim modunda çalıştırılacağını belirtir. YOLO, farklı modlarda çalıştırılabilir örneğin “train” eğitim için, “test” test etme veya doğrulama için kullanılabilir.

model: Eğitim sırasında kullanılacak modelin yolunu ve adını belirtir.

imgsz: Eğitimi yapılacak görsellerin YOLOv8 modeli tarafından düşürüleceği piksel boyutudur.

--plots: Eğitim sırasında oluşturulan grafik çizimlerini ifade eder. Bu grafikler, modelin performansını izlemek için kullanılır.

3.Araştırma Sonuçları

Yapılan çalışmada, nesne tanıma görevleri için özelleştirilmiş dört farklı YOLOv8 modelinin (Nano, Small, Medium, Large) performansları incelenmiştir. Analizler her bir modelin eğitim süresince kaydettiği ilerleme ile başlangıç ve bitiş epochlarında elde edilen metrik değerler üzerinden gerçekleştirilmiştir.YOLOv8s ‘un başlangıçtaki performansı, düşük bir mAP50-95 oranı ile (%2.505) olduğu görülmüştür. Ancak, model hızla olgunlaşmış ve 5. epoch itibarıyla %75.079'luk bir mAP50-95 değerine ulaşarak kayda değer bir gelişme göstermiştir.Modelin eğitimi sırasında, epoch 6'da gözlenen hafif bir kayıp artışına rağmen, model stabil bir ilerleme kaydetmiş ve mAP50-95 değerlerinde tutarlı bir yükseliş göstermiştir. Özellikle epoch 18'de %71.237'lik bir mAP50 değeri ile modelin doğru pozitif tanımlamalarda başarılı olduğu

görülmüştür. Modelin eğitimi boyunca kayıp değerlerinde (loss values) genel bir düşüş trendi ve metriklerde (precision, recall, mAP50, mAP50-95) sürekli bir iyileşme izlenmiştir. Modelin son epoch'larına baktığımızda, YOLOv8s 'in mAP50-95 değeri %87.825 ile en yüksek seviyeye ulaşmıştır. YOLOv8n ve YOLOv8m son epochlarda yüksek performans göstermiş olmasına karşın YOLOv8s 'in gösterdiği istikrar ve yüksek performans seviyelerine ulaşamamışlardır. YOLOv8l, özellikle başlangıç epochlarında düşük performans sergilemiş ve son epochlarda performansında sınırlı bir iyileşme gözlemlenmiştir.Ayrıca Medium ve Large modellerinin eğitimlerinin 52 ve 53. epochlarda kesilmesi, erken durdurma (early stopping) mekanizması nedeniyle gerçekleşmiştir. Erken durdurma, modelin aşırı uyuma (overfitting) gitmesini önlemek ve eğitim sürecinde kaynak kullanımını optimize etmek için tasarlanmış bir yöntemdir. Bu durum, her iki modelde de belirlenen performans eşiği altında ilerleme kaydedilmemesi sonucunda devreye girmiştir. Özellikle, bu modellerin son epochlarında doğrulama kaybında (validation loss) ve metriklerinde önemli bir iyileşme olmaması, sistem tarafından eğitimin otomatik olarak durdurulmasına yol açmıştır.Tablo 1,Tablo 2 ve Tablo 3' de analizi sonuçları verilmiştir.

Tablo 1. Farklı Koşullarda Performans Analizi

Test Koşulu	YOLOv8n Performansı	YOLOv8s Performansı	YOLOv8m Performansı	YOLOv8l Performansı
Düşük Işık	Yeterli	İyi	Çok İyi	Mükemmel
Karmaşık Arka Plan	Yeterli	İyi	Çok İyi	Mükemmel

Nano model, düşük güç ve daha basit görevler için yeterliyken, Large model karmaşık koşullarda üstün performans sergilemiştir.

Tablo 2. Veri Artırma Teknikleri Etkileri

Veri Artırma Tekniği	YOLOv8n Performansı	YOLOv8s Performansı	YOLOv8m Performansı	YOLOv8l Performansı
Döndürme	Pozitif	Pozitif	Pozitif	Pozitif
Renk Uzayı Dönüşümleri	Pozitif	Pozitif	Pozitif	Pozitif

Tüm modeller, veri artırma tekniklerinden olumlu etkilenmiş ve performanslarını artırmıştır.

Tablo 3. Gerçek Zamanlı Performans Değerlendirmesi

Özellik	YOLOv8n Performansı	YOLOv8s Performansı	YOLOv8m Performansı	YOLOv8l Performansı
İşlem Hızı	Hızlı	Hızlı	Orta	Yavaş
Tespit Doğruluğu	Yeterli	İyi	Çok İyi	Mükemmel

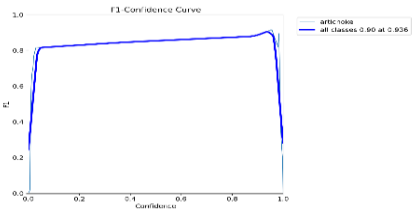
Nano ve Small modeller hız açısından avantaj sağlarken, Medium ve Large modeller doğrulukta daha iyi performans göstermiştir.

YOLOv8 algoritmalarının sonuçlarının hata matrisi metriklerine göre incelenmesi:

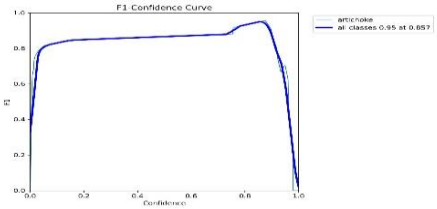
F1 Score Analizi

Yapılan F1 analizi ile modelin precision ve recall değerlerinin harmonik ortalaması hesaplanmakta ve modelin genel performansını ölçmekte kullanılmaktadır.Grafikte F1 Score değerlerinin başta en yüksek değeri gördüğü ve benzer değerlerde kaldığı görülmektedir. Bu durum, modelin daha ilk epochlardan iyi performans gösterdiğini ve nesneleri daha doğru bir şekilde tespit etmeye başladığını göstermektedir.Şekil 3'de F1 score analizi grafiği verilmiştir.

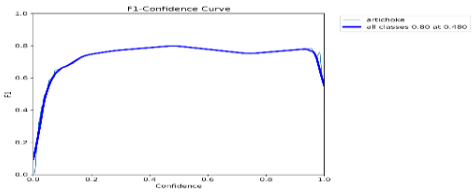
Size: 640x640, Epoch: 80, Algorithm: YOLOv8n



Size: 640x640, Epoch: 80, Algorithm: YOLOv8s



Size: 640x640, Epoch: 80, Algorithm: YOLOv8m



Size: 640x640, Epoch: 80, Algorithm: YOLOv8l



Şekil 3.F1 score analizi grafiği

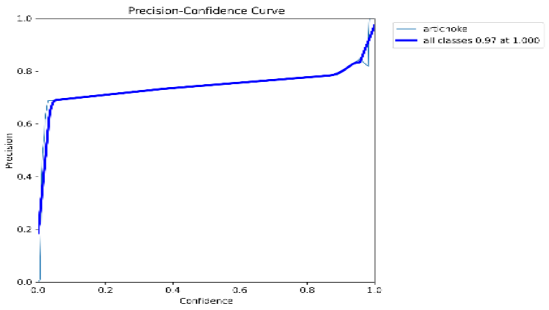
Şekil 3'dek F1 score analizi grafiği verilerine göre, YOLOv8l modelin F1 puanı düşük güven eşiklerinde başlangıçta düşükken, eşik değer arttıkça F1 puanının arttığı gözlemlenmiştir. F1

puanının artışı, yaklaşık 0.7 güven eşiğinde belirgin bir şekilde yükselmiş ve maksimum F1 puanına ulaşmıştır. YOLOv8l modelin belirli bir güven eşiği üzerinde maksimum F1 puanına ulaşabileceğini gösterir. Burada 0.72 güven eşiğinde 1.0 F1 puanına ulaşıldığı görülmektedir. YOLOv8l modelin bu eşikte tespitleri maksimum hassasiyet ve duyarlılık ile gerçekleştirdiğini işaret etmektedir. Ancak, F1 puanının 0.8'den 1.0'a kadar olan güven eşiği aralığında hafif bir düşüş göstermesi, YOLOv8l modelin en yüksek güvenlik düzeylerinde yanlış negatifleri artırabileceğini ve bu da toplam F1 puanını azaltabileceğini göstermektedir. Bu, modelin güven eşiğinin hassas bir şekilde ayarlanmasının gerekliliğini vurgulamaktadır.

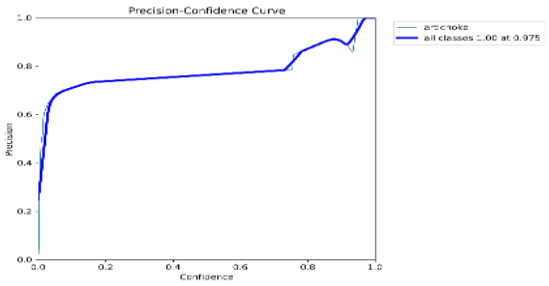
Precision Analizi

Precision, modelin yanlış pozitifleri minimize ederek doğru pozitif tahminlerini ne kadar başarılı bir şekilde gerçekleştirdiğini ölçer. Precision grafiğinde, farklı sınıflar için elde edilen precision değerlerini gözlemlemekteyiz. Precision değeri, doğru pozitif tahminlerin toplam tahmin sayısına oranını ifade eder ve yanlış pozitiflerin minimize edilmesini hedefler. Yüksek bir precision değeri, modelin yanlış pozitifler yapma olasılığının düşük olduğunu gösterir. Şekil 4’de precision(hassasiyet) analizi grafiği verilmiştir.

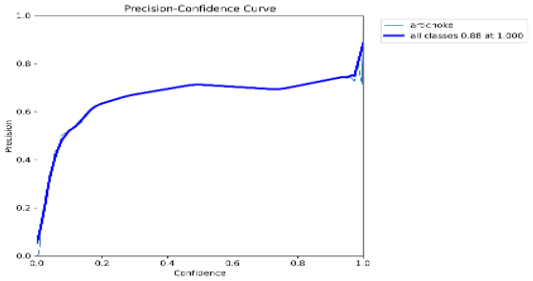
Size: 640x640, Epoch: 80, Algorithm: YOLOv8n



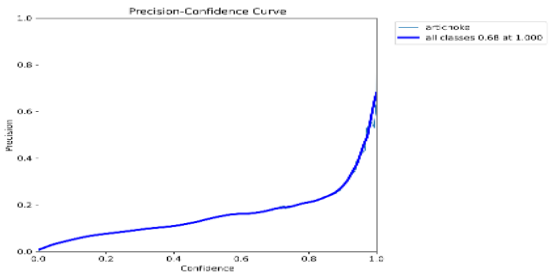
Size: 640x640, Epoch: 80, Algorithm: YOLOv8s



Size: 640x640, Epoch: 80, Algorithm: YOLOv8m



Size: 640x640, Epoch: 80, Algorithm: YOLOv8l



Şekil 4. Precision (hassasiyet) analizi grafiği

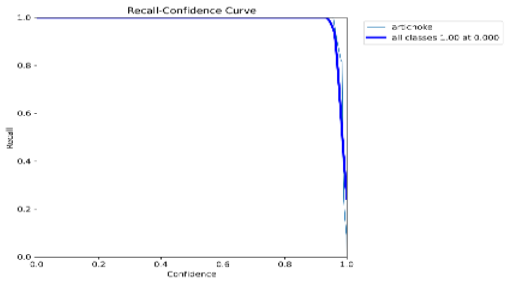
Şekil 4'deki Presicision (hassasiyet) eğrisi, farklı güven eşiklerinde YOLOv8l modelin hassasiyet değerlerinin nasıl değiştiğini ortaya koymaktadır. Grafikteki eğri, YOLOv8l modelin düşük güven eşiklerindeki hassasiyetinin oldukça düşük olduğunu, ancak güven eşiği yükseldikçe hassasiyetin belirgin bir şekilde arttığını göstermektedir. Özellikle, yaklaşık 0.68

güven eşiği değerinde hassasiyetin 1.0'a ulaştığı görülmektedir. Bu değer YOLOv8l modelin yüksek güvenlilikle tespit yapabildiği durumları ifade etmektedir.

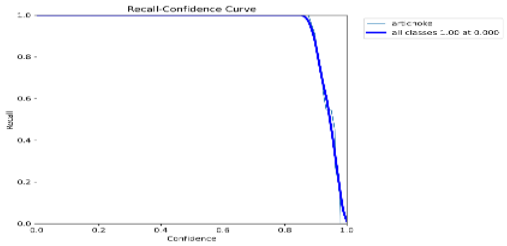
Recall Analizi

Recall, gerçek pozitiflerin ne kadar başarılı bir şekilde tahmin edildiğini ölçer ve yanlış negatifleri minimize etmeyi hedefler. Recall grafiğinde, farklı sınıflar için elde edilen Recall değerlerini gözlemlemekteyiz. Recall değeri, gerçek pozitif tahminlerin gerçek pozitiflerin toplam sayısına oranını ifade eder ve yanlış negatifleri minimize etmeyi hedefler. Şekil 5'de Recall(duyarlılık) analizi grafiği verilmiştir.

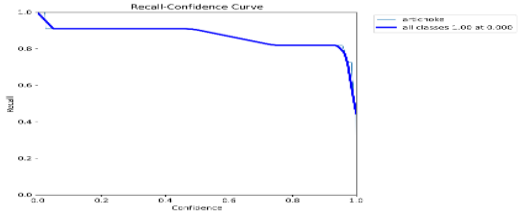
Size: 640x640, Epoch: 80, Algorithm: YOLOv8n



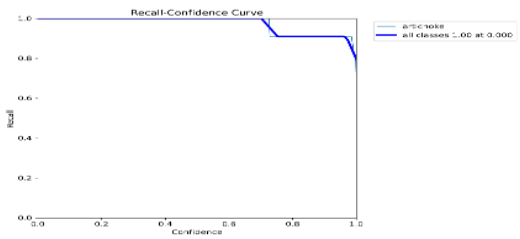
Size: 640x640, Epoch: 80, Algorithm: YOLOv8s



Size: 640x640, Epoch: 80, Algorithm: YOLOv8m



Size: 640x640, Epoch: 80, Algorithm: YOLOv8l



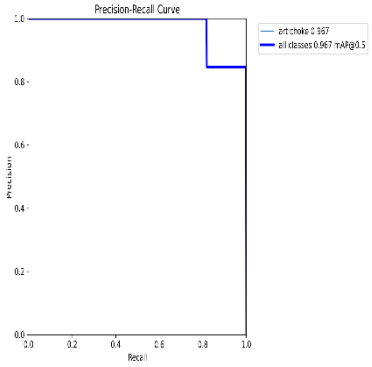
Şekil 5. Recall(duyarlılık) analizi grafiği

Şekil 5'teki Recall(duyarlılık) analizi grafiğinde, YOLOv8l modeli güven eşiğinin çok düşük olduğu noktalarda neredeyse tam duyarlılık sergilediği görülmektedir. YOLOv8l modelinin mevcut tüm pozitif örnekleri tespit etme eğiliminde olduğunu göstermektedir. Bu noktada, hatta sıfır güven eşiğinde, YOLOv8l modelinin tüm pozitifleri yakalama eğiliminde olduğu anlaşılmaktadır. Ancak bu yaklaşımın yanlış pozitiflerin sayısını da artırabileceği anlamına gelmektedir.

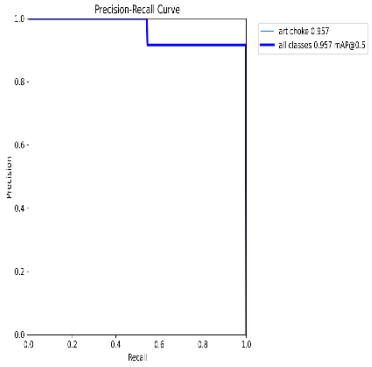
Precision-Recall Analizi

Precision, modelin yanlış pozitifleri minimize ederek doğru pozitif tahminlerini ne kadar başarılı bir şekilde gerçekleştirdiğini ölçerken, Recall, gerçek pozitifleri ne kadar başarılı bir şekilde tahmin ettiğini ölçer. Precision-Recall grafiğinde, farklı sınıflar için elde edilen Precision ve Recall değerlerini gözlemlemekteyiz. Precision, doğru pozitif tahminlerin toplam tahmin sayısına oranını ifade ederken, Recall gerçek pozitiflerin tahmin edilen pozitiflerin toplam sayısına oranını ifade eder. Şekil 6'de Precision-Recall(hassasiyet-duyarlılık) analizi grafiği verilmiştir.

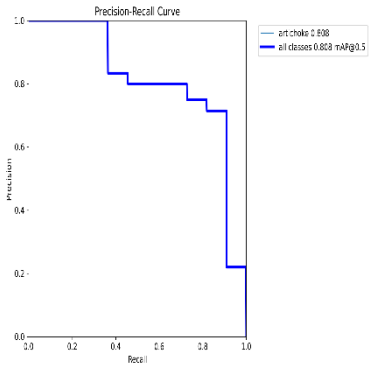
Size: 640x640, Epoch: 80, Algorithm: YOLOv8n



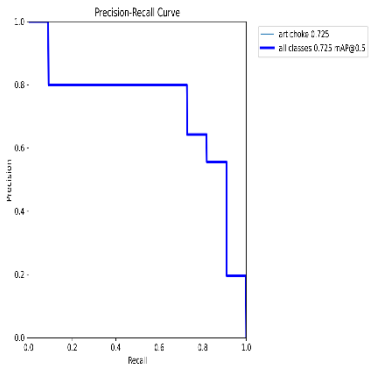
Size: 640x640, Epoch: 80, Algorithm: YOLOv8s



Size: 640x640, Epoch: 80, Algorithm: YOLOv8m



Size: 640x640, Epoch: 80, Algorithm: YOLOv8l



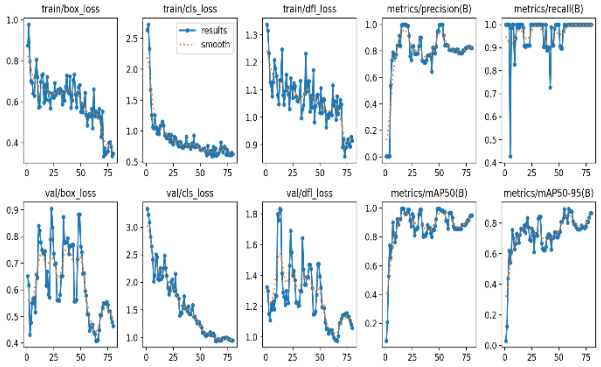
Şekil 6. Precision-Recall(hassasiyet-duyarlılık) analizi grafiği

Şekil 6'da Precision-Recall(hassasiyet-duyarlılık) analizi grafiğinde, yüksek duyarlılık seviyelerinde YOLOV8l modelin hassasiyetinin belirli bir düşüş gösterdiği görülmektedir. YOLOv8l modelin neredeyse tüm pozitif örnekleri tespit etme eğiliminde olduğu anlaşılmaktadır.Ancak bunun yanlış pozitif sayısında artışa yol açtığı anlamına gelmektedir. Özellikle, 0.725 mAP@0.5 değeri, modelin bu belirli duyarlılık düzeyinde ulaştığı hassasiyeti göstermektedir.Eğrinin başında gözlemlenen yüksek hassasiyet seviyesi, YOLOv8l modelin güçlü tespit kabiliyetine işaret ederken, duyarlılık değerleri düşükken hassasiyetin neredeyse mükemmel olduğunu belirtir. Duyarlılık arttıkça hassasiyetin düştüğü alanlar, YOLOv8l modelin doğru pozitif tahminler yapma kapasitesinin belirli bir duyarlılık seviyesinde sınırlı olduğunu gösterir. Bu eğri aynı zamanda, modelin doğru pozitif ve yanlış pozitifler arasında dengeli bir performans sergileme potansiyeline sahip olduğunu gösterir.

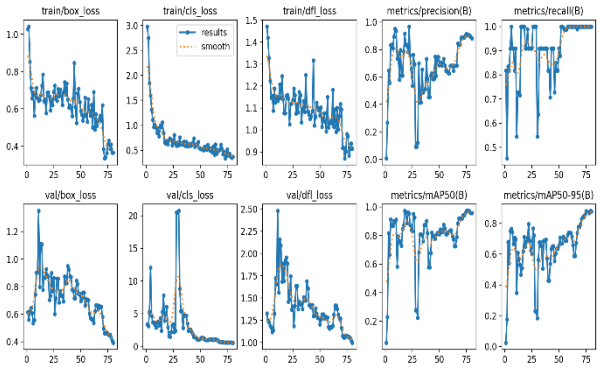
Loss Function Analizi

Loss Function, modelin tahminlerinin gerçek değerlerden ne kadar uzak olduğunu ölçer ve eğitim sürecinde kullanılarak modelin optimize edilmesini sağlar.Loss Function tablosunda, YOLOv8 modelinin eğitim sürecinde elde edilen Loss Function değerlerini gözlemlemekteyiz. Loss Function değeri, modelin tahminlerinin gerçek değerlerden ne kadar uzak olduğunu ölçer ve bu değerin minimize edilmesi hedeflenir. Şekil 7'de Loss Function analiz grafiği verilmiştir.

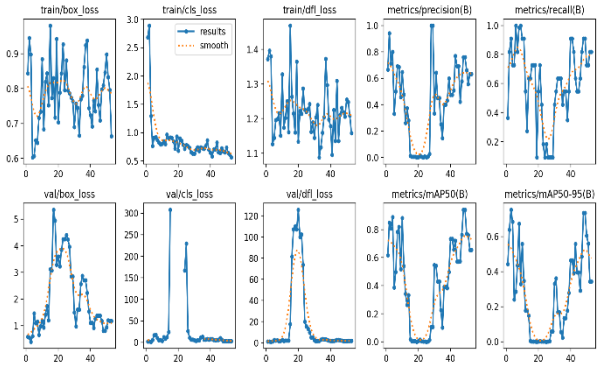
Size: 640x640, Epoch: 80, Algorithm: YOLOv8n



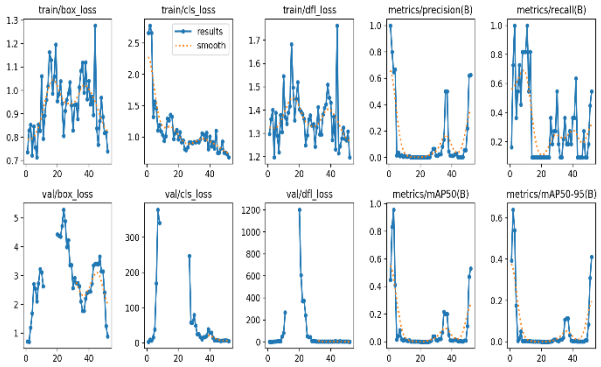
Size: 640x640, Epoch: 80, Algorithm: YOLOv8s



Size:640x640, Epoch: 80, Algorithm: YOLOv8m



Size: 640x640, Epoch: 80, Algorithm: YOLOv8l



Şekil 7. Loss Function analiz grafiği

Daha düşük bir Loss Function değeri, modelin daha iyi bir şekilde eğitildiğini ve tahminlerinin gerçek değerlere daha yakın olduğunu gösterir. Şekil 7'de Loss Function analiz grafiğinde değerlere göz attığımızda, eğitim süreci boyunca Loss Function değerlerinin genellikle

azaldığını görüyoruz. Bu, modelin doğru tahminler yapma yeteneğinin arttığını ve tahmin hatalarının azaldığını gösterir. Şekil 8 'de test sonucu ekran görüntüleri verilmiştir.

Yolov8n



Yolov8s



Yolov8m



Yolov8l



Şekil 8. Test Sonuç ekranı görüntüleri

Analiz Sonuçları

YOLOv8n

```
80 epochs completed in 0.032 hours.
Optimizer stripped from runs/detect/train2/weights/last.pt, 6.3MB
Optimizer stripped from runs/detect/train2/weights/best.pt, 6.3MB

Validating runs/detect/train2/weights/best.pt...
Ultralytics YOLOv8.0.196 🚀 Python-3.10.12 torch-2.2.1+cu121 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 3005843 parameters, 0 gradients, 8.1 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  9.45it/s]
                   all         10         11      0.809          1      0.967      0.893
Speed: 0.2ms preprocess, 2.0ms inference, 0.0ms loss, 1.7ms postprocess per image
```

YOLOv8s

```
80 epochs completed in 0.047 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 22.5MB
Optimizer stripped from runs/detect/train/weights/best.pt, 22.5MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.0.196 🚀 Python-3.10.12 torch-2.2.1+cu121 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 168 layers, 11125971 parameters, 0 gradients, 28.4 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.08it/s]
                   all         10         11      0.895          1      0.957      0.882
Speed: 0.2ms preprocess, 4.6ms inference, 0.0ms loss, 2.2ms postprocess per image
```

YOLOv8m

```
53 epochs completed in 0.061 hours.
Optimizer stripped from runs/detect/train2/weights/last.pt, 52.0MB
Optimizer stripped from runs/detect/train2/weights/best.pt, 52.0MB

Validating runs/detect/train2/weights/best.pt...
Ultralytics YOLOv8.0.196 🚀 Python-3.10.12 torch-2.2.1+cu121 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 218 layers, 25840339 parameters, 0 gradients, 78.7 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  5.08it/s]
                   all         10         11      0.713      0.909      0.808      0.753
Speed: 0.2ms preprocess, 14.1ms inference, 0.0ms loss, 1.4ms postprocess per image
```

YOLOv8l

```
Stopping training early as no improvement observed in last 50 epochs. Best results observed at epoch 2, best model saved as best.pt.
To update EarlyStopping(patience=50) pass a new patience value, i.e. `patience=300` or use `patience=0` to disable EarlyStopping.

52 epochs completed in 0.090 hours.
Optimizer stripped from runs/detect/train/weights/last.pt, 87.7MB
Optimizer stripped from runs/detect/train/weights/best.pt, 87.6MB

Validating runs/detect/train/weights/best.pt...
Ultralytics YOLOv8.0.196 🚀 Python-3.10.12 torch-2.2.1+cu121 CUDA:0 (Tesla T4, 15102MiB)
Model summary (fused): 268 layers, 43607379 parameters, 0 gradients, 164.8 GFLOPs
                 Class     Images  Instances      Box(P          R      mAP50  mAP50-95): 100% 1/1 [00:00<00:00,  3.53it/s]
                   all         10         11        0.8      0.727      0.725      0.563
Speed: 0.2ms preprocess, 21.4ms inference, 0.0ms loss, 1.3ms postprocess per image
```

Yukarıda verilen değerler göre analiz sonuçları şu şekildedir;

- **YOLO Nano**, hız açısından diğer modellere üstünlük sağlarken, tespit doğruluğu daha düşük seviyelerde kalmıştır. Bu, düşük güç tüketimi gerektiren uygulamalar için uygun olduğunu göstermektedir.
- **YOLO Small**, dengeli bir performans sergileyerek, ışık ve arka plan değişkenliğinde iyi sonuçlar elde etmiştir.
- **YOLO Medium**, çeşitlilik ve zorluğu daha yüksek olan veri setlerinde bile etkili bir performans göstererek, genelleştirme kabiliyeti açısından öne çıkmıştır.
- **YOLO Large**, en karmaşık sınıflandırma görevlerinde bile mükemmel doğruluk sunarak, model serisinin en güçlüsü olarak belirlenmiştir.

4.Sonuç

Yapılan çalışma ile YOLOv8 modeli ve hazırlanan veri seti ile yapılan örnek eğitim ve doğrulama görsellerindeki nesne tespiti doğruluk oranları incelenmiştir. Modellerin nesne tespit başarılarını belirten metrik verileri ve doğruluk tahmin oranları incelenmesi sonucunda modelin eğitim sonucunun başarılı olduğu görülmüş ve doğrulanmıştır. İlk epochlar boyunca, eğitim ve doğrulama kayıpları hızlı bir şekilde azaldığı ve metriklerde de belirgin bir gelişme olduğu görülmüştür. Analiz sonuçlarına göre Precision, recall ve mAP değerlerinin daha yüksek seviyelerde başladığı ve sürekli olarak değişkenlik gösterdiği görülmüştür. YOLOv8l(large) modelinin iyi bir başlangıç performansı sergilediği anlaşılmıştır. Son epochlar boyunca, eğitim kaybı ve doğrulama kaybı sürekli olarak azalmış ve en düşük seviyelere ulaşmıştır. Metriklerdeki gelişme de devam etmiştir. Analiz ve doğruluk sonuçlarına göre YOLOv8l(large) modelinin en iyi eğitim modeli olduğu anlaşılmıştır.

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QUEER SİNEMADA ÖTEKİLEŞTİRME BAĞLAMINDA: *YOUR NAME ENGRAVED HEREİN* FİLM ANALİZİ

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Özet
İnsan çağlar boyunca kimlik edinme içgüdüsüyle kendi ötekilerini yaratır. Bu kimliğin ihtiyaç duyduğu aidiyet hissidir. Tarih pek çok dönemde toplumdan belli bir kesimi dışlama, yargılama ve damgalama gibi olgulara tanık olmuştur. Bu çalışma eşcinsel bireyin öteki olma hikâyesini analiz eder ve bunu bir sinema dili haline getiren *queer* kavramının ortaya çıkış sürecini ele alır. Araştırmanın amacı eşcinsel imgesinin olumlu-olumsuz temsilleri üzerine *queer* sinemadaki filmleri analiz etmek ve bununla birlikte kavramın ortaya çıkışındaki tarihsel süreci, nasıl/neden sahiplenilerek sinema dili haline getirildiğini araştırmaktır. Aynı zamanda karşıtı olan Ana akım sinemanın tutucu tavrının sebeplerini ve örneklerini yapıtlar üzerinden içerik analizi yöntemiyle çözümlemektir. Araştırma amacına yönelik ise kuir teori çerçevesinde, muhafazakâr toplumları (din, aile ve sosyal kurumlar gibi) araştırmanın evreni ve örneklemi odağına oturtarak Yönetmenliğini Patrick Kuang Hui-Liu'nun yaptığı 2020 yapımı Tayvan yapımı Your Name Engraved Herein (Adın Buraya Kazınmış,2020) filmi ele alınmıştır. Film, sıkıyönetimin bahsedildiği 1986 yılında iki eşcinsel erkeğin öteki olma hikâyesini konu etmesi bakımında araştırmayla doğrudan örtüşür. Analiz edildiği üzere öteki olan, toplumda muhafazakâr yapı içerisinde kendi varlığını kabul ettirmekte zorluk çekmiş, toplumun her sosyal kurumunda hatta sanat olan sinema da bile hor görülmüş, fakat mücadelesini bırakmayarak kendi evrenini oluşturmuştur. Araştırmanın sonucuna göre tam anlamıyla sorun olmaktan çıkamayan eşcinsellerle ilgili olumsuz temsiller düşük bir yüzdeye sahip olsa dahi düşmüştür. Bu da sinemanın giderek daha olumlu temsiller çıkarması için önündeki engelleri aşmaya hevesli olduğu kanısını ortaya çıkarır. Mücadelesini sürdüreceğini gösterir.
Anahtar Kelimeler: Queer, Queer Sinema, Öteki, Ötekileştirme, Eşcinsellik

IN THE CONTEXT OF OTHERALIZATION IN QUEER CINEMA: MOVIE ANALYSIS OF *YOUR NAME ENGRAVED HERE*

Abstract
Throughout the ages, humans create their own others with the instinct of gaining identity. This is the feeling of belonging that identity needs. History has witnessed phenomena such as exclusion, judgment and stigmatization of certain segments of society in many periods. This study analyzes the homosexual individual's story of being the other and discusses the emergence of the concept of queer, which turns this into a cinema language. The aim of the research is to analyze films in queer cinema on positive and negative representations of the homosexual image, and to investigate the historical process of the emergence of the concept and how/why it was appropriated and turned into a cinema language. At the same time, it is to analyze the reasons and examples of the conservative attitude of mainstream cinema, which is its opposite, through the works by content analysis method. For the purpose of the research, within the framework of queer theory, the 2020 Taiwanese film Your Name Engraved Herein (2020), directed by Patrick Kuang Hui-Liu, focuses on conservative societies (such as religion, family and social institutions) as the universe and sample of the research. It is discussed. The film directly coincides with the research in that it tells the story of two gay men becoming the other in 1986, when martial law was mentioned. As analyzed, the other had difficulty in accepting its existence within the conservative structure of society, was despised in every social institution of the society, even in cinema, which is an art, but it did not give up its struggle and created its own universe. According to the results of the research, negative representations about homosexuals, who cannot completely cease to be a problem, have decreased, even if they are at a low percentage. This suggests that cinema is eager to overcome its obstacles to produce increasingly positive representations. It shows that he will continue his struggle.
KeyWords: Queer, Queer Cinema, Other, Othering, Homosexuality

GİRİŞ

İnsan etrafında ötekiler yaratarak yaşamı şekillendirir ve böylece dogmalar kurar, kurduğu bu dogmalardan da güç alır. Tüm bu dogmalar içinde de yaşamın sınırlı ve düzenli olmasıyla aidiyet hissine kapılır. Aidiyet hissi, ötekinin var olmasıyla yeterince harmanlanınca da yaşam daha anlamlı bir hale gelir. Toplumun özellikle eril bir yapıya sahip olması ve bu eril zihniyetin, zayıf, güçsüz ve farklı cinsel tercihlere olan gruplara karşı değişmez kurallar koyması, toplumun bir noktada ayrışmasına ve ötekilerin nihayetinde var olmasına sebep olur. Bu öteki bir çingene, Yahudi, siyahi, kadın ya da eşcinsel olabilir. Çalışmada öteki olarak karşımıza çıkan "eşcinsel" birey araştırılmıştır. *Queer* kavramı ile birlikte zaman içinde nasıl algılandığına, özellikle sinema gibi güçlü bir sanatın içinde nasıl tasvir edildiğine bakılmıştır.1990'larda AIDS hastalığının yaygınlaşması ve bu hastalığın yalnızca eşcinsel bireylerden bulaştığı iddiasının ortaya atılması kavramın, LGBTİ+ aktivistleri tarafından bilinçli ve stratejik olarak sahiplenilmesine sebep olmuştur. *Queer* birey tarihin pek çok kesiminde kavramın kendisi gibi öteki, iğreti, tuhaf ve acayip olmuştur. Fakat bugün *queer*'in anlamına baktığımızda "öteki" olandan çok tek tip kimliği dayatanlara, bunu sınırlayanlara ve cinsel yönelimleri görmezden gelenlere karşı; din, aile, ırk, hukuk gibi güçlü sosyal yapılara meydan okuduğunu söylemek yanlış olmaz. Tüm bunlar neticesinde kavramın yaratılan olumsuz anlamdan çıkartılması ve dayatılan tüm normlara başkaldırması *queer* olan için önemli bir adımdır. *Queer* her ne kadar ötekileştirilse de sosyoloji gibi bilimlerin içerisinde sınırlı kalmayıp sinemanın da sorunu haline gelmiştir.Araştırmanın amacına yönelik Tayvan yapımı *Your Name Engraved Herein* filminde "öteki/ötekileştirilen" bireyin tarih boyunca nasıl/neden ve ne şekilde var olduğuna, değişimin nelerle ve ne sebeple başladığına bakılmıştır. Aynı zamanda kavramın evrimleşerek sinemaya kadar uzanışına ve tüm bu süreçlerle birlikte yapılan filmlerin Ana akım sinemanın yarattığı cinsiyetçi ideolojiye karşı farklı bir alternatif oluşturabilmesi üzerinde durulmuştur. Sonucunda ise olumlu temsillerin çok az olduğu fakat eskiye nazaran sinemanın bunun için çabaladığı kanısına varılmıştır.

QUEER NEDİR?

Queer ve ya Kuir, 90'lı yıllardan önce "Tuhaf, acayip, iğreti, dengesiz, kötü ve değersiz" gibi anlamlarla ifade edilirdi. Batı'da uzun bir sürede eşcinselleri aşağılamak için kullanıldı ve sonrasında bilinçli ve stratejik olarak karşıt bir ifade oluşturacak şekilde sahiplenildi. Queer bugün bir kimlik modeli olmaktan çok, kimlikleri birbirine bağlayan, kimliği gözetmeksizin herkesin homofobi ile kavga ettiği ve bir araya geldiği bir kavram olarak karşımıza çıkar.

Queer, feminizm çalışmalarında değinilen, Ana Akım'ın kadınları bir kanon içine sokmaya çalışan ve onları sindirmeyi amaçlayan ideolojik tutumun içinde gelişir ve mücadelesini yine toplumsal cinsiyet normlarını yıkma gayesi üzerine kurar. Toplumsal cinsiyet nedir, nasıl ve yeniden üretilir, imkânları nelerdir sorusuna Butler: "Toplumsal cinsiyet normları içerisinde neyin idrak edilebilir bir biçimde insan olup neyin olmayacağına, neyin "gerçek" kabul edilip neyin edilmeyeceğini belirler, bedenlerin meşru ifade kazanabilecekleri ontolojik alanı oluştururlar." (Butler, 2005) diye cevap verir.Queer'i bu denli ötekileştiren, heteronormatif toplumun öncü olduğu düşüncesi ve bu sistemin devamlılığının sağlanması gayesidir. Ayrıca cinsel yönelim, tercih ve kimlikleriyle hayattan başka türlü haz alanlara, başka türlü âşık olanlara henüz alışılmış bir bakış açışının kazandırılmamış olmasıdır. Açıkça toplumun Queer bireyi neden ötekileştirdiği sorusuna aile kurumunun önemi ve din faktörünün maddi gerçekliği şeklinde de cevap verilebilir.Günümüzde Tek tanrılı dinler olan Musevilik, Hıristiyanlık ve İslam'ın eşcinselliğe yaklaşımları görece bellidir ve toplumu bu sebeple etkilediği görülür. (Nil, 2013) Eşcinsellik ve din arasındaki bu tartışmaları Nurten Şahin şöyle açıklar: "İnsanlar kadın ve erkek olarak beden yapısına uygun olan bir ruh yapısı ile birlikte dünyaya gelmektedir. Bu nedenle insanın doğuştan gelen özelliklerine müdahale, kişinin sadece kendisinin değil gelecek nesillerin de, yaratılan temiz fıtratının değişmesi ile sonuçlanır." (Şahin, 2015, s. 514)

İmparatorluklardan ulus-devletlerine kadar aile kurmak, ulusal varoluşun temel taşlarından biri olmuştur. Eşcinsel birey bu noktada aile ve akrabalık bağlarına zarar veren, toplumun temel yapı taşlarını zedeleyen bir konumda addedilir. Dünya küreselleşip, çok kültürlü bir yapıya sahip olsa bile Heteronormative kimlikler, ataerkil toplum normları, homoseksüel ilişkiye olan bakış açışı ne yazık ki çok az değişmiş hatta Queer birey için; hasta, sapkın, günahkâr, terörist ve gayri insanı gibi sıfatlar bile türemiştir. Çünkü din, insani duygulardan çok normal görünme ve davranma yani topluma uyumlu olma ve topluma uygunluğun sosyal yapıdaki karşılığını arar. Michael Warner 90'lı yılların başında "Heteronormativitenin bütün toplumsal kurum ve ideolojilere sirayet ettiğini, dolayısıyla heteronormatif cinsel düzene itiraz etmenin er ya da geç bizzat bu kurum ve ideolojilere itiraz etmek anlamına geleceğini" (Çakırlar & Delice, 2012, s. 17) söyleyerek durumun ehemmiyetinden söz eder. Tarihi kayıtlar göz önüne alındığında eşcinselin yeni bir olgu olmadığı kanısına varmak mümkündür. Örneğin M.Ö. 1400'lerdeki yasaların yazılı olduğu bir tablette Hititlilerde iki erkek arasında evliliğe izin verildiği görülür. (Nil, 2013, s. 7) Benzeri bir şekilde Hristiyanlığın ilk beş yüz yılı içerisinde de hoş karşılandığı fakat sonra ki yüzyıllarda yasaklandığı görülür. Eşcinsel ilişkiye yönelik açık ve şiddetli düşmanlık geleneği 12.yüzyılda başlar ve bugün hala sürmeye devam eder. (Şahin, 2015, s.

511)1970 yılında Amerikan Psikiyatri Birliği, Hooker'in çalışmasına dayanarak cinsiyet yönelimleri için hastalık, psikolojik rahatsızlık, anormal davranış tanımını kaldırmıştır. (Şahin, 2015, s. 511) Neticesinde eşcinselliğin insan cinselliğinin olağan çeşitliliğinin bir görünümü olduğu bilimsel alanda kabul görmüştür. Türkiye'de ise queer teoriye ilişkin köklü bir araştırma henüz geliştirilememiştir.Queer'in tüm bu zorlu süreçler içerisinde istikrarlı ve kendinden emin tavrı nihayetinde medyanın da ilgisini çeker. Sinema, LGBTİ+ bireylerin hikâyesi için en güçlü silahlarından biri haline gelir. Tüm bu söylemler ve çatışmalar sonucunda bugün queer teorinin cinsel yönelimlere, kimliklerin merkezileşmesine, kimliği tek tipleştirip üreten, bunu onaylayan ve heteroseksist düzenin ötelediği eşcinselleri öne çıkarmakla kalmayan; din, dil, ırk, devlet, kültür şeklindeki sınıflandırmaların hepsini aynı çatı altında toplamayı amaçlayan şemsiye bir kavram olarak ele alındığını görürüz.

QUEER SİNEMA?

1990'lı yılların başında ABD'de "Yeni Queer Sinema" akımı sözünü ettiğimiz gibi tamamen stratejik ve politik sebeplerle var olmaya başlar. Bir zamanlar eşcinselleri aşağılarken bu gün sinemada yarattığı imgelerle eşcinselin hikâyesine odaklanır. Eşcinselliğin konu edildiği ilk film *The Gay Brothers* diğer adıyla Dickson Deneysel Ses Filmi, (Gey Kardeşler, William Kennedy Dickson, 1895) filmidir. Filmde 17 saniye boyunca yalnızca keman eşliğinde vals yapan iki genç erkek görünür.Eşcinselliği konu eden bir diğer önemli film *Diğerlerinden Farklı* (*Anders Als Die Anderen*, Richard Oswald, 1919) filmidir. Film, seyirciler tarafından oldukça sarsıcı bulunur. Konusu sebebiyle itirazlara maruz kalmasına karşın Almanya'da gişe rekorları kırarak ve seks filmi olma özelliğiyle dönemin furyasını oldukça etkilemiştir. Oswald, eşcinsel algısına meydan okumuş olsa dahi film de eşcinsel karaktere iyi bir son yazmaz ve karakter finalde intihar eder. Ulusay: Birkaç temsil dışında, filmlerde eşcinsel karakterlerin çoğunun, öldürüldüğü ya da intihar ettiği veyahut başkalarına zarar veren kişiler olarak tasvir edildiğini söyler. (Ulusay, 2011) Queer Sinemanın köklü bir geçmişinin olmayışı Ana Akım sinemanın patriarkal düzene olan bağlılığıdır. Ana Akım Sinema, tercihlerini toplumsal faydalar üzerine kurar. Çünkü neyin nasıl ve kimin yararına gerçekleşeceğine dair izlediği yol sayesinde kitle kazanır. Sinema her ne kadar bir eğlence aracı, haz verici veyahut bir zaman etkinliği olsa da toplumun yansımasıdır ve sorumlu bir amaç edinir. Bu sebeple eşcinsel birey bu muhalif sinemanın kırmızıçizgisidir ve bu sebeple tarih boyunca öteki olarak atfedilir. Fakat Queer Sinema iyi bir izler kitle kazanınca bugün festivallerin gözdesi haline gelmiş aynı zamanda bağımsız sinema içerisinde büyük ses uyandıran bir türe dönüşmüştür.

1940'lı ve 50'li yıllar sansürün etkisiyle eşcinsel bireylerin filmlerde gizli anlamlar altında yaratıldığı dönem olur. 50'lilerin sonunda filmlerde karşımıza sık sık homofobi çıkar. 60'lar da ise yetişkin konularının perdeye aktarılması ve buna bağlı olarak eşcinselinde ele alınmasına izin verilmesi eşcinsel karakterlerin olumsuz tasvir edilmesinin önüne geçemez. Buna en iyi örneği Pscyho (Sapık, Alfred Hitchcock 1960) filmini göstermek yanlış olmaz. Yüksek ihtimalle sinemada gördüğünüz bu tip eşcinseller patolojik rahatsızlığı olan, sapkın, sapık, gülünç ya da uzak durulması gereken temsillerdir. Psycho filminde bir Motel sahibi olan Norman Bates, annesinin kıyafetlerini giyen kişilik bozukluğuna sahip bir katildir. Kuzuların Sessizliğinde ise Buffalo Bill karakteri kendini kadın zanneden ve onların kıyafetlerini giyen bir seri katildir. Bu bağlamda modern toplumlara rağmen eşcinsel temsiller sinema için oldukça yeni ve alışılmışın dışındadır. Çünkü muhalif sinema toplumda ikincil konumda olan eşcinsel bireyin müdahale edilmesi gereken bir cinsel tercih olduğu kanısındadır. Eşcinsel birey aile, üreme, kültürel kodlara ve kadın ve erkek fıtratına ters düştüğü müddetçe ötekidir. Eşcinsel bireyi beyaz perdeye aktarmak yalnızca ötekinin bakış açısıyla mümkündür."Ancak 1960'lar, aynı zamanda, eşcinselliğin bir insan hakları konusu olduğuna ilişkin farkındalığın da artmaya başladığı yıllardır." (Ulusay, 2011, s. 5) "Durumun bu şekilde anlaşılmasında, şüphesiz, 1960'ların sonuna doğru ABD ve Avrupa ülkelerinde öğrencilerin, kadınların ve siyahların sürdürdükleri özgürlük, eşitlik ve demokrasi mücadelesinin büyük katkısı bulunmaktadır." (Ulusay, 2011, s. 5) 28 Haziran 1969'da Amerikan'ın New York eyaletinde Stonewall Inn adında bir bara polis baskını gerçekleşir. Bu baskının gerçekleşmesinin hemen ardından eşcinsel harekâtları ve bir dizi direniş eylemleri başlar. Stonewall ayaklanması olarak bilinen bu olay eşcinsel mücadelesinin başlangıcı olarak bilinir.Türkiye de 1962 yılında Aydın Arakon'un yönettiği *"Ver Elini İstanbul"* ilk Lezbiyen film örneği olarak karşımıza çıkar. Filmde Leyla Sayar ve Mualla Kavur'un öpüşmesi Sansür Kurumu tarafından yayınlanması uygun bulunsa da sonrasında kaldırılır. 1960'lı yıllar Türk Sinemasında birçok LGBT temalı filmin yayınlandığı dönem olur. Fakat çoğunluğu seks filmleri olarak adlandırılır.70'ler döneminin sineması eşcinsellerin hem olumsuz kalıplardan çıkarıldığı hem de hala geçmişte ki tiplemelerinin devam ettiği bir dönem olur. Bu dönemde q*ueer* sinemanın önemli isimlerinden biri olan ve ulus, ırk, sınıf, göçmenlik ve eşcinsellik gibi konuları tartışan Alman yönetmen Rainer Werner Fassbinder karşımıza çıkar. "Fassbinder, 40'ın üzerinde film yapmış ve eşcinsellikle ilgili ilk olarak *Fox ve Arkadaşları*'nı (*Faustrecht der Freiheit*, 1975) filminin çekmiştir." (Ulusay, 2011, s. 6) Devamında Britanyalı yönetmen Derek Jarman, İspanyol yönetmen Pedro Almodovar queeri temsil eden birçok filme imza atmışlardır. Türk Sinemasında 70'ler transların gizlice gösterildikleri bir dönem olur. 50-80'li yıllar arasında lezbiyen aşk veya erotik sahneler açık bir şekilde sergilenmese de iyi bir izleyicinin sezebileceği kapalılıkta

gösterilir.1980'ler *queer*'in AIDS sorunuyla karşı karşıya olduğu önemli bir dönemdir. Homofobi toplumda öyle köklü bir hale gelir ki AIDS'in eşcinsel ilişkiden bulaştığına dair bir inanış başlar. İlk kez 1981 yılında ortaya çıkan bu hastalık milyonlarca insanın ölümüyle sonuçlanır. Queer Sinemanın gelişimindeki en sarsıcı faktör budur. Böylece 80'ler dönemin filmlerine de konu olur. Burada ölüme meydan okuyan pek çok queer filme rastlamak mümkündür. Örneğin, *Zero Patience* (Sıfır Sabır, John Greyson, 1993) adlı Kanada yapımı film, bu hastalığa yakalanan bir pilotun hikâyesini konu eder. Tüm bunlara rağmen 80'ler queer için hala tartışmalı bir konumdadır. Eşcinsel için kriz hala devam etmektedir. Türkiye de eşcinsel karakterler uzun bir süre lezbiyenler üzerinden işlenir. Erkek eşcinselliği içeren filmler lezbiyen filmlere oranla daha az ve geç çevrilir.90'lar Queer'in mücadelesinin daha görünür olduğu ve karşılığını aldığı yıllar olur. Her ne kadar önemli yapımlar da olumsuz temsiller yaratılmaya devam etse de öteki olduğu gerçeği sık sık seyirciye dikte edilir. Böylece izler kitle de farkındalık sağlanması amaçlanır. Örneğin Ve Orkestra Çalmaya Devam Ediyor (1993) filminde AIDS virüsünün ortaya çıktığı yılları ve bu hastalığın bir gey laneti olduğuna ilişkin bilim ve politika arasındaki tartışma konu edinir. Nihayetinde filmde verilmek istenen mesaj öteki olunma ihtimalinin kaçılmaz olabileceğidir. Böylece izler kitlenin yalnızca yargılayan değil, önyargılarını birer empatiye dönüştürmesi amaçlanır. Eşcinsel harekâtın bir başlangıcı olarak bilinen Stonewall Ayaklanması 1995 yapımı Stonewall adlı komedi-dram filmine uyarlanır. Amaç yine eşcinselin vermiş olduğu mücadeleyi sinema aracıyla dile getirmektir. 1991 ve 1992 yıllarında Sundance Film Festivali'nde gösterilen Paris Is Burning (Jennie Livingston), Poison (Todd Hayness), Swoon (Tom Kalin) gibi filmler ötekinin hikâyesini işlemesi sebebiyle dikkat çeker. AIDS'in etkisi, homofobinin politik bir mesele haline gelmesi artık yalnızca aktivistlerin değil sinemanın da bir sorunudur. Türkiye'de 90'larda Düş Gezginleri(1992), Dönersen Islık Çal (1992), Atıf Yılmaz'ın yönettiği Gece, Melek ve Bizim Çocuklar (1993) Kutlu Ataman, Lola and Bilidikid (1998) ve Atilla İlhan'ın yazdığı Sokaktaki Adam (1995) filmleri çekilir. Tüm bu yapımlar içinde queer birey açıkça gösterilmese de hissettirilir."Yeni Queer Sinema" 1992 yılında Amerikalı akademisyen B.Ruby Rich'in Sight&Sound dergisinde yayınladığı bir makale sayesinde görünür olur ve pek çok akademisyen tarafından kullanılmaya başlar. Artık bu sinema bağımsız gey ve lezbiyen film ve videoları için bir prestijdir. Paul Verhoeven'in Temel İçgüdü (1992) ve Derek Jarman'ın Edward II (1991) filmleri New York'ta gösterime girmesinin üzerine Prestijli Yeni Yönetmenler/Yeni Filmler Festivali birkaç gün içinde dört yeni "queer" filmin gösterisini yapar. San Francisco Gay ve Lezbiyen Film Festivali on altı yıllık tarihindeki en başarılı yılını geçirir; katılım 1991'den bu yana iki katına çıkar. Fakat tüm bunlara rağmen filmler festivaller dışında dağıtım şansı bulamaz. "Bu dönemde, özellikle sağ kanat politikacıların queer filmlere yönelttiği baskıcı tutum da bir şekilde filmlerin

duyulmasına katkı sağlıyordu. Böylece özellikle film festivalleri üzerinde yoğunlaşan ve hem türü hem de izleyicileri, dağıtımcıları ve mekânları kapsayan bir sektör meydana gelmişti." (Candemir, 2016, s. 54)*Bugün Queer* kuramın sınırlı bir kavrayışa meydan okuduğunu söylemek yanlış olmaz. Kuram yalnızca cinsel kimlikleri değil bunu kategorize eden sınırlayan tüm kimliklere karşı çıkar. Dönemin önemli filmleri şöyleydi Mulholland Çıkmazı (2001) Blue is the Warmest Colour (Mavi En Sıcak Renktir, 2013), Pride (2014), Moonlight (2015), The Holding Man (2015). Carol (2015), Call Me By Your Name (Beni Adınla Çağır, 2017), Portrait of a Lady on Fire (Alev Almış Bir Kızın Portresi 2019) ve Your Name Egraved Herein (Adın Buraya Kazınmış, 2020) gibi olumlu temsillerin olduğu filmlerdir. Fakat tüm bu yapımlar aynı zamanda eşcinselin hali hazırda ötekileştirildiği dünyada acı çektiği ve mücadele ettiği melodram ve biyografik filmlerdir. Türkiye 'de 2000 sonrasında İki Genç Kız (Kutluğ Ataman, 2005) Yaşamın Kıyısında (Fatih Akın, 2007), Zenne (Binay, Alper 2008) Güneşi Gördüm (Mahsun Kırmızıgül, 2009), Nar (Ümit Ünal, 2011) ve Şahane Misafir (Ferzan Özpetek, 2012) filmleri dışında çok fazla örnek yoktur. Bu filmlerde ise eşcinseller yine heteronormative dünyanın kurbanlarıdır. Ayrıca çoğu için Queer film örnekleri olduğunu söylemek güçtür.

ÖTEKİLEŞTİRME

Kavramsal bağlamda öteki, sözü edilenden ayrı, öbürü, bilinenden uzak gibi anlamların karşılığıdır. Bu sebeple insanın varlık gösterdiği tüm tarihsel süreçlerde pek çok farklı sebepten ötekiye rastlanır. Örneğin Siyahiler, Yahudiler, kadınlar, eşcinseller, çingeneler, göçmenler, mülteciler gibi. Kendilerini bir şekilde kategorize eden insanlar belli bir gruba ait hissetmekten güven duyarlar. Çünkü bu parçası olduğu grupla özdeşleşmek tatmin edicidir. Öteki olmak özellikle modern toplumlarda birer sorun olarak nitelendirilir. Öteki demek kendinden olmayanı, aşağı olanı tasnif eder ve sosyal dışlanma, dışarı da kalma, çoğunluk olamama hissi kişi de birer öteki algısı oluşturur. Bu bağlamda ötekiye olan ihtiyaç bireyin kendi kimliğini inşa etmesine katkıda bulunur. Kimlik "kim" sözcüğünden türeyen aidiyeti, aynı olmayı veyahut kim olduğuna, nereye ait olduğuna ilişkin olan soruların cevabıdır. Ayriyeten kimlik, bir toplumda insanlar veya gruplar arasında ki farklı olanı yaratan temel değişkenlerden biridir. Çünkü 'öteki'nin farkı olmadan kimliğin çok az anlamı vardır. Bu sebeple ötekiye olan ilgi ve motivasyonun yüzyıllarca vazgeçilebilecek bir yönelim olmadığı aksine bir takım grupların kendi kimlikleri için önemli olduğunu söylemek yanlış olmaz. Bu noktada öteki'den söz ederken temel problemin "ben" ve "biz" kutuplaşması olduğu görülür. Biz olan önceden formüle edilmiş konumlar, kişinin doğduğu toplumun ilkeleri, insanın inanç ve yargılarının belli bir grupla tutarlı olması gibi öteki olanın belirli olduğu gruptur. "Ben" ise biz'in yarattığı bu evrenin dışında kalan, farklı olan ve bilinmezliğiyle biz için tehdit oluşturan gruptur.

Biz olma duygusu zaman içinde kişinin bilinç dışı taraf olma motivasyonunu geliştirir. Bu sebeple "biz" olanın kendi anlayışlarının dışında kalan birey ve grupları ötekileştirerek, yok sayma, dışlama, yaşamsal haklarına müdahale etme, nefret söylemleri ve suçlarına uzanan istenmeyen tutum ve davranışları geliştirdiklerini ifade etmek mümkündür. Derrida; "Ancak ötekinin bizim kurallarımıza, yaşam tarzımıza, hatta dilimize, kültürümüze, siyasal sistemimize vb uyması koşuluyla konukseverlik gösteririz." der. (Borradori, 2003, s. 160). Fakat yine Derrida'nın kendisi şöyle der: "Saf ve koşulsuz konukseverlik, konukseverliğin *kendisi,* ne beklenen ne de davet edilen, mutlak anlamda yabancı bir *konuk* olarak, yeni *gelen* olarak ulaşan herkese, tanımlanamaz ve öngörülemez olana, kısacası bütünüyle öteki olana kapıların açılmasıdır." (Borradori, 2003, s. 160) Kimlik olgusu politik, ekonomik, etnik ve kültürel sebeplerle oluşmaya devam eder. Bir diğeri ise biyolojik sebeplerdir. Bununla birlikte ötekileştirme başladığında cinsel kimlik tartışmalarını görmezden gelmek mümkün değildir.

3.1 Cinsel Kimlik

Cinsel kimlik, bireyin biyolojik olarak kendisinin kız ya da erkek cinsiyetinden hangisi olduğunu anlaması ve bununla özdeşleştiğini hissetmesidir. Bireyler doğduğu andan itibaren 2-3 yaşlarına kadar cinselliğin ne olduğuna ilişkin fikir geliştiremezler. 3 yaşından sonra çocuğun kendi cinsel kimliğine dair anlamlar aradığı ve keşfettiği yaşlar olur. Fakat cinsel yönelimin hangi yaşlarda başladığı bilinmez. (Özsungur, 2010) Cinsel yönelim, kişinin duyguları ve arzularıyla hangi cinsiyete ilgi duyduğu ile alakalıdır. Freud'un psiko-seksüel kuramında fallik dönem (3-6 yaş) ile birlikte bireyler cinsiyet farklılıklarının ve vücudundaki haz bölgelerini keşfeder. Latent/Gizil (6-12 yaş) ve Genital(12-18 yaş) dönemde ise libido etkilerinin görüldüğü ve bireyin cinselliğe dair ilgi ve motivasyonunun giderek arttığı görülür. (Celiloğlu, 2022) Tüm bu dönemler içerisinde bireyin doğru cinsel eğitim alması cinsel yönelimi için oldukça önemlidir. Bu eğitim neticesinde birey kendini bedenini tanır. Kendi cinsel kimliğine veyahut başkalarının cinsel kimliklerine dair davranış tutumlarını geliştirir. Fakat günümüz toplumunda cinselliğin ne olduğuna ilişkin konuşmak zordur. Toplumlar cinsellik üzerine konuşmayı genellikle ayıp olarak görür. Bir ebeveynin çocuğu ile bu konu hakkında konuşmaması ya da konuşulduğu takdir de suçluluk hissi uyandırması da beraberinde gelir. Fakat cinsellik, ilişki kurmanın dinamiklerinden biri olmaya devam ettiği müddetçe görünmez olması mümkün değildir.Toplumlar yalnızca iki cinsel kimlik üzerinden cinsiyetleri sınırlar. Bu sebeple kadın ve erkekten giyim, görünüş, davranış ve beden özelliklerinin dışavurumunu dair uygunluk bekler. Cinsel kimlikleri bu şekilde belirginleştirmek ve nesneleştirmek toplumun dinamiklerinden biridir. Bunun dışında ki çeşitli cinsel kimliklerden olan: gey, lezbiyen, biseksüel, transları ayrıştırmaya yönelir. Bu tarz farklı cinsel kimliklerin toplumdan

ayrışması ve ötekileştirilmesi yeni bir olgu değildir. Cinselliği üreme odaklı konumlandıran toplumlar görece kadın ve erkek arasındaki ilişki dışındaki birliktelikleri meşru kılmaz. Bireyden buna ilişkin birliktelikler kurmasını bekler. Bunun dışındaki ilişkileri doğal ve yahut normal kabul etmez. Farklı cinsel kimliklere ilişkin toplumun bu tutumu cinsel kimlik temelli nefret söylemini ve homofobiyi beraberinde getirir.

3.2 Homofobik "Öteki"

"Fobi" sözcüğü bugün belirli nesneler ya da durumlar karşısında duyulan, kaygı, endişe veyahut tehdit oluşturmayan şeylere karşı abartı boyutunda ki korkuya verilen addır. "Homo" eş, benzer, denk anlamlarında kullanılagelen bir önek olduğu için, ne ile ilgili bir korkunun ifadesi olduğunu anlamak kolay değildir." (Başar, Homofobi, 2013) "Homofobi" 1960'larda ilk kullanıldığında eşcinsellerin (homoseksüellerin) yakınında, çevresinde bulunmayla ilgili korkuyu ifade etmek için, yine bu korkuyu duyan kişiler tarafından ortaya atılmıştır." (Başar, Homofobi, 2013, s. 60) Fakat bugün kavramın eşcinsel bireyden korkmaktan çok onu aşağıya çeken, ötekileştiren hatta tiksinme, nefret gibi eylemleri doğuran bir kavrama tekabül ettiğini söylemek yanlış olmaz. İnsanlık tarihi boyunca bireyler kendi cinsiyetinden insanlara karşı bir yakınlık duymuş veyahut duygular beslemiştir. Fakat çoğunluğun heteroseksüel olduğu bu toplumda bu yakınlık kabul görülmemiştir. 17 Mayıs 1990 yılında eşcinsellik bilim içerisinde normal kabul edilmesine karşın politika ve din içerisinde tartışmalara sebebiyet vermeye devam etmiştir. Çünkü toplum bugün hala kendi değerler sistemin dışına çıkan bu bireyleri kabul etmeme konusunda ısrarcıdır. Bu nedenle eşcinsellik heteronormative hayatın günlük pratiklerinden biri olamamış aksine toplumun homofobik söylemlerine maruz kalmıştır.Heteroseksüel düşünce dünyasında eşcinselliğin sağlıksız ve insan doğasına aykırı olduğu savının öne sürülmesi özellikle aile gibi önemli bir kurumun korunmasına yönelik bir önlemdir. Siyasi otorite bugün ahlaki değerleri koruma ideolojisiyle oluşturduğu yasalarla, otoritesini de kullanarak eşcinseli sistem içerisinde bastırır. Nitekim üremeye yönelik olmayan bu cinsel yönelimin toplumun düzenini bozacağına dair bir gerekçe sunulur. Tek tipleştirme, çoğunluk olamama, cinselliği kurallara bağlama, çekirdek aile kurma, tüm bunlar toplumun alışmış olduğu düzendir. Bu sebeple homofobik tutumlar, azınlık olanı dışlama ve ötekileştirme misyonuna bireye doğar doğmaz bahşeder. Bugün tek tanrılı dinlere baktığımızda eşcinsel bireyin günahkâr olduğu vurgulanır. Çünkü yaratana karşı kadın ve erkek fıtratının dışına çıkan bu cinsel tercihlerin birer başkaldırış, düzeni bozan bir olgu olduğu görüşü hâkimdir. Bazı Asya ve Avrupa ülkeleri eşcinselliği uluslararası haklara sahip, normal görülen ve evliliklerinin yasallaştığı konumlara kadar yükseltmiştir. Fakat pek çok ülke bu haklar bir yana eşcinselliği idamla

cezalandırmaya, günahkâr ilan etmeye devam etmiştir. Küreselleşmeyle birlikte kültürel değerlerin yavaş yavaş aşınmaya başladığı bu yüzyılda bile eşcinsellik henüz meşru değildir.

FİLMİN ÇÖZÜMLEMESİ

Bu çalışma kapsamında, Patrick Huang Hui-Liu'nin Tayvan yapımı "Your Name Engraved Herein" filmi, ötekileştirme olgusuyla bağlantılı olarak ve nitel içerik analizi yöntemiyle ele alınmaktadır. İçerik analizi yöntemi sosyal gerçekliğin içinde gizli kalanın keşfedilmesi ve yeniden yorumlanmasını içeren bir tekniktir. Araştırma da amaç incelenen materyalde ötekileştirmeye dair sosyal yapıya ait çıkarımlarda bulunmaktır. İncelenen filmde göstergeler ve metinsel anlatımların ötekileştirme kavramıyla bağlantılı olan eşcinsel imgesini nasıl işlendiğine odaklanılmıştır. Tematik olarak filmdeki ötekiler, ötekileştirme, eşcinsellik, homofobi, toplum gibi kavramlar incelenip metinsel bağlamda açıklanmıştır.

4.1.Filmin Künyesi ve Konusu:

Yönetmen: Patrick Kuang Hui-Liu

Yapımcı: Yu Ning Chu, Danielle Yen, Liu Zhi-Syuan

Senarist: Yu Ning Chu, Jie Zhan, Alcatel Wu

Müzik: Chris Hou, Jason Huang

Türü: Tarih, Dram,Romantik

Yapım Yılı: 2020

Gösterim Süresi: 114 Dakika

Konusu:

Film, 14 Temmuz 1987 yılında sıkı rejimin kaldırıldığı fakat etkisinin hala sürdüğü 1988 yılında, Katolik lisesinde okuyan iki genç erkeğin aşkını anlatır. Yönetmenin ilk uzun metrajlı ve Tayvan'ın ilk LGBT temalı filmi olma özelliğine de sahiptir. Ayriyeten Tayvan, Asya'nın ilk LGBT evliliğini resmileştiren ve Asya tarihinin 100 milyon gişesiyle en yüksek hasılatını yapan ülkedir. Tayvan'da arka arkaya diktatörlüğün olduğu insanların özgürlüklerinin kısıtlandığı, hükümet karşıtı protestoların başladığı ve propaganda medyasının ürettiği her şeyin engellendiği ve hükümetin muhalefeti bastırmaya başladığı bir dönem söz konusudur. Bu dönem Beyaz Terör Katliam'ının başlangıcı olan 1947 yılında birçok Tayvanlının ölmesiyle sonuçlanan, halkın ayaklanmasıyla bağımsızlık hareketini bastırabilmek için hükümetin, 1949-1987 yıllarında işleyen sıkıyönetimi ilan ettiği dönemdir. Fakat 1987 yılında sıkıyönetim kaldırılması siyasal ve devrim sonrası karışıklıkların ortaya çıkmasına sebep olur. Yönetmen tam da bu tarihi Tayvan atmosferinde Erkek Katolik Lisesinde olan Jia-Han (Edward Chen) ve Wang-Po Te (Birdy) (Jing-Hua Tseng) aşkını işlemeye başlar. Başkarakterlerden biri olan Chang Jia-Han Katolik bir aile ve despot bir babayla yetiştirilen bir gençtir. Hayali müzisyen

olmaktır. Abisinin başarısının gölgesinde "kaybedenler için olan" sosyal bilgiler bölümünü seçtiği için evde küçük düşürülür. Wang Po-te (Birdy) karakterimiz askeri geçmişi olan bir babanın 4 kızından tek erkek çocuktur. Ayriyeten Birdy'nin diyaloglarından da anlaşılacağı üzere babası tarafından sıklıkla hor görülür. Homofobinin kol gezdiği, ötekinin sosyal yapının her yerinde yaratıldığı bu çağda eşcinsel olmak zor bir seçimdir. Hikâyede Peder Oliver (Fabio Grangeon) üçüncü bir ana karakter olarak karşımıza çıkar. Eşcinsel kimliğini reddeden, kendini Tanrı'ya adayan ve erkek lisesinde öğrencilere birçok derste liderlik eden bir temsildir.

4.2. "Ötekileştirme" Üzerine Filmin İçerik Analizi

Filmde neredeyse birçok sahne de bize ötekinin kim olduğu söylenir. Açılış sekansında Peder ve Jia-Han'ın arasındaki bir konuşma da Peder, Jia-Han'ın yaralı suratına bakar ve –bir kız yüzünden kavga ettiğini düşünerek- "Kız hangi sınıfta?" diye sorar. Daha ilk sahneyle birlikte eşcinsel bireyin ne kadar görünür –öteki- olduğu tartışması başlar. Filmde bahis edildiği gibi eşcinselliğin cinsiyet rolleri arasında normal sayılması henüz mümkün değildir. Bu sebeple eşcinsel olmak toplumun alışık olmadığı ve müstehcen gördüğü bir anormalliktir. Haneke; "İster cinsellik, ister şiddetle ya da başka bir tabuyla alakalı olsun, normu bozan her şey müstehcendir. " der (Savaş, 2019, s. 26) Böylece müstehcen demek, toplum tarafından dayatılan, belletilen, öğretilen normların dışında kalan her şey demektir. Toplumun %90'ının heteroseksüel olduğu düşünüldüğünde azınlıkta olan eşcinsellerin öteki olması bu noktada kaçınılmazdır.İlk sekanslarda heteroseksüel olan Horn karakterinin arkadaşlarıyla birlikte gey olan Xie Zhen'ın zorbalık yaptığı görülür. Şiddetin alenen gösterildiği bu sahnede homofobik söylemler karakterlerin ağzından dökülür. Horn, elindeki çakmakla Xie Zhen'ın cinsel organını yakmak ister ve ondan uzak durulması gerektiğini, hastalıklı olduğunu, onlara bulaştırabileceğini söyler. Bu sahne, AIDS'in 1980'lerde yarattığı etkiye bir atıftır ve eşcinselin ötekileştirilmesinde gerekçelerinden biri olarak karşımıza çıkar. Horn'un "Onu direğe geçirelim" cümlesi ise Katolik inancındaki çarmıha germe düşüncesiyle özdeşleşen eşcinselin günahkâr olduğu vurgusudur. Horn'un öğrenilmiş zorbalığı ile birlikte heteronormative dünya da eşcinselin ötekileştirilmesinin adeta bir norma dönüştüğünü söylemek yanlış olmaz. Anlaşıldığı üzere eşcinsellik hem kadın ve erkek fıtratına, hem dini olgular için uygunsuz ve öteki olandır. Heteroseksüel kimliklerin homoseksüel kimliklere karşı tutunduğu bu tavır homofobinin sürdürülmesine de katkı sağlamıştır. Jia-Han'ın şahit olduğu bu tavırlar şüphe ve korkuyu beraberinden getirir ve nihayetinde karakterde kimlik kaygısı oluşmaya başlar.İlerleyen sekanslarda öteki olmanın daha da zorlaştığı anlarda Jia-Han'ın kimlik kavgası yerini aşka bırakır. Artık eşcinsel olmak Jia-Han için öteki olmaktan daha kolaydır. Birdy ise güvenli alandan çıkmama konusunda ısrarcıdır. Jia-Han'ı koruduğunu düşünerek bir kızla ilgilenmeye başlar. Toplumun dayattığı yaşamı

tercih ederek 33 yıllık bir pişmanlığın içine sürükleneceğinden habersizdir. Dahası eşcinsel kimliğini reddeden, böyle davranarak düzenin parçası olmayı sevgiden daha cesurca gören bir karaktere dönüşür. Böylece yönetmen, toplumun genç bir çocuğu "öteki terörü" altında gerçeği yaşamaktan nasıl alıkoyduğunu gözler önüne sermiştir.Bir video stüdyosunda ikili, Birdy filmini izlerler. Jia-han Birdy'i öpmek için eğildiğinde oda servisi onları camdan gözlemler. Eşcinselin sık sık gözlemlenmesi ve bunun suç olduğuna ilişkin argümanların sıklıkla söylenmesi adeta toplumun eşcinseller üzerindeki tahakkümünü gözler önüne serer. Bu baskı her yapının içinde belirgindir. Kimi zaman bir arkadaş, aile, okul müdürü ve çoğunlukla dindir. Filmde izleyiciye ötekinin kim olduğu ve neden olduğuna ilişkin pek çok sahne verilir. Amaç eşcinsel ilişkiye dair farklı bir perspektiften alternatifler sunmaktır.Film ile birlikte eşcinselliğin niçin ötekileştirildiği sorusu şöyle cevap bulur. Muhalif toplumlar din, aile, kültür, ulusal değerler gibi toplumsal normları bozan her türlü eyleme karşıdır. Çünkü amaç var olanı korumak ve sürdürmektir. Normu bozduğu iddiasıyla bu noktada eşcinselin öteki olması da kaçınılmazdır. Üreme odaklı olmayan, yalnızca haz merkezli ilişkilerin meşru kılınması hiçbir toplumda kabul görülmemiştir. Özellikle Hristiyanlık, Yahudilik, Müslümanlık gibi tek tanrılı inançlar da eşcinsel olmak günahkâr olmaktır. Çünkü beden eğer böyle yaratılmış ise bedene yapılan tüm müdahale tanrıya karşı bir başkaldırıdır. Bu sebeple eşcinselin tanrıyla arasının açık olduğu inancı baskın görülmüştür. Fakat yönetmen, her sahnesinden dua eden, tanrıya inandığını ve onu sevdiğini söyleyen queer-tanrı ilişkisini daha da güçlendirip yeni bir bakış açısı yaratmaya çalışır. Zhen Xie ve Jia-Han'ın konuştuğu bir sekansta arka fonda güvercin sembollü bir cam vardır. "Güvercin Katolik inancında saflığı, barışı, yeniden doğuşu ve kutsal ruhu ifade eder." (Alp, 2015, s. 202) "Ahit'te ki bu hikâyede güvercin Tanrı'nın insanlarla barış yaptığını ve yeni başlayacak hayatı haber veren bir görev üstlendiğini belirtmiştir." (Alp, 2015, s. 202) Yönetmen bu kadraj da göstergelerle iki eşcinsel karakterin saflığını ve yeni bir başlangıç yapmak istediklerini vurgulamıştır. Toplumun eşcinseli ötekileştirme gayretine karşı yeni alternatifler sunmuştur.Din ile alakalı başka bir sekansta Jia-han ve Pederin sohbet etkileri bir mekânın kutsal tablolar ve tanrıyla örülü olduğu görülür. Yüzleri İsa'ya dönük olan karakterlerimizle Yönetmen queer-tanrı ilişkisini göstergelerle derinleştirerek burada eşcinselin günahkâr olmadığını, inançla yüzünü Tanrı'ya dönebileceğini yeniden hatırlatır. Bunu filmin pek çok sahnesinde yapar. Yapar ki seyirci alenen eşcinsellikle ilgili olan tüm kalıplarına alternatif cevaplar bulabilmiş olsun. Peder ve Jia-Han'ın arasındaki diyaloglarda da bunu vurgulamaya devam eder. Jia-Han; "Tanrı: İstersen elde edersin. Arayan bulur. Kapılar, ona çalana açılır. dedi. Kapıyı son gücümle çalıyorum. Neden duymuyor? " diye karaktere soru sordurarak seyircinin kafasındaki soruları da cevaplar. Yönetmen, eşcinselin öteki olma sorununa her perspektiften bakarak çözüme ulaştırmayı amaçlar.

Tarih boyunca eşcinsel ilişkinin sorun olduğu diğer bir yer aile kurumudur. Ataerkil sistem de ebeveynlerin erkek çocuklardan bekledikleri, iyi, ahlaklı, gerçek bir mesleği olan ve evlenip çocuk sahibi olmalarıdır. Kadın ve erkek birlikteliğinin aile kavramı için ideal olduğu görüşü bu bağlamda kabul edilir. Buna değinmek isteyecek olmalı ki yönetmen "Aile varsa çocuk olmalıdır.", "Normal olan heteroseksüel ilişkidir" gibi söylemlerle konuyu gün yüzüne çıkarır. Böylece karşı bir söylem yaratarak da üreme üzerine yapılan bir konuşma da dünya nüfusunun yeterince arttığını, büyüyünce çocuk yapmak istemediklerini iki karakterimize söyletir. Başka bir sahne de Jia-Han'ın babasıyla tartışması üzerine annesiyle yaptığı konuşma da eşcinselin aile kavramına olan bakışının altını çizer. Jia-Han annesine babasıyla neden evlendiğini sorduğunda aşk için cevabını alamaz ve böylece neden üremek amaçlı birlikte olduklarını anlayamadığını söyler.

Olumlu eşcinsel temsili mümkün müdür sorusunu sorduğumuzda karşımıza üç ana karakterimiz çıkar. Jia-Han yalnızca aşkının karşılığını almak isteyen, eşcinsel olduğunu kabul etse dahi sık sık tanrıya dua eden bir gençtir. Wang-Po-Te karakteri asi, haylaz ve umursamaz görünse de, eğlenceli, düşünceli ve cesurdur. Peder Oliver saygılı bir din adamı ve yol göstericidir. Finalde onunda eşcinsel olduğu görülür. Yönetmen böyle olumlu ve ahlaklı eşcinsel temsiller yaratarak seyircinin öteki anlayışını sorgular ve soyut bir yüzleşme gerçekleştirir. Olumlu eşcinsel temsiller mümkün müdür sorusuna ise iki genç karakterimizin, dönemin Devlet Başkan'ının ölümü için çıktıkları gezide "Evlilik insan hakkıdır. Eşcinsellik hastalık değildir." tabelası taşıyan bir erkek aktivisti göstererek cevaplar. Aktivist, 1986'dan beri ulusal televizyon yayınlarında Tayvan'da ilk eşcinsel haklarını savunan Chi Chia-Wei'nin bir tasviridir. Yönetmen böyle önemli ve gerçek bir karakteri es geçmeyerek tarihe yine saygı duruşunda bulunur ve film boyunca yalnızca queer bireyin öteki sorununu değil güçlü yanlarını da gösterir.

Sonuç olarak yönetmen, duyguların kasten soyutlaştırılmasının güç yanlarını göstererek gerçeğin eninde sonunda yaşanacağını somutlaştırır. Peder Oliver'in filmin sonunda aşığına geri dönmesi ise bunu kanıtlar niteliktedir. Karakterlerimiz 33 yıl birbirlerini göremedikleri bir ayrılıkla birlikte gerçeklerle yüzleşirler. Jia-han daha sonra Birdy'nin eski karısı ve çocuklarının annesi olan Ban Wu ile temasa geçer. Boşandıklarını, Birdy'nin gerçekte kim olduğunu asla kabul etmeyerek hayatlarını mahvettiği gerçeğini anlatır. Ban Wu'nun eşcinselliğin kişinin doğasında olduğunu kabul etmesi ve Jia-Han ile Birdy'nin karşılaştıkları barın önünde iki erkeğin arkada öpüşmesi ülkenin 33 yıl sonra "eşcinsel/öteki" olana bakışının ne denli değiştiğini gösterir. Final de Birdy'nin Jia-han'ı gerçekten sevdiğini rahatça söylemesi ve bunu kabul edemediğini itiraf etmesi ise dönem farkını gözler önüne serer. Patrick Kuang Hui-Liu her sahnesinde eşcinseli olumlarken onun güç yanlarını göstermeyi

ihmal de etmez. Ötekileştirmenin yalnızca cinsellik sorunuyla sınırlı olmadığı heteronormative düzende her türlü yapının içerisinde ötekiler yaratıldığının altını çizer.

SONUÇ

Çalışmamızda kişilerin sosyal yaşamlarında neden ötekileştirmeye yöneldiği sorusu sorulmuştur. Ötekinin kim olduğuna, ötekileştirme pratiklerine, heteronormative dünyanın bu argümana neden ihtiyaç duyduğuna ilişkin görüşler analiz edilmiştir. Kimliğin inşasında ötekinin konumuna, queer kavramının ne olduğuna, öteki ve queer ilişkisine, *queer*'in tarih içerisindeki kavramsal değişimine, bir sinema akımı olarak karşımıza çıktığı sürece kadar olan kronolojik değişimine bakılmıştır. Queer kavramının uzun süre olumsuz anlamlarda kullanıldığı fakat sonrasında eşcinseller de dâhil olmak üzere öteki statüsüne düşürülmüş her kesim tarafından sahiplenildiği tespit edilmiştir. Queer Sinema da ilk temsillerden bu yana eşcinselliğin görece daha kabul edilebilir olduğuna fakat bugün henüz bir sorun olmaktan çıkamadığı kanaatine varılmıştır. Sinema içerisindeki yapımların heteroseksüel ilişkiye dair tutumlarının eşcinsel temsiler için çok yeni olduğu görüşü bu bağlamda kabul edilmiştir. İncelenen filmlerle de bu desteklenmiştir. Homofobik tutumların heteronormative dünyanın davranış kalıplarından biri olduğu kanaatine varılmış ayriyeten toplumun kimlik edinme içgüdüsüyle ötekileştirmeyi birer ihtiyaca dönüştürdüğü de gözlemlenmiştir. Cinsel kimliklerin sınırlılıklarına müsaade edilmediği, görece erkek ve kadının kendisinden bedenen bekleneni yapması istenildiği analiz edilmiştir. Araştırmanın amacına uygun olarak Tayvan yapımı Your Name Engraved Herein (Adın Buraya Kazınmış, 2020) filmi seçilmiş. Filmde eşcinselin maruz kaldığı ötekileştirme pratiklerine karşı alternatifler sunulmuş, öteki olmasına dair yeni bir bakış açısı kazandırılmaya çalışılmıştır. Yönetmen, seyircinin sevebileceği, empati kurabileceği hatta onlar için üzülebileceği olumlu eşcinsel temsiller yaratmış böylece eşcinsele olan ayrıştırıcı tutumlara karşı alternatifler sunmuştur. Sonuç olarak ötekiye dair tüm algıların değiştirilebileceğine, bugün eşcinsel bireyin cinsel yöneliminin hastalık ve ya haz merkezli olmadığına, kimlik edinme sürecindeki tüm sorunların çözümsüz olmayacağına ilişkin farklı bir bakış açısı kazandırılmaya çalışılmıştır. Eşcinselliğin meşrulaştırılması üzerinden argümanlar oluşturmaya çalışılmıştır.

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SÜRDÜRÜLEBİLİR YENİ LÜKS MARKALARIN Y VE Z KUŞAKLARININ SATIN ALMA NİYETLERİ VE TÜKETİCİ DAVRANIŞLARI ÜZERİNE ETKİSİ[1]NİN CİNSİYET VE GELİR DURUMU AÇISINDAN ANALİZİ

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ÖZET
Günümüzde insan odaklı pazarlama yaklaşımı beraberinde "sürdürülebilirlik" kavramını getirmiştir. Özellikle iklim değişikliği ile dünyadaki kaynakların tükenir hale gelmesi gelecek için endişeleri kayda değer şekilde artırmıştır. Bugün özellikle kaynakların sürdürülebilirliği konusunda işletmelerin stratejik eylem planlarında sürdürülebilirlik olsa da, bu yaşam kaynaklarının yok olmasında da işletmelerin duruma sebebiyet vermesi düşündürücü bir durum olarak değerlendirilmektedir. Özellikle daha çok tüketimi teşvik eden bir mekanizmanın "tüketmeme", "az tüketim", "ikinci el tüketim" ya da "yavaş tüketim" kavramlarını referans alması sürdürülebilirlik konusundaki yaklaşımlarına güvenin ve bu konudaki samimiyetlerinin tartışılmasına sebep olmaktadır. Tüketimin devamlılığının iş yaşantısı için önemli olduğu dikkate alındığında ise "lüks ürünlerin" tüketiminin devamlılığının kolayda ya da hızlı tüketim ürünlerinde olduğu kadar önemli olduğu görülmektedir. Özellikle Pandemi döneminde "ikinci el lüks" uygulamalarının görülmesi ise bu alanda sürdürülebilir çalışmaların yapılmasında öncülük etmiştir denilebilir. Diğer taraftan tüketim edimlerinde "sürdürülebilir uygulamalar" açısından hassas olan ve ayrıca "lüks ürünlere" karşı zaafı olan kuşakların göreli olarak Y ve Z kuşağı olması dikkat çekmektedir. Demografik faktörlerden cinsiyet ve gelir durumu ise satın alma niyeti ve davranışı üzerinde etkili olan önemli iki faktördür. Bu kapsamda çalışmada Türkiye'deki Y ve Z kuşaklarını temsil eden tesadüfi olmayan örnekleme yöntemiyle seçilmiş 424 tüketiciye çevrimiçi anket yöntemi uygulanmış olup, çalışma sonucunda gelir durumuna göre tüketicilerin gelir durumu ile Marka Tercihleri Sürdürülebilirlik ve alt boyutları Ekonomik sürdürülebilirlik, Sosyal sürdürülebilirlik ve Çevresel sürdürülebilirlik, Satın alma Niyeti arasında anlamlı bir fark vardır. Ayrıca analiz sonucuna göre tüketicilerin cinsiyet durumu ile Marka Tercihleri Sürdürülebilirlik ve alt boyutları Ekonomik sürdürülebilirlik, Sosyal sürdürülebilirlik ve Çevresel sürdürülebilirlik, Satın alma Niyeti arasında da anlamlı bir fark olduğu görülmüştür.
Anahtar Kelimeler: Lüks Marka, Sürdürülebilirlik, Y ve Z Kuşağı, Tüketici Davranışı

[1] Sürdürülebilir Yeni Lüks Markaların Y ve Z Kuşaklarında Tüketici Algıları ve Satın Alma Niyetleri Üzerindeki Etkisi tez çalışmasından üretilmiştir.

ANALYSIS OF THE IMPACT OF SUSTAINABLE NEW LUXURY BRANDS ON GENERATION Y AND Z'S PURCHASE INTENTIONS AND CONSUMER BEHAVIOR IN TERMS OF GENDER AND INCOME STATUS[2]

ABSTRACT

The human-centered marketing approach of today has brought along the concept of "sustainability." Especially, concerns about the future have significantly increased with climate change and the depletion of resources worldwide. While sustainability is present in the strategic action plans of businesses, the role of businesses in the depletion of life resources is considered alarming. Particularly, when a mechanism that largely promotes consumption references concepts such as "non-consumption," "minimal consumption," "second-hand consumption," or "slow consumption," trust in sustainability approaches and the sincerity of businesses in this regard are questioned. Considering the importance of continuity of consumption for business life, it is seen that the continuity of consumption of "luxury products" is as crucial as in fast-moving consumer goods. Especially, the emergence of "second-hand luxury" practices during the pandemic period has led the way in sustainable practices in this field. On the other hand, the Y and Z generations, who are relatively sensitive to "sustainable practices" in consumption behaviors and also have a weakness for "luxury products," stand out. Gender and income status, among demographic factors, are two important factors that influence purchase intention and behavior. Within this scope, an online survey method was applied to 424 consumers selected through non-random sampling representing the Y and Z generations in Turkey. As a result of the study, it was found that there is a significant difference between consumers' income status and brand preferences, Sustainability, and its sub-dimensions Economic sustainability, Social sustainability, Environmental sustainability, and Purchase Intention. Furthermore, according to the analysis results, there is a significant difference between consumers' gender and brand preferences, Sustainability, and its sub-dimensions Economic sustainability, Social sustainability, Environmental sustainability, and Purchase Intention.

Keywords: Luxury brand, Sustainability, Generation Y and Z, Consumer Behavior

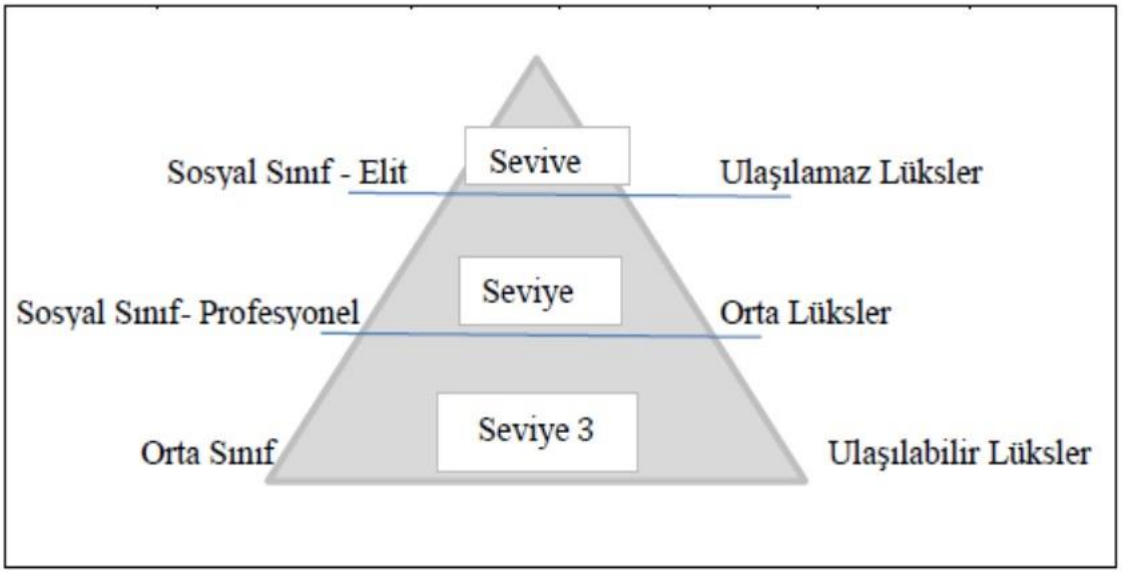
[2] The impact of Sustainable New Luxury Brands on Consumer Perceptions and Buying Intentions in the Y and Z Generations is based on a thesis.

GİRİŞ

Bu çalışmada, sürdürülebilir yeni lüks markaların, Y ve Z kuşaklarının tüketici algıları ve satın alma niyetlerinin, cinsiyet ve gelir durumu bakımından etkisi araştırılmıştır. Öncelikle kavramsal çerçevede lüks marka, sürdürülebilirlik, Y ve Z kuşakları ve tüketici davranışı ve lüks markaların sürdürülebilirliği açıklanmış, diğer bölümlerde markaların satışlarını arttıran sürdürülebilirlik felsefesini benimseyip ya da benimsemeyen lüks markaların tüketici davranışlarına etkileri cinsiyet ve gelir durumu çerçevesinde incelenmiştir. Araştırmanın bu konuda sınırlı olması önemini arttırmaktadır.

LÜKS MARKA

Lüks, genel olarak yüksek kaliteli, özel ve genellikle yüksek fiyat etiketine sahip olan ürünleri, deneyimleri veya hizmetleri ifade eder. Lüks mallar ve hizmetler, genellikle işçilik, tasarım, malzeme ve genel deneyim açısından standart karşıtlarına göre üstün olarak kabul edilir. Ayrıca, lüks ürünler genellikle sahiplerine özgünlük, nadirlik ve sahip oldukları statü ile karakterizedir.Lüks marka sınıflandırması ilk kez Alleres (1990) tarafından yapılmıştır. Alleres'e göre lüks marka sınıflandırması sosyo-ekonomik boyut perspektifinden, tüketicinin lüks markaya ulaşılabilirliği üzerinden açıklanmıştır. Şekil 1'de gösterilmektedir.



Şekil 1: Lüks Marka Sınıflandırması

Kaynak: Alleres, D. (1990). "Luxe - Strategies Marketing", Economica, 1(1).

Allers'in piramidine göre, piramidin en alt tabanını oluşturan ulaşılabilir lüks kısmı (Seviye 3) orta sınıfın ulaşabileceği lüks ürünleri içermektedir. Bu grubun satın aldığı lüks ürünler, statülerini arttırmaktadır. Bir sonraki seviye olan Orta Lüks (Seviye 2), profesyonel sosyo-ekonomik sınıf tarafından elde edilebilen ürünleri içermektedir. En üst seviye olan ulaşılamayan

lüks ise, elit olarak nitelendirilen sosyo-ekonomik kesim tarafından alınabilen ürünleri içermektedir. Bu seviyedeki ürünler, çok yüksek fiyatlı olup, kullanıcısına çok farklı bir sosyal prestij sağlamaktadır. Bu piramide göre lüks ürüne ulaşılabilirliğin derecesi, sosyal sınıf seviyesini yansıtmaktadır. "Lüks kavramı, şüphesiz yıllar içinde değişmektedir. Ekonomik ve teknolojik sebepler nedeniyle lüks artık çok daha farklı bir kavramı temsil ediyor. Özellikle son 10 yılda lüks kavramı kişiselleştirme ve deneyimle birlikte anılıyor. Kalite, işçilik, tasarım ve dayanıklılık gibi konular zaten lüks markaların sunduğu değerler iken yeni lüks kavramı ile beraber, bambaşka parametreler ortaya çıktı. Artık insanlar satın alma kararı alırken aldıkları ürünün hikayesiyle, onlara yaşattığı deneyimle, kendileri için ne kadar kişiselleştirilmiş olduğu ile ilgileniyor. (https://www.platinonline.com/2017)Lüks markalar; prestij sahibi markaların en üstünde yer alan, içinde fiziksel ve psikolojik değerleri bulunduran markalardır. (Wiedmann, vd., 2007: 126). Lüks tüketim, bireyin fizyolojik ihtiyaçlarının ötesinde psikolojik ihtiyaçlarına hizmet eden bir araçtır. Her birey temel ihtiyaçlarını rahatlıkla karşılayabildiğinde, psikolojik ihtiyaçlarına yönelir.Twitchell 'Gereksizi Gerensinmek: Lüksün Demokratikleşmesi' adlı kitabında lüksü şu şekilde tanımlamıştır: ''Lüks; eğer zor ele geçirilen ve sahip olamadıklarımızın karşılığı ise, lüks ihtiyaçlar bireye, topluma ve zamana göre değişiklik gösterebilmektedir. Örneğin, Akdeniz kıyılarında tatil yapmak ya da dizüstü bilgisayara sahip olmak birileri için lüks iken, birileri için zorunlu olabilecektir. Lüks olarak adlandırılan ihtiyaçlar tatmin edildiğinde, yeni bir lüks ihtiyacının ortaya çıkacağı çok aşikârdır. Renksiz televizyona sahip olunduğunda, renklisi lüks olarak kabul edilebilirken, renkliye sahip olunduğunda her türlü iletişim olanağı sağlayabilecek dijital ve etkileşimli televizyonlar şimdilik lüks sayılabilmektedir. Günümüzde ne satın aldığınız, ne yaptığınızdan daha önemli hale geldiği için, lüks bir amaç değildir; artık birçok kişi için lüks mutlu azınlık için olmanın ötesinde, bir gereksinimdir diyen Florida Üniversitesi öğretim üyesi Twitchell'e göre; belki de daha az lüks istemek yerine, tam tersini -çelişkili olsa da, herkes için lüksü- toplumsal amaca uygun bulabiliriz.'' (Twitchell, J.B. 2004, Aktaran; Odabaşı, 2013:23-24).

SÜRDÜRÜLEBİLİRLİK

Sürdürülebilirlik, üretimin ve çeşitliliğin devamı sağlanırken insanlık yaşamının daimi kılınabilmesidir. En iyi anlamıyla kendi ihtiyaçlarımızı karşılarken gelecek kuşakların ihtiyaçlarından ödün vermeden karşılayabilmektir. Bir kavramın ya da şeyin sürdürülebilir olması o şeyin şuan ki durumunu devam ettirebiliyor olması gerekir. Aynı zamanda kendini yenileyebiliyor olması gerekmektedir. Buradan yola çıkarak bu kavram; gelecek kuşaklara

ekonomik, ekolojik ve aynı zamanda sosyal koşulları devam ettirilebilen bir dünya bırakmak için kullanılır. (https://www.iienstitu.com/, 2019)

Sürdürülebilir kalkınmanın ekonomik, çevresel ve sosyal boyut olmak üzere üç boyutundan söz edilmektedir. İdeal ve sürdürülebilir bir ekonomi, en az miktarda kaynak kullanımı ve çevresel zarar ile en yüksek miktarda genel refahı sağlayan ekonomidir. Ekonomik açıdan, gerçekten sürdürülebilir olmak için, doğal kaynaklara yönelik genel talep, doğanın yenilenebilir kaynak arzından daha az olmalıdır (https://econation.co.nz/, 2020).

Çevresel sürdürülebilirlik, sürdürülebilir kalkınmanın ayrılmaz bir parçasıdır. Çevreye bağımlılıkları nedeniyle çalışanlar, müşteriler, hissedarlar ve toplum ile birlikte işletmeler için önemli bir paydaştır. Çevresel sürdürülebilirlik, insanların ve doğanın üretken bir uyum içinde var olabileceği ve gelecek kuşakların sosyal, ekonomik ve çevresel ihtiyaçlarının karşılanmasına izin veren koşulları yaratmak ve sürdürmek olarak tanımlanabilir (U.S Department of Energy, 2020).

Eğitim, sağlık, mutluluk, güvenli bir yaşam, yaşam kalitesi vb. alanlarda toplumsal koşulların sürdürülebilirliği üzerine odaklanır. İnsanlar arasındaki ilişkilerin zenginleştirilmesinin yanında bireysel ve grupsal hedeflere ulaşılmasını sağlar. Ekonomik ve ekolojik değişimlerin sosyal koşullara yaratacağı etkiler tarafından etkilenebilir. (https://.iienstitu.com, 2019)

Y KUŞAĞI

X kuşağından hemen sonra gelen Y kuşağı 1980 ile 1989 yılları arasında doğan nesli kapsamaktadır. Mevcut iş gücüne giren son nüfusun teşkil ettiği gruptur. Bireyciliğin yüksek seyrettiği, esnek ve küreselleşmeyle değişmeye başlayan dünyanın çocukları biçiminde tanımlanan bu kuşak muhtemelen yakın tarihin en eğitimli, en çok iletişim gücüne sahip ve kendine güvenen kuşağını oluşturmaktadır. İş ortamında yer aldıkları gruplar içerisinde üretken ve kararlı bir örgüt kültürünün olmasını isterler ve bu konuda oldukça hassastırlar. İyimserlerdir ve çalışma ortamının eğlenceli olmasını isterler. Tıpkı X kuşağında olduğu gibi, yöneticileri tarafından takdir edilmek onlar için çok önemlidir (Aytaş vd., 2017: 36-37).

Cep telefonları, kişisel bilgisayarlar ve internet doğduklarından itibaren hayatlarında olduğundan ve bu dijital aletlerle büyüdükleri için teknoloji ve dijitallik bu kuşak için birçok şeyin simgesi haline gelmiştir. İnternet sayesinde küresel bir köye dönüşen dünyada Y Kuşağı, işletmelerin bilişim teknolojilerini kullanarak yaşam biçimine kadar birçok alanı kontrol edebildiği veya etkileyebildiği bir çevrede yetişti ve halen de bu çevrede yaşamlarını sürdürmektedirler. Bu nedenle de X kuşağı ile karşılaştırıldığında teknolojik açıdan bir adım öndedirler (Mengi, 2016)

Pazarlama ve tüketici davranışları açısından ele alındığında Y Kuşağı, değişen çevre şartlarına kolay uyum sağlayabilen, dinamik bir pazarlama çevresinde hayatını sürdürmekte zorluk yaşamayan bir kuşaktır. Bu nedenle değişime dair sürekli bir beklenti içinde olan bir tüketim anlayışı sürdürmektedirler. Bu kuşağın bireyleri kullandıkları ürünlerin yeni versiyonlarının ya da uygulamalarının piyasaya çıkmasını bekler ve bunların gelişimini yakından takip etmektedirler. Dünyanın önde gelen stratejistlerinden biri olarak tanınan Michael McQueen, Y Kuşağı bireylerinin iddia edildiği gibi savurgan davranışlar sergilemediğini, bu kuşağın "hayattan zevk alma" anlayışı ile hareket ederek bunu tüketime yansıttığını ve bu açıdan bakıldığında da oldukça bilinçli tüketici özelliği gösterdiklerini belirtmektedir. (Yazıcı,2019. s88)…….

Z KUŞAĞI

Z kuşağı dünyanın yeni kuşaklarından olan en son kuşaktır. Bu kuşağın mensuplarını 2000 yılı ve sonrasında doğanlar oluşturmaktadır. Z kuşağına farklı isimler verilmektedir. Bunlardan bazıları; Kristal çocuklar, I Kuşağı, Gelecek Kuşağı, iGen, Daima çevrimiçi, çocuklarının yanı sıra, bireysellik yanlısı olduklarından dolayı Strauss ve Howe ismi de verilmektedir (Çetin Aydın ve Başol, 2014, s. 6).Kristal kuşak olarak adlandırılan Z Kuşağı mensupları; teknoloji ile doğup büyüyen, bilgiye çok çabuk ulaşan, hırslı ve maddeci olarak değerlendirilmektedir. Ayrıca bu kitlenin daha dikkatsiz, hız tutkunu, bağımsız, özgüveni yüksek, yalnız, sabırsız, tatminsiz, güven arayan, zevkine düşkün, internette bol vakit geçiren, geleneklere bağlı olmayan ve içe dönük gibi çeşitli özellikler barındırdığı ifade edilmektedir. Bu özelliklerin diğer kuşaklardan önemli oranda ayrıştığı bilinmektedir. Bu kuşağın tüketim eğilimleri de diğer kuşaklarla önemli farklılıklar içermektedir. Bu kitle içerisinde kalite arayan, yenilik ve değişimden zevk alan, farklı kültürleri araştıran, plansız ve anlık satın alan, marka bağlılığı ve sadakati düşük, hobileri olan ve bu hobilerden kazanç elde etmek isteyen, çok hızlı tüketen, şekil ve sembollere bağlı, rol model arayan, interneti yoğun kullanan, araştıran ve karşılaştıran gibi çok sayıda tüketim eğilimi bulunmaktadır. (Beyaz,R. s;25)

TÜKETİCİ DAVRANIŞI

Tüketiciyi ve tüketicinin davranışlarını anlamak, pazarlama stratejilerinin geliştirilmesindeki en önemli safhadır, çünkü üretilen mal ve hizmetlerin, faaliyet gösterilen pazarda, kimler tarafından, ne şekilde, ne miktarda ve nasıl satın alınacağının tahminini yapmadan, stratejileri ve o stratejilere uygun planları tasarlamak mümkün olmayabilir. Amerikan Pazarlama Birliği"nin (AMA, American Marketing Association), tanımlamasına göre, Tüketici Davranışları, ürün ve hizmetlerin yer aldığı pazardaki tüketici ve karar veren kullanıcıların

davranışlarını inceleyen, anlamaya ve tanımlamaya çalışan disiplinler arası bir bilimsel çalışmadır. Tüketici davranışları üzerine çalışan araştırmacılar satın alma davranışları üzerinden ilerleyerek konuyla ilgili tanımlamaları oluşturmaya çalışmışlardır. Kotler (1989), tüketicinin satın alma sürecini etkileyen faktörleri kültürel, sosyal, kişisel ve psikolojik olarak sıralayarak bir model oluşturmuştur;

Tablo 1.1: Tüketici davranışını etkileyen faktörler

Kültürel	**Sosyal**	**Kişisel**	**Psikolojik**
Kültür	Referans Grupları	Yaş ve Yaşam Dönemi	Güdüleme
Alt Kültür	Aile	Meslek	Algılama
Sosyal Sınıf	Rol ve Statüler	Ekonomik Özellikler	Öğrenme
		Yaşam Tarzı	İnanç ve Tutumlar
		Kişilik	

Kaynak: Kotler, P. , Armstrong, G. (1989) Principles of Marketing. 4th Ed. Englewood Cliffs: Prentice Hall International, s.118.Y Kuşağı tüketimle anılan, asıl kimliğini kendi isteğiyle tüketici kimliğine dönüştüren ve aynı zamanda tüketim toplumunu da şekillendiren bir kuşaktır. İnternetin de büyük etkisiyle alışveriş tutkusuna sahip, karar verieken özgür davranan, tüketimi bir eğlence aracı olarak gören Y Kuşağı, hem kendisine hem de topluma yabancılaşan bir tüketim modeli oluşturmuştur.Z Kuşağı'na baktığımızda ise kendi kredi kartı olan çok az bir şanslı kesim dışında bu kuşak henüz tek başına tüketim yapan bir kuşak değildir. Tüketim davranışlarını belirleyen faktörlerden en önemlisi ailelerin kararı olduğu için şirketler ve aileler bu kuşağı çok daha fazla önemsemektedir. Z Kuşağı diğer kuşaklardan farklı olarak internetsiz dönemi bilmeyen ve bu nedenle bu konuda uzman olarak yetişen bir kuşaktır. Bu kuşak kendine has, kişiselleşmiş ve imaja öncelik veren bir tüketim eğilimi göstermekte ve tam bir tüketici olarak tanımlanabilecek bir profil çizmektedir. Diğer kuşaklarla kıyaslandığında doğdukları çağın da etkisiyle eğitim açısından daha donanımlı ve ekonomik açıdan da daha rahat büyüyen bir kuşaktır. Bu kuşak talep ettikleri ürün ve hizmetlere anında ulaşmak, anında tüketmek ve daha sonra yeni tüketim deneyimlerine sahip olmayı tercih etmektedirler. (Yazıcı,2019.s 99)

ARAŞTIRMA VE BULGULAR

Araştırmanın Adı

Sürdürülebilir yeni lüks markaların Y ve Z kuşaklarının satın alma niyetleri ve tüketici davranışları üzerine etkisinin cinsiyet ve gelir durumu açısından analizi

Araştırmanın Önemi

Araştırmanın ana kütlesini tüketiciler oluşturmaktadır. Ana kütlenin tamamına ulaşmak mümkün olmadığından örnekleme yoluna gidilmiş, Türkiye'de yaşayan 424 tüketicilerden veri anket yöntemi ile toplanmıştır.

Araştırmanın zaman ve bütçe kısıtından dolayı, tesadüfi olmayan örnekleme yöntemlerinden kolayda örnekleme yönteminin kullanılması uygun görülmüştür. Kolayda örnekleme yöntemi, kısıtlar nedeniyle araştırmaya katılacak kişilerin ulaşılabilirliğine göre tercih edilir. Ayrıca, araştırmacılar tarafından sıklıkla kullanılan bu yöntem ile, tesadüfi yöntemlere göre daha iyi sonuçlar alınması olasıdır (Yükselen, 2008)

Araştırmanın Örneklemi ve Yöntemi

Bu araştırma ilişkisel tarama modelinde desenlenmiştir. İlişkisel model, bir ya da birden fazla değişken arasında ilişkinin belirlendiği modeldir (Fraenkel ve Wallen, 2005). Bu araştırma özelinde, tüketicilerin sürdürülebilirliklerinin(sürdürülebilirlik algılarının) marka tercihleri ve satın alma niyetlerine olan etkisi incelenmiştir.Veriler anket yöntemi kullanılarak toplanmış ve bu formun giriş bölümünde katılımcılara kişisel verilerinin gizlilik prensibine göre değerlendirileceği ifade edilerek sadece akademik bir araştırmada kullanılacağı belirtilmiştir.

Katılımcılar tarafından cevaplanan anket dört bölümden oluşmaktadır. Birinci bölümde tüketicilerin kişisel özelliklerine ilişkin cinsiyet, yaş ve gelir durumu ile ilgili üç soruya verdikleri cevaplara yer verilmiştir.İkinci bölümde ise Kim ve diğerleri (2015) tarafından geliştirilen ölçeğe yer verilmiştir. Ölçek ekonomik sürdürülebilirlik, sosyal sürdürülebilirlik ve çevresel sürdürülebilirlik olmak üzere toplam 3 boyutu ölçmektedir. Ölçek, 5'li Likert ölçeğinde (5: kesinlikle katılıyorum, 1: kesinlikle katılmıyorum) üzenlenmiş toplam 14 ifade içermektedir. Ölçekte ekonomik sürdürülebilirlik boyutu altında 3 ifade yer almaktadır (Örnek ifade: "Marka mali açıdan hesap verebilir (şeffaf politikaları olan) bir markadır."). Ölçekte yer alan sosyal sürdürülebilirlik boyutu toplam 6 ifadeden oluşurken (örnek ifadeler: "Marka, toplumsal katkı sağlayan bir markadır."; "Marka, insan haklarını dikkate almaktadır."); çevresel sürdürülebilirlik boyutu ise toplam 5 ifade içermektedir (örnek ifadeler: "Marka, çevre dostu ürünler üretmektedir."; "Marka, çevre için yatırımda bulunmaktadır."). Ölçekten alınan yüksek puan katılımcının ilgili boyutta olumlu bir değerlendirme yaptığını, düşük puan ise tam tersi bir

durumu göstermektedir.Anket formunun üçüncü bölümünde tüketicilerin marka tercihlerini değerlendirmek amacıyla Sirgy ve diğerleri (1991) tarafından geliştirilen Davies, Veloutsou ve Costa (2006) tarafından uyarlanan Marka Tercihi ölçeği kullanılmıştır. Ölçek, 5'li Likert ölçeğinde (5: kesinlikle katılıyorum, 1: kesinlikle katılmıyorum) düzenlenmiş toplam 3 ifade içermektedir). Dördüncü bölümde ise Satın alma niyetini değerlendirmek amacıyla Satınalma Niyeti ölçeği ise Wongpitch ve diğerlerinin 2016 yılında yapmış oldukları çalışmadan alınan Satınalma Niyeti ölçeği kullanılmıştır. Ölçek, 5'li Likert ölçeğinde (5: kesinlikle katılıyorum, 1: kesinlikle katılmıyorum) düzenlenmiş toplam 3 ifade içermektedir.

Araştırma Soruları

1. X ve Z kuşaklarının sürdürülebilir yeni lüks markaları tercih etme, satın alma ve sürdürülebilirlik boyutları üzerinde cinsiyet faktörünün etkisi nedir?
2. X ve Z kuşaklarının sürdürülebilir yeni lüks markaları tercih etme, satın alma ve sürdürülebilirlik boyutları üzerinde gelir durumunun etkisi nedir?
3. X ve Z kuşaklarının sürdürülebilir yeni lüks markaları tercih etme, satın alma ve sürdürülebilirlik boyutları üzerinde yaş faktörünün etkisi nedir?

BULGULAR

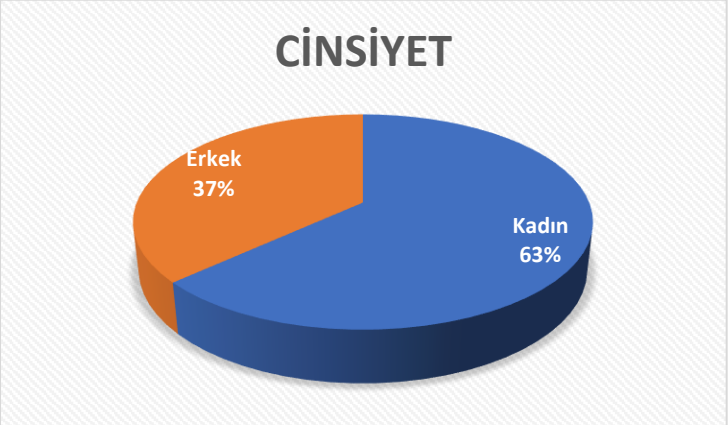
Cinsiyet Bulguları

Tablo 2 Tüketicilerin Cinsiyete Göre Dağılımları N=424

	Kişisel Özellikler	f	%
Cinsiyet	Kadın	268	63,2
	Erkek	156	36,8

Tablo 2'De görüldüğü üzere tüketicilerin 156'sı (%36,8) erkek ve 268'i (%63,2) kadın katılımcılardan oluşmaktadır.

Tüketicilerin Cinsiyet Dağılımlarına Yönelik Pasta Grafiği



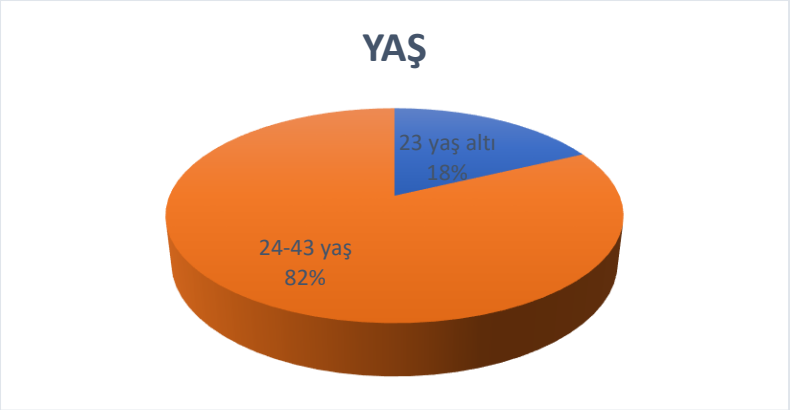
1. Yaş Bulguları

Tablo3 Tüketicilerin Yaş Durumlarına Göre Dağılımları N=424

	Kişisel Özellikler	f	%
Yaş Durumu	23 yaş altı	76	17,9
	24-43 yaş	348	82,1

Tablo 3'de görüldüğü üzere tüketicilerin yaş durumları incelendiğinde; 348'i (%82,1) 23-43 yaş aralığında ve 76'sı (%17,9) 23 yaş altı olduğu belirlenmiştir.

Tüketicilerin Yaş Dağılımlarına Yönelik Pasta Grafiği



Gelir Düzeyi Bulguları

Tablo 4 Tüketicilerin Gelir Düzeyi Durumuna Göre Dağılımları N=424

	Kişisel Özellikler	f	%
Gelir Düzeyi	11.402 TL ve altı	32	7,5
	11.403-17.500 TL arası	96	22,6
	17.501 – 22.500 TL arası	48	11,3
	22.501 TL ve üzeri	248	58,5

Tablo 4'te görüldüğü üzere tüketicilerin gelir düzeyi durumları incelendiğinde; 32'si (%7,5) 11.402 TL ve altı, 96'sı (%22,6) 11.403-17.500 TL arası, 48'i (%11,3) 17.501 – 22.500 TL arası ve 248'i (%58,5) 22.501 TL ve üzeri gelire sahip olduğu belirlenmiştir.

Tüketicilerin Gelir Düzeyi Dağılımlarına Yönelik Pasta Grafiği



DEĞERLENDİRME

Cinsiyet Durumu Değişkenine Göre Değerlendirme

Çalışmanın bu kısmında araştırma grubunu teşkil eden tüketicilerin cinsiyet durumu dağılımlarına göre değişkenlerden elde edilen ortalama puanlar arasındaki farklılaşmalar t Testi ile değerlendirilecektir.

Tablo 5 Tüketicilerin Cinsiyet değişkenine göre ***Marka Tercihleri Satın alma Niyeti ve Sürdürülebilirlik*** Ölçekleri ve Alt Boyutlarından Elde Edilen Puan Ortalamalarının Karşılaştırılması

Değişkenler	Cinsiyet Durumu	N	X̄	SS	t	p
Marka Tercihleri	Kadın	268	3,51	1,17	2,867	,004*
	Erkek	156	3,17	1,20		
Sürdürülebilirlik	Kadın	268	3,64	,95	3,456	,001*
	Erkek	156	3,32	,89		
Ekonomik sürdürülebilirlik	Kadın	268	4,09	1,06	2,415	,016*
	Erkek	156	3,83	1,09		
Sosyal sürdürülebilirlik	Kadın	268	3,50	1,20	3,662	,000*
	Erkek	156	3,08	1,02		
Çevresel sürdürülebilirlik	Kadın	268	3,34	1,22	2,546	,011*
	Erkek	156	3,05	1,02		
Satınalma Niyeti	Kadın	268	3,58	1,19	4,886	,000*
	Erkek	156	3,00	1,17		

*p<.05

Analiz sonucuna göre (Bkz. Tablo 5) tüketicilerin cinsiyet durumu ile Marka Tercihleri (t:2,867, p<.05) Sürdürülebilirlik (t:3,456, p<.05) ve alt boyutları Ekonomik sürdürülebilirlik (t:2,415, p<..05), Sosyal sürdürülebilirlik (t:3,662, p<.05) ve Çevresel sürdürülebilirlik (t:2,546, p<.05), Satınalma Niyeti (t:4,886, p<.05) arasında anlamlı bir fark vardır.

Kadın tüketicilerin Marka Tercihleri puan ortalamalarının ($\bar{X}$=3,51) erkek tüketicilerin Marka Tercihleri puan ortalamalarından ($\bar{X}$=3,17) istatiksel olarak daha yüksek olduğu belirlenmiştir. Kadın tüketicilerin Sürdürülebilirlik puan ortalamalarının ($\bar{X}$=3,64) erkek tüketicilerin Sürdürülebilirlik puan ortalamalarından ($\bar{X}$=3,32) istatiksel olarak daha yüksek olduğu belirlenmiştir.Kadın tüketicilerin Ekonomik sürdürülebilirlik toplam puan ortalamalarının ($\bar{X}$=4,09) erkek tüketicilerin Ekonomik sürdürülebilirlik ortalamalarından ($\bar{X}$=3,83) istatiksel olarak daha yüksek olduğu saptanmıştır.Kadın tüketicilerin Sosyal sürdürülebilirlik ortalamalarının ($\bar{X}$=3,50) erkek tüketicilerin Sosyal sürdürülebilirlik ortalamalarından ($\bar{X}$=3,08) istatiksel olarak daha yüksek olduğu saptanmıştır.Kadın tüketicilerin alt boyut Çevresel sürdürülebilirlik puan ortalamalarının ($\bar{X}$=3,34) erkek tüketicilerin alt boyut Çevresel sürdürülebilirlik ortalamalarından ($\bar{X}$=3,05) istatiksel olarak daha yüksek olduğu saptanmıştır. Kadın tüketicilerin Satınalma Niyeti ortalamalarının ($\bar{X}$=3,58) erkek tüketicilerin Satınalma Niyeti ortalamalarından ($\bar{X}$=3,00) istatiksel olarak daha yüksek olduğu saptanmıştır.

Yaş Durumu Değişkenine Göre Değerlendirme

Tablo 6 Tüketicilerin Yaş Durumu değişkenine göre ***Marka Tercihleri Satınalma Niyeti ve Sürdürülebilirlik*** Ölçekleri ve Alt Boyutlarından Elde Edilen Puan Ortalamalarının Karşılaştırılması

Değişkenler	**Yaş**	**N**	**$\bar{X}$**	**SS**	**t**	**p**
Marka Tercihleri	23 yaş altı	76	3,49	1,13	,842	,400
	24-43 yaş	348	3,36	1,21		
Sürdürülebilirlik	23 yaş altı	76	3,52	,72	,001	,999
	24-43 yaş	348	3,52	,99		
Ekonomik sürdürülebilirlik	23 yaş altı	76	3,86	,89	-1,198	,231
	24-43 yaş	348	4,02	1,11		
Sosyal sürdürülebilirlik	23 yaş altı	76	3,23	1,02	-,984	,326
	24-43 yaş	348	3,37	1,18		
Çevresel sürdürülebilirlik	23 yaş altı	76	3,48	,89	2,110	,035*
	24-43 yaş	348	3,18	1,20		
Satınalma Niyeti	23 yaş altı	76	3,18	1,27	-1,528	,127
	24-43 yaş	348	3,41	1,20		

*p<.05

Analiz sonucuna göre (Bkz. Tablo 6) tüketicilerin yaş durumu ile Marka Tercihleri (p>.05) Sürdürülebilirlik (p>.05) ve alt boyutları Ekonomik sürdürülebilirlik (p>.05), Sosyal sürdürülebilirlik (p>.05) ve Satınalma Niyeti (p>.05) arasında anlamlı bir fark yok iken Çevresel sürdürülebilirlik (t:2,110, p<.05) arasında anlamlı bir fark olduğu belirlenmiştir.

23 yaş altı tüketicilerin alt boyut Çevresel sürdürülebilirlik puan ortalamalarının ($\bar{X}$=3,48) 24-43 yaş tüketicilerin alt boyut Çevresel sürdürülebilirlik ortalamalarından ($\bar{X}$=3,18) istatiksel olarak daha yüksek olduğu saptanmıştır.

Gelir Durumu Değişkenine Göre Değerlendirme

Çalışmanın bu kısmında araştırma grubunu teşkil eden tüketicilerin gelir durumu dağılımlarına göre değişkenlerden elde edilen ortalama puanlar arasındaki farklılaşmalar ANOVA Testi ile değerlendirilecektir. Tablo 7 Tüketicilerin Gelir Durumu değişkenine göre

Marka Tercihleri Satınalma Niyeti ve Sürdürülebilirlik Ölçekleri ve Alt Boyutlarından Elde Edilen Puan Ortalamalarının Karşılaştırılması

Değişkenler	Gelir Durumu	N	$\bar{X}$	SS	F	p
Marka Tercihleri	11.402 TL ve altı(1)	32	3,83	,66	5,104	,002* 3>2,4**
	11.403-17.500 TL arası(2)	96	3,28	1,60		
	17.501–22.500 TL arası(3)	48	3,86	1,10		
	22.501 TL ve üzeri(4)	248	3,28	1,04		
Sürdürülebilirlik	11.402 TL ve altı(1)	32	3,74	,49	11,698	,000* 2,3>4**
	11.403-17.500 TL arası(2)	96	3,78	1,08		
	17.501–22.500 TL arası(3)	48	3,98	,87		
	22.501 TL ve üzeri(4)	248	3,31	,89		
Ekonomik sürdürülebilirlik	11.402 TL ve altı(1)	32	4,17	,94	8,064	,000* 2,3>4**
	11.403-17.500 TL arası(2)	96	4,17	1,11		
	17.501–22.500 TL arası(3)	48	4,53	,57		
	22.501 TL ve üzeri(4)	248	3,80	1,11		
Sosyal sürdürülebilirlik	11.402 TL ve altı(1)	32	3,46	,87	9,964	,000* 2,3>4**
	11.403-17.500 TL arası(2)	96	3,64	1,25		
	17.501–22.500 TL arası(3)	48	3,90	1,13		
	22.501 TL ve üzeri(4)	248	3,11	1,09		
Çevresel sürdürülebilirlik	11.402 TL ve altı(1)	32	3,60	,73	7,330	,000* 1,2,3>4**
	11.403-17.500 TL arası(2)	96	3,53	1,21		
	17.501–22.500 TL arası(3)	48	3,50	1,34		
	22.501 TL ve üzeri(4)	248	3,02	1,09		
Satınalma Niyeti	11.402 TL ve altı(1)	32	3,58	1,05	7,430	,000* 3>2,4**
	11.403-17.500 TL arası(2)	96	3,44	1,35		
	17.501–22.500 TL arası(3)	48	4,03	,85		
	22.501 TL ve üzeri(4)	248	3,18	1,19		

*p<.05, **Grup Farkı

Analiz sonucuna göre (Bkz. Tablo 7) tüketicilerin gelir durumu ile Marka Tercihleri (F:5,104, p<.05) Sürdürülebilirlik (F:11,698, p<.05) ve alt boyutları Ekonomik sürdürülebilirlik (F:8,064, p<..05), Sosyal sürdürülebilirlik (F:9,964, p<.05) ve Çevresel sürdürülebilirlik (F:7,330, p<.05), Satınalma Niyeti (F:7,430, p<.05) arasında anlamlı bir fark vardır.

Geliri 17.501–22.500 TL arası olan tüketicilerin Marka Tercihleri puan ortalamalarının ($\bar{X}$=3,86) geliri 22.501 TL ve üzeri olan tüketicilerin Marka Tercihleri puan ortalamalarından ($\bar{X}$=3,28) ve geliri 11.403-17.500 TL arası olan tüketicilerin Marka Tercihleri puan ortalamalarından ($\bar{X}$=3,28) istatiksel olarak daha yüksek olduğu belirlenmiştir.

Geliri 11.403-17.500 TL arası olan tüketicilerin Sürdürülebilirlik puan ortalamalarının ($\bar{X}$=3,78) ve geliri 17.501–22.500 TL arası olan tüketicilerin Sürdürülebilirlik puan ortalamalarının ($\bar{X}$=3,98) geliri 22.501 TL ve üzeri olan tüketicilerin Sürdürülebilirlik puan ortalamalarından ($\bar{X}$=3,31) istatiksel olarak daha yüksek olduğu belirlenmiştir.

Geliri 11.403-17.500 TL arası olan tüketicilerin Ekonomik sürdürülebilirlik puan ortalamalarının ($\bar{X}$=4,17) ve geliri 17.501–22.500 TL arası olan tüketicilerin Ekonomik sürdürülebilirlik puan ortalamalarının ($\bar{X}$=4,53) geliri 22.501 TL ve üzeri olan tüketicilerin Ekonomik sürdürülebilirlik ortalamalarından ($\bar{X}$=3,80) istatiksel olarak daha yüksek olduğu saptanmıştır.

Geliri 11.403-17.500 TL arası olan tüketicilerin Sosyal sürdürülebilirlik ortalamalarının ($\bar{X}$=3,64) ve geliri 17.501–22.500 TL arası olan tüketicilerin Sosyal sürdürülebilirlik ortalamalarının ($\bar{X}$=3,90) geliri 22.501 TL ve üzeri olan tüketicilerin Sosyal sürdürülebilirlik ortalamalarından ($\bar{X}$=3,11) istatiksel olarak daha yüksek olduğu saptanmıştır.

Geliri 11.402 TL ve altı olan tüketicilerin alt boyut Çevresel sürdürülebilirlik ortalamalarının ($\bar{X}$=3,60), geliri 11.403-17.500 TL arası olan tüketicilerin alt boyut Çevresel sürdürülebilirlik puan ortalamalarının ($\bar{X}$=3,53) ve geliri 17.501–22.500 TL arası olan tüketicilerin Çevresel sürdürülebilirlik ortalamalarının ($\bar{X}$=3,50) geliri 22.501 TL ve üzeri olan tüketicilerin Çevresel sürdürülebilirlik ortalamalarından ($\bar{X}$=3,02) istatiksel olarak daha yüksek olduğu saptanmıştır.

Geliri 17.501–22.500 TL arası olan tüketicilerin Satınalma Niyeti ortalamalarının ($\bar{X}$=4,03) geliri 11.403-17.500 TL arası olan tüketicilerin alt boyut Satınalma Niyeti puan ortalamalarından ($\bar{X}$=3,44) ve geliri 22.501 TL ve üzeri olan tüketicilerin Satınalma Niyeti ortalamalarından ($\bar{X}$=3,18) istatiksel olarak daha yüksek olduğu saptanmıştır.

SONUÇ VE ÖNERİLER

Bu araştırmada sürdürülebilir yeni lüks markaların Y ve Z kuşaklarının satın alma niyetleri ve tüketici davranışları üzerinde etkisini cinsiyet ve gelir durumu açısından analiz edilmiştir. Demografik faktörlerden cinsiyet ve gelir durumu, satın alma niyeti ve davranışı üzerinde etkili olan önemli iki faktördür.Türkiye'deki Y ve Z kuşaklarını temsil eden tesadüfi olmayan örnekleme yöntemiyle seçilmiş 424 tüketiciden, kadın tüketicilerin erkek tüketicilere kıyasla, marka tercihleri, satın alma niyeti ve sürdürülebilirlik (ekonomik, çevresel, sosyal) anlamda istatiksel olarak daha yüksek olduğu saptanmıştır.Lüks markalar, toplum içinde prestij ve statü sembolleri olarak kabul edildiğinden, kadınlar lüks markaları tercih ederek sosyal çevrelerinde prestij kazanmayı amaçlamaktadırlar. Bireylerin kişisel tarzlarını ifade etmelerine yardımcı olabildikleri için, lüks ürünleri giyerek kendi benzersiz tarzlarını vurgulamak istemektedirler. Ayrıca lüks markalar genellikle yüksek kalite ve dayanıklılıkla ilişkilendirilir. Bu yüzden de kadınlar uzun süre kullanabilecekleri kaliteli ürünleri tercih etmektedirler. Lüks alışveriş, insanlara tatmin ve mutluluk hissi verdiğinden, kadınlar, lüks ürünleri satın alarak kendilerini ödüllendirmek istemektedirler.Demografik faktörlerden bir diğeri olan gelir düzeyine baktığımızda da, 17.501-22.500TL olan tüketicilerin marka tercihleri ve satın alma niyetleri diğer gelir durumlarına göre yüksektir. 11.403-17.500 gelir durumuna sahip tüketiciler, sürdürülebilirlik, ekonomik ve sosyal sürdürülebilirlik istatistiklerinde daha önemsedikleri ortaya çıkmaktadır. 11.402 ve altı gelir durumuna sahip tüketicilerin ise, çevresel sürdürülebilirlik istatistiklerinde daha hassas olduğu görülmektedir. Alıcıların kararlarında; alıcının yaşı, mesleği, ekonomik durumu, yaşam tarzı, kişiliği ve benlik kavramı gibi kişisel özelliklerin etkisi büyüktür. Bu nedenle satın alma davranışını etkileyen "kültürel faktörler", "sosyal faktörler", "psikolojik faktörler" ve "kişisel faktörler" üzerinde de gerekli çalışmalar yapılmalıdır. Gelecekte bu konu ile ilgili hem belirtilen faktörler değerlendirilmeli, hem de medeni hali ve eğitim durumu da değişkenlerin içinde olmalıdır.

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FLAT KARAKTER TASARIMI; JETGİLLER ÖRNEĞİ

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Özet
Flat tasarımı ‘‘Düz Tasarım’’ sadeliğin ön planda olduğu minimalist bir tasarım stilidir. Modern, yalın ve temiz bir görünüm hedeflemektedir. Genellikle gölge ve kabartma gibi efektler yerine daha çok basit ve modern şekiller, düz renkler, keskin ve iki boyutlu tasarım dili kullanmaktadır. Üç boyuttan uzak bir yaklaşımı esas aldığı ve aynı zamanda geniş canlı renk skalası kullandığı gözlemlenmektedir. Teknolojinin gelişmesi ile birlikte günümüzde görsel tüketim hızı artmış, basılı ya da basılı olmayan grafik tasarım ürünlerinde, tablet ve telefonlardaki görsel imgelerde, arayüz sayfa tasarımlarında flat tasarım yaklaşımı görülmeye başlanmıştır. Günümüzde kullanım yaygınlığı devam eden bu tasarım yaklaşımının bugüne gelmesinde geçmiş dönem tasarım stillerinin etkisi de bulunmaktadır. İkinci Dünya Savaşı sonrası, 1940–1950’li yıllarda İsviçre’de modernist yaklaşımların görülmesi ve daha sonra popülerleşmesi, flat tasarım yaklaşımının ortaya çıkışı olarak kabul edilmektedir. Bu yaklaşım üzerinden yine aynı dönemlerde Hanna–Barbera yapım şirketi tarafından üretilen ve ABC kanalında (American Broadcasting Company) yayınlanan bir durum komedisi (sitcom) ve bilim kurgu aile çizgi dizisi olan Jetgiller’de de karakter ve mekân resimlemesinde flat tasarımı yaklaşımının uygulandığı gözlemlenmiştir. Bu çalışmada, flat karakter tasarımı yaklaşımı Jetgiller örneği üzerinden incelenecektir. Araştırmada nitel araştırma yöntemlerinden betimsel tarama modeli kullanılacak olup, flat tasarım anlayışının Jetgiller çizgi dizisindeki karakter tasarımlarına nasıl uygulandığı tasarım öğeleri üzerinden incelenecektir.
Anahtar Kelimeler: Grafik Tasarım, Flat Tasarımı, İllüstrasyon, Karakter Tasarımı, Minimalizm.

FLAT CHARACTER DESING; THE EXAMPLE OF THE JETSONS

Abstract
Flat design is a minimalist design style where simplicity is at the forefront. It aims for a modern, simple and clean look. It generally uses simple and modern shapes, solid colors, sharp and two-dimensional design language instead of effects, such as shadow and relief. It is observed that it is based on an approach far from three dimensions and at the same time uses a wide range of vibrant colors. With the development of technology, the speed of visual consumption has increased, and flat design approach has started to be seen in printed or non-printed graphic design products, visual images on tablets phones and interface page designs. This design approach, which continues to be widely used today, has also influenced by the design styles of the past. The emergence and subsequent popularization of modernist approaches in Switzerland in the 1940s-1950s, after the Second World War, is accepted as the emergence of the flat design approach. Based on this approach, it was observed that flat design approach was applied in character and space illustrations in The Jetsons, a sitcom and science fiction family cartoon series produced by Hanna-Barbera production company and broadcast on ABC channel (American Broadcasting Company). In this study, flat character design approach will be analyzed through the example of The Jetsons. The descriptive survey model, one of the qualitative research methods, will be used in the study, and how the flat design approach is applied to the character designs in the Jetgiller cartoon series will be examined through design elements.
Keywords: Graphic Design, Flat Design, Illustration, Character Design, Minimalism.

GİRİŞ

Grafik tasarım alanlarından biri olan illüstrasyon, görsel ifade dilini kullanarak bir metnin, düşüncenin ya da herhangi bir olayın izleyiciye ulaşmasını hedeflemektedir. Geçmişten günümüze teknolojinin gelişmesi ile birlikte resimleme olarak ta bilinen illüstrasyonun, çizim ve boyama teknikleri tablet ve bilgisayar ortamına taşınmıştır. Bununla birlikte dijital bağlamda illüstrasyon; çizgi diziler, animasyon filmleri, oyunlardaki mekân ve karakter tasarımları, üç boyutlu modellemeler üzerinde varlığını sürdürmektedir. İllüstrasyon temelli çizgi diziler, mekân ve karakter tasarımlarının yanı sıra ışık, gölge, doku, çizgi, açı, renk dinamiğinin sağladığı etkiler ile birlikte çocukların hayal dünyasını genişletmeyi amaçlamaktadır.Çocukların hayal dünyasının genişlemesi, iyi bir gözlemci olmaları üzerinden tanımlanabilir. ‘‘Görme konuşmadan önce gelmiştir. Çocuk konuşmaya başlamadan önce bakıp tanımayı öğrenir.’’ der sanat eleştirmeni ve yazar John Berger. Berger’in bu sözünden yola çıkarak çizgi dizilerde ki illüstratif öğelerin, çocuklara görsel etki yaratarak merak duygusunun gelişmesinde katkı saylayabileceği gibi eğitici ve öğretici olarak bilgi aktarım sürecinin de daha güçlü olabileceği söylenebilir. Günümüz çizgi dizilerinde olduğu gibi geçmiş dönem çizgi dizilerinde de bu unsurlar ön plana çıkmaktadır.Araştırmanın konusu olan Jetgiller çizgi dizisinin illüstratif anlatısal ifadesinde flat tasarım yaklaşımı olduğu gözlenmektedir. Jetgiller, 1962-63 yılları arasında yayınlanmış olsa da fütüristik anlatımı olan bir televizyon dizisidir ve aynı dönemlerde hayat bulmaya başlayan flat tasarımı yaklaşımı etkisi görülmektedir. Çalışmanın amacı, flat karakter tasarımı üzerinden Jetgiller örneği ile incelenip illüstratif dilde karakter resimlemesi hakkında bilgi vermektir. Araştırma, nitel araştırma yöntemlerinden betimsel tarama modeli ile internet ve kitap kaynaklarından elde edilen verilerle sınırlıdır. Çalışmanın konusu, görsel örnekler ile birlikte incelenmiş olup daha geniş bir biçimde bir araya getirilmeye çalışılmıştır. Elde edilen gözlem ve bulgular ışığında detaylıca incelenebilir.

FLAT TASARIM

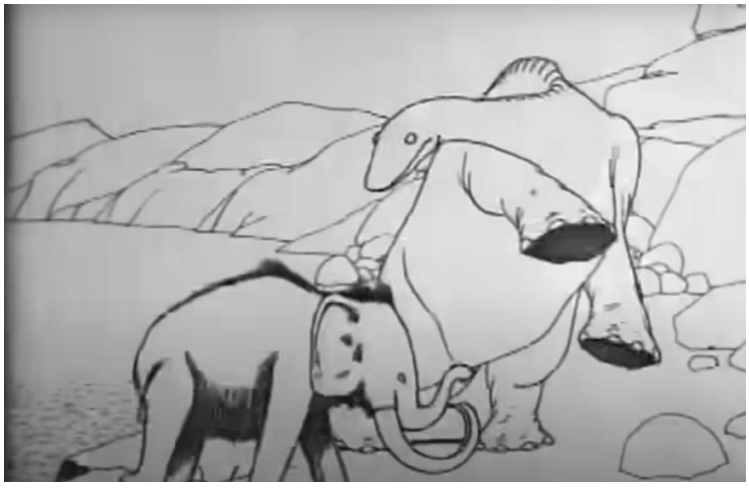
Grafik sanatı, sanat tarihinde yerini almaya başladığından günümüze kadar çeşitli sanat akımlarından etkilenmiş farklı tarz ve tekniklerde karşımıza çıkmıştır. Tasarımcının yaşadığı dönemin sanat anlayışı ve toplumun kültürel yapısı yaptığı tasarımları da etkilemiştir (Becer, 2011, s.101). İngilizce kökenli olan flat kelimesinin Türkçe anlamı ‘‘düz’’ olarak söylenebilir. Düz kelimesini ise Türk Dil Kurumu (TDK) şöyle tanımlamıştır: ‘‘Yatay durumda olan, eğik ve dik olmayan, kıvrımlı olmayan; doğru, stabil. Yalın, sade, süssüz olan, desensiz’’(www.sozluk.gov.tr). Flat tasarım yaklaşımının tasarım dilinin bu tanımlamaya uygun olduğu söylenebilir.

Flat tasarım yaklaşımı günümüz tasarımlarında anlatı dili olarak popülerliğini koruyor olsa da aslında kökeni 1940-1950'li yıllara dayanmaktadır. Evrensel tasarım anlayışı olarak ''Uluslararası Tipografik Üslup'' veya ''İsviçre Tasarımı'' adı verilen stilin yansıması olduğu söylenebilir. Grafik tasarımın gelişmesinde ve grafik tasarım eğitiminin temelini oluşturan İsviçre stili, aktarılmak istenen mesajı matematiksel olarak çizilmiş kanava (grid) sistemi üzerinden net, sade, abartmalardan uzak, serifsiz yazı karakterleri ve basit geometrik şekillerle anlatmayı hedeflemiştir. İsviçre tasarım üslubunun görsel alfabesini oluşturan öğelerini, Becer (2020) ise şu şekilde açıklamıştır;"Matematiksel bir grid çizimi üzerinde asimetrik olarak düzenlenmiş tasarım unsurları ile oluşturulan görsel bütünlük, serifsiz yazı karakterleri kullanımı, genellikle soldan bloklanan, sağda serbest ve değişken satır uzunluklarına dayalı bir tipografik kompozisyon anlayışı, sözel ve görsel bilgileri açık ve berrak bir tasarım anlayışıyla ileten nesnel metin ve fotoğraflar, ticari reklamcılık ve propagandanın abartılı dilinden uzak, bağımsız bir tasarım anlayışı" (Becer, 2020, s. 264). Flat tasarım yaklaşımının kökeninde etkilendiği bir diğer sanat akımı ise minimalizm olduğu söylenebilir. Minimalizmin, grafik tasarım alanında ki etkisini İsviçre'de doğan uluslararası tipografik stil döneminde bulabiliriz. Minimalizm 1950'lerin sonlarında ortaya çıkarak netliği, saflığı ve sadeliği vurgulamıştır. Bu sanat akımının anlatı dili; detaylardan arındırılmış, illüzyon ve efektlerden uzak, anlaşılır olmasıdır. Dönemin modernist mimarlarından "Fakirlik, yoksunluk, eksiklik değildir. Minimalizm; aksine bilinçli bir tercihtir, zor olanı seçmektir, azla çok yapmaktır." sözleriyle açıkladığı Minimalizm felsefesini ünlü "Less is more" sözüyle "Az çoktur" ifadesini kullanarak özetlemiştir (Islakoğlu, 2006, 4'ten akt. Döl ve Avşar, 2013).Bu ifadeden yola çıkarak flat tasarım yaklaşımı üzerinde minimalizm sanat akımının etkileri olduğu tespit edilebilir. Kökeninde minimalizm sanat akımını barındıran flat tasarım yaklaşımı minimalizme göre kullanım alanları çok daha esnektir; web siteleri, kurumsal kimlik tasarımları, mobil ara yüzler, oyun tasarımları, animasyonlar ve çizgi diziler gibi birçok alanda yetkinliğini sürdürmektedir. Flat tasarım yaklaşımı üç boyut hissiyatını oluşturma kaygısına sahip değildir. Bu nedenle efektlerden, abartılardan, süslemelerden uzak ve basit anlatımı benimsediği görülebilir. Bu tasarım yaklaşımı illüstratif anlatımlar üzerinden güncel uygulamalarda ve geçmiş uygulamalarda çok yaygın olarak kullanılmıştır. Bu uygulama alanlarından biriside karakter tasarımıdır.

KARAKTER TASARIMI

Oxford Advanced Learner's Dictionary (Oxford Gelişmiş Öğrenci Sözlüğü) karakter kelimesini: ''Bir kişiyi diğerlerinden farklı kılan tüm nitelikler ve özellikler'' olarak

tanımlamıştır(https://www.oxfordlearnersdictionaries.com/definition/english/character?q=character). Tasarım kelimesinin birçok anlamı olsa da tasarım yapmak, sonucu görmek ve ona ulaşmak konusunda hayal gücüyle ortaya konulan biçim, zihinde hayal etmek veya canlandırmak üzerinden tanımlanabilir. Geçmişten günümüze kadar teknolojinin de gelişmesi ile birlikte çizgi romanlar, animasyon filmleri, çizgi diziler, oyunlar, çocuk kitapları gibi birçok mecrada karakter tasarımı olduğu gözlemlenebilir. Karakterler sosyolojik, psikolojik ve fizyolojik açıdan topluma ve bireylere dair olgular barındırsa da uygulanan doğru karakter tasarımı izleyici tarafından kabul görünüp benimsenmesine olanak sağlayabilir. Bu süreçte çizerler, toplumda gözlemlemiş olduğu insan, nesne, mekân, hayvan gibi unsurlar üzerinden pek çok karaktere ait davranış biçimi yükleyebilir.Karakter tasarımının öncelikli olarak canlandırma sanatçıları ile ortaya çıktığı söylenebilir. Winsor McCay, Frank Moser, Early Hurd, Émile Cohl gibi sanatçılar ilk canlandırma sanatçıları olarak görülebilir. Bu sanatçılar tasarlamış olduğu karakterlerle birlikte yeni oluşturulacak olan karakter tasarımları için de hem ilham kaynağı hem de bir yol gösterici niteliğini taşımaktadır. Bir örnek olarak Winsor Zenic McCay (1869-1934) gazete karikatüristi olarak bilinmektedir. McCay'in çalışması olan Dinozor Gertie (Gertie the Dinosaur (1914)) ile izleyicilere çizgi film karakterlerinin çizim aşamalarını göstermektedir (bkz Görsel 1). Bu çalışma, zoomorfizm olgusunun çizgi karakterler üzerinde ki ilk örneği olarak görülmektedir. Gertie karakterinin verilen komutlara yanıt vermesi ve mamut karakterine alınganlık yaparak ağlaması, dans etmesi üzerinden dinazora karakter tasarımında insana özgü kavramlar yüklendiği görülmektedir.



Görsel 1: Winsor McCay, Dinozor Gertie, 1914.

Kaynak: https://www.youtube.com/watch?v=32pzHWUTcPc

Tasarlanan karakterler izleyicinin karaktere karşı yakın hissedebilmesi, her izleyicinin bir animasyon filminin içerisinde gündelik yaşamdan onu uzaklaştırabilecek karakterlerin olması,

karakterin ve öykünün anlamlı bağlantısı üzerine olan ilgi filmin izlenme olanağını arttırabilmektedir. Karakter tasarımı, günümüzde gelişen teknoloji ile birlikte birçok oyun, çizgi dizi, animasyon gibi alanları ilgilendiren sektörleri kapsamaktadır. Bu alanlar ile ilgilenen sektörler izleyicilerin veya oyuncuların bir ya da birden fazla kurgusal karakterlerin bulunduğu mecralarda hikâye anlatımı üzerinden karakterlerin farklılaşması için karakter tasarımına ihtiyaç duymaktadır.

KARAKTER TASARIM ÖĞELERİ

Karakterlerin birbirlerinden farklılaşabilmesi için ise tasarlanan karakterin form ve renk üzerinden oluşturulabilmesi olduğu söylenebilir. Karakterin kişiliğini sağlayan form ise tasarım kurallarına uygun olarak anatomik oranlar içerisinde verilmesi gerekmektedir. Form, karakterin kolaylıkla ayırt edilebilecek bir siluete sahip olmaları açısından önemli sayılabilecek bir unsur olarakta görülebilir. Tasarlanan karaktere uyum sağlayacak olan kostüm ve aksesuarlar ise karakter tasarımında temel konuların içerisinde yer almaktadır. Karakter tasarımında form, genel hatlarıyla birlikte kabaca geometrik şekillerden oluşmaktadır. Bu geometrik şekiller tasarlanan karakterin kişiliği hakkında ön bilgi niteliği taşıyabilir. Bu yüzden yaratılmak istenen karakter için tasarlanacak olan formun özellikleri de önemlidir. Üçgen formlar sivri tavrıyla hareket, hız, gerilim ve tehlike, yuvarlak formlar sevimlilik, cana yakınlık, mutluluk ve rahatlık, kare formlar ise öfke, güven, inatçılık, dayanıklılık gibi çağrışımlar yaratmaktadır. Karakterin tasarlanan formu onu özgün kılan ilk unsur olarak görülebilir fakat formun yanı sıra karakterin kolaylıkla tanınmasında yardımcı olan bir diğer nokta ise siluettir. Siluet, forma bağlı kalınarak oluşturulmuş olan gölge eş zamanlı olarakta karakterin sahip olduğu özgün bir detay olarak belirtilebilir. Form ve siluet birleştiğinde izleyicinin ya da okuyucunun görsel algısına hitap ederek karakteri ayırt edebilmesini sağlamaktadır. Bir çizer tasarladığı karakterin silueti ile karakterin formu, saçının şekli, kostüm ve aksesuarları vb. görsel unsurları algılamasını kolaylaştırabilir. Bu sayede çizerin iyi bir şekilde tasarladığı siluet, karakterin görsel kimliğinin bir parçası haline gelebilir. Çizerin tasarlamış olduğu form ve siluetin tasarım kurallarına uygun anatomik oran ve denge içerisinde olması da önemli bir unsurdur.Karakterin yapısı tasarlanacak olan form üzerinden belirli ölçü ve oran dahilinde olmalıdır. Karakterdeki anatomik yapısı ve bu yapıyı oluşturan parçalar; ağırlık, yaş ve boy onun fiziksel kapasitesi üzerinden bir sınırlılık yaratabilir. Karakterlerin birbirleri arasında oluşan farklılık ise oran-orantıyla ilgilidir. Tasarlanmak istenen karaktere ait farklılıkları vurgulamak ve daha anlaşılır olması için oran orantı ilişkisiyle birlikte denge unsurundan yararlanılır. Zafer Özden ve Çağdaş Ülgen (2015), karakterin kendi içerinde ki oranlarını şu şekilde açıklamışlardır:

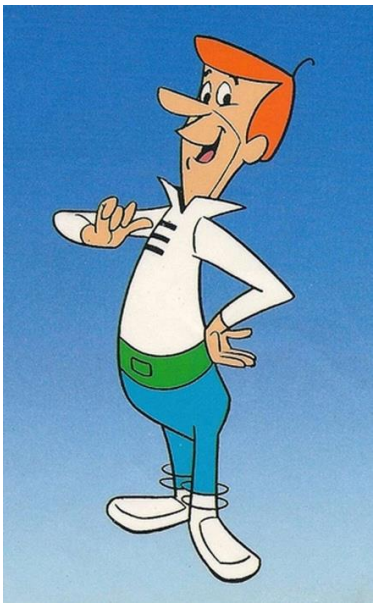
*''Beden oranları saptanırken, ölçüt olarak baş kullanılmaktadır. Beden tasarlanırken beden başa oranla oluşturulmaktadır. Canlandırma filmlerinde karakter tasarımları, genellikle karakterlerin özelliklerine bağlı olarak iki baş ile dokuz baş arasında bir ölçü değeri içinde yapılmaktadır''*Normal bir desen üzerinden değerlendirilecek olunursa bir insanın vücuduna oranı yedi-sekiz baş uzunluğu arasında değişmektedir. Bir çizer karakteri tasarlarken karakterin kişilik yapısıyla anatomik yapısının birbirleriyle uyumlu ve denge içerisinde olacak şekilde tasarlamaktadır. Sevimli bir karakterin formu yuvarlak olarak tasarlansa da bazen anatomik yapısı dengede olacak şekilde baş büyük, beden küçük olarak karşımıza çıkabilmektedir ya da baş küçük beden büyük olarak tasarlanan karakterler güçlü biri yenilmez bir karakter olarakta tanımlanabilmektedir. Karakterin kişilik özelliklerini belirleyen bir diğer unsur ise karakterde ki renk kullanımıdır.Renk, iletişimin doğal bir öğesi olarak sayılsa da insanlar için psikolojik etkileri olduğu gözlenmektedir. Bir bilgi yazılı olmasa dahi renkler aracılığı ile iletilmek istenen mesaj psikolojik bağlamda ve bilinçaltının etkisiyle insanların zihninde canlanabilmektedir. Renkler sıcak (sarı, kırımızı, turuncu) ve soğuk (mavi, yeşil, mor) olarak ikiye ayrılmaktadır. Genellikle sıcak renklerin insanları harekete geçirdiği ve canlılık uyandırdığı gözlenmektedir. Soğuk renklerin ise insanlarda sakinlik, güven ve rahatlık uyandırdığı söylenebilir. Algılama ve yorumlama üzerine renklerin döneme ve kültüre ait anlamlarının değişmesinden dolayı her bir rengin psikolojik etkisinin evrenselliğinden ve sürekliliğinden bahsetmek olumlu olmayabilir. Karakter tasarımında doğru renk dağılımının yapılması önemli bir unsurdur. Karakterlerin hareketlerinin rahatlıkla okunabilmesi, öykü ile birlikte karakterin kişilik özelliklerine ait renklerin seçilmesi ve karakterlerin bir araya geldiğinde anlamlı bir bütün oluşturabilmesi adına renkler karakter tasarımında önemli bir rol oynamaktadır. Karakter tasarımında renk kullanımının yanı sıra kostüm ve aksesuarlarda karaktere ayrıcalık kazandırabilmektedir.Karakter tasarımında kostüm ve aksesuar karakterin kişilik özelliklerini, bedensel özelliklerini, yaşadığı dönemi, içerisinde bulunduğu kültürü ve mesleği üzerine bilgi verme niteliği taşımaktadır. Karakter tasarımı yapılırken kostüm ve aksesuar (pelerin, şapka, baston, kılıç, çanta, vb.) karakterin formunu ve siluetini etkilediği gözlemlenmektedir. Bu nedenle karakterin kostüm ve aksesuar detayları tasarlanırken karakterin kişiliğine uyum sağlayacak ve bedensel görünümünü dikkate alınacak şekilde tasarlanması gerekmektedir. Karakter, hareket ve aksiyon yüklü ise tasarlanan kostüm ve aksesuarda izleyicide hareket uyandıracak nitelikte kıvrımlı çizgilere sahip olabilmektedir. Tam tersi karakter durağan bir kişiliğe sahip ise karakterin kostüm ve aksesuar tasarımında kullanılan çizgilerde sade, kıvrımdan uzak bir şekilde tasarlanabilmektedir. Karakter tasarımında form, siluet, anatomik

yapı, renk, kostüm ve aksesuar gibi karakter tasarım öğelerinin dışında karakterin dış görünüşünü, tarzını ve kişiliğini etkileyebilecek olan üslup öğelerinin olduğu söylenebilir.

Türk Dil Kurumu (TDK) üslup sözcüğünü şu şekilde tanımlamıştır: ‘‘Sanatçının görüş, duyuş ve anlayışındaki kendine özgü anlatış biçimi; biçem, hava, stil’’(www.sozluk.gov.tr). Üslup, karakter tasarımında karakterin tarzını ve kişiliğini yansıtmasında önemli bir rol oynamaktadır. Karakter tasarımında üslup, diğer tasarım öğelerinde olduğu gibi bütünlüğü etkileyebilmektedir. Karakter tasarım öğeleri, kullanılacak olan üsluba bağlı kalınacak ve uyumlu olunacak şekilde oluşturulmalıdır. Üslup aynı zamanda hedef kitleyi de oluşturabilmektedir. Karakter tasarımında kullanılan üslup basit ve sevimli ise çocuklar için tasarlanmış veya karmaşık detaylara yer veren gerçekçi bir üslup kullanılıyorsa yetişkinlere yönelik tasarlanmış olabilmektedir. Bu yaklaşımdan yola çıkılacak olursa bir çizerin tercih ettiği üsluba göre karakterlerin tasarımları da değişiklik gösterdiği söylenebilir. Bu araştırma kapsamında illüstrasyon alanı üzerinden karakter tasarım öğeleri ele alınarak Jetgiller çizgi dizisinin George, Jane, Judy, Elroy ve Astro karakterlerine günümüz tasarım üslubu olan flat yaklaşımının yansımaları incelenecektir.

FLAT TASARIM YAKLAŞIMINDA JETGİLLER KARAKTER TASARIM ÖRNEĞİ

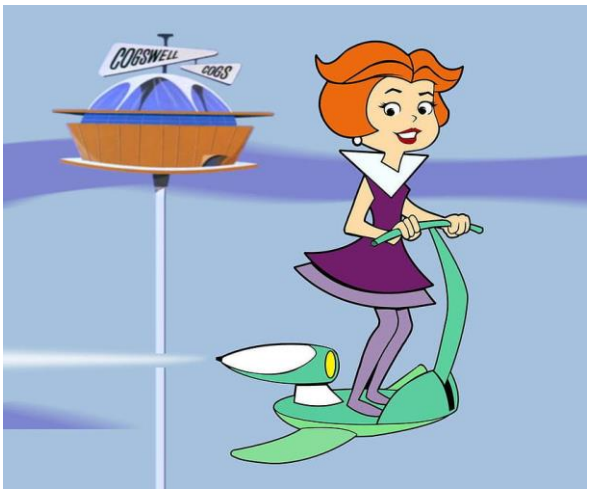
Jetgillerin yaratıcısı olan yapım ve yönetmen ekibi William Hanna ve Joseph Barbera olduğu bilinmektedir. 1950’lerin sonu ile 1960’ların ortası, Hanna ve Barbera’nın en yaratıcı dönemi olduğu söylenebilir. Hanna-Barbera Taş Devri, Ayı Yogi ve Jetgiller animasyon karakterleri ile ön plana çıkmaktadır. Jetgiller ilk olarak 1962-1963’e kadar eğlence kuşağı olarakta bilinen prime time’da yayınlanmış olup daha sonra 1985-87 arasında yeni bölümleri tekrar üretilip gösterime sunulmuştur (Matt Novak, 2012). Jetgiller çizgi dizisinin ilk gösterime sunulduğu tarihten önce ki dönemlerde flat üslubunun başlangıcı olarak kabul görüldüğü söylenebilir. Jetgiller çizgi dizisinin tasarım üslubunda flat yaklaşımının izleri olduğu görülmektedir. İncelenecek olan karakterlerden ilki George Jetson’ dır.George, jetgiller çizgi dizisinin kurgusal bir karakteri olup aynı zamanda Jetgiller ailesinde baba rolünü üstlenmektedir. Düzenli olarak işine gidip gelen bir çalışan olarak bilinmektedir. George karakterinin tasarımında kullanılan form yapısı, geometrik bir yapı olup sade şekliyle ön plana çıkmaktadır. Karakterin formunda ki hatlar kontur çizgileri ile desteklenmektedir. Karakterde gölge kullanılmamış olup aynı zamanda anatomik yapısının üç boyutluluktan uzak yalın bir şekilde ve iki boyutlu olarak tasarlandığı görülmektedir. Karakterde tasarlanan kostüm, mavi pantolon, yeşil kemer, beyaz gömlek ve ayakkabıdan oluşmaktadır. Karakterin beyaz ayakkabısının üzerinde birbirine paralel konumlanan çember şeklinde bir çeşit sade aksesuar bulunmaktadır (bkz. Görsel 2).



Görsel 2: George Jetson

Kaynak: https://adventures-of-chris-and-tifa.fandom.com/wiki/George_Jetson

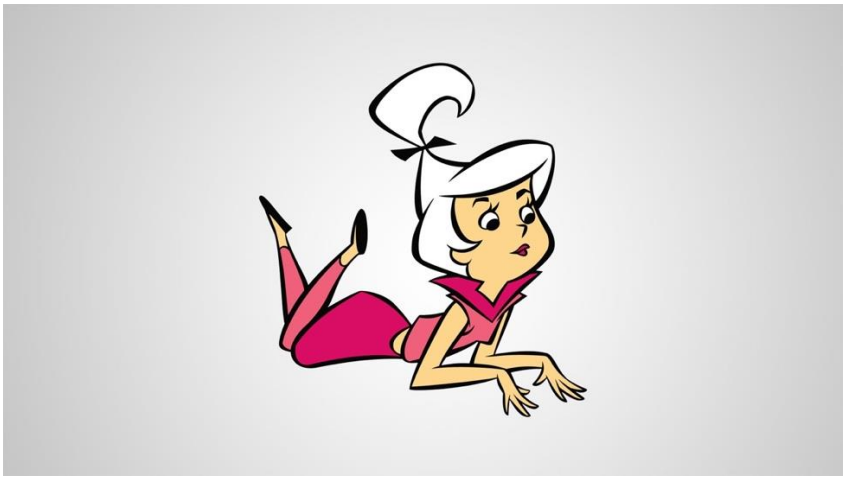
Jetgiller çizgi dizisinde inceleyecek olduğumuz bir başka karakter Jane Jetson' dır. Jane, Goerge karakterinin eşidir ve Jetgiller ailesinde anne rolünü üstlenmektedir. Jane bir ev hanımı aynı zamanda bakımlı olmayı ve alışverişi seven bir karakter olarak bilinmektedir. Karakterin form yapısı sade ve yalındır. Jane karakterinin formunu, kullanılan kontur çizgileri ön plana çıkarmaktadır. Karakterin iki boyutlu anatomik yapısı vardır. Jane üzerine tasarlanan kostüm sade bir elbise olup etek ucu detayı mor rengine yakın lila rengi tonuyla detaylandırıldığı gözlemlenmektedir. Karakterde sade yalın bir anlatımla inci küpeyi andıran bir aksesuar kullanıldığı görülmektedir (bkz. Görsel 3).



Görsel 3: Jane Jetson

Kaynak: https://www.pxfuel.com/en/desktop-wallpaper-aenlg

Jetgiler ailesinde incelenecek olan bir diğer karakter Judy Jetson'dır. Judy, George ve Jane'nin kızlarıdır. Jane daha çok fütüristik zevklere sahip olan bir kız olarak bilinmektedir. Karakterde kullanılan form yapısı sade bir geometrik şekle sahiptir. Judy karakterinin form yapısı kontur çizgileri kullanılarak desteklenmektedir. Karakterde gölge kullanılmamış olup iki boyutlu bir yapıya sahip olduğu gözlemlenmektedir. Judy karakterinin kostümü sade bir t-shirt, etek, çorap ve ayakkabıdan oluşmaktadır. Karakterin kostüm ayrıntıları fuşya renginin farklı tonları ile belirtilmektedir. Karakterde kullanılan toka aksesuarı sade, yalın, düz ve siyah renkli olduğu gözlemlenmektedir (bkz. Görsel 4).



Görsel 4: Judy Jetson

Kaynak:https://tv.apple.com/us/movie/rockin-with-judy-jetson/umc.cmc.6vb9xrmitrldndso0km1280xa

Jetson çizgi dizisinde incelenecek olan bir diğer karakter ise Elroy Jetson' dır. Elroy, Jetgiller ailesinin en küçük çocuğu olup George ve Jane'nin oğlu aynı zamanda Judy'nin erkek kardeşi olarak bilinmektedir. Elroy, oldukça zeki bir çocuk aynı zamanda uzay bilimlerine meraklı olmasıyla ön plana çıkmaktadır. Karakter için kullanılan form yalın geometrik şekillerden oluşmaktadır. Gölge kullanılmamış olup detaylar kontur çizgileri ile ele alınmış, yapısı iki boyutlu olarak ön plana çıkmaktadır. Karakterin kostüm tasarımında yeşil sade bahçıvan kıyafeti, basit beyaz t-shirt ve birbirine paralel olarak sade bir anlatımla tasarlanmış olan çember detaylı şapka kullanıldığı gözlemlenmektedir (bkz. Görsel 5).



Görsel 5: Elroy Jetson

Kaynak: https://warnerbros.fandom.com/wiki/Elroy_Jetson

Jetgiller çizgi dizinde son olarak incelenecek karakter Astro'dur. Astro, Elroy Jetson'ın evcil hayvanı, George Jetson'ın en iyi arkadaşı olarak ve George ile uzay yürüyüşü yapmaktan hoşlandığı bilinmektedir. Astro hayvan karakterinin geometrik formları yalın bir anlatımla köpeği betimlemektedir. Anatomik yapı olarak bir insan boyutu andırmakta olup iki boyutlu olarak tasarlandığı görülmektedir. Karakter, kullanılan kontur çizgileri ile ön plana çıkmaktadır. Aksesuar olarak yeşil sade ve basit bir tasma kullanıldığı gözlemlenmektedir (bkz. Görsel 6).



Görsel 6: Astro

Kaynak: https://animated-dogs.fandom.com/wiki/Astro

SONUÇ

İllüstrasyon alanında gerçekleştirilen uygulamaların çocuk ve yetişkin yönünden her yaşa hitap ettiği söylenebilir. Bununla birlikte resimlemenin eğlence sektöründe oyun, animasyon ve çizgi dizi gibi benzer birçok alanda farklı tasarım yaklaşımları ile ele alındığı gözlemlenebilmektedir. Günümüz teknolojisinin gelişmesiyle birlikte artan tüketim hızının tasarım yaklaşımlarına yansıması sade, net, abartılardan ve görsel efektlerden uzak okunabilirliği kolay ve akıcı olması yönünden flat tasarımı günümüz tasarımlarında güçlü bir anlatım tekniği olarak kullanılmaktadır. Bu yaklaşım türü hala popülerliğini koruyor olsa da geçmiş dönemlerin tasarım anlayışlarında da izleri görülmektedir.Araştırma kapsamında incelenen Jetgiller çizgi dizisinin, flat tasarım yaklaşımı ile ele alındığı saptanmıştır. Bu yaklaşımın yapısı ve var olan anlatım dili geçmiş dönem tasarım anlayışlarında var olduğu görülmüştür. Araştırma üzerinden sunulan örnekler, karakter tasarımları ve tasarım öğeleri açısından incelendiğinde günümüz flat tasarımının bir yansıması olarak karşımıza çıkmaktadır.

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EVALUATION OF GERTRUDE STEIN'S STUDIO IN THE CONTEXT OF POSTMODERN MUSEUM PRACTICES

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ABSTRACT

Today, museums are trying to adapt their exhibition and presentation techniques, approaches and practices to the environments in which new art is produced. In the definition of contemporary museum prepared by the International Council of Museums, it is emphasized that the museum is a non-profit, permanent institution that researches, collects, preserves, interprets, exhibits and is at the service of the society. Along with updating its functions with its new definition, the museum has become responsible for promoting diversity and sustainability as public, accessible and inclusive institutions. To provide a variety of experiences for education, entertainment and knowledge sharing; working ethically, professionally and with the participation of communities, as well as communicating with visitors and audiences, has been added to the definition as the functions that museums assume responsibility for. In this context, with the changing definition, important changes have started to occur in the content of museum visits and in the expectations of visitors. Museum visits, which have started to become individual journeys, become experiences that support lifelong learning with exhibitions that are created in accordance with this expectation that came to the fore with the new definition, and where principles such as "inclusivity", "learning by sharing", which are postmodern museum criteria, are focused and presented. In this study, the art studio of the American writer Gertrude Stein, which is described as “the first museum of modern art", is discussed through the concept of contemporary micro-museum. In this context, examples of museums that are open to diversity, encouraging intercultural communication, organized around Gertrude Stein's "salon-studio model" have been assessed in Turkey. The Adam Michiewicz Museum, Doğançay Museum, Orhan Kemal Museum and Ara Güler Museum in Istanbul, which are thought to be suitable for the salon-studio model in terms of content, were examined. it has also been discussed how the dissemination of the salon-studio model will contribute to the concept of postmodern museum and contemporary micro-museum practices.

Keywords: museum, museum studies, micromuseum, studio museum, Gertrude Stein

POSTMODERNISM, DIVERSITY, AND EVOLVING MUSEUMS

Micro Museums

In contrast to larger museums whose missions and ideals are acknowledged by the public, smaller museums that aim to give visitors a sense of the local and indigenous cultures have started to open in many nations throughout the world in the last century. These museums, which Candlin (2016) calls "Micro museums", generally concentrate on famous people who lived in different parts of the world and added value to the national or international community with their productions, courage or heroism, create exhibitions by displaying the objects these well-known individuals used when they were alive to celebrate their lives and commemorate their memories. The museums mentioned above, the majority of which are small-scale, focus on a single subject or theme outside of academic fields, are independent, and often employ more than ten paid staff members (Candlin, 2016, Hibbins, 2022). The micro museums have sparked a significant shift in the way that museums and museology are conceptualized and have made reformative advancements possible in the area. These spaces hosted exhibitions that were typically centered around the life of a particular artist or a specific theme. The context of any chosen subject served as the foundation for the development of the interaction between the shown objects and the audience. Since opening their doors to the public, particularly in rural areas, micro museums have concentrated on telling local and regional stories and have begun to host exhibitions with original artifacts and genuine local details to draw tourists to these areas (Hibbins, 2022, Vella, Cutajar, 2014). Micro museums, some of which have more flexible administrative structures, are not under the direct control of any national, regional, or local government agency or body. In other words, managerial interventions in the processes of exhibition formation and creation are less usual, according to Candlin (2016), therefore, micro museums are now the ones creating artistic production environments where multifaceted communication takes place by refocusing attention and concentration from culturally dominant formations to extraordinary ones. This is claimed to be the best way to demonstrate diversity and inclusivity, which is one of the key tenets of postmodern museums.

«Lost Generation» and Gertrude Stein’s Salon

Many thinkers and artists of the early 20th century attempted to combat the negative consequences of the depressing, conservative, and oppressive social codes, facts, and conventions of the preceding century, particularly just before World Wars I and II. The startling results of the economic downturns and crises that industrialized nations had through during that period forced society to reevaluate the social norms they had up until that point. Getrude Stein,

a writer and art collector who was a key architect of the social change and transformation movement, was born into a Jewish American family in Allegheny, Pennsylvania, on February 3, 1874. Before moving back to the United States in 1880, Stein—who would later travel to Europe with her family—lived in two separate European cities: Vienna and Paris. The family moved back to America and lived in San Francisco. (Greelane, 2021). After his brother Leo Stein moved to Paris in the early 1900s, Gertrude Stein traveled to France in 1903. In the meantime, some American artists settled in Paris who would later lead new art movements, be a pioneer in social shifts, and have significant roles in the growth of that era's art world. The phrase "lost generation" was coined to characterize this group of people who had lived through the devastation caused by World War I, had witnessed its effects firsthand, had their lives completely upended, and had the guts to speak out against the judgmental, stereotyped values and oppressive lifestyles of the previous generation (Jaracz, 2021). F. Scott Fitzgerald, Gertrude Stein, Ernest Hemingway, and T.S. Eliot were among the writers and poets of this century and generation who relocated to Paris to breathe and immerse themselves in the inventive setting and reap the rewards of this vibrant and progressive milieu (Longley, 2020). In the same years, Gertrude Stein, who started to gain recognition as an authority and specialist on literature and art, welcomed Ernest Hemingway, F. Scott Fitzgerald, Sinclair, Cezanné, Henri Matissé, Pablo Picasso at her art hall, number 27, on Fleurus Street, according to Özsezgin (2015).

In short, Gertrude Stein created this space; the studio hall at 27 Fleurus Street where she hosted writers and painters who were considered "extraordinary" at the time but are now recognized as the most prominent artists and intellectuals of the 20th century. The space evolved into a micro art museum and collective production area where dynamic discussions took place to spark the development of modern art concepts and criteria. As an interdisciplinary interaction space and a shared cluster, Stein's Hall can be regarded as a place where one of the indispensable merits is valued in postmodern museum criteria, given its direct impact on the art creative processes across many fields. Gertrude Stein's 'Salon' also fostered the artistic understanding of the era and established a liberating and queer atmosphere; It evolved into a location that not only meets but also exceeds the requirements of many postmodern and modern museums, helping to shape some of them. In addition, given the content of the collection in the hall and the diversity of the audience and participants, Gertrude Stein's "Studio" was a platform that united various groups and visits which would trigger the creation, sharing, intercultural and interdisciplinary learning processes that individuals were happy with.

Method and Scope

This study was designed as descriptive research in the document scanning model. The screening model is a research model that aims to detect a past and present situation as it exists. In the study, a literature review was conducted, accompanied by written and visual texts, about Gertrude Stein's artist identity, her works, her studies and the salon-studio museum model she created; documents and examples related to micro museums were examined, and the findings were edited and shared as they existed. The document of this study is four Studio - Art and Artist Museums: Adam Michiewicz Museum, Doğançay Museum, Orhan Kemal Museum and Ara Güler Museum, which serve in Turkey and have the status of private museums within the framework of Gertrude Stein's "Salon - Studio museum" example. These museums were first identified and examined as micro museum examples, examples of art museums or studio museums. Secondly, web pages and publications related to the identified museums were searched; they were visited by the researcher between 2021 and 2023, and the collected data was compiled into a report and presented as suggestions.

The data of the research were collected with structured interview forms and researcher observation notes. The researcher asked the following questions to the experts working in relevant museums:

1. Does the museum have an information brochure/booklet prepared in different languages using universal intercultural elements?
2. Does the museum have object labels, touch screens that introduce objects, etc.? Have the items been prepared in different languages in a way that can attract the attention of different age groups?
3. Have exhibitions been prepared and presentations focused on audience participation in the museum?
4. Are the physical conditions and facilities of the museum (education room, recreation areas, cafe, etc.) arranged in a way where "vulnerable and disadvantaged" groups can come together and share their impressions about the museum?
5. Are there activities in the museum that will support the co-creation and sharing process for the participation of different groups?
6. Are interactive methods centered on advanced technology that will support active and lifelong learning used in the museum?
7. Are social media accounts used to introduce museum exhibitions?

Findings and Interpretation

Numerous small-scale museums featuring individuals and artists can be found across Turkey's cities. To assess if these museums are near an inclusive museum model open to cultural diversity that can be created based on Gertrude Stein's "Salon - Studio," it is necessary to determine whether their management styles adhere to contemporary postmodern museum understanding and criteria, whether the exhibitions organized are constructed by applying postmodern presentation methods, and so on. While carrying out this research, four of the “artist-important person” museums that met the micro museum criteria that were open to visitors in Istanbul were selected and visited by the researcher between 2021 and 2023. Before these research trips, an evaluation form containing postmodern micro museum criteria was prepared and the museums visited were examined in line with these criteria.

MICRO ART MUSEUMS IN THE RESEARCH

Adam Mickiewicz Museum

Adam Mickiewicz Museum, located in the center of Istanbul as an artist museum, was converted from a residence to a museum in 1955. The museum building is important because it is the house where Adam Mickiewicz lived until 1855 (Bektaş and Yalçınkaya, 2020). Mickiewicz is a poet, patriot and the most important representative of Romanticism in Polish literature, the author of the Polish national epic, who is equated with names such as George Byron and Johann Wolfgang Goethe. The Adam Mickiewicz Museum has a comprehensive booklet on Mickiewicz published by the Polish Consulate General. This booklet consists of articles full of biographical elements such as the poet's personal history, why and when he came to Istanbul, examples of his poems, and articles about the history of the museum. The museum booklet is prepared only in Turkish. Since this booklet is an example prepared using encyclopaedic information about the poet, the museum, the street and the district (Pera) where it is located, rather than a museum brochure that will appeal to different communities or age groups, the intended audience is limited to a certain intellectual group. Since Mickiewicz is a national poet of Poland, these articles, which center on the historical, social, and cultural ties between the two nations, were penned by highly qualified experts and academics; however, audiences from different age groups and social classes will find them uninteresting. The audience can be drawn in by the "history strip" prepared and hung on the museum walls in three languages (Turkish, English, and Polish). It was made with historical details from both cultures, the poet's personal effects, and the hallways brimming with details and artifacts unique to the local Polish culture. Although the identity cards of the objects on display are meticulously

created, there is not enough information or explanation to spark interest across various age and cultural groups. The museum's digital presentations give visitors detailed information on the subject matter. The "poem tree" artwork on the third level, which is constructed out of tiny book pages, is one of the exhibitions important tools that emphasizes audience engagement and is thought to be an application to boost visitor contact. These little sheets of the poet's many poems are available for readers to read. If they'd like, they can even tear off a branch from one of the pages and carry it with them as a tangible reminder of their trip to the museum. In the three-storey museum building, an infrastructure system has not been created to allow disabled visitors to access the museum floors. While the well-designed seating areas placed on each floor of the museum enable the audience to rest and evaluate the objects they see, yet the terrace on the top floor of the building is not actively used. There are no activities in the museum that will enable the participation of different groups, and there is no museum educator who can communicate with the audience.Therefore, as emphasized by Taylor and Neill (2008), it is not possible for educational activities, which are considered the strongest aspect of contemporary museums in the context of social studies, to be carried out with a planned educator. Furthermore, the museum lacks a social media presence on any platform that could promote more interpersonal communication. The Adam Michiewicz Museum is described on the Ministry's website /museumkart website in both Turkish and English, along with a few images and a brief description, like other museums under the Ministry of Culture and Tourism.

Doğançay Museum

Turkey's first museum dedicated to modern art; Doğançay Museum opened its doors to the public in 2004 (Doğançay Museum, 2023). With collections curated from artist Burhan Doğançay's works from the past to the present, the museum provides an opportunity to explore the artist's evolving understanding of art throughout time as well as look at his paintings. Burhan Doğançay's works exhibited in the museum include his figurative works; In the cities where he lived during his maturity period, he produced works inspired by the walls, which he saw as the most important sharing environments of the post-modern city and depicted as platforms where all the myths and stories about the city could be solved, etc. (Doğançay Museum, 2023). The museum also gives visitors the chance to compare the works produced by the Doğançays, and therefore to follow the differences in both style and content in the art perceptions and approaches of the Doğançays, father and son, and the traces left by the social movements and art movements of the historical periods in which they lived. The museum visitor guide booklet is meant to serve as a reference book for art enthusiasts of all ages and backgrounds, as it

provides extensive information about the painter's life, artwork, and museum exhibits. This contrasts with the brochures and promotional booklets, which lack the comprehensiveness necessary to appeal to various audiences, communities, or age groups. The five-storey Doğançay Museum's well-designed display galleries and lighting system allow it to present the works of Burhan and Adil Doğançay in a spectacular fashion by placing them within their respective historical artistic periods. Audiences from a variety of age groups and cultural backgrounds can enjoy visiting the museum because the bilingual tags of the works are placed in convenient locations, are readable without complicating the presentation of the works, and allow users to download the necessary information to their smartphones via the QR codes prepared for each work. Furthermore, information regarding the time periods in which the works were produced can be accessed by scanning the QR codes that have been placed next to the artwork. One can also create a personal connection with the artist by traveling to the historical process and setting in which the artists created their works through listening to the significant music of the era. Although more interactive and audience-oriented technological methods such as touch screens are not used, the use of important musical works of the period as another art that could trigger the production of painting enable the audience to establish a personal relationship with the exhibited works and make the museum experience more permanent. The museum offers services such as teahouses and elevators designed to facilitate the travels of both general visitors and disadvantaged groups and provide them with a respite. Therefore, a visitor who wants to visit the museum in a wheelchair can go to the upper floors by elevator. Important steps taken to ensure the continuity of the museum include not ignoring this issue, which is crucial for audience inclusion, and fostering an atmosphere where guests from various groups can congregate and discuss their thoughts about the works, thanks to the free tea hours held at specific times in the ground floor teahouse. The museum hosts a few lectures and activities that are open to participation from various organizations. For instance: Since September 2021, the museum's culture and art center has hosted the "Beyond Borders" event, which has facilitated discussions between professionals and academics and young people. The series of seminars called “Beyond Borders” is the first of the Doğançay Museum online seminars.

Orhan Kemal Museum

Orhan Kemal Museum was established in 2000 with the contributions of the Orhan Kemal Culture and Arts Coordination Office on the ground floor of a five-storey building in Beyoğlu, with the aim of keeping the memory of the writer Orhan Kemal alive. In the museum, objects

used by Orhan Kemal in certain periods of his life (his glasses, his typewriter, which was one of the most important objects in the construction and shaping of a writer's production area during his lifetime, etc.), his private belongings, private correspondence, family photographs and photographs taken by the famous photographer Ara Güler are exhibited (Hürriyet, 2023). All works in the museum are exhibited with "object-oriented" classical presentation techniques and lighting system. The works were not presented with more technologically advanced applications like touch displays or Barco vision, which may draw in audiences of all ages. The preparation of item tags, which are primarily date tags, is limited to Turkish, making it difficult for audiences and visitors from other countries or cultures to comprehend and relate to the significance of the objects, their histories, and general background. Audience interaction is not feasible because all the museum's works are exhibited using "object-oriented" display systems and lighting processes. Stated differently, the museum does not employ strategies that would boost attendance by endorsing the technology-driven education-entertainment model. Other than leaving notes in the "memory book" located at the museum's entry, there isn't any activity in which the audience can actively participate. The rooms housing the exhibits on display are the only areas of the museum, which is housed in a tiny flat. The Orhan Kemal Museum draws interest from both domestic and foreign tourists due to its status as an artist-museum named after a significant and well-known writer, as well as the writer's and his works' significant influence in both Turkey and the global literary community. To put it succinctly, the museum's display of its artifacts lacks interactivity, and its planned programs play little part in drawing in people from diverse cultural backgrounds.

Ara Güler Museum

A micromuseum with a similar concept, Ara Güler Museum, converted the old Bomonti Beer Factory into a cultural socializing platform in the city's centre, making it one of the public collective production spaces. In honour of renowned photographer Ara Güler, one of Istanbul's most significant memory collectors, the museum opened its doors in 2018. The museum strives to fulfil these objectives and missions. It was founded to preserve the images that Ara Güler took over the years and present them to the younger generations. It also aims to create both temporary and permanent exhibitions using selected frames from its archive and to make them accessible to audiences interested in photography from a variety of social backgrounds. The 2018 opening of the Ara Güler Museum in Bomontiada and its exhibitions have become a significant link in the formation of ties between various social classes because of the imprints they leave on the city's cultural memory and the interactive and transitional dialogue they foster

within people. The "A Handful of Beautiful People" exhibition welcomes guests into the museum's rooms, which are exceptionally well-designed for a photography museum, maintaining the exhibitions' genuine appearance and meticulous preparation, from the presentations to the well-chosen photos. Books about Ara Güler and his work, which are compiled from his archive, are available for purchase on the museum store's shelves, but no brochure regarding the museum's founding or the current show is available for viewing. Examining the works is made easier by the efficient lighting system that illuminates the panel dividers made of the walls. The fact that date strips and object tags are generated in both Turkish and English gives viewers from other cultures or countries an advantage in terms of information accessibility. The effect created by exhibition presentations made inside the texture of a historical place allows visitors to feel as though they are a part of the works and the historical processes in which they were produced. Because of this genuine environment, the museum has grown to be a significant hub for public acculturation as well as a gathering place and sociability hub for visitors. Specifically, the museum's interior architecture is showcased through its design, which includes exhibition spaces and seating arrangements tailored to suit various audience demographics. While speaking with museum authorities, it was learned that a few workshops and events had been planned for the participation of various organizations; however, no formal program or informational brochure had been prepared for these events. Because it is an artist-museum named after a significant and well-known artist, like Doğançay and Orhan Kemal Museum, and because Ara Güler's works are well-known in Turkey and throughout the world of art, the museum draws both domestic and foreign visitors. The Ara Güler Museum has also active social media profiles in addition to a webpage with basic information about the institution.

Conclusion

Museums are communal centers of acculturation and socialization that seek to build bridges between the past, present and future, offer meaningful experiences to communities and individuals while striving to achieve this purpose and mission, and aim to strengthen communication between societies and cultures by eliminating prejudices. (Anonymous cited by Yılmaz, Er, 2020: 171).

Today, technology is used to create spaces where unlimited communication takes place seamlessly in such an addictive manner, and where our emotions and feelings become a commodity for consumption. Although these socializing environments are spaces created to encourage the strengthening of people's bonds with each other and to support the dialogue

between cultures and different communities, these channels are created to provide instant information exchange and flow rather than to reinforce the communication between individuals. As a result of the excessive and unnecessary use of these spaces, the life arteries of many individuals are blocked, the functional abilities they need to use in daily life are restricted, and it is observed that they become identities with serious problems of focusing. The atmosphere created by these "sharing spaces" aims to make individuals visible instead of creating common grounds upon which they might share and exchange ideas with one another.

Owing to the controversial phenomenon and practice of radical democracy imposed by global capitalism, in which all our personal data is systematically stored and stocked, and which has been simply developed by being placed in the centre of the concept of "deconstruction", one of the postmodern philosophical approaches defined by Derrida (2012), different communities living in the world are forced to live in their own bubbles. In short, modern human, far beyond meeting in common spaces, communities, together with the groups they are characterized by, live their lives in ghettos where they affirm their existence by constantly "otherizing" the others through the social networks they have established with only those who are like them in the safe cocoons created. Despite opinions to the contrary, it is a first-hand reality of our times that there are significant differences between making an identity or a group visible or being aware of the existence of such an identity or group, and encouraging and promoting the creation of spaces where different communities can build social and cultural bridges with each other.

"Homes", which in the past were spaces characterized by the connotations of a "warm" word like "nest" and where individuals with certain common values and habits led their lives together, are now defined in completely different terms. It is no coincidence that the concept of "living space" is defined as an area with the facilities of shopping malls, where you can establish ties and be valued only as long as you consume and spend, or that it evolves into a quality to create such a perception. As one of the compasses of sociocultural change, it is impossible for contemporary museums to remain indifferent to the waves of sociocultural transformation. For this reason, like the evolution of the concept of "home", the concept of museum has been defined with many different qualities and characteristics attributed by governments and societies throughout the course of history.

Today, principles such as "inclusiveness and diversity" or "creating common spaces that foster communication between communities and cultures" which are often underlined and emphasized as being parts of the criteria and trends of contemporary museums, have found their way among the constituents of the up-to-date standards of museums especially because of the reformist

social and cultural movements of the previous century. These concepts have been included in the contemporary museum definition because of difficult processes, painful social resistances and fractions, and have changed the traditional understanding and concept of the museum from scratch, thus becoming phenomena that has diverted and shaped postmodern museum practices. As a result of the imposition of today's lifestyle, museums, which are now identified with the concept of "shopping mall museum", are managed with an institutional structure like the administrative organization of international "fast food" restaurant chains. For this reason, most of the above-mentioned contemporary museum criteria which are of great importance for the creation of an environment of social harmony and tolerance remain on paper without being put into practice, or processes during which the speed and duration of an activity during these applications prevent the continuity of learning can be experienced. Moreover, in some large-scale museums, the use of technology has become more of the goal itself than a means to an end, resulting in the satisfaction of individual's own curiosity being elevated to the top of the list of museum experiences. Thus, the audience becomes more interested in the technological device that is supposed to make the presentation interactive than in creating bonds with the objects on display.For this reason, this study, which makes it possible to thoroughly examine the periods and spaces at which social movements and civil rights struggles changing the history of the world and becoming a touchstone by transforming the traditional understanding of art and the concept of the museum, focuses on evaluating the approaches of postmodern museums in the perspective of a micro-scale art museum. In addition to this, this research aims to answer the questions about how today's museums can benefit from the structure of these formations by being fascinated by the common spaces created organically in different art circles, without prescribed programs or calendars. Therefore, while examining one of the best examples of these spaces, the famous studio of Gertrude Stein who was recognized as an art expert in Parisian art circles in the beginning of the last century, this study had the chance to evaluate both the concept of contemporary museum through the definitions of micro-scale museums and the single artist museums in Turkey in the context of the mentioned criteria.Moreover, in this study, micro-scale museums are in focus since there are many examples and experiences showing that postmodern museum trends and practices, as explained in detail with examples above, sometimes lose their functionality in large-scale and international museums and are presented as part of their institutional identity for the sake of "political correctness". In line with this focus, it has been determined that Doğançay Museum, which is only one of the four single artist museums visited in Istanbul, organizes exhibitions and presentations with an awareness of

contemporary museum trends, and tries to apply postmodern museum criteria within the limits of possibilities. On the other hand, the Adam Michiewicz Museum and the Ara Güler Museum generally emphasize postmodern presentation practices, while the Orhan Kemal Museum, by using traditional presentation techniques, displays an approach which is far from inclusiveness. During this study, another small-scale museum, the "Museum of Innocence" of the famous novelist Orhan Pamuk, which received the European Museum of the Year Award in 2014, was also visited. Although the Museum of Innocence did not become one of the subjects of this study due to its being based on fictional characters and plot, the important role of this museum in the development of new generation small-scale museums, especially in Turkey, is undeniable, both in terms of the originality of its collection and the presentation of objects. However, although the interior design of the museum building was impressively created in a way that emphasizes the presentation of objects with details that deepen the museum experience, the Museum of Innocence, like the other small-scale museums in the scope of the research, except the Doğançay Museum, is weak in terms of audience inclusiveness. Due to the architecture of the building, an elevator cannot be installed, so a viewer in a wheelchair can only visit the first floor, while the limited space of the museum is an obstacle to the creation of an interactive environment where intercultural exchange is encouraged, and any museum education can take place. While today's technology (film projectors, audio guides, etc.) is used only to add dimension to the presentation techniques and exhibition methods, the museum does not organize any activities that visitors can participate in and turn their museum visit into a personal experience, except for the copies of Orhan Pamuk's Museum of Innocence in various languages, the novel from which the museum’s fictional display was adapted, placed in the resting areas for the visitors to be able to read the sections where the objects on display are mentioned. To sum up, even the "Museum of Innocence", a small-scale museum with international recognition and relatively more opportunities, connections and importance, has difficulty in creating a contemporary perception of a "queer" museum that is interculturally and internationally dynamic and transitional, which the Steins created in the early 1900s by centring the energy of inclusive artistic production.Except for the "poetry tree" activity at the Adam Michiewicz Museum, none of the museums visited had any interactive activities that would involve the audience in one-on-one participation and thus support hands-on learning. In short, only one of these museums has tried to make the audience a part of the visit by designing only one activity. The fact that the Ara Güler Museum does not have an information brochure or booklet that can be understood by different national and international communities in different

languages, using universal intercultural elements, certainly shows that it is one step behind the other museums in terms of inclusiveness. The fact that only Doğançay Museum has a well-developed website that is open to social interaction, and that it organizes educational activities and workshops makes it clear that the other three museums are not in active interaction with the audience.During these visits, it was found that micro-scale organizations, such as single artist museums in Istanbul, primarily lack sufficient financial resources and supporters. This is the primary reason preventing micro-scale museums from organizing more inclusive exhibitions and reaching different audiences. Nevertheless, setting up social media accounts that can be used effectively is an effortless, fast and cost-effective process nowadays. The need for large financial powers or powerful sponsoring companies to feed the social interaction created by these platforms with marketing strategies targeting different age groups and cultural communities, and thus to reach museum audiences, has considerably decreased. Therefore, these financial difficulties, which are also cited as the reason for the lack of audience interest in single artist museums, can actually be overcome in a quicker way with a properly utilized workforce and energy, thanks to the online establishment of connections and social networks similar to those that the Steins established in the first quarter of the 1900s by visiting art salons and various exhibitions in Paris.In short, the first step for today's micro-scale single artist museums to become places where the inclusive, diverse, cross-cultural, interdisciplinary and open atmosphere of Gertrude Stein's salon can be experienced will be the effective use of the right social media tools. Increasing interaction between individuals and communities using targeted marketing techniques and advertising methods will be the second important step, as it will lead to the recognition of the names, images and logos of these museums in different online groups. Gertrude Stein's studio became a common space of freedom across borders, where the art of the period was passed through communities, and where artistic and intellectual production was constantly nourished both individually and collectively. The fact that Gertrude Stein, the owner of the salon, the creator and supporter of this "queer" environment, who was seen as an authority on art and literature at the time, shared social and artistic developments, movements and changes with those who visited her studio and created discussions aligns with the definition of the contemporary museum educator. Therefore, one of the steps that today's micro-scale single artist museums can take to create the aforementioned dynamic and transitional environment is to work with a well-equipped museum educator to ensure that the audience transforms their museum visit into a meaningful experience. Gertrude Stein also opened the modest and homely walls of her studio, which she covered from one side to the other with

original and the most widely discussed paintings of the period, to every viewer interested in art, even though it is now considered a traditional, object-oriented display technique. The fact that these valuable works of art were taken from the familiar exhibition halls and started to be exhibited in an authentic house-workshop with a composition focusing mainly on the "modern art theme" coincides with the logic of contemporary exhibition display that today's curators strive to create. It is a fact that the "walls" of the studio are the most advanced technological tool that could be used at the time for the display of the works; however, the fact that an authentic atmosphere where one-on-one discussions could be held with the artists who created the works in front of these walls was presented to the audience with a thematic exhibition display makes Stein's studio one of the pioneering spaces where the educational activities of contemporary museums are taking place. At this point, if today's micro-scale single artist museums adopt a similar vision and organize face-to-face or online "edu-tainment" oriented events using today's technology, they will provide an information flow that will strengthen the audience's bond with the objects exhibited, and thus, these museums will have taken a step to support the phenomenon of lifelong learning.To summarize, considering the suggestions above, the modeling and dissemination of the inclusive, diverse, intercultural, interdisciplinary atmosphere of Gertrude Stein's salon as a micro-museum is considered as a valuable effort for the postmodern museum concept. Moreover, the implementation of such a modeling is thought to contribute both to the cultural and artistic exchange that will take place in a more organic way and to the sustainability of micro-scale and large-scale museum practices in the long term, especially in the post-Covid period. Following the formation and development processes of micro-museums and supporting them with research will create spaces for sharing stories that are trapped in between due to dominant policies by supporting to open out the door to the diversity and polyphony of cultural exchange within national and international areas.

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IĞDIR İLİNDE YARA BAKIMINDA YAYGIN OLARAK KULLANILAN FİTOTERAPÖTİK BİTKİLER

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Özet
Antik çağlardan beri geleneksel olarak bitkilerin, gövde, yaprak, kök, meyve, çiçek gibi kısımlarının ve saflaştırılmış fitokimyasal bileşiklerin çeşitli tıbbi durumların tedavisinde mevcut olduğu görülmektedir. Fitokimyasallar bitkilere rengini, lezzetini ve kokusunu veren bileşiklerdir. Bu bileşiklerin şifalı bitkilerin tıbbi özelliklerinden ve sağlık yararlarından büyük ölçüde sorumlu olduğu düşünülmektedir. Bununla birlikte fitokimyasallar aynı zamanda zehirli ve toksik kimyasalları da içermektedir. Bitki kaynaklı metabolitler ve şifalı bitkiler dünya çapında tüm kültürler tarafından uygulanmış ve birçok tıbbi ve farmakolojik amaç ile terapötik değerleri tarihsel olarak kanıtlanmıştır. Iğdır ilinde yaşayanların çoğu kırsal alanda yaşadığı için doğal bitkiler ile yakın ilişkide olup şifalı bitkileri gıda veya tıbbi amaçla kullanmaktadır. Geleneksel olarak kullanılan bitkilerin yan etkilerinin az olması veya hiç olmaması ve doğada çok fazla bulunması nedeniyle alternatif tedavi olarak kullanılmaktadır. Bitkisel ekstraktlar, köklerinden, yapraklarından veya çiçeklerinden elde edilenlerin yara iyileşmesini hızlandırıcı etkilere sahip olduğu bilimsel çalışmalarca gösterilmiştir. Bu ekstraktlar, antibakteriyel etkileriyle birlikte kollajen sentezini arttırma, yara iyileşmesinin proliferasyon fazını uyarıcı, fibroblastları stimüle edici, antimikrobiyal ve antioksidan özellikler sergilemektedir. Tıbbi bitkiler genellikle iyileşme sürecinin en az bir fazını etkilemekte ve yara iyileşmesi için uygun bir ortam olan nemli bir alan sağlamaktadırlar. Iğdır ilinde halk arasında yara tedavisi için Belhavıs, Buğa tikanı, Camışgulağı, Gılıçotu, Horoz pipiği, Kötangoparan, Kuş eppeği ve Öküzguyruğu, gibi bitkisel ürünlerin etkili olduğu ve kullanılabileceği belirtilmiştir. Bu çalışmada Iğdır ilinde yara bakımında yaygın olarak kullanılan fitoterapötik bitkilerin özellikleri hakkında bilgi vermek amacıyla yazılmıştır.
Anahtar Kelimeler: Fitoterapötik, Yara Bakımı, Iğdır

PHYTOTHERAPEUTIC PLANTS COMMONLY USED IN WOUND CARE IN IĞDIR PROVINCE

Abstract
Traditionally since ancient times, parts of plants such as stems, leaves, roots, fruits, flowers and purified phytochemical compounds have been available for the treatment of various medical conditions. Phytochemicals are compounds that give plants their colour, flavour and smell. These compounds are thought to be largely responsible for the medicinal properties and health benefits of medicinal plants. However, phytochemicals also contain poisonous and toxic chemicals. Plant-derived metabolites and medicinal plants have been applied by all cultures worldwide and have historically proven their therapeutic value for many medicinal and pharmacological purposes. Since most of the people living in Iğdır province live in rural areas, they are in close contact with natural plants and use medicinal plants for food or medicinal purposes. Traditionally used plants are used as alternative treatment because they have few or no side effects and are abundant in nature. Herbal extracts, obtained from roots, leaves or flowers, have been shown by scientific studies to have accelerating effects on wound healing. These extracts exhibit antimicrobial and antioxidant properties, increasing collagen synthesis, stimulating the proliferation phase of wound healing, stimulating fibroblasts, along with antibacterial effects. Medicinal plants usually influence at least one phase of the healing process and provide a moist area, which is a favourable environment for wound healing. It was stated that herbal products such as Belhevis, Buğa tikanı, Camışgulağı, Gılıçotu, Horoz pipiği, Kötangoparan, Kuş eppeği and Öküzguyruğu can be effective and used for wound treatment among the people in Iğdır province. This study was written to give information about the properties of phytotherapeutic plants commonly used in wound care in Iğdır province.
Keywords: Phytotherapeutıc, Wound Care, Iğdır

Introduction

Medicinal plants have been practised by all cultures worldwide and have historically proven their therapeutic value for many medicinal and pharmacological purposes (Kadri, 2023). Phytochemical compounds derived from medicinal plants are reported to achieve maximum efficacy with proven therapeutic potential in the treatment of recently emerging and chronic diseases (Kadri, 2023). Phytochemicals are compounds that give plants their colour, flavour and smell. Phytochemicals are compounds that give plants their colour, flavour and smell (Kong et al., 2021). Traditionally since ancient times, parts of plants such as stems, leaves, roots, fruits, flowers and purified phytochemical compounds have been available for the treatment of various medical conditions (Parthasarathy & Evan Prince, 2021). Phytochemicals are essential components of plants that reduce necrotic cell death, restore the antioxidant defence mechanism, limit oxidative stress and prevent tissue inflammation and mitochondrial dysfunction (Parthasarathy & Evan Prince, 2021). In contemporary society, there is an increasing trend towards the use of natural products and medicinal plants for the prevention and treatment of diseases. However, it is important to remember that not all natural products are harmless and their effectiveness must be evaluated through scientific research (Vardar, Mollahaliloğlu, & Öztaş, 2018). Since most of the people living in Iğdır province live in rural areas, they are in close contact with natural plants and use medicinal plants for food or medicinal purposes. Traditionally used plants are used as alternative therapies because they have few or no side effects and are widely available in natüre (Altundağ, 2009). Phytochemical compounds obtained from the roots, leaves or flowers of plants have been shown by scientific studies to have wound healing accelerating effects (Bedir & Turgut, 2021). Due to their positive effects on wound healing, plants are often used in holistic medicine (Sürme & Çürük, 2020).

Wound Healing

Wound healing is a complex physiological process involving highly organized cellular, humoral and molecular mechanisms (Tsourdi, Barthel, Rietzsch, Reichel, & Bornstein, 2013). Delayed wound healing represents a major challenge not only for the patient but also for the healthcare system in general. One of the many ways to overcome this challenge is to use herbal remedies and developments that have been widely used in folk medicine for centuries (Rajput, 2022). During the wound healing process, cells, growth factors and cytokines interact with each other to close the lesion (Parlar Köprülü, Mutlu, İpekçi, & Okur, 2022). This interaction process consists of haemostasis, inflammation, proliferative and remodelling stages as shown in Figure 1. (Miraj et al., 2023). The first stage is haemostasis, in which the coagulation cascade is

activated and blood loss is prevented by the formation of a fibrin clot (Kavıyalakshmı & Mekala, 2021; Parlar Köprülü et al., 2022). The second phase is the inflammation phase, which begins after the injury has occurred and can last up to 6 days (Tsourdi et al., 2013). The onset of the inflammatory phase occurs with the secretion of proteolytic enzymes and proinflammatory cytokines from immune cells at the wound site (Varghese & Shinde, 2021). Inflammatory cells produce reactive oxygen species (ROS), which are found at higher levels in chronic wounds and burns. ROS prevent the entry of microorganisms and bacteria. In addition, foreign particles and tissue debris are removed by macrophages and neutrophils during the inflammatory phase (Mirhaj, Labbaf, Tavakoli, & Seifalian, 2022). The next phase is proliferation, which starts 4 days after injury and can last up to 14 days. In this phase, re-epithelialisation and granulation tissue formation occurs (Varghese & Shinde, 2021). The final stage of wound healing is the remodelling (maturation) stage in which type III collagen is replaced by type I collagen (Park, Hwang, & Yoon, 2017; Ribatti & Crivellato, 2012).

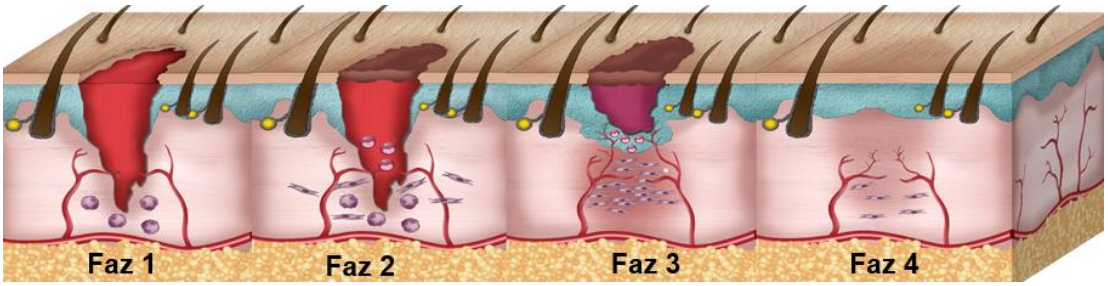


Figure 1. Shows the wound healing process schematically. (Mirhaj et al., 2022)

Faz 1: Haemostasis, **Faz 2:** Inflammation, **Faz 3:** Proliferative, **Faz 4:** Remodelling

For the treatment and management of wounds, some medicinal plants have been shown to be effective wound healers (Jarić et al., 2018). For example, Terminalia arjuna, a member of the Combretaceae family, commonly known as Arjuna in India, is a common plant that can be found all over India. It is used for healing wounds (Rajput, 2022). It is also a member of the Salvia officinalis (Lamiaceae) family, which grows widely in Iran and is popularly known as sage. It is stated to be effective in wound healing (Farahpour, Pirkhezr, Ashrafian, & Sonboli, 2020). In addition, the Aloe vera plant, which belongs to the Liliaceae family, has been used in many countries such as Greece, China and Mexico since B.C. It has been used traditionally since 1500. Showed that it can improve the wound healing process and reduce inflammation (Hekmatpou, Mehrabi, Rahzani, & Aminiyan, 2019). Many herbs are used as wound healing agents in Turkey (Fatma & Afife, 2019). In Iğdır province of Turkey, it is stated that herbal

products such as Belhavıs, Buğa tikanı, Camışgulağı, Gılıçotu, Horoz pipiği, Kötangoparan, Kuş eppeği and Öküzguyruğu are effective and can be used for wound treatment (Table 1.). This study was written to give information about the properties of phytotherapeutic plants commonly used in wound care in Iğdır province.

Table 1. Phytotherapeutic plants commonly used in wound care in Igdır province

No	Family	Plant Name (Scientific)	Plant Name (local)	Part Used	Method of use
1	Plantaginaceae	Plantago major	Bağa yaprağı, Belhevis	Leaves	Leaves are used externally to treat boils and as a wound healer..
2	Apiaceae	Eryngium billardieri Delar	Buğa tikanı, Boğa dikeni, Demir tikanı	Root and Body	While the root parts are used in the treatment of haemorrhoids, the stem parts are also used in wound treatment.
3	Crassulaceae	Sedum telephium subsp. maximum	Camışgulağı	Leaves	Leaves are crushed and placed on the wounds on the skin.
4	Plantaginaceae	Plantago lanceolata	Gılıçotu, Kılıçotu	Leaves	The leaves are applied externally as a blood stopper in cuts and as an anti-inflammatory in festering wounds. It is used as a wound healer and in the treatment of boils.
5	Caryophyllaceae	Silene compacta	Horoz pipiği	Leaves	Leaves are crushed and applied externally as a wound healer
6	Asteraceae	Centaurea glastifolia	Kötangoparan, Kotankıran	Leaves	The leaves are crushed and applied externally as a blood stopper and wound healer.
7	Brassicaceae	Capsella bursa-pastoris	Kuş eppeği	Body	The above-ground parts are crushed and applied externally to bleeding wounds as a blood stopper.
8	Lamiaceae	Leonurus glaucescens	Öküzguyruğu	Root	The root is boiled, dough is made from the juice obtained and applied externally to inflamed wounds.

1. Bağa yaprağı, Belhevis

Plantago major, commonly known as Bağa yaprağı or Belhavis, is a widely used medicinal plant from the Plantaginaceae family (Altundağ, 2009; Najafian, Hamedi, Farshchi, & Feyzabadi, 2018; Bayrakdar & Keleş, 2024). Plantago major is a herbaceous perennial plant with leaves that grow in rosettes, are elliptic-oval in shape and have between 5 and 9 veins. The plant usually grows up to 15 cm in height, but can vary in size depending on the growing environment (Akbaş, 2019). Plantago major is a plant native to a large area of Europe and Asia, as well as North Africa and North America. Although Plantago species are widely recognised

as weeds, they have been used as medicinal plants for centuries (Gonçalves & Romano, 2016). Plantago majör contains many active compounds such as flavonoids, polysaccharides, terpenoids, lipids, iridoid glycosides and caffeic acid derivatives and is used in the treatment of various diseases such as constipation, cough, wounds, infection, fever, bleeding and inflammation (Gonçalves & Romano, 2016). Plantago major has long been used as an immune modulating, anti-infective, analgesic, anti-inflammatory, antiulcerogenic, antimicrobial, anticancer and antioxidant agent and has also been applied for wound healing purposes (Gonçalves & Romano, 2016; Nikaeen, Yousefinejad, Rahmdel, Samari, & Mahdavinia, 2020). It is stated by many studies that Plantago major leaves have long promoted wound healing and are still used in traditional medicine (Ghanadian et al., 2022; Gonçalves & Romano, 2016; Najafian et al., 2018; Nikaeen et al., 2020; Sırrı & Sırrı, 2020). In Iğdır province, the leaves are used externally in the treatment of boils, and also on acute and chronic wounds, green and fresh leaves are applied topically on the wound after slightly crushed and used as a wound healer.

2. Boğa dikeni, Buğa tikanı, Demir tikanı

Eryngium billardieri Delar, popularly known as Boğa dikeni, Buğa tikanı and Demir tikanı, is a medicinal plant in the Apiaceae family. Eryngium billardieri Delar is a perennial plant and its stem can be more than one. It usually grows on rocky slopes, steppes and fallow fields. The parts of the plant used include the stem and above-ground parts. In Iğdır, the root is used for conditions such as haemorrhoids, sinusitis, colds, boils, snake bites and wound treatment, while the stem can be peeled and eaten as food and used as a wound healer in powder form (Altundağ, 2009). It is an important plant that grows worldwide, especially in Asia, Europe, Australia, North Africa and North and South America (Allafchian, Balali, Vahabi, & Jalali, 2022). Flavonoids, phytosterols, triterpenoid saponins, ecdysteroids, coumarin derivatives, polyacetylenes, phenolic acids and essential oils are the main phytonutrient components of Eryngium (Hajian-Maleki & Shams-Bakhsh, 2023; Heidari et al., 2023). Furthermore, the extract of this plant has demonstrated in the laboratory several biological activities against different cell lines of human tumours, including anti-inflammatory, antihyperglycaemic, antimicrobial, antifungal, and antioxidant effects (Allafchian et al., 2022). Extracts from the roots and above-ground parts of various Eryngium (Apiaceae) species are used worldwide as folk remedies for the treatment of various inflammatory diseases, scorpion bites, rheumatism, urinary tract infections, wound healing and sinusitis (Allafchian et al., 2022; Khani et al., 2021; Küpeli, Kartal, Aslan, & Yesilada, 2006; SIRRI & SIRRI, 2020).

3. Camışgulağı

Sedum telephium L., locally known as Camışgulağı, is a medicinal plant in the Crassulaceae family. It usually grows in stony, dry places and larch forests. In Turkey, it is also known as Camuskulağı, Manda kulağı, Yaraotu and çıban çiçeği. In Turkey, the leaves of the plant are generally used as a wound healer, in burns, in the treatment of boils and haemorrhoids. It is also used as food in the treatment of constipation.r (Altundağ, 2009). The Camışgulağı plant was widely used in ancient times in the treatment of many inflammatory skin diseases. The leaves (without the outer cuticle) were often applied topically to painful wounds, burns and eczema to speed healing and reduce inflammation and pain (Bonina et al., 2000; Cavero, Akerreta, & Calvo, 2013). Also in traditional medicine the leaves of this plant are known for their widespread use in the treatment of skin diseases (anti-inflammatory, keratolytic and analgesic activity). Moreover, it has been stated to heal burns, acne and wounds (Jovanović et al., 2017; Karunakaran, Jagathambal, Kumar, & Kolesnikov, 2020). In Iğdır province, the leaves are crushed and left on the wound and used as a wound healing agent.

4. Gılıçotu, Kılıçotu

Plantago lanceolata, commonly known as Gılıçotu or Kılıçotu in Iğdır, is a plant belonging to the Plantaginaceae family. It is commonly found in roadside grasslands, meadows, pastures and green areas (Drava, Cornara, Giordani, & Minganti, 2019; Pol, Schmidtke, & Lewandowska, 2021). In Turkey, it is known by many different names such as nerve herb, sinirli herb, vein herb, veined herb, cut herb, wound herb, snakandili, snakanotu and vineyard leaf (Altundağ, 2009). The leaves of the plant are used in many countries for medicinal purposes in the treatment of diseases such as wound healing, inflammation, cancer, respiratory system disorder, blood circulation, reproductive system and digestive organs (Abate, Bachheti, Tadesse, & Bachheti, 2022; Drava et al., 2019; Pol et al., 2021). It is also used against insect and snake bites, toothache or as an immune enhancer (Bahadori et al., 2020; Pol et al., 2021). In Iğdır, the leaves are used as a wound healer and in the treatment of boils. It is also applied externally as a blood stopper in cuts and as an anti-inflammatory in festering wounds.

5. Horoz pipiği

Silene compacta Fischer, popularly known as Horoz pipiği in Iğdır, is a member of the Caryophyllaceae family (Arslan, 2024). It is found naturally in Western, Northern, Eastern, Southern and Central Anatolia regions of Turkey in the altitude range of 0-2100 m. (Kosa & Karaguzel, 2020). In Turkey it is also called Silene compacta, Kanlıbasıra grass, densely flowered weed, sticky plant (Çimen & Ekici, 2023; Külekçi & Bulut, 2016). The roots and

above-ground parts of the plant have been used as infusion in diseases of the urinary bladder and biliary tract (Akdeniz, 2022; Boğa, 2017). In Iğdır, the leaves are crushed and applied externally as a wound healer.

6. Kötangoparan

Centaurea glastifolia, popularly known as Kötangoparan, is a member of the Asteraceae family. Since the root of the plant is very hard and deep, it often breaks the tip of the sickle (sickle) when the herbs are mown, so the plant was named as Kötangoparan or kotankıran in the region. In addition, although it is generally known as prophet's herb in Turkey; it is also known by different local names such as Zerdali thorn, Shepherd's thor, Gökbaş, etc. The plant grows in meadows, rocky slopes, at altitudes between 1500-2500 m. It is distributed in Central and Eastern Anatolia (Altundağ, 2009; Altundağ, Altundağ, & Gürdal, 2009). Fresh flowers are known to be used against peptic ulcer in Turkey (Aksoy & Gönüz, 2007). In Iğdır, the leaves are crushed and applied externally to cuts as a blood stopper and to wounds as a wound healer.

7. Kuş eppeği

Capsella bursa-pastoris, which is widespread worldwide, is a plant belonging to the Brassicaceae family. In our country, it is generally known as 'shepherd's purse' (Cha et al., 2017). It is also known among the people with names such as jingle grass, shepherd's bag, birdbird grass (Altundağ, 2009). The plant is mainly used as haemostatic for injuries, haemorrhoids, intermittent bleeding outside the menstrual cycle, menstrual irregularities, meno-metrorrhagia, kidney and urinary tract infections, blood pressure, oedema and some muscle diseases. For this purpose, the fresh plant can be used topically as a poultice or tincture and the dried plant can be used orally by brewing (Cha et al., 2017; Tuncel & Coşkun, 2022). In Iğdır, the above-ground parts are crushed and applied externally to bleeding wounds as a blood stopper.

8. Öküzguyruğu

Leonurus glaucescens, known as Öküzguyruğu herb, is a plant belonging to the Lamiaceae family. The plant has a long history of use in Asian, European and American folk medicine (Zhang et al., 2018). Grows on mountain slopes, from coastal slopes to riverbanks, on cliffs, along houses and roads (Kirillov et al., 2018). Traditionally, since ancient times, folk medicine has used a decoction of the above-ground part of the plant in the treatment of diseases of the heart, stomach and nervous system. In addition, tea and infusion of the plant are also used in the treatment of nervous system disorders, hypertension, epilepsy, tachycardia, gastrointestinal diseases, as a sleep aid, diaphoretic, laxative and anti-inflammatory agent (Sermukhamedova,

Sakipova, Ternynko, & Gemedzhieva, 2017). It is used in folk medicine in the Eastern Anatolia region of Turkey for cardiotonic and burn wounds (Kirillov et al., 2018). It is also used in East Asia for anti-gynaecological disorders and in Europe as a sedative (Zhang et al., 2018). In Iğdır, the root is boiled medicinally, and dough is made from the juice obtained and applied externally to inflamed wounds.

Conclusıon

In the literature, it is seen that there are many studies with phytotherapeutic plants related to wound care. In our research, it was observed that the phytotherapeutic plants that are traditionally widely used in wound care in Iğdır province are Belhavıs, Buğa tikanı, Camışgulağı, Gılıçotu, Horoz pipiği, Kötangoparan, Kuş eppeği and Öküzguyrğu. These plants are used in Iğdır as well as in other parts of Turkey and in many countries of the world. Although the part of the plants used and the way of use varies, it has been shown in the literature that these plants are used in wound healing. Studies on phytotherapeutic plants traditionally used in wound care in Iğdır are not sufficient. In this context, we believe that in vivo and invitro studies on these plants should be carried out and used in preclinical studies.

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FROM BITS TO QUBITS: EXPLORING THE QUANTUM SOFTWARE DEVELOPMENT LIFECYCLE

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Abstract
Today, quantum computing represents a paradigm shift in our computational capabilities. It offers unprecedented processing power to tackle problems intractable for classical computers. At the core of this revolution is the quantum bit, or qubit. Unlike a regular computer bit that can be either 0 or 1, a qubit can be both at the same time, leveraging the principles of quantum mechanics. This ability opens up a whole new world of computing possibilities. This capability not only redefines what is computationally possible but also necessitates a reimagining of software development practices tailored to the quantum domain. This capability not only redefines computational possibilities but also necessitates a new set of software development practices uniquely tailored to the quantum domain. This paper aims to explore the Quantum Software Development Lifecycle (QSDLC), a framework that adapts and extends traditional software development methodologies to address the unique challenges and opportunities of quantum computing. Through an examination of each phase of the QSDLC, from requirements analysis through to maintenance, this study highlights the differences, challenges, and innovative solutions inherent to quantum software development. By comparing classical and quantum software development practices, the paper sheds light on the need for new programming paradigms, tools, and techniques to fully leverage quantum computing's potential. Through an investigation of emerging trends, this work also provides insights into the current state and future directions of quantum computing applications across various industries.
Keywords: quantum computing, quantum software development, quantum algorithms, quantum programming languages, software development lifecycle, quantum software engineering

INTRODUCTION

Quantum computing is a groundbreaking field of technology that harnesses the laws of quantum mechanics to solve problems too complex for traditional computers. Unlike classical computers, which use bits as the smallest unit of data represented as either 0 or 1, quantum computers use quantum bits, or qubits, which can exist simultaneously in multiple states due to the principle of superposition (Cho et al., 2021; Gill et al., 2022). This capability, along with quantum entanglement and quantum interference, enables quantum computers to perform vast numbers of calculations at once, offering potential breakthroughs in fields such as cryptography, drug discovery, and complex system optimization. As this technology develops, it promises not only to speed up certain types of calculations dramatically but also to tackle challenges that are currently beyond our reach (Gill et al., 2022; Ozdenizci Kose et al., 2024).

Developing applications that utilize quantum computing is not straightforward due to its complex nature. Quantum computing combines elements of quantum physics, mathematics, computer science, and engineering, and makes it a field that requires a broad range of expertise. The hardware used in quantum computing is particularly complex and sensitive to even small environmental changes, which means it requires careful control and specific strategies to manage errors and perform calculations accurately (Hevia et al., 2022; García de la Barrera et al., 2023; Dwivedi et al., 2024).Furthermore, developing software for quantum computers is not like creaing traditional software. It involves learning new programming languages and approaches specifically designed for quantum computing. Programmers also need to create special algorithms that can work with the quantum properties of the hardware. Currently, the available quantum computers, known as Noisy Intermediate-Scale Quantum (NISQ) devices, are still in the early stages of development (Weder et al., 2020; Sodhi et al., 2021; Weder et al., 2022; Serrano et al., 2022). They have limited capabilities and can make more errors than older, non-quantum computers.These challenges highlight the need for a well-organized and systematic approach to developing quantum software. Such an approach needs to be flexible enough to adapt as new advancements in quantum computing technology are made, ensuring that developers can continue to create effective and reliable quantum software as the field evolves. This structured development process is essential for overcoming the current limitations and fully tapping into the potential of quantum computing in the future (Weder et al., 2020; Weder et al., 2022; Dwivedi et al., 2024).The emerging field of Quantum Software Engineering seeks to address these challenges by establishing a lifecycle for the development of quantum applications. This lifecycle aims to provide a structured framework that guides the development

process from conception to deployment, incorporating best practices, tools, and methodologies suited to the quantum domain. It encompasses everything from initial requirement analysis and design through to implementation, testing, deployment, and maintenance, considering the unique aspects of quantum computing. By formalizing these processes, the goal is to facilitate the creation of high-quality, efficient, and robust quantum software, enabling researchers, developers, and organizations to more effectively harness the power of quantum computing and contribute to its advancement.This paper aims to explore the Quantum Software Development Lifecycle (QSDLC), a framework that adapts and extends traditional software development methodologies to address the unique challenges and opportunities of quantum computing. Through an examination of each phase of the QSDLC, from analysis through to maintenance, this study highlights the differences, challenges, and innovative solutions inherent to quantum software development. By comparing classical and quantum software development practices, the paper sheds light on the need for new programming paradigms, tools, and techniques to fully leverage quantum computing's potential. Through an investigation of emerging tools and platforms, this work also provides insights into the current state and future directions of quantum computing applications.

UNDERSTANDING QUANTUM SOFTWARE DEVELOPMENT LIFECYCLE

The QSDLC is structured into several distinct phases, each critical for the successful development of hybrid quantum applications (Weder et al., 2020; Weder et al., 2022; Dwivedi et al., 2024). These phases facilitate a systematic approach that spans from conceptualization to deployment and beyond. This section provides a conceptual description of each phase within the QSDLC, outlining their respective roles and importance in the lifecycle.

(1) Conceptualization: This first stage focuses on problem identification and feasibility study. The development team idenntifies specific challenges that quantum computing could address, given its superior capability for certain computations over classical systems. A feasibility study then follows to evaluate the practicality of using quantum solutions, including the evaluation of current quantum technology and determining if quantum advantages can be realized.*(2) Quantum Software Analysis:* This phase involves gathering and analyzing the requirements for the quantum application. It includes collecting detailed specifications of what the quantum software needs to achieve, including both functional (i.e., what the software should do) and non-functional requirements (i.e., how the software should perform). *Quantum Algorithm Mapping* is also crucial at this stage in order to align identified requirements with suitable

quantum algorithms or frameworks, or to identify the need for developing new quantum algorithms.

(3) Quantum Software Design: In this phase, developers decide which parts of the application are best suited for quantum computing and which should rely on classical computing methods. *Quantum-Classical Splitting* is critical for optimizing performance and leveraging the unique advantages of quantum computing. The decision-making process is informed by the application's requirements and the current state of quantum hardware capabilities. Once the quantum-classical split is performed, the next step is to design the overall architecture of the application. This includes specifying the high-level structure, defining the components and their interactions, and outlining the data flow between quantum and classical parts. This includes outlining the quantum circuit designs, qubit allocations, and gate operations. Afterwards, the design stage advances into a more granular focus with low-level design that focus on the detailed implementation of quantum circuits, including specific gates, error correction techniques, and optimization for quantum hardware constraints. The design phase aims to create a blueprint that ensures the application is scalable, maintainable, and meets the defined requirements.*(4) Quantum Coding:* During implementation stage, the generated design blueprints are translated into executable code. This involves coding both the quantum algorithms and the classical software components. *Quantum Coding* is carried out using specialized *Quantum Programming Languages*. Alongside, classical integration is executed, wherein the classical components -designed to interact with or support the quantum operations- are developed and refined. This step is crucial to ensure a seamless integration between classical and quantum processing, and enables them to function together as a cohesive unit.*(5) Quantum Software Testing:* Testing in the QSDLC involves verifying both the individual quantum and classical components and their integration. This includes unit testing, integration testing, and end-to-end system testing. The goal is to ensure the application behaves as expected, performs efficiently, and is free from defects. Unit Testing is concerned with the smallest parts of the quantum application. It ensures that each individual quantum component, such as a specific gate or subroutine, operates correctly in isolation. This is vital in quantum computing, where the functionality of basic elements can have significant impacts on the overall system due to the entangled nature of quantum states. Integration Testing focus on how quantum and classical components interact with each other. Integration testing verifies that these diverse elements work together harmoniously under a variety of conditions. It is a critical step for hybrid systems where quantum and classical computing coexist and must interact without errors. System

Testing evaluates the system's performance, functionality, and behavior, not just in isolated parts or during interactions but as an entire operational unit. This testing can take place on actual quantum hardware, which provides the most realistic environment, or on high-fidelity simulators.*(6) Deployment:* This stage in quantum software development involves several crucial steps to ensure the application is ready for real-world operations. Initially, deployment planning focuses on where considerations such as the availability of quantum hardware and the specific operational environment are addressed. This preparation is essential for ensuring that all necessary resources are aligned and the software is optimized for the conditions it will face. Following this, the deployment execution phase begins, where the software is rolled out to its intended platform. Depending on the application's requirements, this could mean deploying to a cloud-based quantum computing service for scalability and accessibility, or directly to dedicated quantum hardware for enhanced security and performance. This comprehensive approach ensures that the transition from development to active use is seamless, allowing the software to start delivering practical value effectively.*(7) Maintenance:* This phase is a crucial part of the QSDLC which focuses on ensuring the application performs reliably over time. It involves constant monitoring of the application's performance and the health of the quantum environment. The software is regularly checked for issues, with logs and alerts set up to flag any problems. Maintenance also means updating and scaling the software to incorporate new advances in quantum algorithms and hardware, ensuring that the application remains up-to-date and can handle increased demands as quantum technology progresses.These phases are not strictly linear and may overlap or require iteration, reflecting the adaptive and exploratory nature of quantum application development. The QSDLC provides a structured framework that guides teams through the complexities of creating applications that leverage both quantum and classical computing.

RECENT TOOLS AND PLATFORMS IN QUANTUM SOFTWARE ENGINEERING

The quantum computing field includes a variety of tools and platforms that are popular among researchers, practitioners and developers. These tools focus on the different aspects of quantum computing, including algorithm development, simulation, and hardware interaction. Some of the most popular quantum computing tools are described hereunder:*(*) Quantum Development Kits and Libraries:* IBM's Qiskit [*https://qiskit.org*], Google's Cirq [*https://quantumai.google/cirq*], and Rigetti's PyQuil [*https://www.rigetti.com*] are some essential tools of development kits and libraries for creating quantum programs. Qiskit is notable for its comprehensive suite that allows users to write, simulate, and run quantum

algorithms on IBM quantum computers. Cirq offers a Python library tailored for constructing and operating quantum circuits on Google's quantum processors. Meanwhile, Ocean Software from D-Wave [*https://www.dwavesys.com*] specializes in tackling complex optimization problems with quantum annealers, and ProjectQ [*https://github.com/ProjectQ-Framework/ProjectQ*] facilitates the implementation of quantum programs that can run on simulators or actual quantum hardware. PennyLane [*https://www.xanadu.ai/products/pennylane*] uniquely positions itself at the intersection of quantum computing and machine learning, enabling the optimization of hybrid systems.*(*) Quantum Simulators:* Simulators like the IBM Quantum Experience [https://quantum.ibm.com] and Microsoft's Quantum Development Kit offer developers simulated environments to test and debug quantum algorithms without the need for physical quantum hardware. These platforms support the early stages of development, and provides a vital testing ground for algorithms with their integrated tools and simulators. Strawberry Fields from Xanadu [https://strawberryfields.ai] also plays a key role in the simulation and optimization of quantum photonic circuits, expanding the realm of quantum computing into the photonic domain.*(*) Quantum Hardware Access Platforms:* Services like Amazon Braket [https://aws.amazon.com/braket] and Azure Quantum [https://azure.microsoft.com/en-us/services/quantum] improves access to quantum hardware, and allows developers to run quantum algorithms on a variety of quantum machines from different providers. These platforms provide not only the essential bridge between quantum software and hardware but also the capability for developers to experiment with and fine-tune their programs across different types of quantum systems.*(*) Integrated Development Environments and Tools:* Comprehensive development and execution environments such as Quantum Lab [https://quantum.ibm.com/lab] and Visual Studio Code, with their quantum-centric extensions, support developers with intuitive interfaces and powerful tools. These IDEs streamline the process of writing, running, and debugging quantum code, making quantum software development more accessible and efficient.These tools and platforms are integral to the development and exploration of quantum computing, and provides resources for education, research, and practical application development in the quantum world. The landscape is rapidly evolving, with new tools and features being regularly introduced to advance quantum computing technology.

CONCLUSION

This study examined the fundamentals of QSDLC, as a comprehensive roadmap for crafting software for the emergent paradigm of quantum computing. Quantum computers have the potential to solve certain problems much quicker than today's classical computers. The QSDLC offers a step-by-step framework that guides practitioners from the initial conception of a quantum software application through to its deployment and maintenance. It combines the new ways of quantum computing with the familiar methods of classical computing, and ensures that software is made in a careful and planned way.Future research in the QSDLC is expected to advance quantum computing significantly. Developing sophisticated quantum error correction methods, enhancing fault tolerance, and refining the interfaces between quantum and classical systems stand as pivotal challenges. Moreover, scaling quantum systems, advancing the design of quantum programming languages, and creating more intuitive software development kits (SDKs) will be essential for realizing the full spectrum of quantum computing's capabilities. These developments are anticipated to enhance the robustness of quantum computers and also facilitate their broader application across disciplines that could benefit from quantum computational power, such as cryptography, optimization, and complex system modeling.

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CHALLENGES AND INNOVATIONS IN TESTING AND VALIDATION FOR QUANTUM SOFTWARE DEVELOPMENT

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Abstract
Quantum computing stands on the threshold of a new era and promises to revolutionize our approach to computation and problem solving. At this point, the development of quantum software is so critical that it presents unique challenges and opportunities, particularly in the realms of testing and validation. Traditional software testing methodologies fall short when applied to quantum software due to its inherently probabilistic nature, the complexity of quantum states, and the entanglement phenomenon. These characteristics necessitate innovative approaches to ensure the reliability, correctness, and efficiency of quantum software. This paper aims to explore the multifaceted challenges associated with testing and validating quantum software. It focuses on the distinctive aspects of quantum computing that complicate standard testing practices, such as the no-cloning theorem and quantum decoherence. Furthermore, the paper sheds light on the current methodologies and tools developed specifically for quantum software testing, from quantum circuit simulators and error correction techniques to the testing frameworks that accommodate the probabilistic outcomes of quantum computations. Through an examination of these innovations, this paper contributes to a deeper understanding of the evolving field of quantum software development. It underscores the need for ongoing innovation in robust testing and validation practices to realize the potential of quantum computing technology.
Keywords: quantum computing, quantum software testing, validation techniques, quantum algorithms, quantum error correction, software development challenges

INTRODUCTION

Today, quantum computing represents a significant advancement that harnesses the principles of quantum mechanics to solve problems that are currently beyond the reach of classical computers. This advanced computing technology utilizes quantum bits or qubits, which unlike classical bits, can exist in multiple states simultaneously through superposition, and are interconnected through entanglement (Cho et al., 2021; Gill et al., 2022). This allows quantum computers to perform complex calculations at incredibly high speeds and with greater efficiency. The development of software for such complex systems is structured through the Quantum Software Development Lifecycle (QSDLC), which adapts traditional software development methodologies to meet the unique demands of quantum technology. The QSDLC guides developers from conceptualization through to deployment and maintenance, and addresses the specific challenges posed by quantum computing along the way (Weder et al., 2020; Weder et al., 2022; Dwivedi et al., 2024).Testing and validation play crucial roles for the development of any software, ensuring that the final product functions as intended and is free from defects. In the realm of quantum software development, these processes take on even greater significance due to the inherently complex and revolutionary nature of quantum computing (Ali & Yue, 2023; García de la Barrera et al., 2023). As quantum computing seeks to leverage the principles of quantum mechanics -such as superposition, entanglement, and quantum interference- the tasks of testing and validation become markedly more challenging. These principles enable quantum computers to perform calculations at unprecedented speeds and manage tasks that are infeasible for classical computers. However, they also introduce a unique set of challenges that traditional software testing methodologies are not designed to handle.The challenges in testing and validation for quantum software stem from several quantum-specific characteristics. This paper aims to examine the unique challenges that arise in the testing and validation of quantum software, driven by the inherent properties of quantum computing such as the no-cloning theorem and the phenomenon of quantum decoherence. These quantum-specific characteristics disrupt traditional testing methodologies, and requires a shift in how software validation is approached. The investigation extends to the current state of the art in quantum software testing methodologies and tools. By providing a comprehensive overview of these developments, the paper deepens the understanding of the current landscape of quantum software development and emphasize the critical role of continuous innovation in testing and validation strategies. This focus is essential for advancing the reliability and

efficiency of quantum software and also for unlocking the transformative potential of quantum computing technologies.

CHALLENGES IN TESTING AND VALIDATION OF QUANTUM SOFTWARE

Testing and validation of quantum software introduce a set of unique challenges that stem from the foundational principles of quantum mechanics, significantly diverging from the established practices in classical software testing (Weder et al., 2020; Weder et al., 2022; Ali & Yue, 2023; García de la Barrera et al., 2023). These challenges include:*(*) No-Cloning Theorem:* This fundamental principle of quantum mechanics stipulates that it is impossible to create an identical copy of an unknown quantum state. In practical terms, this prohibits replicating exact testing conditions for quantum states, a method often used in classical software testing for identifying and fixing errors.*(*) Quantum Decoherence:* Decoherence occurs when quantum systems, highly sensitive to their surroundings, lose their quantum properties after interacting with their environment. This instability creates a challenge for testing, as it becomes difficult to maintain stable conditions for repeatable tests, which can impact the consistency and reliability of the results.*(*) Measurement Disturbance:* Measuring a quantum state inevitably alters that state. This phenomenon presents a significant challenge for quantum software testing, as the act of observing or measuring can change the software's behavior, complicating the processes of validation and debugging that rely on stable test conditions.*(*) Probabilistic Nature of Quantum Computing:* Quantum computing operates on probabilities, not certainties, which contrasts with the deterministic nature of classical computing. Since the outcomes of quantum algorithms are probabilistic, testing these algorithms involves statistical analysis rather than straightforward pass/fail checks. This means a large number of tests must be conducted to ensure the behavior of the software is correct with statistical confidence.*(*) Error Rates and Fault Tolerance:* The current generation of quantum hardware is prone to errors at a rate higher than that of classical hardware. Creating tests that can accurately identify and separate errors from correct quantum behavior is difficult. Furthermore, integrating quantum error correction into these tests introduces additional complexity and requires more resources.

(*) Limited Availability of Quantum Hardware: There is a scarcity of accessible quantum computers, leading many developers to rely on simulators that can not always mimic the exact behavior of actual quantum hardware. This limitation poses a significant challenge in testing and validating quantum software to perform reliably under real-world operational conditions.

(*) Complexity of Quantum Algorithms: Quantum algorithms are often highly complex, and incorporates advanced mathematics and logic that can be challenging to grasp and implement

accurately. Testing these algorithms demands an extensive understanding of both quantum mechanics and computational principles, which can be an obstacle for testers who do not have a strong background in these specialized areas.*(*) Lack of Standardized Testing Frameworks:* Quantum computing is a rapidly evolving field, and there is a lack of established testing frameworks and methodologies specifically designed for quantum computing. Without these standards, developers might face inconsistencies in testing methods, and makes it hard to ensure the correctness and reliability of quantum programs. Developing these tools is crucial for advancing the field but requires overcoming the unique challenges mentioned above.These challenges highlight the need for innovative approaches to testing and validation in quantum software development. Addressing these issues is crucial for ensuring the reliability, correctness, and efficiency of quantum software, paving the way for the realization of quantum computing's full potential.

METHODOLOGIES AND TOOLS FOR QUANTUM SOFTWARE TESTING

To guarantee the reliability and accuracy of quantum software, a range of advanced testing methodologies is being developed (Nilsen, 2007; Merkel et al., 2013; Keith et al., 2018; Bantysh et al., 2021; García de la Barrera et al., 2023). These methodologies are designed to address the unique challenges presented by quantum computing:*(*) Quantum State Tomography:* This technique is utilized to deduce the exact state of a quantum system. By conducting a series of measurements on a collection of identically prepared quantum systems, researchers can infer the quantum state, even though it cannot be measured directly. This method provides a comprehensive understanding of the quantum state but can be resource-intensive and challenging to implement as the number of qubits increases.*(*) Randomized Benchmarking:* This technique offers a practical alternative by evaluating the overall fidelity of quantum gates without needing to identify every potential error. Through the application of random sequences of gates, this method estimates the average error rate across the entire system. It is particularly useful because it reflects how errors accumulate in a realistic computational setting with noise.*(*) Quantum Process Tomography:* Extending beyond state tomography, Quantum Process Tomography aims to characterize the full quantum process. Rather than just the final state, this technique aims to map out the transformation that the quantum state undergoes through the computational process. It is an extensive method that can provide deep insights into the behavior of quantum algorithms and the effects of quantum operations.

(*) Monte Carlo Simulations: Traditionally used in fields like statistical physics and finance, Monte Carlo Simulations are a powerful tool for modeling the probabilistic nature of quantum systems. They use random sampling to predict how a quantum system might respond under various scenarios, helping to understand the influence of errors and environmental noise on a quantum system's behavior.Recent developments in testing tools have introduced innovative solutions that assist in the practical application of these methodologies, described as follows:

- Integrated Quantum Development Environments (IDEs): These comprehensive software platforms merge the processes of writing, executing, and testing quantum code. They often feature visualization tools for quantum states and operations, which help in interpreting test outcomes.
- Quantum Circuit Simulators: Simulators enable the testing of quantum circuit behavior on classical computers and offer developers a way to predict how their quantum algorithms will perform, even without direct access to quantum hardware.
- Automated Testing Frameworks: These frameworks streamline the quantum software testing process. They utilize advanced algorithms to explore the extensive potential outcomes of quantum states, pinpoint possible errors and suggest optimizations.
- Quantum Hardware Emulators: Emulators replicate the functionality of quantum processors, and provide a crucial testing tool for developers to see how their software would run on different quantum hardware setups.
- Quantum Error Analysis Tools: With error rates being a critical factor in quantum computing, these tools are essential for examining the nature and frequency of errors in quantum operations. The insights gained are invaluable for refining algorithm design and enhancing software performance.

In the advancing field of quantum computing, a range of specialized tools have been developed to facilitate the design, testing, and deployment of quantum software. For instance, IBM's Qiskit [*https://qiskit.org*] provides an extensive toolkit for analyzing and visualizing quantum circuits, as well as simulating them on classical hardware to anticipate their performance on actual quantum processors. Google's Cirq [*https://quantumai.google/cirq*] offers features for noise modeling and simulation, key for evaluating how quantum algorithms will fare in the noisy environments typical of today's quantum hardware. Microsoft has contributed with its Quantum Development Kit [*https://docs.microsoft.com/quantum*], which boasts full-state simulators capable of handling up to 30 qubits on standard servers, all while integrating seamlessly with

the Visual Studio environment for testing and debugging.Rigetti's Forest [*https://www.rigetti.com/forest*] platform delivers a comprehensive set of tools, including noise and error modeling simulators, creating a testbed that mirrors the conditions quantum programs will encounter on real quantum hardware. Open-source software framework ProjectQ facilitates the running of quantum circuits on both simulators and actual quantum processors, emphasizing circuit optimization and error emulation. Lastly, Quantum++ [*https://github.com/vsoftco/qpp*] offers a C++ library dedicated to quantum computing and simulations, perfect for crafting and trialing novel quantum algorithms and exploring the realms of quantum computation. Each of these tools plays a vital role in the quantum software development ecosystem, and provides developers with the resources needed to navigate the complexities of quantum programming.

CONCLUSION

This study explored the complexities and unique challenges of testing and validating quantum software. By focusing on methodologies like Quantum State Tomography, Randomized Benchmarking, and Monte Carlo Simulations, alongside innovative tools such as Quantum Circuit Simulators and Quantum Development Environments, this study has illuminated the current landscape of quantum software testing. These approaches are crucial for addressing the unique properties of quantum mechanics, such as the no-cloning theorem, quantum decoherence, and the inherently probabilistic nature of quantum computing. The study underscored how traditional testing methods are inadequate without significant adaptations to accommodate the revolutionary characteristics of quantum computing.Future research should focus on enhancing the precision and efficiency of existing quantum testing methodologies and developing new tools to better accommodate the rapid advancements in quantum hardware. There is an increasing need for more robust quantum error correction techniques, improved frameworks for simulating quantum noise, and more accessible testing environments. Additionally, a deeper integration between theoretical quantum mechanics and practical software engineering practices will be essential for the next generation of quantum software developers.

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İLERİ KADEME EKMEKLİK BUĞDAY *(*Triticum aestivum L.*)* GENOTİPLERİNİN VERİM VE BAZI TEKNOLOJİK KALİTE ÖZELLİKLERİ YÖNÜNDEN İNCELENMESİ

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ÖZET
Buğday, insan beslenmesinde temel gıda olması ve farklı çevre koşullarına yüksek adaptasyon kabiliyeti sebebiyle stratejik önemini korumaktadır. Çalışmada amaç, tane verimi ve/veya kalite özellikleri yönüyle standart çeşitlerden üstün olan hatları belirlemek ve buğday ıslah programlarına katkı sağlamaktı. Araştırma, 2014-2015 üretim sezonunda Diyarbakır ilinin yağışa dayalı şartlarında 25 genotip ile tesadüf blokları deneme desenine göre üç tekrarlamalı olarak yürütüldü. İncelenen tüm özelliklerde istatistiki olarak genotipler arasında $p \leq 0.01$ veya $p \leq 0.05$ seviyesinde önemli anlamlılık olduğu gözlenmiştir. Başaklanma süresi 170-184 gün, bitki boyu 85-120 cm, tane verimi 499.3-748.1 kg.da^{-1}, hektolitre ağırlığı 71.4-80.8 kg.hl^{-1} ve bin tane ağırlığı 29.9-40.4 g arasında farklılık gösterdi. Araştırmada; G9, G13, G14 ve G24 ileri kademe hatlarının Diyarbakır koşullarında en erken başaklanan genotipler olduğu gözlenmiştir. Tane veriminde G19 en yüksek birim alan tane verimini vermekle beraber G1, G6, G9 ve G13 hatları yüksek tane verimleriyle dikkat çekmiştir. Teknolojik kalite özelliklerinde; G1, G6, G8, G9, Pehlivan, G14, G19, G23, G24 ve Adana-99 genotiplerinin öne çıktığı belirlenmiştir. Diyarbakır ilinde ekmeklik buğdayın generatif döneminde sıcaklık stresine maruz kalacağı dikkate alınarak erkenci ve aynı zamanda yüksek verimli olduğu tespit edilen G9 ve G13 ileri kademe hatlarının koruma altına alınarak ıslah süreçlerinin devam ettirilmesi gerekmektedir. İlaveten, teknolojik kalite özelliklerinde ön sırada yer alan G9, G14 ve Pehlivan genotiplerinin ekmeklik buğday ıslah programlarında genitor olarak kullanılabileceği sonucuna varılmıştır.
Anahtar Kelimeler : Ekmeklik buğday, başaklanma süresi, kalite

EXAMINATION OF ADVANCED BREAD WHEAT GENOTYPES *(Triticum aestivum L.)* IN TERMS OF YIELD AND SOME TECHNOLOGICAL QUALITY CHARACTERISTICS

ABSTRACT

Wheat maintains its strategic importance because it is the basic food in human nutrition and its high adaptability in in different environments. The aim of the study was to identify lines that were superior to standard varieties in terms of grain yield and/or quality characteristics and to contribute to wheat breeding programs. The research was conducted in three replications according to the randomized block experiment design with 25 genotypes under the rainfed conditions of Diyarbakır province in the 2014-2015 production season. It was observed that there was statistically significant significance between genotypes at the $p \leq 0.01$ or $p \leq 0.05$ level in all examined characteristics. Heading time 170-184 days, plant height 85-120 cm, grain yield 499.3-748.1 $kg.da^{-1}$, test weight 71.4-80.8 $kg.hl^{-1}$ and thousand grain weight 29.9-40.4 g were varied. In the research; it was observed that G9, G13, G14 and G24 advanced stage lines were the earliest spiked genotypes under Diyarbakır province conditions. While G19 gave the highest grain yield per unit area, G1, G6, G9 and G13 lines attracted attention with their high grain yield. In technological quality features; it was determined that G1, G6, G8, G9, Pehlivan, G14, G19, G23, G24 and Adana-99 genotypes were prominent. Considering that bread wheat will be exposed to heat stress during the generative period in Diyarbakır province, the G9 and G13 advanced stage lines, which are found to be early and also highly productive, should be protected and the breeding processes should be continued. Additionally, it was concluded that G9, G14 and Pehlivan genotypes, which are at the forefront in terms of technological quality characteristics, can be used as genitors in bread wheat breeding programs.

Keywords: Bread wheat, heading time, quality

GİRİŞ

Buğdayın kalitesi birçok faktörün etkisi altında şekillenmektedir. Kalite tarıma dayalı sanayinin ve tüketicinin arzu ettiği özelliklerin bütünü olarak değerlendirilmekte (Dziki and Laskowski, 2005) ve kullanım amacına bağlı olarak buğdaya geniş bir anlam yüklemektedir. Teknolojik kalite parametreleri olarak değerlendirilen hektolitre ve bin tane ağırlığı genel kalite kriterleri içerisinde önem arz etmektedir (Kün, 1996; Elgün ve ark., 2002; Ulucan & Atak, 2020).

Dünyada ve ülkemizde tarla bitkileri içerisinde buğday stratejik bir öneme sahiptir. Ülke nüfusumuzun artışına paralel olarak üretimin artması için ıslah çalışmaları hızla devam etmektedir. Geçmişten günümüze başta ekmek olmak üzere buğday ürünleri Türk halkının ana besin kaynaklarından biri olmakla birlikte yıllık kişi başı>200 kg buğday tüketimi ile ülkemiz dünyada ön sıralarda yer almaktadır (Morgounov ve ark., 2016; Atak ve ark., 2021).

Tablo 1. Buğday ile ilgili güncel istatistiki veriler

Piyasa yılı	Üretim (ton)	Ekilen alan (hektar)	İthalat (ton)	İhracat (ton)	Yeterlilik (%)
2013-14	22.050000	7.772600	4.185189	4.677855	101.8
2014-15	19.000000	7.919209	5.780716	4.358527	89.2
2015-16	22.600000	7.866887	4.109527	5.918407	113.6
2016-17	20.600000	7.671945	4.586405	7.463969	103.8
2017-18	21.500000	7.668879	6.109569	7.489664	111.7
2018-19	20.000000	7.299271	6.467562	7.873454	100.5
2019-20	19.000000	6.846327	10.793317	7.530767	89.5
2020-21	20.500000	6.922237	8.237981	7.583765	102.3
2021-22	17.650000	6.744666	9.525066	7.898297	87.3
2022-23	19.750000	6.628738			

Kaynak: Anonim, (2023)

Türkiye'de buğday ile ilgili son on yıla ait istatistiki veriler incelendiğinde; ekim alanının 6.628738-7.919209 hektar, üretim alanının 17.650000-22.600000 ton ve yeterlilik oranının %87.3-113.6 arasında farklılık gösterdiği görülmektedir (Tablo 1).

Bu çalışmada amaç, ileri kademe ekmeklik buğday hatlarını teknolojik kalite özellikleri yönüyle standart çeşitler ile kıyaslamak, üstün vasıflara sahip olanları belirlemek ve ıslah süreçlerini devam ettirmekti.

MATERYAL VE METOT

Araştırma, Diyarbakır merkez lokasyonunda yağışa dayalı şartlarda yürütülmüştür. Deneme materyalini 20 ileri kademe ekmeklik buğday hattı ve 5 standart çeşit oluşturmuştur. Tesadüf blokları deneme desenine göre tasarlanan deneme 3 tekerrürlü olarak kurulmuştur. Deneme parselleri; 6 sıra, sıra arası 20 cm, 6 m uzunluğunda ve ekim normu 450 tohum.m^{-2} yoğunluğunda tasarlanmıştır. Ekim sırasında 7.2 m^2 olarak dizayn edilen parseller kardeşlenme dönemi sonunda başından ve sonundan 0.5 m kesilerek net 6 m^2 bırakılmıştır.

Tablo 2. Deneme alanı topraklarının içeriğine ilişkin bilgiler

Toprak Bünyesi	Toplam tuz (%)	Ph	Kireç CaCO3 (%)	Fosfor P_2O_5 (kg.da^{-1})	Organik madde (%)
Killi-Tın	0.03	7.6	10.1	2.0	0.67

Deneme alanı topraklarının tuzsuz, fosfor içeriği yetersiz ve organik madde içeriği bakımından fakir olduğu belirlenmiştir (Tablo 2). Bitki besin elementi takviyesi için saf madde dikkate alınarak 6 kg fosfor (P_2O_5) ve 12 kg azot (N) tatbik edilmiştir. Fosforun tamamı ve azotun ½'si ekimle beraber, azotun kalan ½'si ise kardeşlenme döneminin ortalarında uygulanmıştır.

Tablo 3. Çalışmanın yapıldığı sezon ile uzun yıllara ilişkin iklim verileri

Aylar	Ortalama sıcaklık		Toplam yağış miktarı (mm)	
	2014-2015	Uzun yıllar	2014-2015	Uzun yıllar
Eylül	25.2	24.8	27.4	4.1
Ekim	17.4	17.2	34.2	34.7
Kasım	8.1	9.2	97.6	51.8
Aralık	5.9	4.0	73.6	71.4
Ocak	1.5	1.8	64.6	68.0
Şubat	6.1	3.5	55.2	68.8
Mart	7.8	8.5	127.0	67.3
Nisan	14.4	13.8	48.6	68.7
Mayıs	19.5	19.3	48.2	41.3
Haziran	24.3	26.3	7.4	7.9
Toplam			583.8	484.0

Araştırmanın yapıldığı sezonda uzun yılların ortalaması ile kıyaslandığında yaklaşık 100 mm daha fazla yağış düşmüştür. Fakat, yağışın aylar bazında dağılımı incelendiğinde düzensiz bir yağış dağılımı olduğu görülmektedir. Özellikle Eylül, Kasım ve Mart aylarında uzun yıllar ortalamasının çok üzerinde yağış gerçekleşmiştir (Tablo 3). Sıcaklık verileri incelendiğinde Kasım, Ocak, Mart ve Haziran hariç diğer aylarda sıcaklık değerlerinin uzun yıllar ortalamasının üzerinde olduğu belirlenmiştir. Özellikle haziran ayının serin geçmesi tane dolum döneminin uzamasına katkı sağladığı düşünülmektedir (Tablo 3).

Çalışmada, başaklanma süresi için ekim tarihinden her parselin 2/3'ü başaklanıncaya kadar geçen süre gün olarak belirlenmiştir. Bitki boyu için her parselden 10 bitki seçilmiş ve toprak seviyesinden en üst başakçığa kadar olan mesafe ölçülerek cm cinsinden tespit edilmiştir. Tane verimi için her parselde hasat ve harman işlemi tamamlandıktan sonra elde edilen ürün 0.001 g düzeyde hassas terazide tartıldıktan sonra elde edilen değer kg.da^{-1}'a dönüştürülmüştür. Hektolitre ağırlığı için NID IM 550 cihazında tanede okuma yapılarak kg.hl^{-1} cinsinden belirlenmiştir. Bin tane ağırlığının tespitinde 1000 buğday tanesi sayıldıktan sonra tartılarak belirlenmiştir.

3.ARAŞTIRMA VE BULGULAR

Çalışmada incelenen özelliklerde genotipler arasında %1 veya %5 seviyesinde önemli farklılık olduğu gözlenmiştir (Tablo 4).

Tablo 4. İncelenen özellikler ve oluşan farklı gruplar

Genotip	Başaklanma süresi (gün)	Bitki boyu (cm)	Tane verimi (kg.da^{-1})	Hektolitre Ağırlığı (kg.hl^{-1})	Bin tane ağırlığı (g)
G1	173.0 h	105.0 fg	714.8 abc	79.5 abc	33.3 ef
G2	172.0 ı	95.0 ı	607.3 a-g	71.4 h	33.4 ef
G3	173.0 h	107.5 ef	626.0 a-g	71.8fgh	32.9 ef
G4	174.0 g	100.0 h	667.7 a-f	76.2 a-g	30.7 gh
Nurkent	180.0 c	120.0 a	619.1 a-g	76.8 a-e	32.7 efg
G6	173.0 h	110.0 de	712.3 a-d	79.2 abc	33.3 ef
G7	175.0 f	110.0 de	564.2 d-g	76.7 a-e	32.9 ef
G8	176.0 e	110.0 de	574.4 c-g	71.5 gh	29.9 hı
G9	170.0 j	105.0 fg	713.3 abc	80.8 a	39.4 abc
Pehlivan	181.0 b	115.0 bc	680.3 a-e	77.8 a-e	40.4 a
G11	180.0 c	110.0 de	600.5 a-g	73.8 d-h	34.2 e
G12	180.0 c	110.0 de	548.5 efg	73.2 e-h	33.1 ef
G13	170.0 j	110.0 de	726.3 ab	73.6 e-h	38.2 bcd
G14	170.0 j	100.0 h	674.4 a-e	79.8 ab	39.9 ab
Cemre	184.0 a	112.5 cd	591.2 b-g	76.4 a-f	37.6 cd
G16	173.0 h	95.0 ı	641.3 a-g	75.9 b-h	32.1 fg
G17	175.0 f	117.5 ab	585.0 b-g	77.9 a-e	38.2 bcd
G18	176.0 e	105.0 fg	612.1 a-g	75.0 c-h	30.7 gh
G19	181.0 b	110.0 de	748.1 a	78.4 a-d	33.4 ef
Sagitario	177.0 d	85.0 k	524.5 f-g	75.4 b-h	36.6 d
G21	173.0 h	90.0 j	499.3 g	75.7 b-h	32.4 efg
G22	174.0 g	102.5 gh	518.9 g	77.5 a-e	28.5 ı
G23	172.0 ı	102.5 gh	706.7 a-d	75.0 c-h	39.7 ab
G24	170.0 j	92.5 ıj	618.2 a-g	78.9 abc	32.2 efg
Adana-99	174.0 g	107.5 ef	614.7 a-g	78.8 abc	33.5 ef
G. Ortalama:	175.0	105.1	627.6	76.3	34.4
LSD (0.05) :	0.33**	3.43**	148.36*	4.71**	2.08**
VK (%) :	0.11	1.99	14.4	3.76	3.69

G. Ortalama: genel ortalama

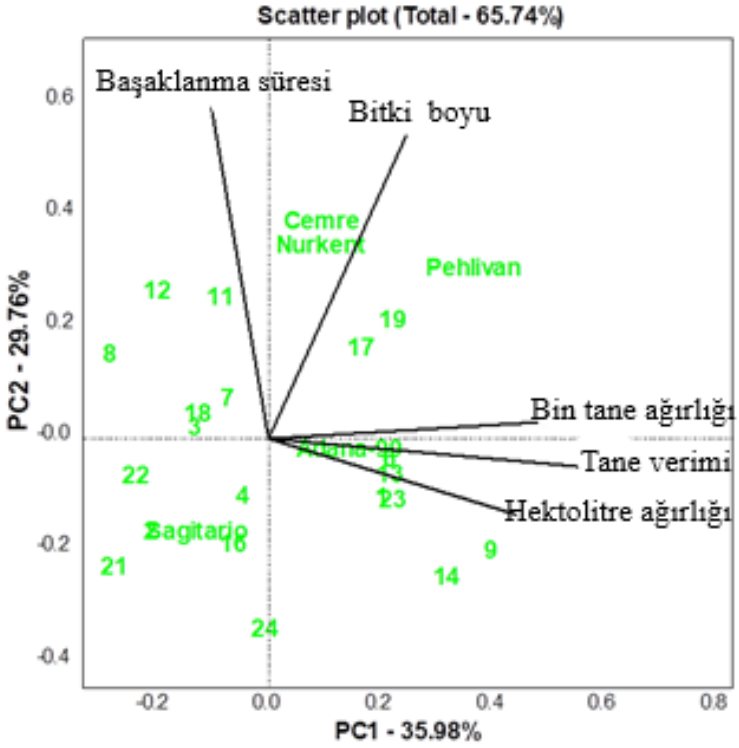
Araştırmada, başaklanma süresi yönünden genotipler arasında geniş varyasyon olduğu tespit edilmiştir. Başaklanma süresinin 170-184 gün arasında farklılık gösterdiği ve deneme

ortalamasının ise 175 gün olduğu belirlenmiştir. Mevcut materyalde G9, G13, G14 ve G24 genotipleri 170 gün süre ile en erkenci, Cemre (184 gün) çeşidi ise en geçci genotip olarak kayıt altına alınmıştır (Tablo 4). Başaklanma süresini Kendal ve ark. (2012) 108.5-114.5 gün, Abbas (2017) 110.90-146.65 gün, Koç & Aydoğan Çifci (2022) 142.25-149.75 gün olduğunu bildirmiştir. Çalışmamızda, daha uzun başaklanma sürelerinin gözlenmesi çevre koşullarının etkisine bağlanabilir.Ekmeklik buğday genotiplerine ilişkin bitki boylarının 85-120 cm arasında değiştiği ve deneme ortalamasının 105.1 cm olduğu belirlenmiştir. Çalışmada, Sagitario (85.0 cm) ekmeklik buğday çeşidinin en kısa ve Nurkent (120 cm) çeşidinin ise en uzun boylu olduğu gözlenmiştir (Tablo 4). Bitki boyu ile ilgili farklı çevrelerde yapılan çalışmalarda Aktaş (2010) 72.63-114.43 cm, Çifci & Doğan (2013) 83.15 ile 85.01 cm, Bozkurt ve ark., (2022) 56.60-76.25 cm, Koç & Aydoğan Çifci (2022) 68.50-86.50 cm olduğu belirlenmiştir. Çalışmamızda elde edilen sonuçlar Aktaş ve ark., (2010)'nın sonuçlarına benzerdir.Çalışmada, tane veriminin 499.3-748.1 kg.da^{-1} arasında değiştiği, deneme ortalamasının 627.6 kg.da^{-1} olduğu tespit edilmiştir. G19 (748.1 kg.da^{-1}) en yüksek verimli ve G21 (499.3 kg.da^{-1}) en düşük verimli genotip olarak kayda alınmıştır (Tablo 4). Buğdayda birim alan tane verimini artırmanın yolunun farklı ıslah teknikleriyle genetik kapasiteyi genişletmenin yanı sıra verimi kısıtlayan unsurları minimum düzeye indirmeyle ilişkili olduğu vurgulanmıştır (Roth ve ark., 1984; Erdem & Sakin, 2023). Maksimum verime ulaşmanın yüksek verimli çeşitlerin tercih edilmesine ve doğru agronomik uygulamalara bağlı olduğu bildirilmiştir (Kaya ve ark., 2015; Erdem & Sakin, 2023).Hektolitre ağırlığı, un randımanını önemli seviyede etkileyen teknolojik kalite parametrelerinden biridir. İlaveten, tanenin şekline, boyutuna ve saydamlığına bağlı olarak farklılık göstermektedir. Mevcut materyalde hektolitre ağırlığının 71.4-80.8 kg.hl^{-1} arasında değişim gösterdiği ve deneme ortalamasının 76.3 kg.hl^{-1} olduğu belirlenmiştir (Tablo 4). Çalışmada, G9 (80.8 kg.hl^{-1}) en yüksek ve G2 (71.4 kg.hl^{-1}) en düşük hektolitre ağırlığını vermiştir. Bu bağlamda, G9 ekmeklik buğday genotipinde un randımanının daha yüksek olması beklenebilir. Hektolitre ağırlığına ilişkin olarak Aktaş ve ark., (2017) 78.0-85.1 kg.hl-^{1}, Karaman (2020a) 75.0-80.2 kg.hl^{-1} arasında değişim gösterdiğini bildirmiştir.Bin tane ağırlığı, genetik yapının yanı sıra önemli düzeyde çevre faktörlerinin etkisi altındadır. İlaveten, bin tane ağırlığı da un randımanını etkilemektedir. Bin tane ağırlığının 29.9-40.4 g arasında farklılık gösterdiği ve deneme ortalamasının 34.4 g olduğu tespit edilmiştir. Pehlivan (40.4 g) ekmeklik buğday çeşidi en yüksek bin tane ağırlığına sahip olurken, G8 (29.9 g) en düşük bin tane ağırlığını vermiştir (Tablo 4). Bin tane ağırlığı kalıtım ve ekolojinin etkisi altında farklılık göstermekle ile beraber bin tane ağırlığının Aydın ve ark. (2007) 32.4- 43.2 g, Metin (2019)

37.28-37.29 g, Bozkurt ve ark., (2022) 30.60-41.55 g, Koç & Aydoğan Çifci (2022) 26.96-36.25 g farklılık gösterdiğini tespit etmiştir.

3.1.GGE Biplot Tekniğinde Genotip-Özellik İlişkisinin Vektörler İle Yorumlanması

Araştırmada; PC1 %35.98, PC2 %29.76 ve PC1+PC2 %65.74 oranında incelenen özellikler yönünden genotipler arasındaki varyasyonu açıklamıştır (Şekil 1). Biplot analizinin vektörler ile yorumlanmasında özellikleri temsil eden vektörlerin yönü, aralarındaki açı ve uzunluğu dikkate alınarak özellikler arasındaki ilişki ve genotipler arasındaki varyasyon açıklanabilir (Yan & Tinker, 2006; Karaman, 2020b). Bu bağlamda, tane verimi ile bin tane ve hektolitre ağırlığı arasında güçlü pozitif korelasyon olduğu belirlenmiştir. Başaklanma süresi ile bitki boyu arasında pozitif korelasyon olduğu gözlenmiş olmakla beraber tane verimi ve hektolitre ağırlığı ile negatif korelasyon olduğu tespit edilmiştir.



Şekil 1. Genotip-özellik ilişkisinin vektörler ile sunumu

Ayrıca, başaklana süresi ve bitki boyu yönünden genotipler arasındaki varyasyon yüksek, bin tane ve hektolitre ağırlığında varyasyonun düşük olduğu söylenebilir (Şekil 1). Başaklanma süresi uzadıkça tane veriminin ve hektolitre ağırlığının düşmesi Diyarbakır ili koşullarında sıcaklık stresine maruz kalma ile açıklanabilir. G1, G6, G13, G14, G19 tane veriminde, G1, G6, G9, G14 ve G23 bin tane ağırlığında, G9, Pehlivan, G14 ve G23 hektolitre ağırlığında öne çıkan genotipler olmuştur (Şekil 1).Korelasyon analizi sonuçlarına göre tane verimi ile hektolitre (r=0.2945*) ve bin tane ağırlığı (0.2383*) arasında pozitif korelasyon olduğu belirlenmiştir.

İlaveten, bin tane ağırlığı ile hektolitre ağırlığı (0.2304*) arasında pozitif korelasyon olduğu tespit edilmiştir (Tablo 5).

Tablo 5.İncelenen özellikler arası korelasyon ve önemlilik durumu

Özellikler	Başaklanma süresi (gün)	Bitki boyu (cm)	Tane verimi ($kg.da^{-1}$)	Hektolitre ağırlığı ($kg.hl^{-1}$)
Bitki boyu	0.4617**			
Tane verim	-0.1596	0.1891		
Hektolitre ağırlığı	-0.1014	0.0543	0.2945*	
Bin tane ağırlığı	-0.0289	0.1535	0.2383*	0.2304*

Tane verimi ile başaklanma süresi arasında önemsiz olmakla beraber negatif korelasyon görülmesi bölge koşulları için seleksiyon sürecinde dikkate alınması gereken bir sonuçtur (Tablo 5).

4. SONUÇLAR

Çalışmada, erkenci ve aynı zamanda tane verimi ve/veya kalite bakımından kontrol çeşitlerden daha üstün olan birçok ileri kademe hattın olduğu tespit edilmiştir. Üstün nitelikli olduğu belirlenen ileri kademe bu hatların aynı zamanda ortalama bir bitki boyuna (95-110 cm) sahip olması saman verimi açısından da kıymetlidir. Bu bağlamda; G1, G6, G9, G13, G14, G23 ve G24 ileri kademe hatlarının geleceğe dönük ümit var hatlar olabileceği, aynı zamanda bu hatların ıslah programlarında ebeveyn olarak kullanılabileceği sonucuna varılmıştır.

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BAZI NOHUT ÇEŞİTLERİNİN MORFOLOJİK VE FİZYOLOJİK ÖZELLİKLER BAKIMINDAN DEĞERLENDİRİLMESİ

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ÖZET
Nohut *(Cicer arietinum* L.*)*, dünyada ve Türkiye'de ekim alanı ve üretim miktarı bakımından yemeklik tane baklagiller içerisinde ön sıralarda yer almaktadır. Nohut tanesinin besin içeriği bakımından zengin olması insan beslenmesinde büyük önem arz etmektedir. Çalışmada amaç, bazı nohut genotiplerini tane verimi, morfolojik ve fizyolojik özellikler bakımından incelemekti. Deneme, Muş ilinin yağışa dayalı koşullarında tesadüf blokları deneme desenine göre beş tekrarlamalı olarak yürütüldü. İncelenen özelliklerden ana dal sayısı hariç kalan tüm özelliklerde genotipler arasında $p \leq 0.01$ veya $p \leq 0.05$ düzeyinde önemli farklılıklar olduğu belirlendi. Çalışmada, tane verimi 100.2-149.2 kg.da^{-1}, bitki boyu 25.0-30.9 cm, ilk bakla yüksekliği 8.9-11.8 cm, bakla sayısı 17.3-27.6 adet.bitki^{-1}, çiçeklenme süresi 50.0-53.2 gün, bitki örtüsü sıcaklığı 33.1-34.1 ^{o}C, normalize edilmiş vejetasyon farklılık indeksi 0.446-0.632 arasında farklılık gösterdi. Zuhal nohut çeşidi en yüksek tane verimine sahip olmakla beraber en düşük bitki örtüsü sıcaklığı ve en yüksek normalize edilmiş vejetasyon indeksi değerini verdi. Bitki örtüsünü serin tutan ve aynı zamanda iyi biyomasa sahip genotiplerin yüksek tane verimi verdiği gözlenmiştir. Korelasyon analizi sonuçlarına göre tane verimi ile bitki boyu (r=0.5675**), bakla sayısı (r=0.8213**) ve normalize edilmiş vejatasyon farklılık indeksi (0.9344**) arasında pozitif ve önemli ilişki olduğu belirlendi. Zuhal nohut çeşidinin ebeveyn, bitki örtüsü sıcaklığı ve normalize edilmiş vejatasyon indeksinin seleksiyon kriteri olarak ıslah programlarında kullanılması faydalı olacaktır. İlaveten, çalışmanın birkaç yıl ve/veya lokasyonda tekrar edilmesinin ise sonuçların kesinliği yönünden ihtiyaç olduğu düşünülmektedir.
Anahtar Kelimeler: Nohut, verim, morfoloji, fizyoloji

EVALUATION OF SOME CHICKPEA VARIETIES IN TERMS OF MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERISTICS

ABSTRACT
Chickpea *(Cicer arietinum* L.*)* ranks among the edible legumes in the world and in Türkiye in terms of cultivation area and production amount in front of row. The rich nutritional content of chickpeas is of great importance in human nutrition. The aim of the study was to examine some chickpea genotypes in terms of grain yield, morphological and physiological characteristics. The experiment was carried out with five replications according to the randomized experiment blok design based of rainfed conditions in Muş province. It was determined that there were significant differences between genotypes at the level of $p \leq 0.01$ or $p \leq 0.05$ in all characteristics examined, except for the number of major branches. In the study, grain yield 100.2-149.2 $kg.da^{-1}$, plant height 25.0-30.9 cm, first pod height 8.9-11.8 cm, number of pods 17.3-27.6 $pcs.plant^{-1}$, flowering time 50.0-53.2 days, canopy temperature 33.1-1. 34.1 ^{o}C, normalized difference vegetation index 0.446-0.632 between were changed. Zuhal chickpea variety was the highest grain yield, but also the lowest canopy temperature and the highest normalized difference vegetation index value. It has been observed that genotypes that keep the vegetation cool and also have good biomass give high grain yield. According to the correlation analysis results, it was determined that there were a positive and significant relationship between grain yield and plant height (r=0.5675**), number of pods (r=0.8213**) and normalized difference vegetation index (0.9344**). It would be useful to use the parent, canopy temperature and normalized difference vegetation index of the Zuhal chickpea variety as selection criteria in breeding programs. Additionally, it is thought that it is necessary to repeat the study in several years and/or locations in order to ensure the accuracy of the results.
Keywords: Chickpea, yield, morphology, physiology

GİRİŞ

Nohut (*Cicer arietinum* L.), dünya genelinde insan ve hayvan beslenmesinde kullanılan önemli yemekli tane baklagillerden biridir. Türkiye'de nohut ekim alanı 518 bin hektar, üretimi 630 bin ton ve tane verimi ise 122 kg/da'dır. Bu veriler doğrultusunda nohut Türkiye'de en önemli yemeklik tane baklagillerden biri olma potansiyelini korumaktadır (FAO, 2021). Nohutta tane besin değeri yönünden %16.4-31.2 protein, %1.5-6.8 yağ, %38.1-73.3 karbonhidrat ve %1.6-9.0 selüloz içermektedir. Protein kapsamına bakıldığında insan beslenmesinde kıymetli olan amino asitlerce (lysine, isoleucine ve leucine) zengin olduğu söylenebilir. Fakat, methionine, cystine ve tryptophan bakımından fakirdir (Şehirali, 1988; Doğan ve ark., 2015). Nohutta bitki boyu, bitkide dal sayısı ve bitkide bakla sayısı gibi özellikler birim alan tane verimi üzerinde etkili olan faktörlerdir (Tosun ve Eser, 1975; Açıkgöz ve Kıtıkı, 1994; Düzdemir ve ark., 2007). Tarla bitkilerinin yetiştiriciliğinde toprakta su miktarı azaldıkça stomaların kapanmasına bağlı olarak yaprak sıcaklığının arttığı ve hava sıcaklığından daha yüksek sıcaklıkların görülebileceği, bu bağlamda bitki örtüsü sıcaklığının bitkilerin tarlada yetiştirilme performansıyla doğrudan ilişkili olduğu vurgulanmıştır (Reynolds ve ark., 1994; Başdemir ve Yıldırım). Bitki örtüsü ile ilgili sıcaklık ölçümlerinin verimle en güçlü korelasyonu yüksek sıcaklık problemi olmakla birlikte su kısıtlılığının olmadığı şartlarda verdiği bildirilmiştir (Reynolds ve ark., 1994; Başdemir ve Yıldırım). Çalışmanın amacı; tane verimi ile bazı verim komponentleri, morfolojik ve fizyolojik özellikler arasındaki ilişkiyi belirlemektir.

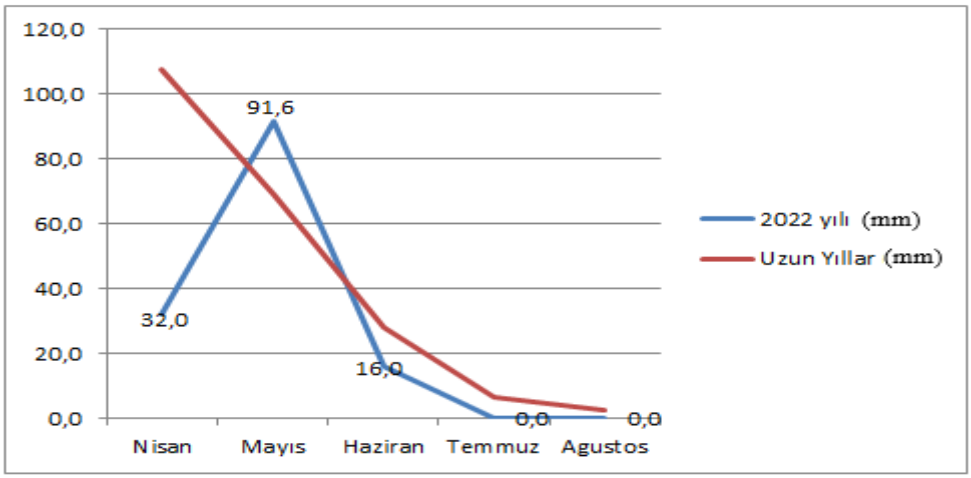
2.MATERYAL VE METOT

Araştırma, Muş ilinin yağışa dayalı koşullarında 2022 yılı nohut yetiştirme sezonunda yazlık ekim koşullarında yürütülmüştür. Araştırma materyalini Aksu (Orijini: Doğu Akdeniz Geçit Kuşağı Tarımsal Araştırma Enstitüsü Müdürlüğü), Aslanbey (Orijini: Doğu Akdeniz Geçit Kuşağı Tarımsal Araştırma Enstitüsü Müdürlüğü) ve Zuhal (Orijini: Karadeniz Tarımsal Araştırma Enstitüsü Müdürlüğü) çeşitleri ile 1 yerel (Orijini: Muş ili) nohut çeşidi oluşturmuştur. Denemede; her parsel 4 sıra, sıra arası 30 cm, parsel uzunluğu 4 metre uzunluğunda ve ekim normu 50 tohum.m^{-2} yoğunluğunda ve deneme deseni tesadüf blokları deneme desenine göre 5 tekerrürlü olarak tasarlanmıştır. Yabancı otlar ile mücadele ihtiyaç dahilinde el ile sökülerek temizlik yapılmıştır. Ekimde toplam 4.8 m^2 olan parselin sağından, solundan birer sıra ve başından, sonundan 0.5 m kesildikten sonra geriye kalan 1.8 m^2 üzerinden hasat yapılmıştır. Hasat işlemi 8 Ağustos 2022 yılında, harmanlama ise 09-30 Ağustos 2024'te tamamlanmıştır.

Tablo 1. Deneme alanı topraklarının içeriğine ilişkin bilgiler

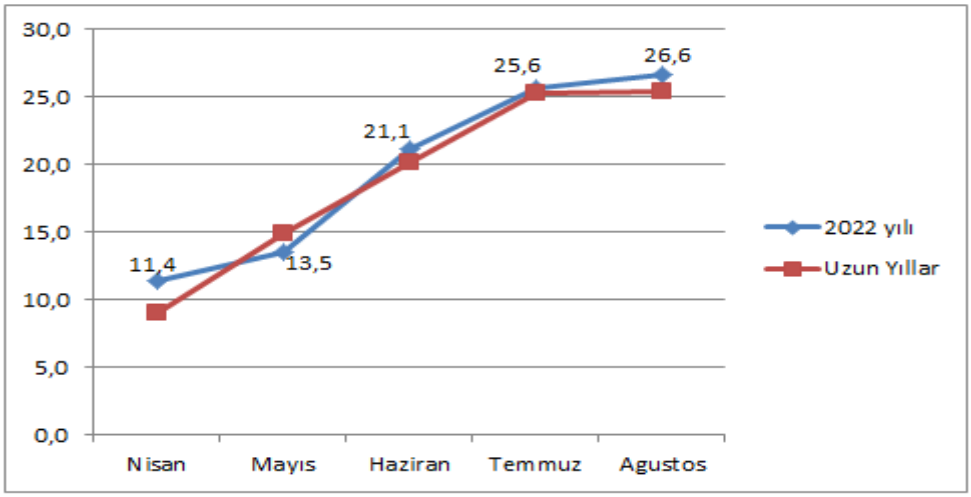
Toprak Bünyesi	Toplam tuz (%)	Ph	Kireç CaCO3 (%)	Fosfor P_2O_5 (kg/da)	Organik madde (%)
Killi-Tın	0.38	7.8	2.5	2.0	1.57

Deneme alanı topraklarının tuzsuz, hafif bazik, fosfor ve organik madde içeriğinin az olduğu belirlenmiştir (Tablo 1). Eksik olan bitki besin elementi ihtiyacını tamamlamak için ekim ile beraber saf madde üzerinden 6 kg fosfor (P_2O_5) ve 2.5 azot (N) verilmiştir. Çalışmada, üst gübre uygulaması yapılmamıştır.



Şekil 1. Muş İlinin 2022 nohut yetiştirme sezonu ve uzun yıllar yağış miktarı (mm)

Muş ilinde gerçekleşen yağış miktarı incelendiğinde, 2022 nohut yetiştirme sezonunda Mayıs ayı hariç diğer aylarda uzun yıllar ortalamasının altında yağış olduğu gözlenmektedir. Mayıs ayında daha yüksek yağış olması nohut çıkışlarının homojen olmasına katkı sağladığı düşünülmektedir (Şekil 1).Sıcaklık değerlerine bakıldığında Mayıs ayı hariç geriye kalan tüm aylarda daha yüksek sıcaklıkların yaşandığı anlaşılmaktadır. Bu durum, vejetasyon süresinin kısalmasına bağlı olarak tane dolum süresinin beklenenden daha kısa sürmesine sebep olmuş ve nohutta birim alan tane verimini olumsuz etkilediği düşünülmektedir (Şekil 2).



Şekil 2. Muş İlinin 2022 nohut yetiştirme sezonu ve uzun yıllar sıcaklık değerleri (°C)

2022 yılı nohut yetiştirme sezonu yağış ve sıcaklık ekseninde değerlendirildiğinde olağan olmayan bir sezonun yaşandığı söylenebilir.Araştırmada, tane verimini belirlemek için parsel bazında kenar tesirleri devre dışı bırakıldıktan sonra kalan kısım hasat edilmiş ve 0.001 seviyede hassas terazide tartılarak elde edilen değer kg.da^{-1}'a dönüştürülmüştür. Bitki boyu, ilk bakla yüksekliği, ana dal sayısı ve bakla sayısı hasat öncesinde her parselde 10 bitki üzerinde alınan gözlemlerin ortalaması alınarak belirlenmiştir. Çiçeklenme süresi için ekimden her parselin %50'si çiçekleninceye kadar geçen süre gün olarak hesaplanmıştır. Bitki örtüsü sıcaklığı ve normalize edilmiş vejetasyon farklılık indeksi için gözlemler parsel bazında %50 bakla bağlama döneminde alınmıştır.

3.ARAŞTIRMA VE BULGULAR

Araştırmada, bitkideki ana dal sayısı (ADS) hariç tüm özelliklerde genotipler arasında önemli düzeyde varyasyon olduğu belirlenmiştir (Tablo 2). Çalışmada tane verimi 100.2-149.2 kg.da^{-1} arasında değişim göstermiş ve deneme ortalamasının 129.5 kg.da^{-1} olduğu tespit edilmiştir. Zuhal (149.2 kg.da^{-1}) nohut çeşidi en yüksek birim alan tane verimi ile ilk sırada yer almıştır (Tablo 2). Birim alan tane verimi ile ilgili farklı çevrelerde yapılan çalışmalarda Biçer ve Anlarsal (2004) 121.5-166.6 kg.da^{-1}, Düzdemir ve ark. (2007) 94.9-153.1 kg.da^{-1}, Mart ve ark. (2021) 45.52-309.33 kg.da^{-1} olduğunu bildirmiştir.

Tablo 2. İncelenen özellikler, elde edilen değerler ve oluşan gruplar

Çeşit	TV (kg.da^{-1})	BB (cm)	İBY (cm)	ADS (ad.bit^{-1})	BS (ad.bit^{-1})	ÇS (gün)	BÖS (^{o}C)	NDVI
Aksu	129.0 c	30.9 a	11.78 a	2.38	25.0 a	53.2 a	33.1 b	0.593 b
Aslanbey	139.6 b	30.8 a	11.74 a	2.50	27.6 a	51.6 ab	34.1 a	0.620 a
Yerel	100.2 d	25.0 b	8.94 b	2.60	17.3 b	50.0 b	33.9 a	0.446 c
Zuhal	149.2 a	29.6 a	11.80 a	2.56	27.2 a	51.8 a	33.0 b	0.632 a
G. Ortalama	129.5	29.1	11.07	2.51	24.3	51.7	33.5	0.573
Mak. değer	149.2	30.9	11.80	2.60	27.6	53.2	34.1	0.632
Min. Değer	100.2	25.0	8.94	2.38	17.3	50.0	33.1	0.446
LSD (0.05)	5.87**	1.95**	1.81*	Ö.D.	3.56**	1.66*	0.50**	0.02**
CV (%)	3.29	4.87	11.89	11.07	10.65	2.34	1.09	2.51

TV: tane verimi, BB: bitki boyu, İBY: ilk bakla yüksekliği, ADS: bitkide ana dal sayısı, BS: bakla sayısı, ÇS: çiçeklenme gün sayısı, BÖS: bitki örtüsü sıcaklığı, NDVI: normalize edilmiş vejetasyon farklılık indeksi, Mak.; maksimum, Min.: minimum, G. Ortalama: genel ortalama, ad.bit^{-1}: adet.bitki^{-1}Bitki boyunun 25.0-30.9 cm arasında farklılık gösterdiği ve bitki boyuna ilişkin deneme ortalamasının 29.1 cm olduğu gözlenmiştir. Zuhal (29.6 cm) nohut çeşidinin en uzun, yerel (25.0 cm) çeşidin ise en kısa boylu olduğu görülmüştür (Tablo 2). Bitki boyunu; Düzdemir ve ark. (2007) 35.7-44.3 cm, Yalçın ve ark. (2018) 38.2-41.9 cm, Ercan ve ark. (2019) 30.5-47.4 cm, Demirci ve Bildirici (2020) 39.0-48.3 cm olduğunu belirlemiştir. Çalışmada, çeşitlere ait bitki boylarının genel olarak kısa kalmasının yazlık ekim sebebiyle vejetasyon süresinin kısa olmasından kaynaklandığı düşünülmektedir.İlk bakla yüksekliğinin 8.9-11.8 cm arasında değiştiği, yerel çeşit hariç tüm çeşitlerin aynı grupta yer alarak benzer değerler verdiği belirlenmiştir. İlk bakla yüksekliği dikkate alındığında yerel çeşit hariç tüm çeşitlerin makinalı tarıma uygun olduğu söylenebilir (Tablo 2). İlk bakla yüksekliğinin Karakan Kaya (2014) 24.4-35.1 cm, Dinç (2014) 19.1-25.3 cm, Demirci ve Bildirici (2020) 28.8-38.8 cm arasında değişim gösterdiğini belirlemiştir.Bitkide ana dal sayısının 2.4-2.6 adet arasında değiştiği, çeşitler bazında elde edilen değerlerin benzer olduğu ve istatistiki açıdan fark olmadığı tespit edilmiştir (Tablo 2). Ana dal sayısı ile ilgili Kaçar ve ark. (2005) 2.5-3.2 adet.bitki^{-1}, Yiğitoğlu (2006) 2.6-3.3 adet.bitki^{-1}, Ercan ve ark.(2019) 1.7-2.7 adet.bitki^{-1} olduğunu bildirmiştir.Bitkide bakla sayısının 17.3-27.6 adet.bitki^{-1}, deneme ortalamasının 24.3 adet.bitki^{-1} ve Aslanbey (27.6 adet.bitki^{-1}) çeşidinin ilk sırada yer aldığı belirlenmiştir. Bakla sayısına ilişkin yapılan çalışmalarda Düzdemir ve ark., (2007) 13.6-22.2 adet.bitki^{-1}, Çiftçi ve ark. (2004) 6.5-18.4 adet.bitki^{-1}, Dinç (2014) 5.5-8.3 adet.bitki^{-1}, Demirci ve Bildirici (2020) 6.9-13.0 adet.bitki^{-1} olduğunu tespit etmiştir (Tablo 2).Çiçeklenme süresinin 50.0-53.2 gün ve

deneme ortalamasının 51.7 gün olduğu gözlenmiştir. Çalışma, yazlık ekim koşullarında yürütüldüğünden dolayı çiçeklenme süreleri kısa olmakla beraber yerel çeşit en erken ve Zuhal çeşidi ise en geç çiçeklenen nohut çeşidi olmuştur. Çiçeklenme süresinin Uzun ve ark. (2012), 57.5- 65.5 gün, Demirci ve Bildirici (2020) 47.3-53.6 gün olduğunu vurgulamıştır (Tablo 2). Bitki örtüsü sıcaklığı yönünden nohut çeşitleri arasında istatistiki açıdan önemli farklılıklar olduğu belirlenmiştir. Denemede, bitki örtüsü sıcaklığının 33.1-34.1 ^{o}C aralığında ve deneme ortalamasının ise 33.5 ^{o}C olduğu tespit edilmiştir. Çalışmada, Aksu çeşidi (33.1 ^{o}C) bitki örtüsünü en serin tutan çeşit olmuştur (Tablo 2). Bitki örtüsünü serin tutan genotiplerin kuraklık stresinin yaşandığı koşullara daha toleranslı olduğu, su stresine ve kuraklığa karşı tolerant genotip geliştirmede bitki örtüsü sıcaklığının seleksiyon unsuru olabileceği bildirilmiştir (Blum ve ark., 1989).Birim alandaki yeşil aksamın yoğunluğu hakkında fikir veren normalize edilmiş vejatasyon indeksi (NDVI) değerinin 0.446-0.632 aralığında ve deneme ortalamasının 0.573 olduğu gözlenmiştir (Tablo 2). Çalışmada tane verimi sıralaması ile NDVI sıralamasının aynı olduğu belirlenmiştir. Bu durum NDVI ile tane verimi arasında önemli bir ilişki olduğunu göstermektedir. Geçit Kuşağı Tarımsal Araştırma Enstitüsü Müdürlüğü deneme alanında nohutun tane doldurma döneminde yapılan NDVI ölçümlerinde 0.60-0.71 arasında değerler elde edilmiştir (Alkan, 2024). Çalışmamızda daha düşük değerlerin elde edilmesinin çeşit ve ekolojik faktörlerden kaynaklandığı düşünülmektedir.

Tablo 3. Araştırılan özelliklere ilişkin korelasyon kat sayısı ve önemlilik durumu ($p<0.01$ veya 0.05)

Özellikler	TV (kg.da^{-1})	BB (cm)	İBY (cm)	DS (adet.bitki^{-1})	BS (adet.bitki^{-1})	ÇS (gün)	CS (^{o}C)
BB	0.5675**						
İBY	0.5087*	0.7233**					
DS	-0.0603	0.0059	0.2978				
BS	0.8213**	0.5512**	0.5646**	-0.1111			
ÇS	0.3662	0.6782**	0.4461*	-0.1445	0.277		
CS	-0.3048	-0.2291	-0.3136	0.259	-0.1173	-0.2533	
NDVI	0.9344**	0.7514**	0.7045**	-0.1007	0.8456**	0.496*	-0.3328

Korelasyon analizi sonuçlarına göre TV ile IBY (0.5087*), BS (0.8213**) ve NDVI (0.9344**) arasında pozitif korelasyon olduğu belirlenmiştir. Ayrıca, NDVI'nın BS (0.8456**) ve ÇS (0.496*) ile pozitif ilişkili olduğu tespit edilmiştir (Tablo 3). NDVI'nın BS ile pozitif ilişkili olması nohut ıslahında tane verimi odaklı yapılacak olan seleksiyonlarda önem arz etmektedir.

4. SONUÇLAR

Araştırmada, tane verimi ile morfolojik ve fizyolojik özellikler arasında pozitif ilişki olduğu belirlenmiştir. Bitki örtüsünü serin tutan genotiplerin yüksek normalize edilmiş vejetasyon farklılık indeksi değeri verdiği ve aynı genotiplerin tane verimi bakımından öne çıktığı tespit edilmiştir. Korelasyon analizi sonuçlarına göre tane verimi ile verim komponentlerinden bakla sayısı, morfolojik özelliklerden bitki boyu ve fizyolojik özelliklerden normalize edilmiş vejetasyon farklılık indeksi arasında olumlu ilişki olduğu belirlenmiştir. Zuhal nohut çeşidinin incelenen özellikler yönünden ideal çeşit olması sebebiyle ıslah programlarında genitor olarak, normalize edilmiş vejetasyon farklılık indeksi ve bitki örtüsü sıcaklığı özelliklerinin seleksiyon kriteri olarak kullanılabileceği sonucuna varılmıştır.

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Özet
Biyokütle bazlı karbon malzemelerinin araştırılması ve geliştirilmesi, çevresel sürdürülebilirlik ve yenilenebilir enerji kaynaklarının keşfi açısından son derece önemlidir. Özellikle atık biyokütle kaynaklarının, ceviz kabuğu ve yer fıstığı kabuğu gibi doğal kaynaklardan karbon bazlı malzemelerin üretimi için potansiyeli oldukça büyüktür. Ceviz kabuğu ve yer fıstığı kabuğu gibi bitkisel atıklar, genellikle değerlendirilmeden önce çevresel sorunlara yol açabilirler. Ancak bu atık kaynakları, uygun işlemlerle karbon bazlı malzemelere dönüştürülerek çeşitli endüstriyel uygulamalarda ve çevresel iyileştirme projelerinde kullanılabilir. Karbon bazlı malzemeler, yüksek yüzey alanına sahip olmaları, mükemmel adsorpsiyon özellikleri ve termal iletkenlik gibi özelliklerinden dolayı birçok alanda potansiyel sunarlar. Bu çalışmada, ceviz kabuğu ve yer fıstığı kabuğu gibi sıkça atık olarak ortaya çıkan biyokütle kaynaklarından karbon bazlı malzemelerin üretim potansiyeli araştırılmıştır. Öncelikle kuru ceviz ve yer fıstığı kabuğu biyokütleri toplanıp, parçalanarak öğütme işlemi ardından 75 μm altı boyutlarında elendi. Boyutu küçültülüp elenen biyokütleler kül fırınında belirlenen sıcaklık ve sürede demir içerikli katalizör varlığında karbonisazyon işlemine tabi tutuldu. Karbonize edilen örnekler soğutularak toplandı. Karbonizasyon işlemi sonunda elde edilen karbon bazlı malzemelerin karakterizasyonu X-ray difraksiyonu (XRD), Fourier dönüşümlü kızılötesi spektrofotometresi (FTIR) ve Raman analizleri ile gerçekleştirildi. XRD, FTIR ve Raman analizlerinin sonuçları, lignoselülozik biyokütlenin karbonlaşma sürecinin başarıyla gerçekleştiğini ortaya koymaktadır. Bu analizler, hammaddenin yapısal değişimlerini

ve karbonizasyonun ilerleyişini ayrıntılı bir şekilde göstermektedir. Bu araştırma, ceviz kabuğu ve yer fıstığı kabuğu gibi atık biyokütle kaynaklarının yeniden değerlendirilerek karbon bazlı malzemelerin üretimindeki potansiyelini ortaya koymaktadır. Bu malzemelerin üretim süreci, çevresel olarak sürdürülebilir ve ekonomik açıdan etkin bir yaklaşımı temsil ederken, aynı zamanda çeşitli endüstriyel ihtiyaçlara da yanıt verebilmektedir. Dolayısıyla, biyokütle bazlı karbon malzemelerinin araştırılması ve geliştirilmesi, gelecekteki yeşil ve sürdürülebilir teknolojilerin geliştirilmesine önemli bir katkı sağlayacağı düşünülmektedir.
Anahtar Kelimeler: Yer fıstığı, ceviz kabuğu, biyokütle, karbon bazlı malzeme

PRODUCTION OF CARBON-BASED MATERIALS FROM WALNUT AND PEANUT BIOMASS

Abstract
The research and development of biomass-based carbon materials is extremely important for environmental sustainability and the exploration of renewable energy sources. In particular, waste biomass sources have great potential for the production of carbon-based materials from natural resources such as walnut hulls and peanut shells. Crop wastes such as walnut hulls and peanut shells can often cause environmental problems before they are utilized. However, these waste sources can be converted into carbon-based materials through appropriate processes and used in various industrial applications and environmental remediation projects. Carbon-based materials offer potential in many fields due to their high surface area, excellent adsorption properties and thermal conductivity. In this study, the potential for the production of carbon-based materials from biomass sources such as walnut shells and peanut shells was investigated. First of all, dry walnut and peanut shell biomasses were collected, crushed and sieved to a size of less than 75 μm after grinding. The reduced and sieved biomasses were subjected to carbonization process in the presence of iron-containing catalyst in a muffle furnace at the specified temperature and time. Carbonized samples were cooled and collected. The carbon-based materials obtained at the end of the carbonization process were characterized by X-ray diffraction (XRD), Fourier transform infrared spectrophotometry (FTIR) and Raman analysis. The results of XRD, FTIR and Raman analyses reveal that the carbonization process of the lignocellulosic biomass was successful. These analyses show in detail the structural changes of the feedstock and the progress of carbonization. This research demonstrates the potential of recycling waste biomass resources such as walnut shells and peanut shells for the production of carbon-based materials. The production process of these materials represents an environmentally sustainable and economically efficient approach, while at the same time responding to various industrial needs. Therefore, the research and development of biomass-based carbon materials is expected to make a significant contribution to the development of future green and sustainable technologies.
Keywords: Peanuts, walnut shells, biomass, carbon-based material

Introduction

Biomass is a renewable, abundant and cheap resource and its conversion into fuel, chemical and material precursors is of great importance to alleviate the energy crisis by reducing over-reliance on fossil resources, reduce environmental pollution and promote sustainable development (Baweja & Jeet, 2019). Recently, there is a high proportion of agricultural waste generated globally that is inefficiently used and cannot be recycled. These wastes can be considered as a viable resource that can impact environmental management. Furthermore, the utilization of biomass resources is thought to enable the use of less toxic reagents during the production phase, as well as adding value to agricultural by-products and reducing global dependence on petroleum-based feedstocks (Çavuş at al., 2022).In this study, it was aimed to investigate the potential of producing carbon-based materials from walnut shell and peanut shell, which are waste biomass sources. The obtained carbon-based materials were characterized by XRD, FTIR and Raman analysis.

Materials and Methods

Dried walnut shells were obtained from Çorum region and dried peanut shells were obtained from Osmaniye region Dried walnut and peanut shell biomasses were collected, crushed, ground and sieved to a size of less than 75 μm. The sieved biomasses were subjected to carbonization in the presence of iron-containing catalyst in a muffle furnace at 350°C. Carbonized samples were cooled and collected. The carbonized products obtained from dry walnut and peanut shell biomasses were named CC1 and CF1, respectively.

Findings and Discussion

The synthesized samples were characterized by XRD, FTIR and RAMAN analysis. The phases of the biomasses and carbonized samples were observed by XRD patterns (Figure 1). Compared to the biomasses, the characteristic peaks of the prepared CC1 and CF1 carbonized products become more pronounced, indicating that the carbonization process only consumes impurities, but does not destroy the “core” structure of the biomasses. XRD spectra obtained from the crystal phase models of biochar (Figure 1) showed the presence of a peak indicating the formation of the intact structure of carbonaceous materials (Assirey & Altamimi, 2021). As shown in Figure 1, the XRD pattern of the prepared CC1 and CF1 exhibited a diffraction peak ($2\theta=14°$), indicating that the prepared carbon-based material has an amorphous carbon composed of aromatic carbon layers. This result clearly shows that under the process condition of carbonization and activation, it gives a carbonaceous structure composed of aromatic carbon layers (Wang, at al., 2020). After the carbonization process, it is seen that the peak at $2\theta= 16.3°$

shifted to 2θ= 14° and sharpened and also the peak between 2θ= 21.9-22° broadened and a new peak was formed around 2θ= 25°.

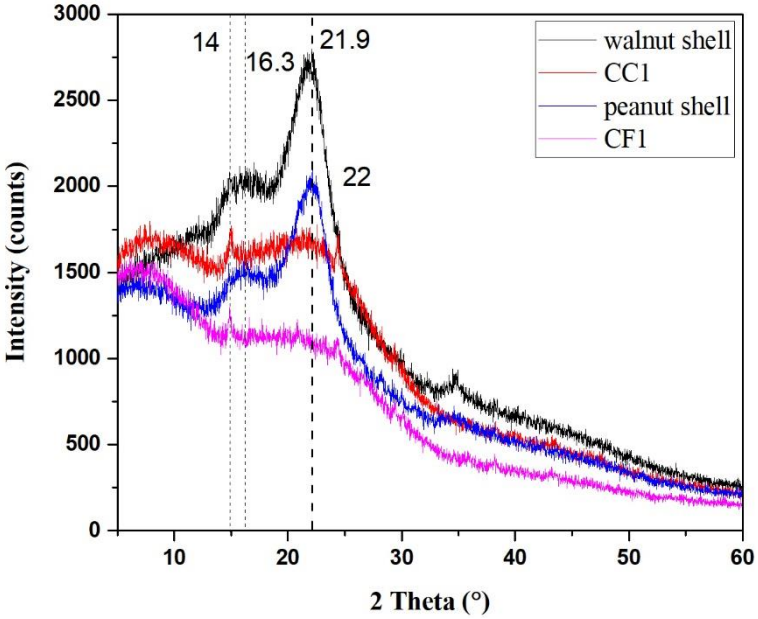


Figure 1. XRD diffractograms of biomass wastes and carbon-based materials obtained from these wastes FT-IR analysis of walnut and peanut wastes and carbon-based materials obtained from these biomasses is shown in Figure 2. It is seen that the broadband absorption peak is at 3700-3000 cm^{-1}, indicating the presence of hydroxyl group (OH). This peak was found to be broadened in CC1 and CF1 samples while it was strong and narrow in biomasses. The absorption peak observed at 2923 cm^{-1} in biomasses indicates the presence of aliphatic C-H vibration peaks originating from sp3-hybridized carbon atoms. It is observed that the intensity of this peak completely disappears in CC1 and CF1 samples (Melese at al., 2020). The bands at 1040 cm^{-1} attributed to aromatic C-O almost disappeared, while the C=C peak at 1610 cm^{-1} and the C=O peak at 1708 cm^{-1} appeared. All of these observations point to carbonization of lignocellulosic biomass (Wang at al., 2020).

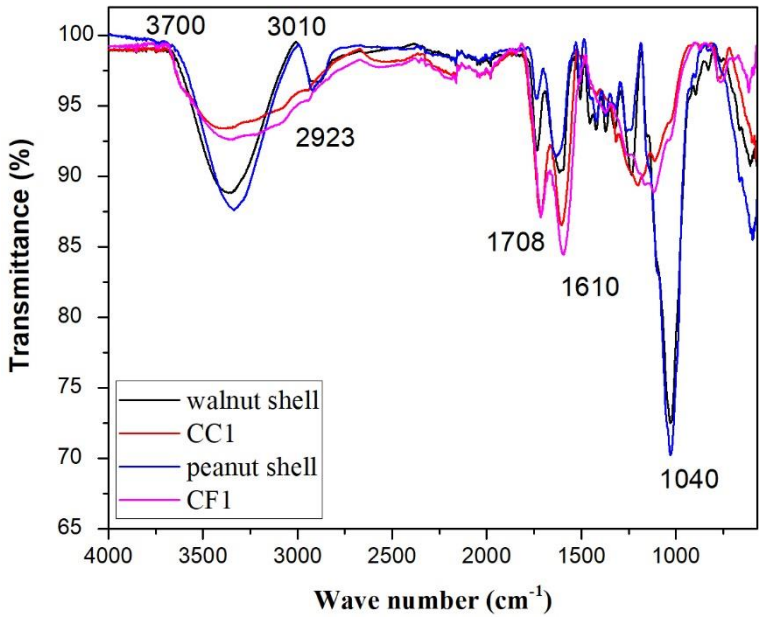


Figure 2. FT-IR spectra of biomass wastes and carbon-based materials obtained from these wastes Figure 3 shows the Raman spectra of the respective G and D bands of carbon-based materials derived from various biomass wastes. One of the leading indicators of carbon-based material formation is the characteristic peaks seen in Raman spectroscopy. Raman spectra of carbon-based materials are regularly characterized by two characteristic bands, the D-band and the G-band. The D peak is usually located around ~1350 cm^{-1} and arises due to point defects in the planar structure. This band corresponds to sp3 carbon atoms of disordered or defective carbons. The G band corresponds to the in-plane stretching vibration of sp2 hybridized C atoms in a two-dimensional hexagonal lattice and appears around ~ 1580 cm^{-1} (Li at al., 2016).

On the other hand, XRD diffractograms support the Raman analysis by showing the formation of partially turbostratic structures with assigned peaks. In our study, when all samples are evaluated within themselves, it is seen that only D and G bands belonging to carbon-based material-like structures appear.

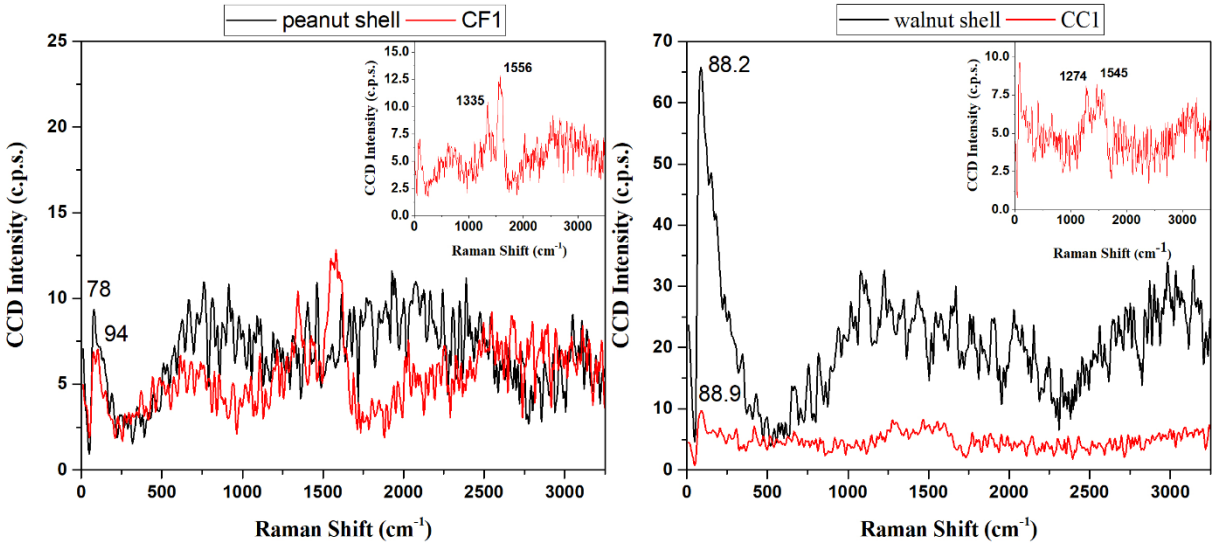


Figure 3. Raman spectra of biomass wastes and carbon-based materials obtained from these wastes

Conclusion and Recommendations

Carbon-based materials were successfully obtained from walnut shell and peanut shell biomasses. XRD diffractograms, Raman and FTIR spectra of the prepared biomasses and carbon-based materials were taken. It was determined that the carbon-based materials produced have a carbonaceous structure consisting of aromatic carbon layers.

This research has demonstrated the potential of recycling waste biomass resources such as walnut shells and peanut shells for the production of carbon-based materials. The production process of these materials represents an environmentally sustainable and economically efficient approach, while at the same time responding to various industrial needs.

As a result, the research and development of biomass-based carbon materials is expected to make a significant contribution to the development of future green and sustainable technologies.

Thanks and Information Note

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CR(VI) ÇANAKKALE ÇAN TERMİK SANTRALİ BACA GAZI ARITMA ATIKLARININ ATIKSUDAN GİDERİLMESİ: MANYETİK AKTİF KARBON İLE KARŞILAŞTIRILMASI

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Özet
Kaplama, madencilik ve deri üretimi başta olmak üzere endüstrilerin faaliyetleri sonucunda sıklıkla atık sularla birlikte yüzey ve yeraltı sularına ciddi kirlilik oluşturan altı değerlikli ağır metal iyonu olan Cr(VI) karışmaktadır. İnsan ve diğer canlıların sağlığı üzerinde tehlikeye neden olan krom, solunum yolu rahatsızlıklarından kansere kadar birçok hastalığa yol açabilmektedir. Buna karşın üç değerlikli Cr(III) iyonlarının sudaki çözünürlüğü ve toksik etkisi çok daza azdır. Son zamanlarda, Cr(VI) içeren atık suların arıtılması için adsorbsiyon tekniği dikkat çekmektedir. Atıkların katma değerli ürünlere dönüştürülmesi amacından yola çıkılarak termik santral atığı ile Cr(VI) iyonlarının giderimi incelenmiştir. Yüksek toksik Cr(VI) türlerinin Cr(III) türlerine dönüştürülmesi ve iyonların adsorblanarak giderilmesi amaçlanmıştır. Bu kapsamda çalışma parametreleri Taguchi deneysel tasarım yöntemi kullanılması ile optimize edilmiştir. pH, konsantrasyon, doz, süre ve sıcaklık kontrol edilebilir değişkenler olarak seçilmiştir. Taguchi optimizasyon çalışmasında 5 farklı faktör ve her parametre için 4 farklı seviye seçilerek L16 Taguchi faktöriyel deney tasarımı yapılmıştır. Deneylerin tamamlanmasının ardından Cr (VI) giderim yüzdeleri (%) hesaplanarak, Taguchi yöntemi ile optimum deneysel çalışma koşullarında başlangıç pH'ı 2, konsantrasyon 80 ppm, doz 20 g/L, süre 3 saat ve sıcaklık 25 ^{o}C olduğu belirlenmiştir ve belirtilen şartlarda % 99,43 oranında Cr (VI) giderme işlemi başarıyla gerçekleştirilmiştir. Termik santral atığının yüzey morfolojisi ve kimyasını belirlemek amacıyla FT-IR, SEM-EDX, pHZPC, TGA ve XRD analizleri yapılmıştır. Atığın adsorpsiyon kapasitesini belirlenmesi adına Langmuir, Freundlich, Tempkin ve Dubinin-Radushkevich modelleri kullanılacaktır. Performans değerlendirmesi amacıyla $CaSO_4$ içerikli termik santral atığının ve ko-piroliz tekniği ile sentezlenen manyetik aktif karbonun Cr(VI) giderimi üzerine karşılaştırmalı değerlendirme çalışması yapılmıştır. Bu

çalışma Çanakkale Onsekiz Mart Üniversitesi Bilimsel Araştırma Koordinasyon Birimi tarafından FBA-2023-4480 numaralı proje ile desteklenmiştir.
Anahtar Kelimeler: Termik santral atığı, manyetik aktif karbon; Cr(VI) giderimi; atık su giderimi

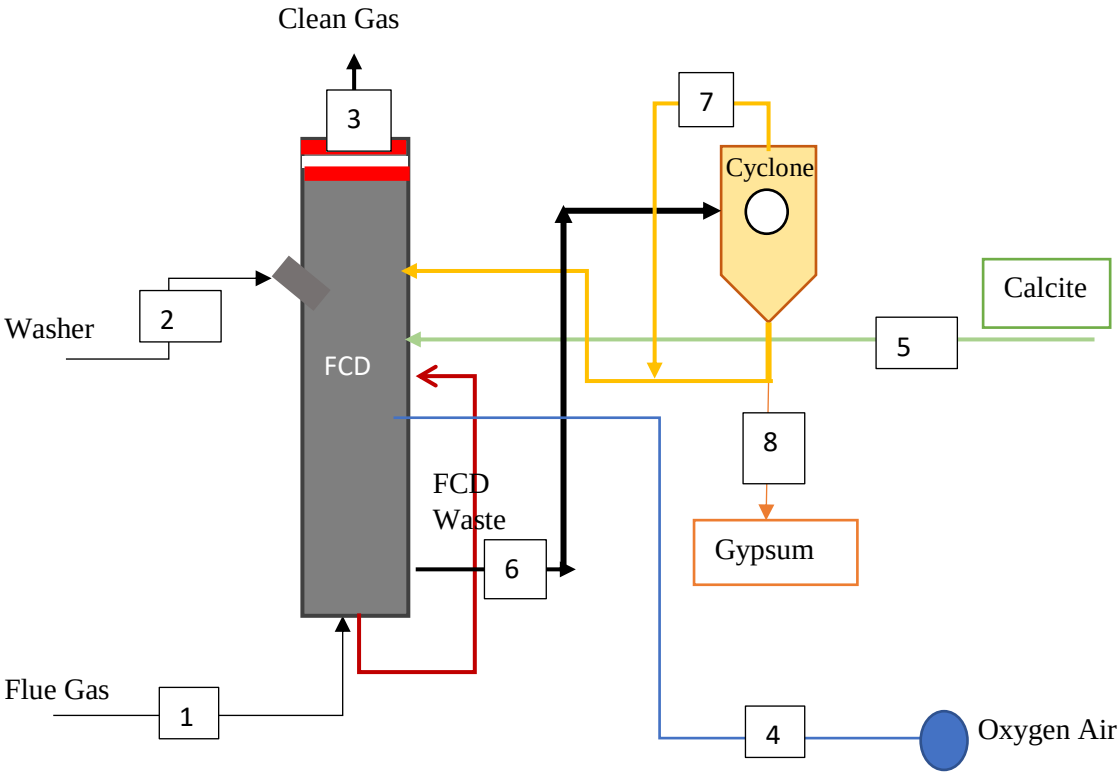
CR(VI) REMOVAL OF ÇANAKKALE ÇAN THERMAL POWER PLANT FLUE GAS TREATMENT WASTE FROM WASTEWATER: COMPARISON WITH MAGNETIC ACTIVATED CARBON

Abstract
As a result of the activities of industries such as plating, mining and leather production, Cr(VI), a hexavalent heavy metal ion that causes serious pollution to surface and groundwater, is often mixed with wastewater. Chromium, which poses a danger to the health of humans and other living organisms, can cause many diseases ranging from respiratory diseases to cancer. In contrast, the solubility and toxic effect of trivalent Cr(III) ions in water is very low. Recently, adsorption technique has attracted attention for the treatment of wastewater containing Cr(VI). Based on the aim of transforming wastes into value-added products, the removal of Cr(VI) ions with thermal power plant waste was investigated. It was aimed to convert highly toxic Cr(VI) species into Cr(III) species and remove the ions by adsorbing. In this context, the study parameters were optimized using Taguchi experimental design method. pH, concentration, dose, time and temperature were selected as controllable variables. In Taguchi optimization study, L16 Taguchi factorial experimental design was performed by selecting 5 different factors and 4 different levels for each parameter. After the completion of the experiments, Cr (VI) removal percentages (%) were calculated and it was determined by Taguchi method that the optimum experimental working conditions were initial pH 2, concentration 80 ppm, dose 20 g/L, time 3 hours and temperature 25 ^{o}C and 99.43% Cr (VI) removal was successfully achieved under the specified conditions. FT-IR, SEM-EDX, pHZPC, TGA and XRD analyses were performed to determine the surface morphology and chemistry of the thermal power plant waste. Langmuir, Freundlich, Tempkin and Dubinin-Radushkevich models will be used to determine the adsorption capacity of the waste. For the purpose of performance evaluation, a comparative evaluation study was carried out on Cr(VI) removal of CaSO4-containing thermal power plant waste and magnetic activated carbon synthesized by co-pyrolysis technique. This study was supported by Çanakkale Onsekiz Mart University Scientific Research Coordination Unit with the project number FBA-2023-4480.
Keywords: Thermal power plant waste, magnetic activated carbon; Cr(VI) removal; wastewater treatment

Introduction

In recent years, the decrease in water resources due to the rapid increase in population, urbanization and industrialization has become an important problem. As a result of the increasing production activities with the effect of the increase in industrial demands, the levels of pollutants entering the water also increase. This situation causes water resources to be polluted and limited. Water pollutants such as antibiotics, dyestuffs and heavy metals are serious pollutants due to their toxicity levels. Heavy metals, one of the pollutants, are an important area that needs to be studied to remove them from water because they have a high toxic effect on living organisms, especially humans (Wang et al., 2024). Heavy metals are among the most harmful contaminants in water. Heavy metals (e.g. Pb, As, Hg, Cd, Zn, Ag, Cu, Fe, Cr, Ni, Pd and Pt) are mainly transition metals, elements from the lower left of the periodic table and some metalloids. They are highly concentrated elements and are toxic even at ppb levels (Abu Shmeis, 2022).Among heavy metals, chromium (Cr) is highly mobile and therefore highly toxic. As a result of the activities of industries such as plating, metallurgy, tannery and leather production, it is mixed into wastewater and discharged into the environment (Gu et al., 2023). It occurs in nature as oxyanions and is frequently found in hexavalent (Cr(VI)) and trivalent (Cr(III)) forms. Chromium, which enters surface and groundwater through wastewater discharged as a result of industrial activities, can also penetrate the soil and enter the food chain through agricultural products (Ren et al., 2020).The Cr(VI) form has extremely high toxicity, while the Cr(III) form is known to be 500-1000 times less biotoxic (Ren et al., 2020). At the same time, chromium in this form is a necessary ion at limited levels for some metabolic activities such as blood sugar regulation. In contrast, the Cr(VI) form can cause many diseases such as skin irritation, organ failure and even cancer. Since the trivalent form of chromium is less toxic, it is possible to reduce the toxic effect by converting Cr(VI) to Cr(III) (Lathe & Palve, 2023).Recently, adsorption technique for the treatment of Cr(VI) containing wastewater has attracted attention. A study was conducted to investigate the removal of Cr(VI) ions using thermal power plant flue gas desulfurization (FCD) effluents as a way to convert wastes into value-added products. FCD wastes are produced in FCD systems of thermal power plant flue gases. The FGD flue gas desulfurization process used in Çanakkale Çan Thermal Power Plant is schematically shown in Figure 1. The flue gas is fed to the column from zone 1. Lime slurry is fed downwards from the top of the column. The $CaSO_4$ containing waste material generated in the system is collected from the bottom of the column and stored in the fields (Shanthakumar et al., 2008).

Figure 6. FCD flue gas treatment system flow chart



The clean gas formed after the purification process is released from the upper part of the column.There is no previous study in which thermal power plant flue gas treatment waste was used. In this study, it was aimed to utilize flue gas treatment waste for the first time and to use it as an adsorbent for the removal of heavy metals in wastewater. By using this waste containing CaSO4, Cr(VI) species in wastewater will be converted into Cr(III) species and ions will be removed by adsorbing.

Materials and Methods

Thermal power plant flue gas treatment waste was obtained from Çanakkale Çan Thermal Power Plant. SEM-EDX (Scanning electron microscopy/Energy dispersive spectroscopy), FTIR (Fourier transform infrared spectroscopy), XRD (X-Ray diffraction), XRF (X-Ray fluorescence), TGA techniques were applied for the characterization of surface morphology, particle size, determination of functional groups and elemental composition of the waste.The waste obtained from Çanakkale Çan Thermal Power Plant was dried at 80ºC for 24 hours and then the dried material was sieved through a 100-mesh sieve.Stock chromium solution was prepared to determine the Cr(VI) ion adsorption capacity of the waste. For this purpose, 2.808 g of 99% pure $Na_2Cr_2O_7$ (Merck) was weighed. It was placed in a 1 L balloon jug, some distilled

water was added to dissolve it, and a stock solution of 1000 mg/l was prepared by adding distilled water up to the line of the balloon jug. 6N H_2SO_4 was prepared from 95-98% (d = 1.84 g/cm^3) H_2SO_4 (Merck) solution to be used in the experiments.Experimental parameters were optimized using MINITAB software. Factors affecting the adsorption process such as pH, concentration, dose, time and temperature were determined as study parameters. These 5 factors were determined as controllable variables and 4 levels were determined for each of them and 5 factor 4 level L16 Taguchi factorial experimental design was applied.The pH values were chosen as 1.5, 2, 3, 4, concentration values as 20, 40, 60, 80 ppm, dosages as 5, 10, 20, 40 g/L, time as 1, 3, 6, 12 hours and temperature as 25, 35, 45, 55 ^oC. 16 experimental sets were determined by Taguchi method and the experimental sets are given in Table 1.

Table 3. Taguchi experimental sets and % chromium removal

Experimental No	pH	Concantration	Dosage	Time	Temperature	% Removal
1	**1.5**	**20**	**5**	**1**	**25**	**100**
2	**1.5**	**40**	**10**	**3**	**35**	**100**
3	**1.5**	**60**	**20**	**6**	**45**	**98,27**
4	**1.5**	**80**	**40**	**12**	**55**	**100**
5	**2**	**20**	**10**	**6**	**55**	**100**
6	**2**	**40**	**5**	**12**	**45**	**98,70**
7	**2**	**60**	**40**	**1**	**35**	**98,79**
8	**2**	**80**	**20**	**3**	**25**	**99,43**
9	**3**	**20**	**20**	**12**	**35**	**100**
10	**3**	**40**	**40**	**6**	**25**	**0,01**
11	**3**	**60**	**5**	**3**	**55**	**0,01**
12	**3**	**80**	**10**	**1**	**45**	**0,01**
13	**4**	**20**	**40**	**3**	**45**	**0,01**
14	**4**	**40**	**20**	**1**	**55**	**0,01**
15	**4**	**60**	**10**	**12**	**25**	**0,01**
16	**4**	**80**	**5**	**6**	**35**	**0,01**

After completion of the experiments, the amount of Cr(VI) in the solutions was determined by diphenyl carbazide method (APHA-AWWA-WPCF, 1989).

Chromium solutions with concentrations ranging from 0.1-1.0 mg/L were prepared. Diphenyl carbazide solution was prepared by dissolving 0.5 g 1,5-diphenyl carbazide in 100 ml acetone solution. Additions were made to the solutions according to the procedure and the colors were allowed to stabilize. Absorbance values were measured at 540 nm wavelength with L7 Double Beam UV Spectrophotometer visible region spectrophotometer to generate standard calibration

curve.The solutions formed as a result of Cr(VI) removal processes were diluted considering the color differences and diphenyl carbazide method was applied. Absorbance values were measured by adding 2 ml 6N H2SO4, 1 ml 1,5-diphenyl carbazide solution to the solutions. The concentrations of Cr(VI) ions in the solutions were determined using the standard calibration curve equation. The percentage of chromium removal is expressed in Table 1.

The optimum experimental operating parameters were determined by Taguchi method. The optimum experimental operating parameters were determined as initial pH 2, concentration 80 ppm, dose 20 g/L, time 3 hours and temperature 25 ^{o}C.

Upon testing the reusability of the adsorbent, 3 sets of experiments were repeated with the same adsorbent under optimum conditions.

Findings and Discussion

Elemental analysis, BET, TGA, XRD, FT-IR, SEM-EDX, XRD, FT-IR, SEM-EDX, FT-IR analyses were carried out to determine the physicochemical properties of thermal power plant flue gas treatment waste. Adsorption isotherms and kinetics were also studied to investigate the Cr(VI) removal and mechanism of the material.

Figure 1 shows the FTIR results of the FCD waste. The characteristic vibration bands of sulfates around 1085 cm^{-1} confirmed the presence of calcium sulfate in the structure.

Figure 2a shows the EDX result after drying of FCD waste. Figure 2b shows the EDX result of the adsorbent after chromium removal. $CaSO_4$ content in the structure was observed in both graphs. Cr(VI) ions adsorbed on the structure are seen in the EDX result.

Figure 3a shows the SEM images of the FCD waste. The pore structure on the surface was visualized by SEM analysis. Furthermore, BET analysis of the effluent shows that it has a surface area of 11.936 m^2/g. Despite exhibiting a low surface area, a high level of removal was achieved. The mapping image in Figure 3b shows the Cr adsorbed on the structure.

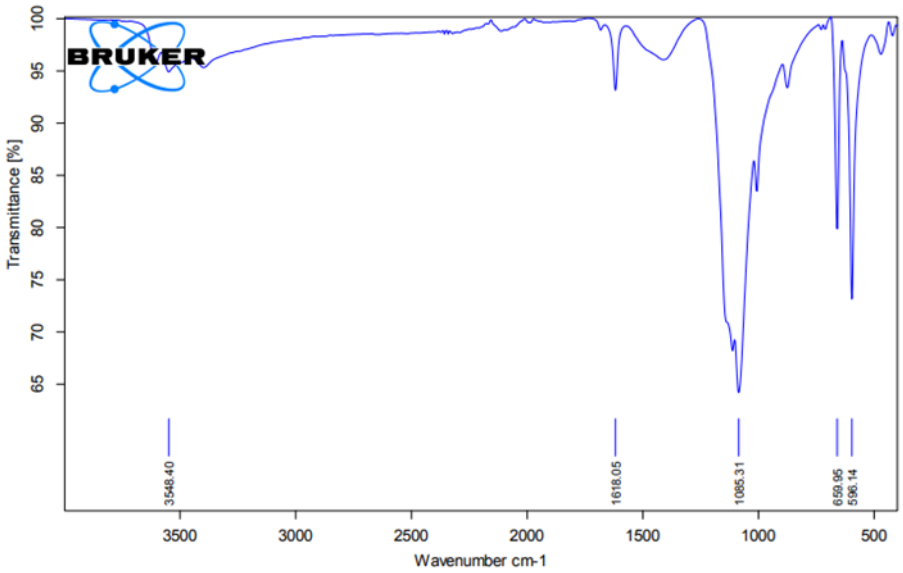
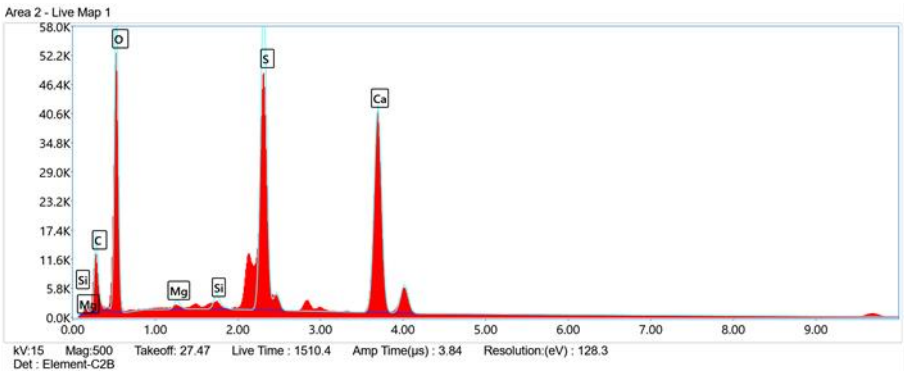
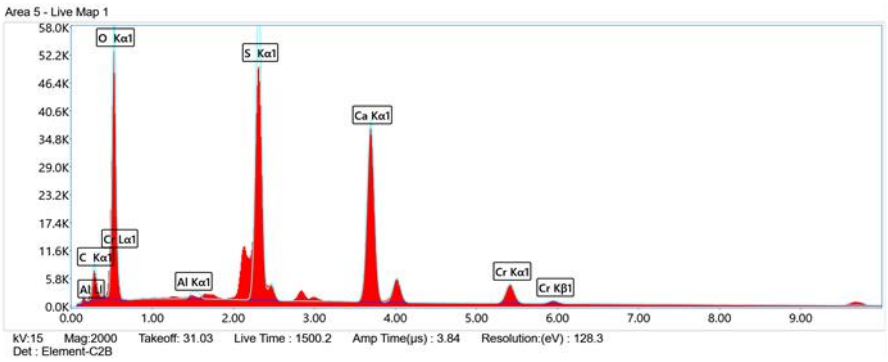


Figure 10. FTIR result of FCD waste after chromium removal

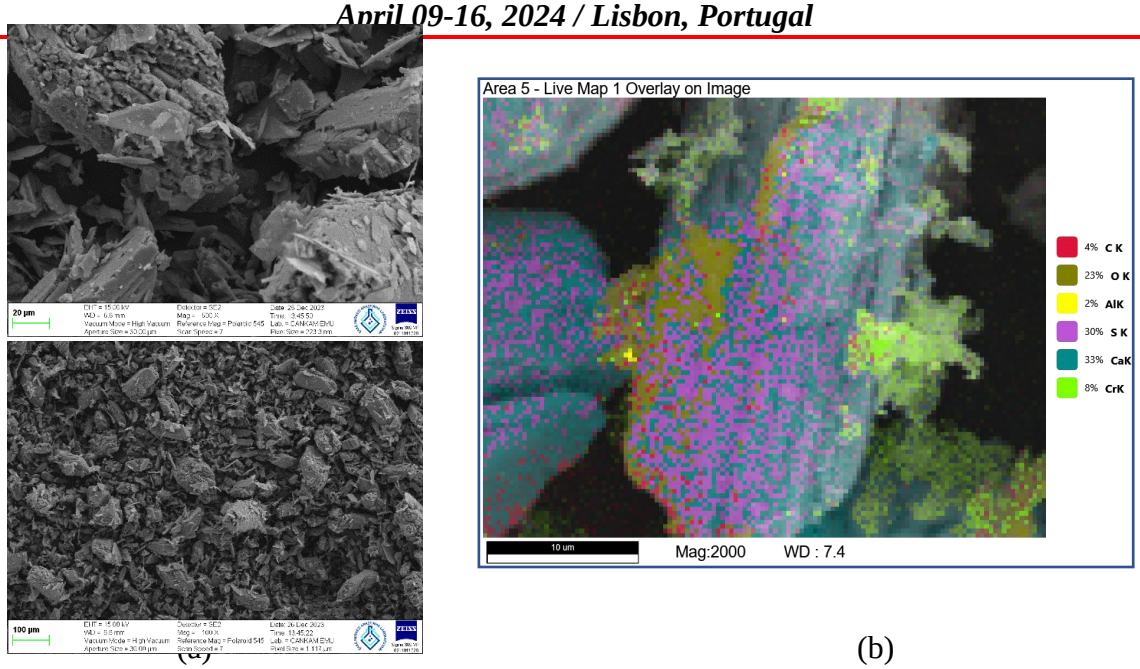


(a)



(b)

Figure 7. (a) EDX result of thermal power plant waste (b) EDX result of FCD waste after chromium removal



(a) (b)

Figure 8. (a) SEM images of thermal power plant waste, (b) Mapping image of the waste after chromium removal process

Conclusion and Recommendations

By Taguchi method, initial pH 2, concentration 80 ppm, dose 20 g/L, time 3 hours and temperature 25 oC were determined as optimum adsorption experimental conditions and 99.43% Cr(VI) removal was successfully achieved under these conditions. The experiment was repeated 3 times with the same adsorbent under optimum conditions and the reusability of the waste was investigated. It was found to be reusable. Considering the color changes during the adsorption process, it was observed that Cr(VI) ions were reduced to Cr(III) form and adsorbed by 99.43% under optimum conditions. When the experiment sets were analyzed, chromium removal could not be achieved in the 9th experiment and after. This shows the effect of pH. At low pH values (1.5-2), chromium removal could be realized effectively. In order to evaluate the adsorption performance of thermal power plant flue gas treatment waste, a comparative evaluation study was carried out with magnetic activated carbon (MAC) synthesized by co-pyrolysis technique. Chromium removal experiments of MAC synthesized from red sludge and sugar beet pulp by slow pyrolysis technique at 800oC were carried out. In this way, the adsorption capacity of FCD waste was compared with a different type of adsorbent.

Thanks and Information Note

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KEMOTERAPÖTİK AJAN İLE İNDÜKLENEN KARACİĞER HASARINDA SELENYUMUN APOPTOTİK BELİRTEÇLER İLE ETKİLEŞİMİ: *IN SILICO* DEĞERLENDİRME

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Özet
Siklofosfamid (CP), metronomik kemoterapötik bir ajan olarak müsinöz ve epitelyal yumurtalık kanserleri, sarkom, akciğer ve prostat kanserleri de dâhil olmak üzere çeşitli tümör tiplerinde etkinlik gösteren antikanser ilaçlardandır. CP'nin iki aktif metabolitinden fosforamid mustard antineoplastik etkilerinden sorumlu olurken diğer aktif metaboliti olan akrolein ise CP'nin toksik etkileri ile ilişkilidir. Bu aktif metabolit doku antioksidan savunma sisteminde yüksek oranda oksijensiz radikal oluşumuna neden olur ve memeli hücreleri için mutajeniktir. CP'nin bu metaboliti ve CP'nin aktivasyonu sırasında oluşan reaktif oksijen türlerinin (ROS) hücre redoks dengesinde değişikliklere neden olarak oksidatif strese yol açar. Bu durum CP kaynaklı kanserleşme ve sağlıklı hücre hasarının nedeni olabilir. Selenyum (Se), memelilerde antioksidan işlevi ve immünomodülasyon fonksiyonlarına sahip temel bir eser elementtir. Se'un antioksidan ve antikanser etkinliği insanlarda çeşitli biyolojik fonksiyonlara sahip selenoproteinlerin yapısına dâhil olması ile gerçekleşir. CP metabolizmasına bağlı artan ROS apoptozda önemli bir kontrol noktası olan mitokondriyal lipit peroksidasyonunu indükleyebilir ve bu durum membran potansiyelini etkileyebilir. Bcl-2 protein ailesi apoptozda mitokondriyal porasyonu kontrol eder. Bu çalışmanın amacı CP'nin neden olduğu karaciğer hasarında mitokondriyal fonksiyon bozukluğunu kontrol eden Bcl-2 ve Bax proteinlerinin Se ile etkileşimlerinin *in silico* olarak araştırılmasıdır. Se'nin CP kaynaklı hasara karşı koruyucu etkisinin mekanizmasının açıklanmasıdır. Bu amaçla AutoDockTools (1.5.6) yazılım programı kullanılarak ilgilenilen proteinlerin üç boyutlu kristal yapıları ile Se, CP ve Se+CP kombinasyonları dikkate alınarak moleküler yerleştirme çalışmaları gerçekleştirilmiştir. Se ve CP uygulama kombinasyonlarına bağlı olarak elde edilen Se@Bcl-2, CP@Bcl-2, Se/C@Bcl-2, Se@Bax, CP@Bax ve Se/CP@Bax komplekslerinde Se'un ve CP'nin makromoleküllerin aktif bölge amino asit kalıntıları ile ve diğer amino asitlerle olan etkileşimleri başta konvensiyonel hidrojen bağ ve Pi-Alkyl türleri olmak üzere değerlendirilmiştir. Bu etkileşimler sonucunda hesaplanan Gibbs Serbest Enerji değişimi (ΔG) değerleri protein-ligand etkileşimi dikkate alınarak proteinin liganda olan bağlanma afinitesi kapsamında değerlendirilmiştir. Elde edilen sonuçlar *in vivo* uygulama sonuçları için ayrıca değerlendirilmiştir.
Anahtar Kelimeler: Siklofosfamid, selenyum, hücre ölümü, mitokondriyal lipit peroksidasyonunu, reaktif oksijen türleri

INTERACTION OF SELENIUM WITH APOPTOTIC MARKERS IN CHEMOTHERAPEUTIC AGENT-INDUCED LIVER INJURY: *IN SILICO* EVALUATION

Abstract
Cyclophosphamide (CP), a metronomic chemotherapeutic agent, is a cancer drug that is effective in various tumor types, including mucinous and epithelial ovarian cancer, sarcoma, and lung and prostate cancer. Of the two active metabolites of CP, phosphoramide mustard is responsible for the antineoplastic effects of CP. In contrast, the other active metabolite, acrolein, is associated with the toxic effects of CP. This active metabolite causes a high rate of oxygen-free radical formation in the tissue antioxidant defense system and is mutagenic to mammalian cells. This metabolite of CP and the reactive oxygen species (ROS) generated during CP activation cause changes in the cell redox balance of cells leading to oxidative stress. This could be the cause of CP-induced carcinogenesis and damage to healthy cells. Selenium (Se) is an essential trace element with antioxidant and immunomodulatory functions in mammals. The antioxidant and anticancer effects of Se is realized by its incorporation into the structure of selenoproteins with various biological functions in humans. Increased ROS due to CP metabolism can induce mitochondrial lipid peroxidation, an important checkpoint in apoptosis, which can impair membrane potential. The Bcl-2 protein family controls mitochondrial porosity during apoptosis. The aim of this study was to investigate in silico the interactions of Bcl-2 and Bax proteins, which control mitochondrial dysfunction in CP-induced liver injury, with Se. To clarify the mechanism of the protective effect of Se against CP-induced damage. To this end, molecular docking studies were performed using the software program AutoDockTools (1.5.6), taking into account the three-dimensional crystal structures of the proteins of interest and the combinations of Se, CP, and Se+CP. In Se@Bcl-2, CP@Bcl-2, Se/C@Bcl-2, Se/C@Bcl-2, Se@Bax, CP@Bax and Se/CP@Bax complexes obtained as a function of the Se and CP application combinations, the interactions of Se and CP with the active site amino acid residues of the macromolecules and with other amino acids were evaluated, mainly conventional hydrogen bonds and Pi-alkyl species. The Gibbs free energy change values (ΔG) calculated as a result of these interactions were evaluated in the context of the binding affinity of the protein to the ligand, considering the protein-ligand interaction. The results obtained were also evaluated for in vivo application results.
Keywords: Cyclophosphamide, selenium, cell death, mitochondrial lipid peroxidation, reactive oxygen species

Giriş

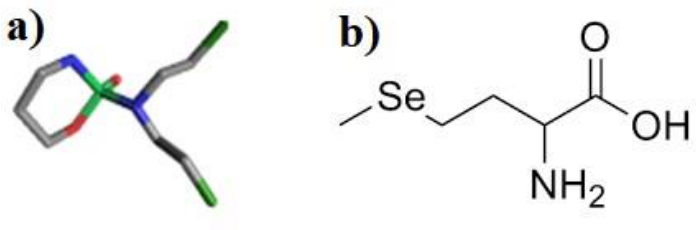
Metronomik kemoterapi, geleneksel kemoterapide olduğu gibi yüksek dozlarda ve aralarla verilen döngüler yerine, düşük dozlarda anti-kanser ilaçlarının sürekli olarak veya düzenli aralıklarla uygulanmasını içeren yeni bir kemoterapi yaklaşımıdır (Cazzaniga et al., 2022). Bu kemoterapik yaklaşımın azaltılmış yan etkiler, daha iyi tolere edilebilirlik ve doğrudan kanserli hücrenin apoptoza uğratılmasının ötesinde anti-tümör etki potansiyeli gibi avantajları vardır. Metronomik tedavide ilaç dozu konvensiyonel tedaviye kıyasla daha düşük olduğu için, metronomik tedavi tipik olarak geleneksel kemoterapiye göre daha az ve daha az şiddetli yan etkiler beklenmektedir. Bu özellik azaltılmış yan etkiler olarak tanımlanmaktadır (Gür & Cengiz, 2023; Kieran et al., 2005). Bu, özellikle yüksek doz kemoterapinin olumsuz yan etkilerini tolere edemeyen hastalar için faydalı olabilir. Metronomik tedavinin daha düşük dozları ve sürekli programı, hastaların tedaviyi tolere etmesini kolaylaştırabilir ve yaşam kalitelerini artırabilir. Bu yönü metronomik tedavinin daha iyi tolere edilebilirlik açısından avantajlarını ortaya koymaktadır (Mir et al., 2024). Metronomik tedavi, anjiyogenez (tümörlerin büyümek için ihtiyaç duyduğu yeni kan damarlarının oluşumu), metastaz (kanser hücrelerinin vücudun diğer bölgelerine yayılması) ve bağışıklık sistemi dâhil olmak üzere birden fazla tümör büyüme ve ilerleme mekanizmasını hedef almaktadır. Bu yönüyle de metronomik tedavi doğrudan kanserli hücrenin apoptoza uğratılmasının ötesinde anti-tümör etki potansiyeli gibi avantajlar sağlamaktadır (Kareva, 2017; Kim & Kim, 2019).Düşük dozda kemoterapötik ajanların sürekli uygulanması olarak tanımlanan metronomik kanser tedavisi (MKT), etkilerini immünomodülasyon, anti-anjiyogenez ve doğrudan sitotoksik etkiler yoluyla ortaya koyan bir tedavi olarak kabul edilmektedir. Bu ilaçlar tipik olarak ağızdan verilir, bu da tedaviyi hastalar için daha uygun hale getirebilir. MKT'nin ağızdan uygulanması güvenlidir, kullanımı kolaydır ve esnek ilaç dozajına izin verir. Tolere edilemeyen yan etkilerle ilişkili doz birikimleri nadir olduğundan ilaç daha uzun süre uygulanabilir (Krajnak et al., 2022; Muraro et al., 2023). Tedavi sonrası yeniden tümör oluşumunu önlemeye yardımcı olabilir (Kong et al., 2010). Diğer kanser tedavileri ile birlikte iyi sonuç verebilir (Hadjicharalambous et al., 2022). Tolere edilemeyen yan etkilerle ilişkili doz birikimleri nadir olduğundan ilaç daha uzun süre uygulanabilir.MKT halen araştırılmaktadır, ancak tek başına veya diğer tedavilerle kombinasyon halinde çeşitli kanserler için bir tedavi olarak umut vaat etmektedir. En yaygın kullanılan metronomik kemoteropotik ajanlardan bazıları siklofosfamid (CP), metotreksat, kapesitabin, ve vinorelbine'dir (De Lorenzo et al., 2018; Estevinho et al., 2022; Hamm et al., 2009; Soriano et al., 2011).

CP, Dünya Sağlık Örgütünün (WHO) temel ilaçlar model listesinde yer alan metronomik kemoterapötik bir ajan olarak müsinöz ve epitelyal yumurtalık kanserleri, sarkom, akciğer ve prostat kanserleri de dâhil olmak üzere çeşitli tümör tiplerinde etkinlik gösteren antikanser ilaçlardandır. Yaygın kullanım alanına sahip ilaçlardan olan CP hem geleneksel hem de metronomik kanser tedavisinde yaygın olarak kullanılan bir kemoterapi ilacıdır. Metronomik tedavide CP, geleneksel yüksek doz kemoterapi rejimlerine kıyasla genellikle daha düşük dozlarda ve daha sık aralıklarla uygulanır. CP, alkilleyici ajanlar olarak bilinen ve kanser hücrelerinin DNA'sına müdahale ederek sonuçta ölümlerine yol açan bir kemoterapi ilacıdır (Penel et al., 2012). Genel olarak, CP, anti-anjiyogenez ve immünomodülasyon dahil olmak üzere çoklu mekanizmalar yoluyla kanser hücrelerini hedefleyebilen çok yönlü bir kemoterapi ilacı olarak metronomik kanser tedavisinde önemli bir rol oynamaktadır. Metronomik tedavide, CP anti-anjiyogenik özellikleri için kullanılabilir, yani tümörler içinde yeni kan damarlarının büyümesini engellemeye yardımcı olabilir, böylece kan akışını kısıtlayabilir ve büyümelerini yavaşlatabilir. Anti-anjiyogenik etkilerine ek olarak CP, vücudun kanser hücrelerine karşı bağışıklık tepkisini artırabilen immünomodülatör özelliklere de sahiptir. Bu özellik, ilacın doğrudan sitotoksik etkilerini tamamlayabildiği için metronomik tedavide özellikle önemlidir (Kerbel & Kamen, 2004; Lopes-Coelho et al., 2021).MKT'de CP kullanımının önemli avantajları ve dikkate alınması gereken dezavantajları bulunmaktadır. Yüksek doz kemoterapiyi kaldıramayan hastalar için çok önemli olabilecek azaltılmış doz uygulaması sonucu gelişmiş tolere edilebilirlik özelliğine sahiptir. MKT tedavisinde CP, kanser hücrelerini doğrudan öldürmenin ötesinde tümör büyümesini ve yayılmasını engelleyerek anti-tümör etki potansiyeli gösterir. CP ayrıca metronomik yaklaşıma uygunluğu nedeni ile dirençli kanserlere karşı daha iyi etkinlik gösterebilir (Carraher Jr et al., 2014; Elaziz et al., 2024; Lopes-Coelho et al., 2021; Yuan et al., 2021).Öte yandan CP'nin bilinen bu olumlu etkilerine ilaveten bazı dezavantajlı yönleri de literatürde bildirilmiştir. MKT'de düşük doz uygulamaları nedeni ile agresif kanserler için geleneksel kanser tedavisine kıyasla daha zayıf bir doğrudan hücre öldürme etkisi gösterebilirler. Sürekli düşük doz uygulamaları nedeni ile uzun süre kullanımına bağlı olarak kemik iliği baskılanması ve ikincil kanser riskinde artış gibi potansiyel komplikasyonlar önemli araştırma konularıdır. CP'nin dezavantajlarına ilişkin ana endişe konusu mesane ve gonadal toksisite olmuştur. Ayrıca CP'nin sperm morfolojisi, testis histolojisi ve kan oksidan-antioksidan dengesi üzerindeki toksik etkisi de bildirilmiştir (Çeribaşi et al., 2010). CP'nin önemli diğer toksik etkileri hepatotoksisite ve kardiyotoksisitedir.

CP'nin metabolik aktivasyonu, nükleik asitler ve proteinler gibi duyarlı moleküllerin elektron bakımından zengin bölgeleriyle reaksiyona giren yüksek oranda reaktif karbonyum iyonları üreten sitotoksik bir alkilleyici ajandır ve karaciğerde aktif formuna dönüştürülür (Elrashdy et al., 2022). CP'nin bu metabolik dönüşümü iki sitotoksik metabolitin, fosforamid mustard ve akroleinin oluşumuna yol açar. Fosforamid mustard antineoplastik aktiviteye sahiptir ve DNA üzerinden hücre bölünmesine engel olur. Aynı zamanda CP'nin immünosupresif ve antitümör etkilerine aracılık ettiği de bildirilmiştir. Bununla birlikte CP'nin toksik etkileri ise diğer aktif metaboliti olan akroleine atfedilmektedir. Akrolein, biyolojik yarı ömrü kısa olan oldukça reaktif bir metabolittir ve bu durum CP'nin neden olduğu karaciğer hasarından sorumlu olabileceği anlamına gelir. Akrolein yüksek oranda oksijensiz radikal oluşumuna neden olur ve memeli hücreleri için mutajeniktir (Gür & Cengiz, 2023; Hales, 1982; Panigrahy et al., 2011; Senthilkumar et al., 2006).Reaktif oksijen türleri (ROS) hücrelerdeki en yaygın oksidanlardan bazılarıdır. ROS, moleküler oksijenin süperoksit ($O_2^{-}\cdot$), hidrojen peroksit (H_2O_2), lipid peroksitler (ROOH) veya bunlara karşılık gelen hidroksil ($HO\cdot$) ve peroksil radikallerine ($ROO\cdot$) kısmi indirgenmesiyle oluşur (Collin, 2019; Liu et al., 2012).CP'nin neden olduğu oksidatif stres ROS malondialdehit (MDA), süperoksit dismutaz (SOD), katalaz (CAT), glutatyon (GSH), glutatyon peroksidaz (GPx) ve glutatyon redüktaz (GR) belirteçleri ile değerlendirilir. Ayrıca CP metabolizmasına bağlı artan ROS apoptozda önemli bir kontrol noktası olan mitokondriyal lipit peroksidasyonunu da indükleyebilir ve bu durum membran potansiyelini etkileyebilir.Bcl-2 protein ailesi apoptozda mitokondriyal poroziteyi kontrol eder. Bu protein ailesinden Bcl-2 proapoptotik bir belirteçtir ve sağlıklı hücrede var olması istenmektedir, aksine azalması durumu apoptozu göstermektedir. Aynı protein ailesinden Bax ise antiapoptotik bir belirteçtir ve sağlıklı hücrede Bax miktarının artışı hücre apoptoza uğruyor anlamına gelir (Cengiz, Ayhanci, et al., 2022; Edlich, 2018).Selenoprotein, selenosistein amino asit kalıntısı içeren bir proteindir. Selenosistein amino asidi, glutatyon peroksidaz, thioredoksin redüktaz gibi enzimlerin yapısında yer alır. Selenoproteinler adı verilen çeşitli enzim ve proteinlerin bir bileşeni olan selenyum, DNA yapımında rol alır, üreme ve tiroid sağlığını destekler, metabolizmanın sağlıklı çalışmasına yardımcı olur ve oksidatif hücre hasarının yanı sıra enfeksiyonlara karşı vücudu korur. Selenyum (Se), memelilerde antioksidan işlevi ve immünomodülasyon fonksiyonlarına sahip temel bir eser elementtir (Fernández-Lázaro et al., 2020; Ye et al., 2021).Bu çalışmanın amacı CP'nin neden olduğu karaciğer hasarında mitokondriyal fonksiyon bozukluğunun bir belirteci olan Bcl-2 ve Bax proteinlerinin Se ile etkileşimlerinin *in silico* çalışmalarla araştırılmasıdır.

Materyal ve Metot

Se'nin CP kaynaklı hasara karşı koruyucu etkisinin mekanizmasının açıklanması amacıyla AutoDockTools (1.5.6) yazılım programı kullanılmıştır. Bağlanma dinamiklerini analiz etmek ve görselleştirmek amacıyla da Discovery Studio 3.0 programı kullanılmıştır. Çalışılan proteinlerin (Bcl-2 ve Bax) üç boyutlu kristal yapıları ile Se, CP ve Se+CP kombinasyonları dikkate alınarak moleküler yerleştirme çalışmaları gerçekleştirilmiştir. Bu amaçla Bcl-2 (PDB ID: 2O2F) ve Bax (PDB ID: 1F16) hedef proteinlerinin 3D kristal yapıları RCSB protein veri tabanından indirildi (Bruncko et al., 2007; Suzuki et al., 2000). CP'nin ve Se'nin moleküler modelleri SDF formatında sırasıyla Structure2D_CID_2907 ve Structure2D_COMPOUND_CID_15103 kodlarıyla PubChem veri tabanından indirildi. AutoDockTools yazılımı (1.5.6) kullanılarak yapılan moleküler yerleştirme işleminden önce protein yapısından su molekülleri uzaklaştırıldı, hidrojen atomları eklendi, polar olmayan hidrojen atomları birleştirildi ve son olarak Kollman yükleri eklenerek protein yapıları hazırlanmıştır. CP ve Se'nin Bcl-2 ve Bax proteinlerine moleküler docking çalışması PyRx programı kullanılarak gerçekleştirilmiştir (Gür, 2020; Gür, Cengiz, et al., 2021; Trott & Olson, 2010). Enerji minimizasyonu ve diğer parametreler önceki çalışmalarımızda yapıldığı gibi ayarlandı (Gür, Cengiz, & Gür, 2021; Gür et al., 2020).PyRx programı ile CP ve Selenomethionine moleküllerinin Bcl-2 ve Bax'ın hangi kalıntılarına bağlanma eğiliminde olduğunu bulmak için dokuz farklı bağlanma modu seçildi ve bunun üzerine hem CP hem de Selenomethionine molekülleri ligand olarak kullanılmak üzere Discovery Studio 3.0 programına uyumlu olacak şekilde ayarlandı. Daha sonra Bcl-2 ve Bax makromoleküllerinin CP ve Selenomethionine molekülleri ile etkileşimleri 2D ve 3D etkileşim modları kullanılarak ortaya çıkarılmıştır. Negatif bağlanma enerjisi parametreleri ise en düşük Gibbs serbest enerji değişimi (ΔG) değerleri dikkate alınarak belirlenmiştir. Se ve CP uygulama kombinasyonlarına bağlı olarak elde edilen komplekslerde Se'un ve CP'nin, makromoleküllerin aktif bölge amino asit kalıntıları ile ve diğer amino asitlerle olan etkileşimleri başta konvensiyonel hidrojen bağ (CHB) ve Pi-Alkyl türleri olmak üzere değerlendirilmiştir. Moleküler yerleştirme çalışmalarında öncelikle Bcl-2 ve Bax proteinlerine CP'nin ligand olarak bağlanma dinamikleri araştırılmış ve bu amaçla CP@Bcl-2 ve CP@Bax kompleksleri elde edilmiştir. Daha sonra Se ve CP'nin birlikte kenetlenme işlemleri yapılarak ayrı ayrı Se/CP@Bcl-2 ve Se/CP@Bax kompleksleri elde edilmiştir. Çalışmada kullanılan CP ve Selenomethionine moleküllerinin kimyasal yapıları Şekil 1'de gösterilmiştir.



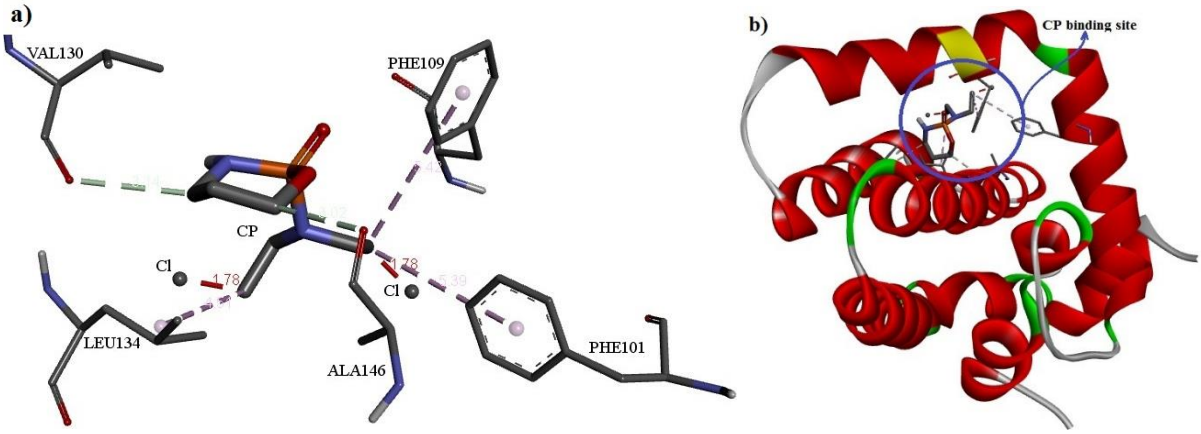
Şekil 1. Ligand moleküllerinin kimyasal yapıları; a) Siklofosfamid, b) Selenomethionine

Bulgular ve Tartışma

CP kaynaklı apoptoza karşı selenyumun koruyucu etkisinin olup olmadığının *in silico* olarak araştırıldığı bu çalışmada, kemoterapötik bir ajan olan CP ile indüklenen karaciğer hasarında selenyumun apoptotik belirteçlerden Bcl-2 ve Bax ile etkileşimi *in silico* olarak değerlendirilmiştir (Gür, Cengiz, & Gür, 2021; Trott & Olson, 2010).

CP@Bcl-2 ve Se/CP@Bcl-2 kompleks oluşum sonuçları

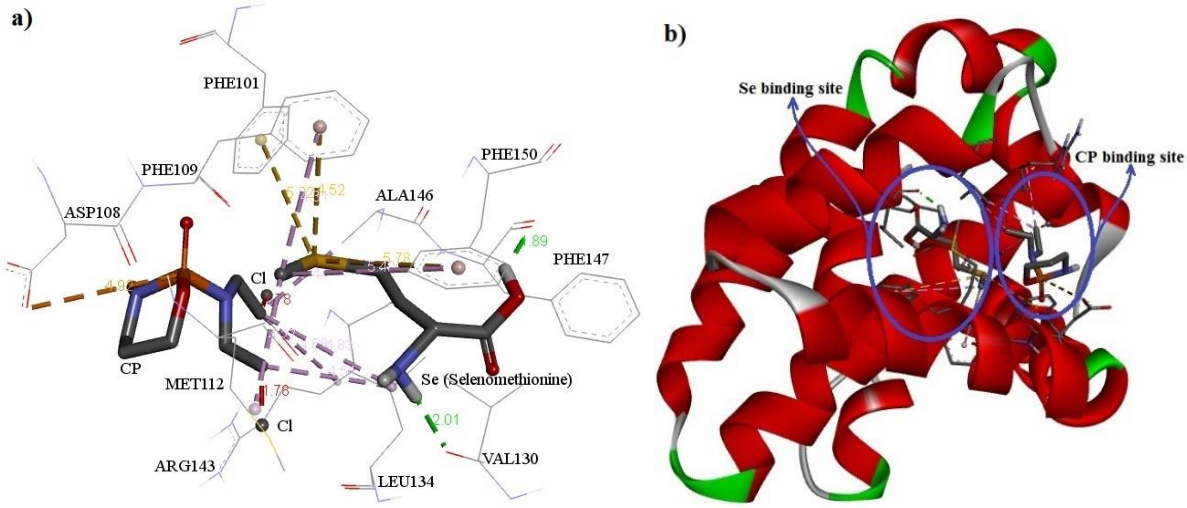
CP ile Bcl-2 proteini arasında meydana gelen etkileşimlere bağlı olarak ortaya çıkan bağlanmalar Şekil 2'de gösterilmiştir.



Şekil 2. CP ile Bcl-2 etkileşimine bağlı moleküler docking sonuçları; a) CP'nin Bcl-2'nin amino asit kalıntılarıyla etkileşimini gösteren 2D görünüm, b) CP'nin Bcl-2 ile etkileşimlerini gösteren 3D görünüm (Çubuk yapı)

Bir CP molekülünün Bcl-2'nin bağlanma bölgesine yerleştirilmesinin ardından, Şekil 2'de gösterildiği gibi bir CP@Bcl-2 kompleksi elde edilmiştir. Bağlanmanın gerçekleştiği bölgenin Bcl-2'nin aktif bölgesi olduğu anlaşılmıştır.

CP'nin Bcl-2'nin aktif bölge amino asitleri ile etkileşimi ve dolayısı ile CP'nin Bcl-2 aktivasyonuna etkisi üzerine selenyum katkısının değerlendirilmesi amacıyla CP ve Se'un Bcl-2 ile birlikte moleküler docking çalışmaları yapılmış ve sonuçlar Şekil 3'te verilmiştir.



Şekil 3. CP + Se'nin Bcl-2 ile birlikte etkileşimine bağlı moleküler docking sonuçları; a) CP + Se'nin Bcl-2'nin amino asit kalıntılarıyla etkileşimini gösteren 2D görünüm, b) CP + Se'nin Bcl-2 ile etkileşimlerini gösteren 3D görünüm (Çubuk yapı)

CP ve Se'nin Bcl-2 aktivitesi üzerindeki etkileri birlikte uygulama sonucu moleküler docking çalışmaları ile Se/CP@Bcl-2 kompleksi elde edilmiştir. CP@Bcl-2 ve CP/Se@Bcl-2 kompleks oluşumlarına bağlı olarak elde edilen moleküler docking çalışmalarına ait özet sonuçlar Tablo 1'de sunulmuştur.

Tablo 1. Bcl-2'ye CP ve Se + CP kenetlenmelerinin özet sonuçları

Ligand	**Bcl-2 Interactions (Distance: Å)**		
	Con. H Bond / *Carbon H.Bond*	Alkyl / *Pi-Alkyl* / **Pi-Sulfur**	**ΔG (kcal/mol)**
CP	*ALA146 (3.02)*, VAL130 (3.14)**	LEU134 (3.53)*/ *PHE101 (5.39), PHE109 (5.42)*	**-4.94**
Se + CP	Se: **Val130 (2.01)*, Phe147(1.89)**	Se: MET112 (4.27)* / *PHE109 (4.31) PHE150 (5,41)* / **PHE101 (5,21), PHE109 (4,51), PHE150 (5,78)**	-3.89
	Cp: Herhangi bir etkileşim yok	Cp: ASP108* (Electrostatic)	

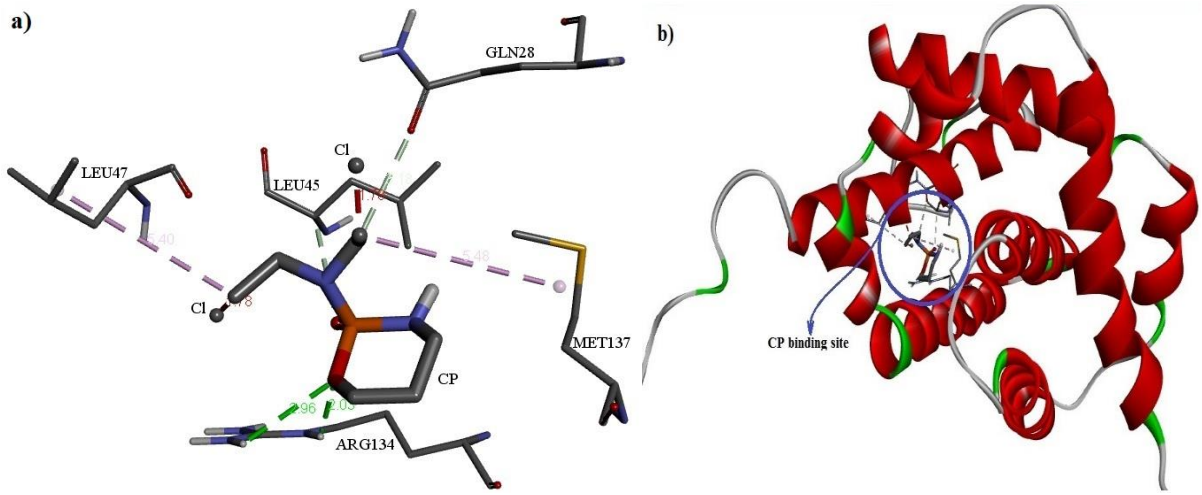
*** Active-site residues:** ALA97, ASP100, TYR105, ASP108, MET112, VAL130, LEU134, TRP141, GLY142, VAL145, ALA146, TYR199

CP ve Se'nin birlikte uygulanması, CP için sistemin ΔG değerinde 1.05 kcal/mol gibi önemli bir artışa neden olmuştur (Tablo 1). Tablo 1 dikkate alındığında CP'nin Bcl-2 ile iki önemli hidrojen bağ etkileşimi ve üç tane de alkil ve Pi-alkil etkileşimi yaptığı anlaşılmıştır. CP@Bcl-2 kompleks oluşumuna ait ΔG değeri -4.94 kcal/mol olarak hesaplanmıştır. Ancak Se ilavesiyle

tüm bu etkileşimlerin gerçekleşmediği sadece CP ile aktif bölge amino asit kalıntılarından ASP108 arasında bir elektrostatik etkileşim olduğu tespit edilmiştir. CP'nin aksine Se ilavesi sonucunda Se ve Bcl-2 arasında önemli CHB etkileşimlerine ek olarak alkil, Pi-alkil ve Pi-sülfür etkileşimleri meydana gelmiştir. Bu etkileşimler sonucunda Se/CP@Bcl-2 kompleks oluşumuna ait ΔG değeri -3.89 kcal/mol'e yükselmiştir.*In silico* çalışmalarımız, CP ve Se kombinasyonunda CP'nin Bcl-2'nin katalitik amino asit kalıntıları ile etkileşiminin Se ilavesine bağlı olarak bloklandığını ve dolayısıyla CP nedenli Bcl-2 inhibisyonunun önlendiğini göstermiştir (Cengiz, Ayhanci, et al., 2022; Cengiz, Kutlu, et al., 2022). Se ilavesine bağlı olarak ortaya çıkan önemli bir etkileşim de Pi-sülfür etkileşimleri olmuştur. Şekil 3 ve Tablo 1 dikkate alındığında Se'un Bcl-2'nin aktif bölge çevresinde bulunan PHE101, PHE109 ve PHE150 amino asitleri ile Pi-sülfür etkileşimleri yaptığı anlaşılmıştır. Bu etkileşimler Bcl-2 proteininde kararlılık ve aktivite gibi iki temel özelliği etkileyerek enzim aktivitesinde önemli katkılar sağlamış olabilir (Ringer et al., 2007). Se ile etkileşim sonucu oluşan Pi-sülfür bağlarına bağlı ortaya çıkan stabilite Bcl-2'nin aktif bölge içinde katalize dâhil olan amino asit kalıntılarının doğru konumlandırılmasının sağlanmasında katkıda bulunmuş olabilir (Dubey et al., 2019). Ayrıca metiyonin gibi kükürt içeren yan zincirler yakındaki amino asitlerdeki aromatik halkalarla zayıf bağlar oluşturarak enzimin substrat bağlanması ve kataliz için en uygun şeklini korumasına yardımcı olmuş olabilir (Brosnan & Brosnan, 2006). Ayrıca meydana gelen bu Pi-sülfür etkileşimleri Bcl-2'nin katalitik mekanizmasına doğrudan dâhil olabilir. Bu etkileşim, katalize katılan amino asitlerin elektronik özelliklerini etkileyerek potansiyel olarak onları daha reaktif hale getirmiş veya kataliz için daha iyi konumlanmış hale getirebilir (Dubey et al., 2019).

CP@Bax ve Se/CP@Bax kompleks oluşum sonuçları

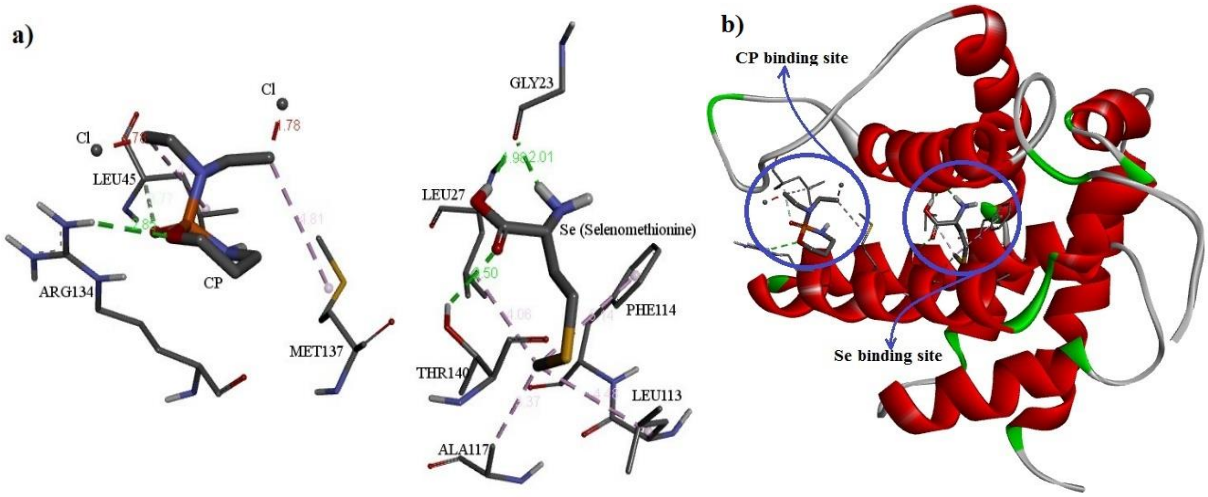
CP ile Bax proteini arasında meydana gelen etkileşimlere bağlı olarak ortaya çıkan bağlanmalar Şekil 4'te gösterilmiştir.



Şekil 4. CP ile Bax etkileşimine bağlı moleküler docking sonuçları; a) CP'nin Bax'ın amino asit kalıntılarıyla etkileşimini gösteren 2D görünüm, b) CP'nin Bax ile etkileşimlerini gösteren 3D görünüm (Çubuk yapı)

CP molekülünün Bax'ın bağlanma bölgesine yerleştirilmesinin ardından, Şekil 4'te gösterildiği gibi bir CP@Bax kompleksi elde edilmiştir.

CP'nin Bax'ın amino asitleri ile etkileşimi ve dolayısı ile CP'nin Bax aktivasyonuna etkisinin selenyum katkısı ile nasıl değiştiğinin değerlendirilmesi amacıyla CP ve Se'un Bax ile birlikte moleküler docking çalışmaları yapılmış ve sonuçlar Şekil 5'de verilmiştir.



Şekil 5. CP + Se'nin Bax ile birlikte etkileşimine bağlı moleküler docking sonuçları; a) CP + Se'nin Bax'ın amino asit kalıntılarıyla etkileşimini gösteren 2D görünüm, b) CP + Se'nin Bax ile etkileşimlerini gösteren 3D görünüm (Çubuk yapı)

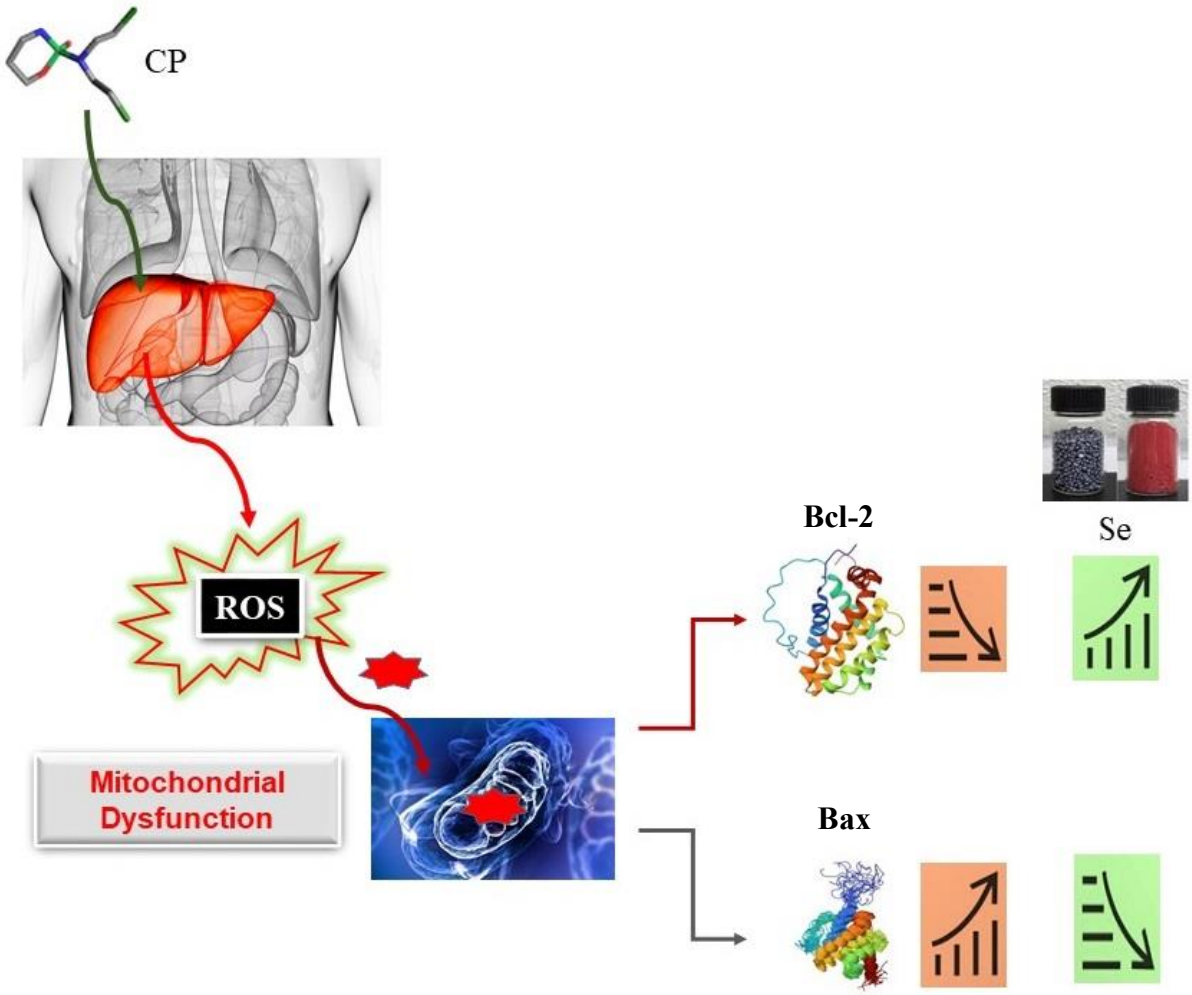
CP ve Se'nin Bax aktivitesi üzerindeki etkileri birlikte uygulama sonucu moleküler docking çalışmaları ile Se/CP@Bax kompleksi elde edilmiştir. CP@Bax ve CP/Se@Bax kompleks

oluşumlarına bağlı olarak elde edilen moleküler docking çalışmalarına ait özet sonuçlar Tablo 2'de sunulmuştur.

Tablo 2. Bax'a CP ve Se + CP kenetlenmelerinin özet sonuçları

Ligand	**Bax Interactions (Distance: Å)**		
	Con. H Bond / *Carbon H.Bond*	Alkyl / *Pi-Alkyl* / **Pi-Sulfur**	**ΔG (kcal/mol)**
CP	**ARG134 (2.03 ve 2.96)** / *GLN28 (3.18), LEU45 (3.57)*	LEU47 (5.40), ARG134 (4.02), MET137 (4.66 ve 4.48)	**-3.82**
Se + CP	Se: **GLY23 (1.98 ve 2.00)**	Se: : LEU27 (4.06), LEU113 (4.48), ALA117 (3.37) / *PHE114 (5.14)* / **PHE114 (5,29)**	-3.89
	CP: **ARG134 (1.96 ve 2.85)** / *LEU45 (3.77)*	CP: LEU45 (4.91), ARG134 (4.04), MET137 (4.89)	

CP ve Se'nin birlikte uygulanması, CP için sistemin ΔG değerinde 0,07 kcal/mol gibi bir azalmaya neden olmuştur (Tablo 2). Tablo 2 dikkate alındığında CP'nin Bax ile dört önemli hidrojen bağ etkileşimi ve dört tane de alkil etkileşimi yaptığı ve kompleks oluşumuna ait ΔG değerinin -3.82 kcal/mol olduğu anlaşılmıştır. Se ilavesiyle Se/CP@Bax kompleksinde ARG134'e ait hidrojen bağ uzunluklarının kısaldığı belirlenmiş ve bu durum oluşan kompleksin kararlılığının arttığını düşündürmüştür. Bcl-2 ile CP ve Se kompleks özelliklerinin aksine Se varlığında Se/CP@Bax kompleksinde aktif bölge ile olan etkileşimler hem CP için hem de Se için daha fazla olmuştur. Bunun sonucunda ΔG değerinde daha da azalma olmuştur. Se ve Bax'ın amino asit kalıntıları arasında önemli hidrojen ve alkil, pi-alkil bağlanmalarına ilave olarak bir tane pi-sülfür etkileşimi de meydana gelmiştir. Bu etkileşimler Bax proteinini daha da kararlı hale getirmiş ve özellikle Pi-sülfür etkileşimine bağlı olarak inhibe etmiş olabilir (Gao et al., 2020; Gür et al., 2023; Sami et al., 2022).CP kaynaklı apoptoza karşı selenyumun koruyucu etkisinin olup olmadığının *in silico* olarak araştırıldığı bu çalışmada karaciğerde lipit peroksidasyonu ve buna bağlı olarak ortaya çıkan mitokondriyal fonksiyon bozukluğu sonucunda önemli proapoptotoik ve antiapoptotoik belirteçler üzerinde Se katkısının etkisi değerlendirilmiştir. Bu değerlendirme Şema 1'de özetlenmiştir.



Şema 1. Se ve CP'nin Bcl-2 ve Bax proteinleri üzerine etkisi (Petros et al., 2001; Regina, 2020; Suzuki et al., 2000)

Sonuç ve Öneriler

In silico sonuçlara dayanarak, Se'nin CP ile indüklenen apoptoza karşı koruyucu etkilerinin Bcl-2 inhibisyonunun önlenmesi ile artması ve kararlı Bax komplekleri oluşturarak azalması yoluyla ortaya çıkabileceğini ve bu amaçla kullanılabilecek bir aday olduğu düşünülebilir. Sonuç olarak Se'un CP ve benzeri alkilleyici ajanların kullanımını gerektiren kanser hastalarında klinik uygulamadan önce daha iyi değerlendirilmesini sağlayabileceğine inanıyoruz.

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Özet
Endüstriyel tarımın gelişmesi, uzak bölgelerden gelen gıdaların daha yaygın bir şekilde tüketilmesine ve bu gıdaların taşınmasıyla ilgili çevresel etkilerin fark edilmesine yol açmıştır. İlk olarak, gıdaların hangi mesafeler boyunca taşındığı ve bu taşımanın ne kadar enerji gerektirdiği gibi konulara odaklanan araştırmalar, gıda mili kavramının gelişmesine katkı sağlamıştır. Gıda mili kavramı, gıda sistemlerinin ve küresel ticaretin evrimiyle birlikte ortaya çıkmıştır. Bu kavram, tüketicilerin gıda alımlarını daha sürdürülebilir bir şekilde yönlendirmelerine yardımcı olmak için önemli bir araç haline gelmiştir. Gıda mili kavramı, bir gıdanın üretildiği yerden tüketicilere ulaşana kadar kat ettiği mesafeyi ölçmektedir. Gıda mili tarımsal ürünlerin taşınma sürecindeki çevresel etkileri, tüketiciye ulaşmadan önceki süreyi ve ürünlerin tazeliğini etkilemektedir. Daha uzun gıda mili, daha fazla enerji tüketimi ve çevresel etkiye yol açtığı gibi, ürünlerin tazeliğini ve besleyiciliğini de olumsuz etkilemektedir. Bu çalışmanın temel amacı tarımsal ürünlerdeki gıda millerine yönelik bir değerlendirme yapmaktır. Bu çalışma dört bölümden oluşmaktadır. Birinci bölümde gıda milinin tarımda neden önemli olduğu açıklanmıştır. İkinci bölümde gıda milinin nasıl ölçüldüğüne yönelik bilgiler verilmiştir. Üçüncü bölümde tarımsal ürünlerdeki gıda millerine yönelik bir değerlendirme yapılmıştır. Bu kapsamda çeşitli tarımsal ürünlerden örnekler sunulmuştur. Dördüncü bölümde ise, tarım ürünleri ticaretinde gıda mili ile ilgili karşılaşın temel sorunlar belirtilerek öneriler getirilmiştir.
Anahtar Kelimeler: Gıda Mili, Tarım, Tarımsal Ürünler, Sürdürülebilirlik

FOOD MILES: AN ASSESSMENT OF AGRICULTURAL PRODUCTS

Abstract
The development of industrial agriculture has led to more widespread consumption of foods from remote areas and a recognition of the environmental impacts associated with transporting these foods. Firstly, research focusing on the distances food is transported and how much energy this transportation requires contributed to developing the food mile concept. The concept of the food mile emerged with the evolution of food systems and global trade. This concept has become an important tool to help consumers direct their food purchases more sustainably. The food mile measures the distance a food travels from where it is produced to reach consumers. Food mileage affects the environmental impacts of agricultural products during the transportation process, the time before they reach the consumer and the freshness of the products. Longer food miles not only lead to greater energy consumption and environmental impact but also negatively affect the freshness and nutrition of products. The primary purpose of this study is to make an evaluation of food miles in agricultural products. This study consists of four parts. The first part explains why the food mile is essential in agriculture. The second section gives information on how food miles are measured. In the third section, an evaluation was made regarding food miles for agricultural products. In this context, examples from various agricultural products are presented. In the fourth chapter, the main problems encountered regarding food miles in the trade of agricultural products are stated and suggestions are made.
Keywords: Food Miles, Agriculture, Agricultural Products, Sustainability

Giriş

Yirminci yüzyılın sonunda gıda ürünlerine yönelik değerlendirmeler küresel sürdürülebilirlik veya sürdürülebilir üretim kavramları ile düşünülmektedir. Öncelikle Rachel Carson'un 1962'de yayınladığı Sessiz Bahar eserinde gıda ürünleri üretiminin çevresel etkileri olduğu açıklanmıştır. Bu kavramlar üzerinde yapılan araştırmalar, genellikle gıda ürünlerinin çiftlik ve çatal arası mesafelerini incelemektedir. Bu değerlendirmeler neticesinde yerel ürün tüketmek ve yerel gıda depoları oluşturmak sürdürülebilir tarımın ihtiyaç duyduğu bir anlayış olmuştur. Gıda üretiminin çevre ve insanlar üzerinde etkileri alanındaki araştırmaların devamı ile gıdanın ulaşım mesafesine tüketicilerin ilgi düzeyleri artmıştır. Gıda mili olarak literatüre kazandırılmış olan bu kavram, gıdanın üretildiği yerden tüketicilere ulaştığı yere kadarki mesafedir (Mcwilliams, 2013). 1990 yıllardan günümüze kadar bu ana akım konu hakkında çeşitli çalışmalar yapılmıştır (Grant, 2007; Goleman, 2009). Bu çalışmalarda Avrupa ve Kuzey Amerika ön plana çıkmıştır. Gıda üretiminin ve seçimlerinin çevre üzerindeki etkileri fark edilmiştir. Tüketilen gıdanın güvenliği ve menşei diğer girdi maliyetlerin yükselmesine neden olduğu için yönetimler tarafından da takip edilmeye başlanmıştır.İklim değişikliği veya iklim krizi konusundaki son zamanlarda yapılmakta olan araştırmalar sera gazı ve emisyon kelimelerini çok sık kullanmaktadır. Sürdürülebilir üretim ve tüketim alanının genişlemesi ile gıda ürünlerinin üretim ve tüketiminin çevresel ve iklim üzerindeki etkileri gösterilmeye başlanmıştır (Hertwich, 2005; Weber and Matthews, 2008; Tukker and Jansen, 2006). Tüketicilerin gıda ürünleri tercihlerinde çevresel sürdürülebilirlikle bağlantılı günümüzde birçok trend oluşmuştur. ABD ve Avrupa'da yerel ve organik üretilen ürünlerin miktarındaki artışlar, tüketicilerin tükettikleri gıdaların nereden ve nasıl üretildiği kriterlerine dikkat ettiğini göstermektedir. Bu alanda 1995 yılında Birleşik Krallık'ta ortaya çıkmış olan gıda mili kavramı ise gıda sürdürülebilirliği konusundaki araştırmalara yön vermiştir (Paxton, 1994; Canals et al, 2007). Uluslararası ticaretin günümüzde gelişmesi ile gıda mili kavramına odaklanılmış ve çeşitli araştırmalar yapılmıştır. Bu araştırmaların etkisi nedeni ile çoğu çevre aktivistleri tarafından küresel tedarik zincirinin yerelleşmesi gerektiği savunulmaktadır (Jones, 2002). Bu görüşün aksine farklı bölgelerdeki üretim uygulamaları yapanlar ve depolama-taşımacılık işletmeleri ise bu isteğin haklı ve doğru olup olmadığını sorgulamışlar ve açıklamışlardır. Hayvansal ürün üretiminin ve tüketiminin çevresel etkilerini gösteren çoğu araştırmacılar gıda tercihlerinde genel olarak bitkisel ürünlerin olması gerektiğini açıklamışlardır (Eshel and Martin, 2006).Gıda ürünleri, birçok çevresel sorunlara neden kabul edildiği için yaşam döngüsü değerlendirmesi (LCA) araştırmalarında önemli bir yere sahiptir (Jungbluth et al, 2000).

Tüketilen gıda ürünlerinin sayısı nedeni ile analizlerin çoğu az sayıda gıda ürünü ile ilgili çalışmalarla sınırlı kalmıştır. Sınırlı gıda ürünleri üzerinde ise çok ayrıntılı analizler yapılmıştır (Carlsson et al, 2003). Literatürdeki gıda mili ve gıda taşımacılığına olan yüksek ilgiye rağmen, sera gazı emisyonları için önemli olabilecek çiftlik ekipmanları ve malzemelerin çiftliklere taşınması gibi konulardaki araştırmalar sınırlı kalmıştır.Bu çalışmanın temel amacı tarımsal ürünlerdeki gıda millerine yönelik bir değerlendirme yapmaktır. Bu çalışma dört bölümden oluşmaktadır. Birinci bölümde gıda milinin tarımda neden önemli olduğu açıklanmıştır. İkinci bölümde gıda milinin nasıl ölçüldüğüne yönelik bilgiler verilmiştir. Üçüncü bölümde tarımsal ürünlerdeki gıda millerine yönelik bir değerlendirme yapılmıştır. Bu kapsamda çeşitli tarımsal ürünlerden örnekler sunulmuştur. Dördüncü bölümde ise, tarım ürünleri ticaretinde gıda mili ile ilgili karşılaşın temel sorunlar belirtilerek öneriler getirilmiştir.

Materyal ve Yöntem

Bu araştırmanın verileri ikincil veri kaynaklarına dayanmaktadır. Konu ile ilişkili ulusal ve uluslararası makaleler, kitaplar, tezler, kurumların yayınladığı raporlar ve web siteleri başlıca ikincil veri kaynaklarını oluşturmaktadır.

Gıda Mili Kavramı ve Önemi

Gıda mili kavramı, Birleşik Krallık'ta 1990 yılında ortaya çıkmıştır. Prof. Dr. Lang tarafından 'Gıda Milleri Raporu: Uzun Mesafe Gıda Taşımacılığının Tehlikeleri' yayınında açıklanmıştır. Lang bir sözünde, 'ölümün kimse tarafından hatırlanmaz ancak, kitabemde gıda milini icat eden bilim insanı olarak yazması önemlidir' demiştir. Bu durum Angela Paxton tarafından da yazıya geçirilmiştir (Lang 2006; Paxton 1994; Iles, 2005).1994 yılında gıda mili kavramı ayrıntılı olarak açıklanmış ve kamuoyunda konu hakkında tartışmalar başlamıştır. 1995 yılında Birleşik Krallık Çevre Bakanlığı tarafından finanse edilmiş Tüketici Bilgilendirme Projesinin yapıldığı, aynı yılda 'Çok Uzak Bir Ziyafetin Hesabı: Tüketicilerin Endişeleri' isimli bir başka araştırma gerçekleştirildiği görülmektedir. 1996 yılında ise Gıda Milleri Eylemi paketi (yerel gıda ekonomisi stratejileri) hazırlanmıştır. 1997 yılında gıda mili konusunda ekmek, patates ve çilek ürünlerinde ilk Food Facts (Gıda Gerçekleri) araştırması yapılmıştır. 1998 yılında portakal, bitkisel yağ, tavuk eti, marul, bira, soya, havuç, armut, elma, süt ve sığır eti ürünlerinde Food Facts araştırmaları yapılmış ve broşür-materyaller piyasaya dağıtılmıştır. 1999 yılında 5 yılı kapsayan gıda mili güncelleme çalışması yapılmıştır (Sustain, 1999). 2007 yılında yapılan gıda mili üzerindeki araştırmalar ile 'Locavore' kelimesi literatüre kazandırılmıştır. Locavore; ürün üretilme aşamasında çevreye olan etkilerin göz önünde bulundurulmasıdır (Anonim, 2024b).Gıda mili, üretim yerinden tüketildiği yere kadarki mesafede gıda taşınmasının üretmiş

olduğu emisyon miktarını ve çevresel etkilerini incelemektedir. Gıdanın uzaklığı, karbon ayak izi ve çevresel etkileri bu kapsamda ayrıntılı ele alınmaktadır (Engelhaupt, 2008; Kissinger, 2012). Gıda mili araştırmalarında et, meyve ve sebze ürünleri incelenmektedir (Andersson et al, 1998; Marletto and Sillig, 2014; Wiedemann et al, 2015; Meisterling et al, 2009). Bu kavramın Birleşik Krallıkta çıkmasının ve ilgi görmesinin iki nedeni vardır. Bu da Birleşik Krallıkta tüketilen sebzelerin %50'sinin ve meyvelerin %95'inin ithal olarak karşılanmasıdır (Stacey, 2008).Gıda mili, gıda ürünlerinin tüketicilere ulaşmadan önceki kat etmiş olduğu coğrafi mesafeyi ifade etmektedir. Üretimden tüketime olan mesafenin kısa olması hem insanlar hem de çevre için faydalı olduğu açıklanmaktadır. Ürünlerin işlenmesi ve taşınmasında fosil yakıtlar kullanılmakta ve miktarları değişmektedir. Kullanılan yakıt miktarlarının en önemli sonuçları ise iklim değişikliği ve ürün fiyatlarındaki artışlardır. Ne kadar çok gıda taşıması ve kilometresi olursa o kadar emisyon üretilir ve iklim değişikliği de o ölçüde etkilenmektedir (Anonim, 2024a). ABD'de et endüstrisinin %80'nini dört işletmenin kontrol ettiği (üretim ve satış aşamaları) bulunmuştur (USDA, 1998). Küresel firmaların üretimi ve taşımacılığı sonucu ürünlerin büyük üreticiler, işleyiciler, nakliyeciler, distribütörler ve perakendeler aracılığıyla ulaştırıldığı ortaya çıkmıştır (Brian, 2006). Bu tedarik zinciri nedeni ile ABD'nin ürünlerinin ortalama gıda mili 1500 mil olarak bulunmuştur (Foodwise, 2024).Gıda mili kavramı sürdürülebilir ve küresel gıda sanayisinin ayak izinin hesaplanmasında ve yerel kaynakların verimli kullanılmasına önemli katkı sağlanmıştır. Fazla mile sahip gıdalar taşıma ve depolama aşamalarında besin değerini ve tazeliğini kaybetmektedir. Yerel ürünlerin tazelik, yüksek besin değerli ürünler, istihdama olan katkısı ve yerel üreticilerin desteklenmesi gibi olumlu katkıları bulunmaktadır (Commons, 2024). Geleneksel gıda ürünlerinin yerel ürünlere göre tüketiciye ulaşmasında 4-17 (arası) kat daha fazla yakıt tükettiği bulunmuştur. Bu yakıt tüketimi aynı oranda emisyon üretimi olarak da anlaşılmaktadır (Deweert, 2009). ABD'de Time dergisinde yayınlanan 'Yerel Gıda Hareketi: 100 Mil Diyeti' makalesiyle yerel gıdanı teşvik edilmiş ve gıda milinin azaltılması için önemli bir adım olmuştur (Roosevelt, 2006). ABD'de çalışmalar neticesinde üretici pazarı sayısında artışlar tespit edilmiştir. ABD'de aktif üretici pazarı sayısı 2000 yılında 2863'den 2012 yılına kadar 7864'e yükselmiştir. Üretici pazarı sayısında ortalama 3 katı artış olduğu bulunmuştur. Diğer bir araştırmaya göre, üretici pazarı müşterilerinin %64'ünün yerel ürün için geldikleri tespit edilmiştir (Wolf et al, 2005).Ürünlerin suyolu, demiryolu, karayolu ve havayolu sıralamasında emisyon miktarının artış gösterdiği bulunmuştur. Uçakla taşınan gıda ürünleri, karayolu ile taşınan ürünlere göre 10 kat fazla emisyona neden olduğu bulunmuştur. Gıdanın

uçakla taşınması, su yolu ile taşınmasına göre %50 daha çok emisyon üretmektedir (Harris, 2022). İngiltere'de mevsim dışı olan ve uçakla taşınan yüksek değerli ürünler Birleşik Krallığın gıda taşımacılığı emisyonunun %11'ni oluşturmaktadır. DEFRA araştırmasında, Birleşik Krallık'ta yapılan taşımacılığın %25'ini gıda ürünleri taşımacılığı oluşturduğu bulunmuştur. Birleşik Krallık ve çevresinde gıda ürünü taşımacılığında yılda 19 milyon ton CO2 üretilmektedir ve bu da yaklaşık 5,5 milyon normal araca karşılık gelmektedir (DEFRA, 2020).Gıda mili ve emisyon konusuna en yakın tarım sektörü bulunmaktadır. Tarım sektörü; üretim, işleme, taşıma, depolama ve perakende aşamalarında emisyon üretmektedir. Gıda mili araştırmalarında önemli yere sahip olan tarım sektörünün öneminin anlaşılması için dünyanın tarım ihracat ve ithalat miktarlarının incelenmesi gerekmektedir. Küresel tarım ürünleri ihracatı 2022 yılında yaklaşık 2 trilyon dolar olarak bulunmuştur. Küresel tarım ürünleri ihracatı içindeki ürünler (en çok ihraç edilen ürünler) incelendiğinde, hayvansal ve bitkisel yağlar %8.5 (171.1 milyar dolar), hububat %8.3 (166.7 milyar dolar), et ve et ürünleri %8.0 (162.6 milyar dolar), yağlı tohumlar %7.5 (151.4 milyar dolar) ve meşrubat, alkollü içecekler ve sirke %7.2 (146.4 milyar dolar) oranlarında pay almaktadır (Trademap, 2022).Tarım ürünlerinde üretim miktarı, dağıtım kanalı seçenekleri ve tüketicilerin bulunma noktası gıda mili hesaplamalarında farklılıklara neden olmaktadır. Tarımsal faaliyetler ve gıda üretimi gıda milinde artışa ve çevre sorunlarına yol açabilmektedir.

Gıda Milinin Ölçülmesi

Gıda millerini hesaplamak için bir dizi formül geliştirilmiş ve genel olarak kabul görmüştür. Bir gıda ürününün kat ettiği mesafeyi hesaplamanın karmaşıklığı, ürünün tek bir bileşenden mi yoksa birden çok malzemeden mi oluştuğuna ve ürünü taşımak için kullanılan nakliye yöntemine bağlı olarak değişmektedir. Ağırlıklı Ortalama Kaynak Mesafesi (WASD) formülü, 1997 yılında Annika Carlsson-Kanyama tarafından geliştirildi ve taşınan gıda miktarını ve üretim yerinden satış yerine kadar kat ettiği mesafeyi hesaba katmaktadır. Sadece bir bileşenden oluşan meyve ve sebzeler ve diğer ürünlerde gıda millerini hesaplamak için WASD formülü kullanılmaktadır. Ağırlıklı Toplam Kaynak Mesafesi (WTSD) formülü, Leopold Sürdürülebilir Tarım Merkezi tarafından geliştirilmiştir ve her bir bileşen için kat edilen mesafeyi ve ağırlığı hesaplayarak çok bileşenli gıdaları açıklamaktadır. Aromalı yoğurt, ekmek ve diğer işlenmiş gıdalar gibi gıdalarda, gıda millerini hesaplamak için WTSD formülü kullanılmaktadır. Hem WASD hem de WTSD, üretici ile tüketici arasında gıdanın kat ettiği mesafeye ilişkin hesaplama yaparken, hiçbir formül kat edilen bu mesafeyle ilişkili sera gazı emisyonlarını ele almamaktadır. Ağırlıklı Ortalama Emisyon Oranı (WAER) formülünde, farklı ulaşım

yöntemleri için hem mesafe hem de ilişkili sera gazı emisyonları hesaba dahil edilmektedir Bu formül, 2004 yılında kar amacı gütmeyen kuruluş LifeCycles tarafından geliştirilmiştir.Çevresel etkinin ölçülmesinde sadece seyahat miktarının ele alınması doğru değildir. Gıda milinin önemli belirleyicisi olan yakıtın verimliliği üzerinde eğitim, araç cinsi ve lojistik de önemlidir. Gıda ürünlerinin nakliyesinde sera gazı üretimini etkileyen unsurlar incelendiğinde;

- Taşıma yöntemi,
- Yakıt cinsi,
- Taşıma esnasındaki hava koşulları,
- Yük faktörü,
- Gıda ürünlerinin ortam sıcaklığı ve soğutulması durumu,
- Taşıma için gerekli olan diğer faktörler ve depolama ihtiyacı bulunmaktadır.

Ağırlıklı ortalama kaynak mesafesi (km) aşağıdaki şekilde hesaplanmaktadır (Aras ve Uğurluoğlu, 2018):

AOKM = m k .d(k)/ m(k)

k = Üretim noktası

m = Her üretim noktasından tüketiciye ulaştırılan ürünün miktarı (ton)

d = Üretim noktasından tüketim noktasına olan mesafe (km)

Ağırlıklı ortalama emisyon oranı (CO2 eşd./ton) aşağıdaki şekilde hesaplanmaktadır.

AOEMO = m k . d k . e(k)/ m(k)

k = Farklı üretim noktaları

m = Her üretim noktasından tüketiciye ulaştırılan ürünün miktarı (ton)

d = Üretim noktasından tüketim noktasına olan mesafe (km)

e= Sera gazı emisyonu miktarı (CO2 eşd./ton.km)

Gıdanın üretim yerinden tüketiciye taşınması esnasında açığa çıkan ton cinsinden CO2 eşdeğeri olarak sera gazı miktarı ise aşağıdaki formül ile hesaplanmaktadır.

SGM = AOEMO. c. i

c= Belirlenen bölgede gıdanın toplam tüketimi (ton)

i= Tüketimin ithalattan gerçekleşme yüzdesi (%) olarak ifade edilmektedir.

Ağırlıklı ortalama enerji oranı (MJ/ton), gıda maddesinin üretim yerinden tüketiciye ulaştırılması esnasında birim ağırlık başına harcanan enerji olarak tanımlanmakta olup, aşağıdaki formül yardımıyla hesaplanmaktadır.

AOENO = m k .q k .d(k)/ m k

k = Farklı üretim noktaları

m = Her üretim noktasından tüketiciye ulaştırılan ürünün miktarı (Ton)

d = Üretim noktasından tüketim noktasına olan mesafe (km)

q= Birim nakliyat başına enerji tüketimi (MJ/Ton.km)

Gıda mili hesaplanmasında yapılmış farklı araştırmalar bulunmaktadır. Iowa'da komisyoncu ve toptancıların Chicago Terminal pazarına satın aldıkları ürünlerin ve Ferry Plaza çiftliği ürünlerinin tüketiciye ulaştığı miller hesaplanmıştır ve karşılaştırılmıştır. Terminal Pazarı ve Ferry Plaza Çiftçi Pazarı ürünleri için sırasıyla; elmaların 1.555 mil ve 77 mil, domateslerin 1.369 mil ve 117 mil, üzümlerin 3.543 mil ve 134 mil, fasulyelerin 766 mil ve 101 mil, şeftalilerin 1.674 mil ve 173 mil, kış kabağının 781 mil ve 98 mil, yeşillerin 889 mil ve 99 mil, marulların 2.055 mil ve 102 mil yol kat ettiği bulunmuştur (Foodwise, 2024).Gıda ürünleri tedarik zinciri içerisinde (ABD'de) yapılmış bir araştırmaya göre, ortalama 1640-6760 km içerisinde sera gazı oluştuğu tespit edilmiştir. Oluşan emisyon miktarı ABD'nin 8.1 ton CO2 emisyonunun %83'ü olduğu bulunmuştur. Gıda ürünleri içerisinde özellikle kırmızı et, tavuk eti ve balık ürünleri emisyon üretiminde başlıca ürünler olarak bulunmuştur. Bu sonuçlar göz önüne alındığında gıda milinin önemli ölçüde azaltılması için yerel ürün satın almak yerine öncelikle et ürünlerinin tüketiminin azaltılması gerektiği bulunmuştur (Weber and Matthews, 2008).ABD'de Leopold Sürdürülebilir Tarım Merkezi, yerel ürünlerin gıda millerini hesaplamıştır. Gıda milleri üzümde 2143 mil, brokolide 2095 mil, kuşkonmazda 1671 mil, elmada 1555 mil mısırda 813 mil ve bal kabağında 233 mil olarak bulunmuştur (LCSA, 1998). Diğer ürünlerle birlikte ortalama mesafe ise 1518 olarak bulunmuştur. Diğer bir çalışmada ise, yoğun bir şekilde tüketilen 58 ithal ürünün gıda mili hesaplanmıştır. Gıda ürünlerinin ortalaması 4497 kilometre ve 2811 mil mesafe kat ettiği belirlenmiştir. Yıllık bu ürünlerin 51 709 ton sera gazı ürettikleri bulunmuştur (Xuereb, 2005).ABD'de yapılmış bir araştırmada, dünyanın çeşitli bölgelerinden gelen ürünlerin gıda milleri hesaplanmıştır. Karpuzun 1886 mil Meksika'dan, kivinin 5015 mil Şili'den, domatesin 456 mil Kanada'dan, Muzun 2048 mil Panama'dan, armutun 5216 mil Arjantin'den ve ananasın 2048 mil Kosta Rika'dan geldiği bulunmuştur. Bu millerin uzun olmasını başlıca nedeni olarak yakıtlara ulaşılabilir olması ve gelişmiş taşımacılık sistemleri gösterilmiştir (Yee, 2012).Gıda mili hesaplamasında üretim faktörüne dikkat edilmesi gerekmektedir. Yeni Zelanda'dan Londra'ya gönderilen kuzuların, İngiltere'nin kendi kırsallarında üretilmiş kuzulardan dört kat daha fazla enerjide verimli olduğu tespit edilmiştir (Barber et al, 2006). Burada önemli olan kuzu üretiminde kuzunun hangi mesafe veya nereden geldiği değil, nasıl üretildiğidir. Brezilyadan ithal edilerek alınan Alman elma suyunda yerel

üretim ve işlemeye göre daha az enerji kullanıldığı bulunmuştur. Almanya'da elmaların enerji yoğun seralarda yetiştirilmesinin gıda mili mesafesini artırdığı saptanmıştır. İthal edilebilecek elma ürünlerinin daha az mile sahip olduğu ortaya çıkmıştır (Blanke and Burdick, 2005).Yüksek gıda miline sahip gıda ürünlerine şüphe ile yaklaşan araştırmacılara göre gıdanın yerelleşmesi veya sadece yerel gıda tüketiminin sonuçları araştırılmıştır. ABD'de yerel ürünlerin talebi karşılayamayacağı, tropik ürünlerin tüketicilere ulaştırılamayacağı ve toplumların sağlık durumunda ciddi etkilerinin olabileceği bulunmuştur (Wilkins, 2009). Gıdanın yerelleşmesi ile küçük üretici birimlerinin oluşmasının, kirlilik, koku, atıkların imhası ve çevresel diğer sorunlara neden olabileceği tahmin edilmiştir (Jones et al, 2004). Bu çalışmalara göre, ihtiyaçlar doğrultusunda farklı bölgelerde yetiştirilen bazı yüksek gıda miline sahip ürünlerin ithalatı ve tüketiminin yapılmasının doğru olduğu bulunmuştur.Tarımsal Ürünlerde Gıda Milleri: Çeşitli Tarımsal Ürünlerden Örnekler ABD'nin gıda endüstrisi tüm fosil yakıt tüketiminin %10'unu oluşturmaktadır. Gıda sisteminin tükettiği enerjinin %21'inin üretim, %14'ünün taşımacılık, %16'sının ürün işleme, %7'sinin paketleme, %4'ünün gıda perakende, %7'sinin restoran-kafe ve %31'inin konut ısıtma için kullanıldığı bulunmuştur. ABD küresel olarak %23'lük emisyon miktarı ile dünyada en büyük emisyon üreticisidir. ABD gıda sisteminin yıllık kullandığı enerji miktarı Fransa'nın yıllık enerji miktarına karşılık gelmektedir (Tablo 1) (Murray, 2005).

Tablo 1 ABD Gıda Sisteminin Enerji Kullanımı

Alanlar	**Kullanım Miktarı**
Üretim	%21
Taşımacılık	%14
Ürün işleme	%16
Paketleme	%7
Gıda perakende	%4
Restoran ve Kafe	%7
Konut ısıtma	%31
Toplam	**%100**

Birleşik Krallıkta ürünlerin gıda mili hesaplanması dört ulaşım yöntemine göre incelenmiştir. Gıda milleri 423 ton-km suyolu, 677 ton-km demiryolu, 2890 ton-km karayolu ve 15839 ton-km havayolu olarak bulunmuştur. Hava taşımacılığı, gıda ve diğer malların taşınmasında çok fazla enerji yoğun bir ulaşım yöntemi olarak belirlenmiştir. Hava taşımacılığı, Birleşik Krallıkta

%1'lik yer kaplamasına rağmen, ülkede %11'lik bir emisyon ürettiği tespit edilmiştir. Bunun yanı sıra; gürültü, kazalar ve trafik sorunları gibi diğer problemlerle gıda taşımacılığının ekonomik ve sosyal maliyetinin yıllık 9 milyar sterlin veya 18 milyar doları geçtiği saptanmıştır (Tablo 2) (Smith et al, 2005).

Tablo 2 Farklı Yük Taşımacılığı Modları İçin Enerji Kullanımı Ve Emisyon Miktarları

	Suyolu	Demiryolu	Karayolu	Havayolu
Birincil enerji tüketimi KJ Ton-km	423	677	2890	15839
Spesifik toplam emisyonlar g/Ton-km				
Karbondioksit	30.0	41.0	207	1260
Hidrokarbonlar	0.04	0.06	0.3	2.0
VOC	0.1	0.08	1.1	3.0
Nitrojen oksit	0.4	0.2	3.6	5.5
Karbon monoksit	0.12	0.05	2.4	1.4

Kaynak: Whitlegg, 1993

Yerel gıda ürünlerinin millerinin geleneksel gıda ürünlerine göre kısa olduğu ve az emisyon ürettikleri bulunmuştur. ABD-Iowa bölgesinde yapılan araştırmada, yerel ve geleneksel gıda ürünlerinin gıda milleri karşılaştırılmıştır. Yerel gıda ürünlerinin gıda mili toplamı 716 mil ve geleneksel gıda ürünlerinin gıda mili toplamı 25 301 mil olarak bulunmuştur (Tablo 3). Geleneksel gıdaların yerel gıdalara göre 4-17 kat daha fazla yakıt kullandığı ve 5-17 kat daha fazla emisyon ürettiği saptanmıştır (Tablo 4). Bu araştırma ile bölgede fazla enerji için yakıt kullanıldığı da tespit edilmiştir. Taşıma yöntemi göz önüne alındığında bölgesel ürün taşıması için küçük araçlar ve kamyonlar kullanılmaktadır. Küçük kapasiteli araç kullanılmasının fazla sefer, fazla yol ve fazla emisyona neden olduğu da tespit edilmiştir. Gıda taşımacılığında araç türlerine göre verimliliğin değişebileceği belirtilmektedir.

Tablo 3 Yerel Ürünler ve Geleneksel Ürünlerin Gıda Milleri

Ürün Cinsi	Yerel Yetişen Ürün	Geleneksel Yöntemle Karşılanan Ürün
	WASD(Miles)	WASD(Miles)
Elmalar	61	1 726
Fasulye	65	1 313
Brokoli	20	1 846
Lahana	50	719
Havuçlar	27	1 838
Karbonhidrat	20	1 426
Sarımsak	31	1 811
Marul	43	1 823
Soğanlar	35	1 759
Biberler	44	1 589
Patates	75	1 155
Kabaklar	41	311
Ispanak	36	1 815
Kabak	52	1 277
Çilekler	56	1 830
Domates	60	1 569
Tüm WASD'lerin Toplamı	716	25 301

Kaynak: LCSA, 2001

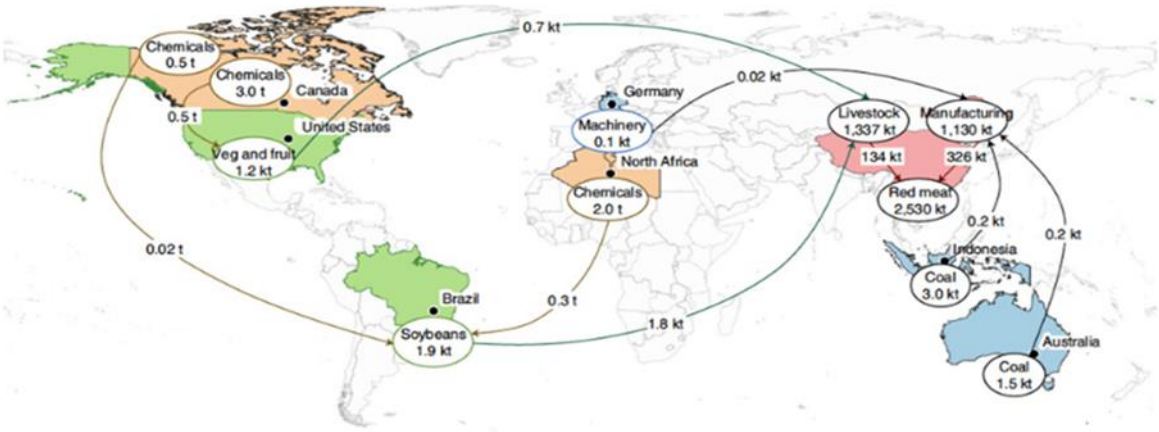
Tablo 4 Iowa Merkezli Geleneksel, Bölgesel ve Yerel Gıda Taşıma Sistemlerinin Yakıt Tüketimi, CO2 Emisyonları ve Kat Edilen Mesafe

Gıda Sistemi ve Kamyon Tipi	Yakıt Tüketimi (Gal/Yıl)	Yakıtın Parasal Değeri (2001 Yılı Fiyatı)	Co2 Emisyonları	Kat Edilen Mesafe (Mil)
Konvansiyonel Yarı Römork	368 102	$581 601	8 392 727	2 245 423
Iova Bölgesel Yarı Römork	22 005	$35 208	501 714	134 230
Iova Bölgesel Orta Boy Kamyon	43 564	$69 702	993 243	370 289
Iova Local - Çiftçi Pazarı Küçük Kamyon	49 359	$78 974	967 436	848 981
Iova Yerel Kurumsal Küçük Kamyon	88 265	$141 224	1 729 994	1 518 155

Kaynak: LCSA, 2001

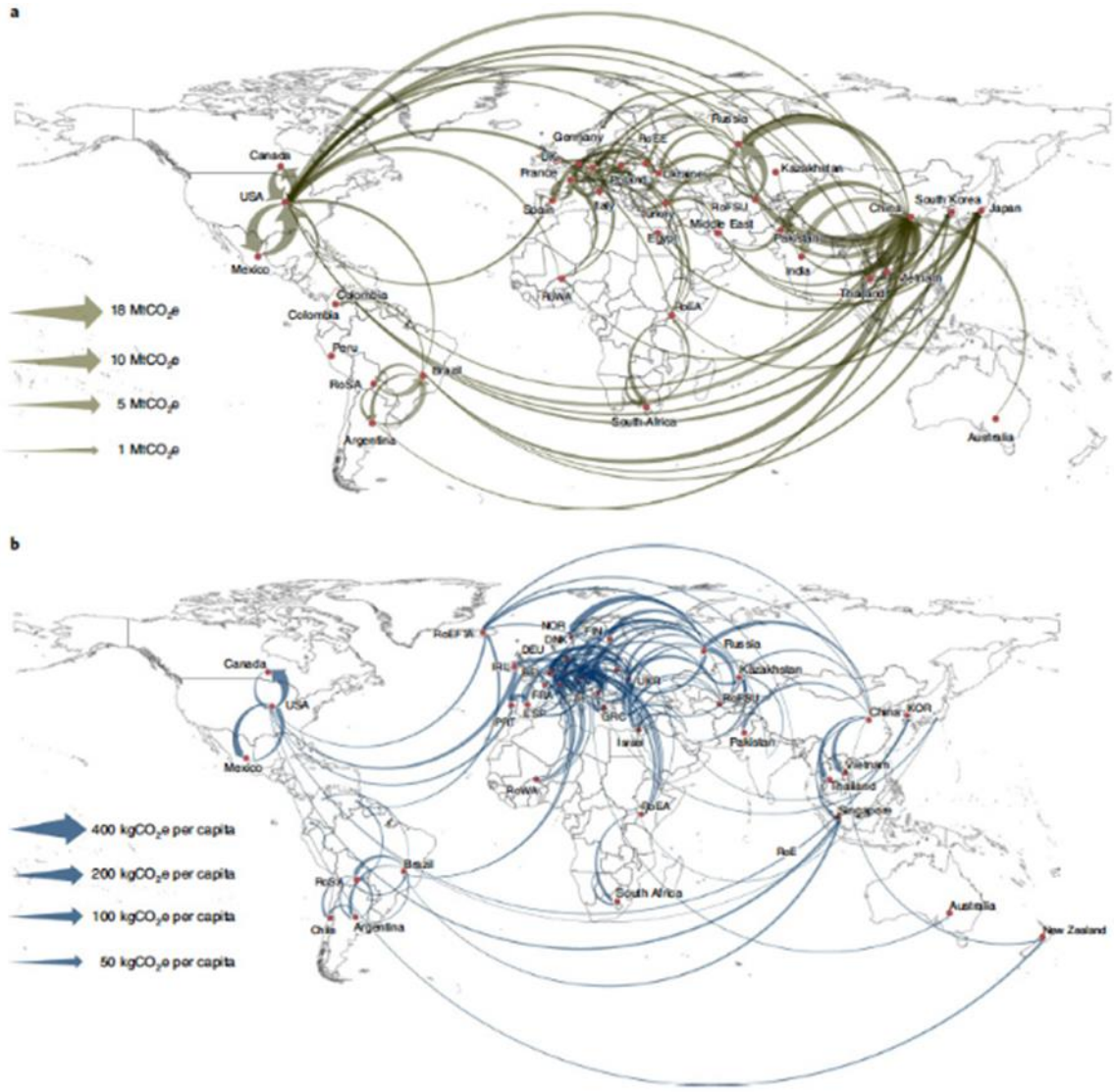
Küresel gıda sistemi birbirine çok sıkı şekilde bağlıdır. Çin'de tüketilen bir etin üretimi için dünyanın çeşitli bölgelerindeki üretim materyallerine ihtiyaç duymaktadır. Şekil 1'de baloncuklar gıda üretimi emisyonlarını ve oklar ise gıda kilometresini göstermektedir. Çin'deki et talebini karşılamak için girdiler çeşitli ülkelerden ithal edilmektedir. ABD'de meyve-sebze ve Brezilya'da soya fasulyesi üretimi için karayolu kullanılarak Kanada'dan kimyasallar ithal edilmektedir. Almanya'dan makine ve Avustralya-Endonezya'dan kömür ithal edilmektedir.

Ülkeler arası bu gıda tedarik zinciri et üretimini sağlamak ve Çin'deki et talebini karşılamak içindir. Üretimin gıda milini artırdığı hipotezinin doğruluğu anlaşılmaktadır.



Şekil 1 Çin'de Kırmızı Et Tüketimine İlişkin Tedarik Zinciri Emisyonu (Li et al, 2022)

Küresel tedarik zincirinde gıda sisteminin emisyon miktarları hesaplanmıştır. Avrupa ve Çin merkezli ticaret noktaları vurgulanmıştır. Afrika kıtasında önemli bir ticaret miktarının olmadığı da bulunmuştur. Gıda emisyonlarını önemli ölçüde zengin ülkelerin arttırdığı tespit edilmiştir. Düşük gelirli ülkelerin (kişi başı 3000 ABD doları altında) uluslararası gıda kilometrelerinin %12'sini ve emisyonların ise %20'sinden sorumlu oldukları ortaya çıkmıştır. Okyanusya, Kuzey Amerika ve Avrupa dahil zengin ülkelerin gıda kilometreleri ve emisyon miktarları diğer bölgelerden 2.7-2.8 kat daha fazla olduğu tespit edilmiştir. Mt CO2e cinsinden uluslararası gıda mili emisyonlarının ilk 100 ikili akışı (üstte) ve kişi başına kgCO2e cinsinden uluslararası gıda mili emisyonlarının ilk 100 ikili akışı (altta) gösterilmektedir. Okların kalınlığı emisyonların miktarını göstermektedir (Şekil 2).



Şekil 2 Küresel Tedarik Zinciri Ağı Boyunca Gıda Kilometresi Akış Haritası (Li et al, 2022)

Birleşik krallıkta yapılan bir çalışmada gıda ürünlerinin taşıma yöntemlerine göre emisyon miktarları incelenmiştir. ~25 emisyon (gCO2/tkm) derin deniz – okyanus, ~50 emisyon (gCO2/tkm) kısa deniz- iç su yolları, ~600 emisyon (gCO2/tkm) havayolları (uzun mesafe) ve ~1600 emisyon (gCO2/tkm) havayolları (kısa mesafe) olarak bulunmuştur. Gıda millerinin artması ve emisyon miktarının artmasındaki ana neden havayollarının kullanılması ve kısa mesafede defalarca sefer yapılması olarak bulunmuştur. Gıda ürünlerini ideal gıda mili ve emisyon miktarları ile taşımak için uzun mesafeli denizyolu kullanımının uygun olacağı belirlenmiştir (Tablo 5).

Tablo 5 Birleşik Krallıkta Ürünlerin Ulaşım Yöntemlerine Göre Emisyon Üretim Miktarları

Ulaştırma Yöntemi	**Emisyon (gCO2/tkm)**
Derin Deniz-Okyanus	~25
Kısa Deniz ve İç Su Yolları	~50
Havayolları (Uzun mesafe)	~600
Havayolları (Kısa mesafe)	~1600

Kaynak: AEA Technology, 2005

Üretilen ürünlerin fosil kaynaklar kullanılarak tüketiciye ulaştırılmasındaki akış incelenmiştir. Geleneksel ürün ve yerel ürün(doğrudan pazarlama, üretici pazarı veya çiftlikten satış) aşamaları verilmiştir. Geleneksel üründe üretilen bir ürün için sekiz aşama ve yerel ürünlerde ise üç aşama ile tamamlanmaktadır. Geleneksel yöntemlerle üretilen ve pazarlaması yapılan ürünlerde fosil yakıt, elektrik, fazla insan-araç, uzun mesafeler ve farklı yollar kullanılmaktadır. Ulaştırmada fazla faktörün bulunmasının gıda milini ve emisyon miktarını artırdığı bulunmuştur. Yerel üretilen ve pazarlanan ürünler için ise üç aşamada (üretim ve pazarlama) tamamlanmaktadır. Yerel ürünlerde fazla fosil yakıt, araç, yol ve insan kullanımı olmadığı için gıda mili ve emisyon üretim miktarı düşük kalmaktadır (Tablo 6).

Tablo 6 Geleneksel ve Yerel Ürünlerin Akış Şeması

Aşamalar	**Geleneksel Ürün Akışı**		**Yerel Ürün Akışı**
1	Tarımsal üretim: Traktörler ve diğer makineler (dizel)	1	Tarımsal üretim: Traktörler ve diğer makineler (dizel)
2	Çiftlikte soğuk hava deposu (elektrik)	2	Müşteri tarafından çiftlik mağazasına seyahat ve ürün alma (benzin)
3	Paketleme ve yönetim (elektrik ve ısıtma)	3	Tüketicinin depolama aşaması (elektrik)
4	Ağır vasıtalarla bölgesel merkezlere dağıtım (dizel)		
5	Merkezde soğuk hava deposu (elektrik)		
6	Yükleme ve merkez yönetimi (elektrik ve ısıtma)		
7	Hafif ticari araçla eve teslim (dizel)		
8	Tüketicinin depolama aşaması (elektrik)		

Kaynak: Coley et al, 2008

ABD'de gıda ürünleri arasında emisyon üretim miktarları incelenmiştir. Emisyon miktarı ile gıda milleri hakkında çıkarımlar yapılmıştır. ABD'de gıda ürünleri emisyon miktarları incelendiğinde; %30'unun kırmızı et, %18'inin süt ürünleri, %11'inin tahıllar-karbonhidratlar, %11'inin meyve-sebzeler, %10'unun tavuk-balık-yumurta, %9'unun diğer ürünler, %6'sının içecekler ve %5'inin yağlar-tatlılar-çeşniler kaynaklı olduğu belirlenmiştir. En fazla emisyon üreten ve gıda miline sahip olan ürünler kırmızı et ve süt ürünleri olarak saptanmıştır (Tablo 7).

Tablo 7 ABD'de Gıda Ürünlerinin Emisyon Üretim Miktarları

Ürünler	**% Pay**
Kırmızı Et	30
Süt Ürünleri	18
Tahıllar/Karbonhidratlar	11
Meyve ve Sebzeler	11
Tavuk/Balık/Yumurta	10
Diğer Ürünler	9
İçecekler	6
Yağlar/Tatlılar/Çeşniler	5
Toplam	100

Kaynak: ACS, 2008

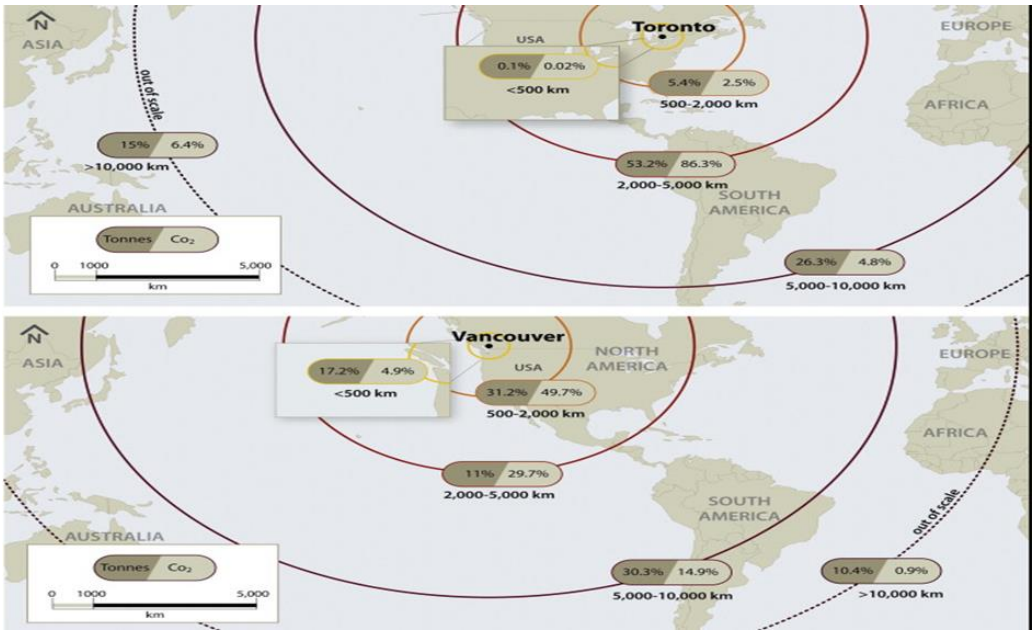
Gıda mili üzerinde yapılan araştırmalar neticesinde kavram ve içerik yönünden belli değişiklikler olmuştur. Gıda mili, gıda ürünlerinin tarladan tabağa kadarki mesafeyi ele almaktadır. Geliştirilmiş gıda mili, gıda millerinin çevresel, sosyal ve ekonomik maliyetlerinin de olması nedeni ile bir bütün olarak incelenmektedir. Gıda zincirinin sürdürülebilirliği, taşımacılıktan kaynaklanan dışsallıklar (çevresel, sosyal ve ekonomik maliyetler) yanında üretim, işleme, dağıtım, satış ve tüketimden kaynaklanan dışsallıklarında dahil edilerek incelenmesidir (Tablo 8). Gıda zincirinin sürdürülebilirliği, yaşam döngüsü analizi (LCA) olarak da tanımlanmaktadır. Yaşam döngüsü analizi (LCA), üretim ve tüketim aşamalarına kadar tüm çevresel etkilerin bütünsel olarak incelendiği yöntemdir.

Tablo 8 Gıda Mili, Geliştirilmiş Gıda Mili ve Gıda Zincirinin Sürdürülebilirliği Şeması

Kavramlar	Gıda Mili	Geliştirilmiş Gıda Mili	Gıda Zincirinin Sürdürülebilirliği
1	Gıda Taşımacılığı (Kilometre-Mil)	Çevresel Maliyetler	Üretim
2		Sosyal Maliyetler	İşleme
3		Ekonomik Maliyetler	Dağıtım
4		Taşıma Yöntemi Taşıma verimliliği	Satış
5			Tüketim

Kaynak: Passel, 2013

Kanada'nın ithal etmiş olduğu meyvelerin gıda milleri ve CO2 emisyon miktarları da incelenmiştir. Şekil 3'de ithal edilen meyvelerin Kanada'nın Ontario eyaletine ve Britanya Columbia'sına ulaştırılmak için kat ettiği mesafeler gösterilmiştir. Gıda millerinin ürünler bazında farklı olduğu bulunmuştur. Britanya Columbia meyvelerinin %17'si 500 km'nin altındaki bölgelerden getirtilirken, Ontario meyvelerinin sadece %0.1'i bu mesafelerden (500 km) getirtilmektedir. Ortalama meyvelerinin %40'ı 5 000 km'den fazla yok kat ettiği bulunmuştur. Ontario meyvelerinin %15'i ve Britanya Columbia meyvelerinin %10'u 10 000 km'den fazla mesafeden ithal edilmektedir. Bu araştırmada; bütün ülkenin ve bir bölgenin gıda mili hesabının ötesinde belli ürünlerin taşınmasında üretilen CO2 emisyon miktarları da bulunmuştur. Kanada'ya ithal edilen meyve ürünlerinin gıda mil, emisyon miktarı ve ürün menşei ayrıntısı ile sunulmuştur (Tablo 9).



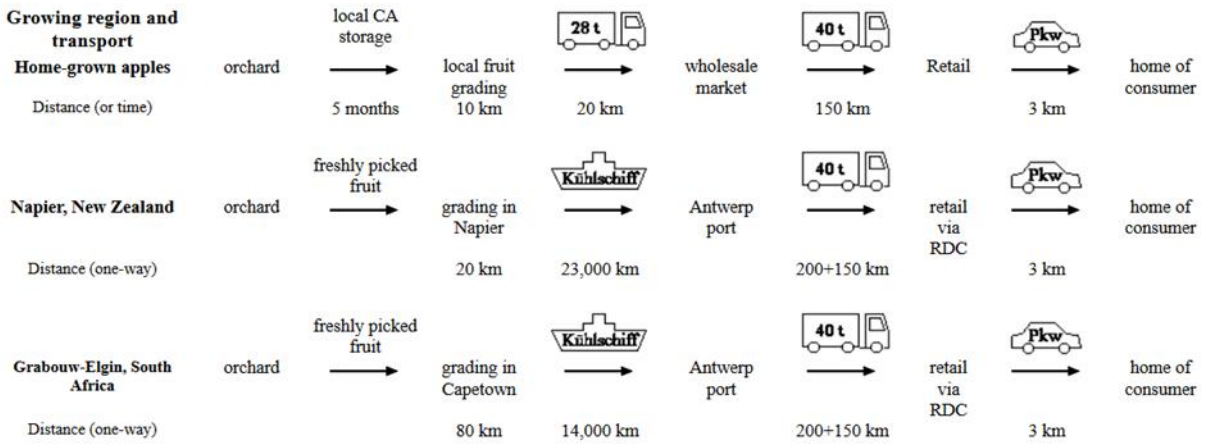
Şekil 3 Kanada'nın Ontario ve Britanya Columbia'sına İthal Edilen Meyvelerin Haritada Gıda Mili Gösterimi, (Kissinger, 2012)

Tablo 9 Kanada'nın Ontario ve Britanya Columbia'sına İthal Edilen Meyvelerin Gıda Milleri ve Tedarik Kaynakları

Ürünler	Ortalama Mesafe (km/kg)	Ortalama CO2 gCO2/Kg	Tedarik Kaynakları	
			ABD Eyaletleri	Diğer Ülkeler
Elma	4990	360	Washington, Kaliforniya, Michigan	Yeni Zelanda, Şili, Güney Afrika
Muz	6566	75	-	Columbia, Kosta Rika, Ekvador, Guatemala, Honduras
Armut	7970	350	Kaliforniya, Michigan, Oregon, Washington	Arjantin, Çin
Şeftali	4110	480	Kaliforniya, New York, Washington	Şili
Erik	5400	530	Kaliforniya, Michigan, Washington	Şili
Çilek	3250	580	Kaliforniya, Florida, Michigan	Meksika
Kivi	10 700	190	Kaliforniya	Şili, Yeni Zelanda, İtalya
Hurma	13 800	130	Kaliforniya	Çin, İran, Tunus
Ananas	6300	160	Kaliforniya, Hawaii	Columbia, Kosta Rika, Ekvador, Guatemala, Honduras
Avokado	3200	450	Kaliforniya	Şili, Meksika
Portakal	5500	500	Kaliforniya, Florida	Meksika, İspanya, Güney Afrika

Kaynak: Kissinger, 2012

Almanya'da üretilen ve ithal edilen elma ürününün gıda mili de hesaplanmıştır. Yerel olarak üretilen elmalar; 5 hafta soğuk depolama, 170 km zincir marketlere ve 3 km sonrasında tüketici evine ulaşmaktadır. Yeni Zelanda'dan ithal edilen elmalar; gemi ile 23 000 km, zincir marketlere 350 km ve 3 km sonrasında tüketici evine ulaşmaktadır. Güney Afrika'dan ithal edilen elmalar; gemi ile 14 000 km, zincir marketlere 350 km ve 3 km sonrasında tüketici evine ulaşmaktadır. Bu araştırmada Almanya'da tüketim için yerel üretilen ve ithal edilen elmaların gıda mili hesaplanmıştır. Gıda mili fazla olan ithal elmalarda; soğuk depolama için elektrik, deniz taşımacılığı için gemi, ülke içi taşımacılık için çeşitli kara araçları ve fazla personel kullanılmaktadır. Gıda mili fazla olan ithal elmaların emisyon üretim miktarının da yüksek olduğu bulunmuştur (Şekil 4).



Şekil 4 Almanya'ya İthal Edilen Elmaların Akışı(Taşımacılık ve Gıda Zinciri) (Blanke, 2006)

Sonuç ve Öneriler

Literatüre belli süre önce (1990-1995) girmiş olan gıda mili kavramı üzerinde çeşitli ve ayrıntılı araştırmalar yapılmıştır. Araştırmalar öncelikle ABD ve Avrupa ülkelerinde ithal edilen ürünler incelenerek devam etmiştir. Gıda mili kavramı sadece mesafe ile ilgilenmektedir. Son gelişmeler ile üretim, işleme, dağıtım, perakende ve tüketim aşamaları da dahil edilerek çevresel, sosyal ve ekonomik maliyetlerde bir bütün olarak ele alınmaktadır. Gıda mili ne kadar yüksek olursa o kadar çevreye olumsuz etkisinin var olduğu bulunmuştur. Ancak bazı ürünlerde yerel ürünlerin gıda mili (üretim emisyon değeri nedeni ile yüksek olması) ithal ürünlerden yüksek olmaktadır. İspanya'nın domates, Almanya'nın elma ve Birleşik Krallığın kuzu örnekleri bu konuda örnek gösterilebilmektedir. Gıda mili konusunda karşılaşılan sorunlar; küresel gıda üreten firmaların sayısının artması, fosil yakıtın ulaşılabilir olması ve aşırı kullanımı, ulaşım sistemlerinin gelişmiş olması ve fazla araç ile seferlerin yapılması, yerel firmaların ürün pazarlamada yetersiz kalması ve pazarda küresel firmaların etkin rol oynaması, üretici ve tüketici açısından öncelikli ilkenin ürün miktarı ve kazanç payı olması, her bölgede her ürünün yetişememesi veya ithalatın zorunlu olması, bazı ürünlerin ithalatının yetiştirilmesine göre düşük mil içermesi (Almanya, İspanya, İngiltere) şeklinde belirtilebilir.Ürünlerde gıda mili miktarını azaltmak için çeşitli öneriler bulunmaktadır. Bunların belli ölçüde uygulanması bile gıda mili ve çevresel etkileri azaltmak konusunda fayda sağlayabilecektir. Bu kapsamda yerel ürün ve üretici pazarlarının tercih edilmesi, mevsimsel yiyeceklerin tüketilmesi, hayvansal ürünlerden et ve süt ürünleri tüketim miktarının azaltılması, genellikle az işlenmiş ve paketlenmiş ürünlerin tercih edilmesi, yerel ve organik ürünlerin tüketimi ve pazarlamasının artırılması söz konusu önerilerden bazılarıdır.

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ANTİBİYOTİKLERİN BİYOTEKNOLOJİK ÜRETİMİNDE VE ANALİZİNDE KEMOMETRİK YÖNTEMLERİN KULLANILMASINA İLİŞKİN ÇALIŞMALAR

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Özet
Kemometrik yöntemler, özellikle son birkaç on yılda ilaç endüstrisinde son derece değerli araçlar haline gelmiştir. Bu yöntemler, farmasötik üretim ve kalite kontrolünün farklı yönlerinde yaygın olarak kullanılmaktadır. Önemli uygulamalardan biri, farmasötik ürünlerin etkinliğini ve güvenliğini sağlamak için çok önemli olan tabletlerdeki aktif bileşen içeriğinin tahmin edilmesidir. Kemometrik yöntemler ayrıca üretim hatalarının tespit edilmesinde ve farmasötik ürünlerin genel kalitesinin korunmasında da rol oynar. Çeşitli uygulama alanları arasında, temel bileşen regresyonu (PCR) ve kısmi en küçük kareler regresyonu (PLS) gibi kemometrik yaklaşımlar, farmasötik formülasyonların kantitatif analizinde büyük başarı göstermiştir. Bu derlemede, endüstriyel antibiyotik üretimi ve analizi bağlamında kemometrik yöntemlerin potansiyeline odaklanacağız. Antibiyotikler sağlık hizmetlerinde büyük önem taşımaktadır ve kalite ve etkinliklerinin sağlanması çok önemlidir. Kemometrik yöntemler kullanılarak, üretim sürecini gerçek zamanlı olarak izlemek ve kontrol etmek mümkündür, bu da verimliliğin ve güvenilirliğin artmasına yol açar. Özellikle eritromisin, vankomisin, penisilin, sefalosporin ve amoksisilin gibi antibiyotikler kemometrik analizden büyük ölçüde faydalanabilir. Bir mikro bilgisayar kontrol sistemi, fermantasyon süreçlerinin gerçek zamanlı olarak izlenmesini kolaylaştırarak anormalliklerin ve beklenen modellerden sapmaların erken tespit edilmesini sağlayabilir. Örneğin, eritromisin üretiminde kemometrik yöntemler verimliliği artırabilir ve biyoteknolojik metabolizmada yer alan karmaşık fermantasyon sürecini optimize edebilir. Ayrıca kemometrik teknikler, fermantasyon sırasında istenen ölçüm prosedürlerinin oluşturulmasına olanak tanır. Bu, farmasötik dozaj formlarının belirlenmesine ve tutarlı kalite kontrolünün sürdürülmesine yardımcı olur. Kemometrik yöntemler, fermantasyon sırasındaki hataları anında tespit edip düzelterek antibiyotik üretiminin genel güvenilirliğine ve güvenliğine büyük ölçüde katkıda bulunur.Sonuç olarak, bu derleme, kemometrik yöntemlerin endüstriyel antibiyotik üretimi ve analizindeki pratik uygulamalarına ışık tutmayı amaçlamaktadır. Bu gelişmiş analitik tekniklerin kullanılması, ilaç üreticilerinin süreçlerini kolaylaştırmalarına, ürün kalitesini artırmalarına ve nihayetinde sağlık hizmetlerinin iyileştirilmesine önemli katkılarda bulunmalarına olanak tanır.
Anahtar kelimeler: Kemometri, Antibiyotikler, Biyoteknoloji, Üretim, Eritromisin, Vankomisin, Penisilin, Sefalosporin.

STUDIES ON THE USE OF CHEMOMETRIC METHODS IN THE BIOTECHNOLOGICAL PRODUCTION AND ANALYSIS OF ANTIBIOTICS

Abstract
Chemometric methods have become extremely valuable tools in the pharmaceutical industry, particularly in the past couple of decades. These methods are widely used in different aspects of pharmaceutical manufacturing and quality control. One important application is estimating the active ingredient content in tablets, which is crucial for ensuring the efficacy and safety of pharmaceutical products. Chemometric methods also play a role in detecting production errors and maintaining the overall quality of pharmaceutical products. Chemometric methods such as baseline regression (PCR) and partial least squares regression (PLS) have become established in pharmaceutical content analysis. In this review, we will focus on the potential of chemometric methods in the context of industrial antibiotic production and analysis. Antibiotics are of utmost importance in healthcare, and it is crucial to ensure their quality and effectiveness. By utilizing chemometric methods, it is possible to monitor and control the production process in real time, leading to increased efficiency and reliability. Specifically, antibiotics like erythromycin, vancomycin, penicillin, cephalosporin, and amoxicillin can greatly benefit from chemometric analysis. A microcomputer control system can facilitate the real-time monitoring of fermentation processes, enabling the early detection of anomalies and deviations from expected patterns. For instance, in erythromycin production, chemometric methods can improve efficiency and optimize the complex fermentation process involved in biotechnological metabolism. Additionally, chemometric techniques allow the establishment of desired measurement procedures during fermentation. This aids in determining pharmaceutical dosage forms and maintaining consistent quality control. By promptly identifying and rectifying errors during fermentation, chemometric methods greatly contribute to the overall reliability and safety of antibiotic production. In conclusion, this overview will shed light on the practical applications of chemometric methods in industrial antibiotic production and analysis. The utilization of these advanced analytical techniques allows pharmaceutical manufacturers to streamline their processes, enhance product quality, and ultimately make significant contributions to improved healthcare.
Keywords: Chemometry, Antibiotics, Biotechnology, Production, Erythromycin, Vancomycin, Penicillin, Cephalosporin.

Introduction

Chemometrics encompasses a variety of concepts and applications related to data processing. These include descriptive and descriptive statistics, signal processing, experimental design, modeling, calibration, optimization, structure recognition, classification, artificial intelligence methods, image processing, and information and systems theory (Heyden, and Massart 2001). High-throughput experimental studies are based on experimental design and quantitative evaluation methods. These studies are usually conducted using mathematical models or designs. Especially for complex nonlinear systems, artificial intelligence methods, such as artificial neural networks, are widely preferred (Chen 2022). In the field of chemistry, solving industrial and scientific practical problems is very important. In chemistry, values that cannot be measured directly can be determined indirectly. Chemists have developed special techniques and instruments for such measurements. Any data obtained in this way can be converted into information, such as how much of a substance is in a mixture. With modern analytical methods, this data can be collected in large quantities and with high precision (Wang and Xu 2023). Chemometrics has a wide range of applications. In quantitative research, experimental design has a useful structure that encompasses many concepts and applications that can be discussed under the name of optimization and calibration.High-throughput experimental studies are based on experimental design and quantitative evaluation methods (Assubaie, Alnajjar and Naheid 2013). Such studies can be realized by mathematical models or designs. Especially for complex non-linear systems, artificial neural networks are often used as methods of artificial intelligence. In the field of chemistry, the solution of practical problems that arise in industrial and scientific fields is of crucial importance. With modern analytical methods, this data can be collected in large quantities and with high precision (Engel, Buydens, Blanchet 2017). Biotechnological processes are usually characterized by a variety of inputs, outputs and complex correlations between them, including operational and performance parameters. A biotechnological application consists of 15 to 30 steps. These parameters can influence the performance of the application and the product quality (Roggo, Chalus, Maurer, Lema-Martinez, Edmond, Jent 2007).Chemometrics offers an effective approach to understanding processes based on complex data sets. The increased use of this approach supports the progressive acceptance of quality through advanced design and process analytical technology in the regulatory and biotechnology industries.

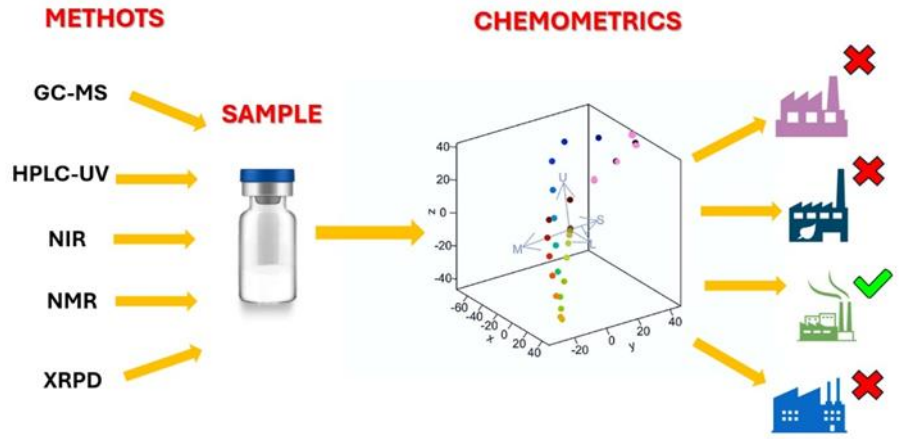


Figure 1.

Applications of chemometrics in industry

Application of Chemometric Methods to Antibiotic Production "Erythromycin, Vancomycin, Penicillin, Cephalosporin." and Their Analysis

The analysis of scientific processes and components requires the analysis and understanding of components and processes. In particular, it is essential to identify and monitor the components of complex mixtures. Techniques such as chromatography and spectroscopy are often used for this purpose. Chemometrics is particularly used to analyze complex mixtures and generates large amounts of data using spectroscopic techniques to identify components of biological origin. Chemometrics helps to analyze this data and convert it into meaningful information. Chemometrics also reduces the complexity of the data through data processing and modeling and develops appropriate models for analysis that highlight important information (Yuk 1992).

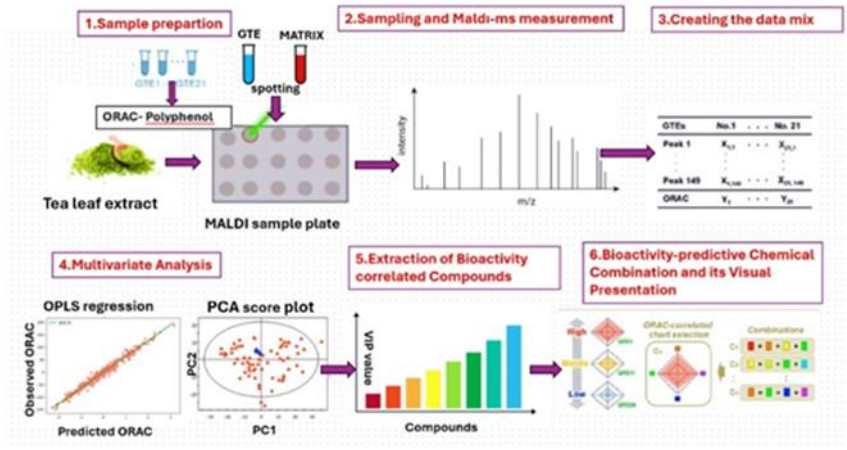


Figure 2: Chemometric Modelling of Biotechnological Processes

Erythromycin

Erythromycin is a macrolide antibiotic discovered in 1952 (Zhang and Qin 2010). Macrolides are a group of antibiotics that prevent bacteria from synthesizing proteins. Erythromycin is useful in the treatment of respiratory diseases, including bronchitis, pneumonia, Legionnaires' disease (a type of lung disease) and diseases caused by conditions such as whooping cough (pertussis; a serious illness that can cause severe coughing), recurrent rheumatic fever (Guay 1996). Its mechanism of action is to stop the growth of bacteria. Erythromycin, which is effective against gramme-positive bacteria, has also been shown to be effective against some gramme-negative bacteria and some other organisms.

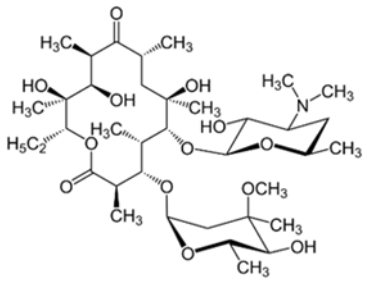


Figure 3: Molecular Structure of Erythromycin

Penicillin

Penicillin is the most important antimicrobial agent and dates back to the 1920s. In terms of their mechanism of action, penicillin belongs to the group of inhibitors of cell wall synthesis (Usleber and Märtlbauer 1998). Some types of penicillin are: Amoxicillin, Ampicillin, Cloxacillin, Dicloxacillin, Methicillin, Nafcillin, Oxacillin, Penicillin G, Penicillin V, Ticarcillin, Piperacillin (Rocco, Moloney, O'Beirne, Earley, Berendsen, Furey, and Danaher 2017). Penicillins are used to treat diseases such as ear, throat and sinus infections and to prevent dental infections. These antibiotics can be effective against bacterial infections and play an important role in the treatment of many diseases.

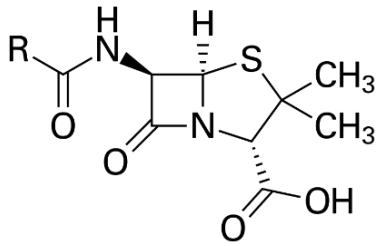


Figure 4: Molecular Structure of Penicillin

Cephalosporins: Cephalosporins are antibiotics from the group of β-lactams and have a bactericidal effect, i.e. they kill bacteria (Bush and Macielag 2010). These properties play an important role in fighting infections. Cephalosporins have a broad spectrum against gramme-negative and gramme-positive bacteria. The first and second generation cephalosporins are generally effective against gramme-positive bacteria, while the third generation cephalosporins are more effective against gramme-negative bacteria (García-Rodríguez, Bellido and Sánchez, 1995). Due to their chemical structure, they are similar to penicillins. Their effect is to destroy the bacteria by stopping the synthesis of the bacterial cell wall. Cephalosporins are used for treatment purposes in a variety of areas, from the respiratory tract to the world, from subcutaneous sugar to bone and muscle diseases. They are also effective in treating infections affecting the brain and nervous system, bacterial infections spread through the bloodstream and sexually transmitted diseases such as gonorrhea. Cephalosporins protect against many different bacteria and have become a very popular treatment option in the health sector.

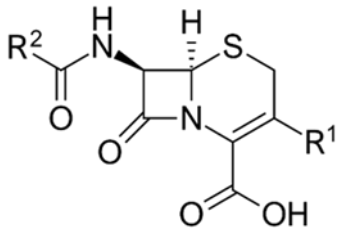


Figure 5: Molecular Structure of Cephalosporin

Vancomycin: Vancomycin, one of the first bactericidal antibiotics, is synthesized by Amycolatopsis orientalis (Yarlagadda, Sarkar, Manjunath, and Haldar 2015). This microorganism first produces vancomycin A and then synthesizes vancomycin B, which contains gyrocytisin. Vancomycin is a high molecular weight glycopeptide antibiotic. It shows its antibacterial properties by inhibiting the formation of the bacterial cell wall (Lian, Liu, Wang, Xu, Cui, and Bai 2013). It is particularly active against gram-positive bacteria and is effective against organisms such as staphylococci, streptococci, aerobic and anaerobic bacilli and Corynebacterium. Vancomycin achieves its bactericidal effect by interrupting the formation of the N-acetylmuramic acid pentaglycan chain, one of the cell wall components (Guthei 2021). Vancomycin is an important antibiotic that can cure serious and life-threatening infections. It is effective for infections of the pericardium, lungs, meninges and enterobacteria, as well as conditions such as sepsis caused by resistant bacteria (Martin, Alaya, Mallet, Viviand, Ennabli, Said, and De Micco 1994).

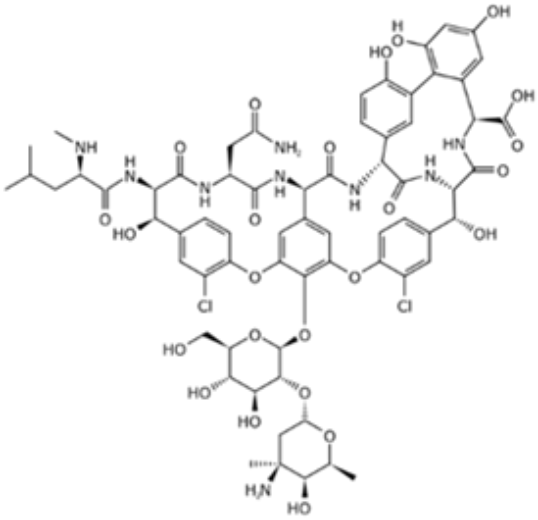


Figure 6: Molecular Structure of Vancomycin

Application of chemometric methods to the production and analysis of erythromycin, penicillin, cephalosporin, vancomycin antibiotic species

Biotechnological production of erythromycin

Erythromycin is produced by the bacterium Streptomyces erythraeus. It is important for biotechnological production. The steps of biotechnological production include the selection of suitable microorganisms, fermentation, optimization of conditions, extraction of the product, purification and production of the final product. This process can be more efficient than that obtained from natural sources and better results can be achieved by genetically modifying the microorganisms. In a study on erythromycin biotechnology (Zeng and LI 2010), Saccharopolyspora erythraea strains were found to control the amount of enzymes that enable the biotransformation of erythromycin D to Er-A (Liu 2008). The main objective of this study was to use metabolic engineering approaches to increase the production of Er-A and improve its purity in the experiments, it was determined that adding corn sump liquor to the 50-litre fermenter increased Er-A production, and furthermore, the maximum Er-A production was 8.196 U/mL by 191-fold. This value is 81.8% higher than the control group (control class 184 times 4.507 U/mL) (Zeng and LI 2010). It was also observed that Er-B impurities were completely eliminated and Er-C impurities were reduced.

Chemometric Studies on Erythromycin

Erythromycin estolate was characterized by thermogravimetric analysis and differential scanning calorimetry. Compatibility tests were carried out with four different incompatibilities such as magnesium stearate, sodium starch glycolate, povidone and mannitol and possible

incompatibilities were analyzed (Daniel and Trevisan 2021). Potential thermal mismatches were identified using Pearson correlation coefficients and simulated and experimental thermogravimetric curves were compared. An r(2) Table 1 value of about 0.91 for mixtures of magnesium stearate and mannitol shows that there is communication. Dynamic thermal FT-IR spectroscopy and MCR-ALS analysis of atomic particles to allow separation of chemical classes without the mass loss observed in thermogravimetric analysis. These techniques have successfully detected incompatibilities between erythromycin and magnesium stearate and mannitol, as well as between povidone and sodium starch glycolate.

Eksipiyans	**Pearson correlation coefficient (r^2)**
Magnesium stearat and Mannitol	~ 0,91

Table 1: Value of Eksipiyans for Mixtures.

An analytical method developed for the analysis of mixtures of antibacterial drugs was investigated. The UV absorption spectra of mixtures containing norfloxacin, tinidazole, erythromycin and trimethoprim show a clear spectral overlap. Chemometric techniques such as first derivative of zero crossing (D-1), classical least squares (CLS) regression analysis and principal component regression (PCR) can be used for quantitative analysis of drugs, including norfloxacin-tinidazole mixtures and trimethoprim-tinidazole mixtures (Mohamed, Abdelmageed, and Refaat 2007). The methods developed are in agreement with the results of the chemometric and colorimetric methods and show that the investigated drugs can be accurately determined in binary mixtures and commercial dosage forms. These methods are recognized as an effective tool for the analysis of antibacterial drug mixtures.Ren's 2008 study used near-infrared (NIR) spectroscopy to quantify the amounts of active ingredients in drug samples. In this block, four different GA-RBF network models are developed using genetic diseases for the diversity of RBF networks. GA-RBF networks achieve the best results according to SNV. The same structures were used in the quantitative analysis of erythromycin ethyl succinate powder samples. Thanks to the global search capabilities of GA, the risk of jamming at local minima was reduced. It was experimentally demonstrated that GA-RBF networks performed better compared to conventional RBF networks. It has been shown that SNV spectra have the lowest AIC value of GA-RBF network and SNV correction can achieve satisfactory results for the application of GA-RBF network.Marcello and Trevisan (2020) investigated the compatibility between ERY and excipients by thermal analysis. TG curves were important to identify potential interactions. Chemical incompatibilities were investigated by FT-IR on the hotplate, but PCA did not confirm the incompatibilities. MCR-ALS confirmed

the presence of five major components. No new degradation products were detected in the mixture of erythromycin and mannitol, but the deconvolution method confirmed the change in erythromycin concentration. The low correlation between ERY and magnesium stearate indicated incompatibility ERY + magnesium stearate ΔH_{fusion}/J g^{-1} 39.1 ± 0.9c (Silva, Trevisan, and Garcia 2020).An easy-to-use and reliable reversed-phase liquid chromatography (LC) spectrophotometric method was developed for the detection of erythromycin stearate (Elkady 2011). The method involved analyses using spectrophotometry, spectrofluorometry, near-infrared spectroscopy and high-performance liquid chromatography (HPLC). Two spectrophotometric methods were used to examine the colored product formed when erythromycin stearate (12 M) reacts with perchloric acid.The spectrophotometric method was used for simultaneous and inverse quantification. Other spectrophotometric methods used consist of three separate chemometric techniques: classical least squares (CLS), inverse least squares (ILS), principal component regression (PCR) and partial least squares (PLS). It is also used to separate and analyze strongly overlapping spectra.In addition, the absorbance values of zero degree and derivative spectra were measured at many points in the lymphatic path, spectral interferences between erythromycin and its colored product, spectral interferences between erythromycin and its colored product, in the first spectrophometric method or spectrometric techniques, namely classical least squares, principal component regression and partial least squares regression. The most common methods for solving spectral interference between other components ERS are classical least squares, inverse least squares, principal component regression and partial least squares.

Optimal Control of Erythromycin Fermentation Processes

The fermentation process used in the production of erythromycin was developed by a special pattern optimization method. This method was effectively utilized in erythromycin production units in a pharmaceutical manufacturing plant (Zhu, Lu, and Xu 1998). The effects of important factors such as temperature, pressure, pH value and air flow during the production process were analyzed in detail. The dissolved oxygen content and the condition of the fermenters were also measured using appropriate sensors. The temperature and pH values were intermittently adjusted according to the fermentation status using a CS-91 programmable digital controller.

The microcomputerised feeding system has shown that computerized feeding can improve the fermentation process compared to manual feeding. This control system lays a solid foundation for optimizing the erythromycin fermentation process through pattern recognition. Various pattern recognition methods were used to create a pattern space that can well represent the

process. The resulting process data was processed with an artificial neural network (ANN) and used as input for this system (Mei, Yang, Shu, Jiang, Liu, and Liao 2016).The PLS method shows how the samples are represented in a two-dimensional pattern space as a result of analyzing the pre-processed data. As can be seen in the figure, the samples are almost completely separated thanks to the developed method. The PLS method shows that the erythromycin fermentation process is a suitable modeling method for pattern recognition. The arrow in the figure indicates the direction of optimization. This means that the top right region corresponds to high chemical activity. The two points on the plane (i.e. points A and B) are chosen intentionally.

Penicillin

Biotechnological production of penicillin.

Penicillin is an antibiotic that is used to treat bacterial infections. The biotechnological production process usually involves the fermentation of fungi such as Penicillium chrysogenum. In this process, the microorganisms are grown in suitable culture media and fermentation takes place under strict control (Srirangan, Orr, Akawi, Westbrook, Moo-Young, and Chou 2013). Once produced, penicillin is collected, purified and processed into various medicines. Once produced, penicillin is collected, purified and processed into various medicines. After penicillin production, this valuable antibiotic is collected, purified and integrated into various drug formulations. Biotechnological methods of production can offer higher efficiency than conventional methods, and genetic engineering techniques can further increase the production capacity of penicillin. The study “Integrated Condition Monitoring and Control of Feed Batch Fermentation Processes” shows how important the use of DCS models is in such fermentation processes (Zhang and Lennox 2004). This modeling allows for more effective control of production plants by accurately assessing the factors affecting the quality of the fermentation process. Moreover, the inclusion of predictive control mechanisms contributes to a more effective diagnosis of control systems, improving error analysis.

Chemometric Studies on Penicillin

The study focused on the combination of chemometrics and laser-induced breakdown spectroscopy (LIBS) to determine the conditions of penicillin production (Wang 2022). The aim was to monitor quality differences in the production of the same type of drugs by different manufacturers. By proposing a LIBS-based method, it was highlighted as an important step to identify problems that may affect drug quality and identify production. The study examined three different penicillin strains produced by 10 different manufacturers. The LIBS spectra were

used to identify the characteristic lines of the penicillin species. Three different classification methods were used to identify the different producers of the penicillin species. The best classification result was obtained with the RF-ANN model with an accuracy of 100%.The results show that the LIBS technique can be used for product quality control in the manufacture of penicillin. An FIA system with factorial design was investigated for penicillin determination. In this method, penicillinase [E.C.] was deposited on silica gel in the reactor where production took place. 3.5.2.6], the enzyme was immobilized and analyzed (Lima and Lins 1997). A potentiometric FIA system with a statistical experimental design was developed and evaluated based on the effects of certain parameters on the signal response and the number of measurements per hour.In the study, using the three-factor factorization technique, parameters such as reactor length, carrier flow rate and sample volume were investigated in two stages to determine the best operating conditions. The pure measurement error was estimated using unequal replicates. The balance between the best response signal and the number of detections per hour and the ideal operating conditions were determined when the reactor length was 1.5 cm, the carrier flow rate was 2.2 mL/min and the sample volume was 150 µL. It was determined that a shorter reactor length and a lower flow rate led to an increase in the reaction signal (reference). It was found that the sample volume had no effect on the reaction. An interaction between the reactor length and the flow rate of the carrier was observed, and it was determined that the interaction was greater for relatively short reactor lengths.Due to the stability of the immobile silica surface of the enzyme, approximately 45 samples per hour could be analyzed. The system was tested for 73 days with a total of 800 measurements. It was found that the environmental conditions applied caused a decrease in activity of 8.9 and a recovery of 98% (Kubota 1997).The detection of penicillin G salts in pharmaceutical mixtures was carried out using FT-IR spectroscopy with a chemometric approach. Due to the complexity of the content, partial least squares (PLS) and radial basis function-partial least squares (RBF-PLS) methods were used and orthogenic signal correction (OSC) was pre-processed. The results showed that OSC is an effective preprocessing method for both linear (PLS) and nonlinear (RBF-PLS) models.

Optimal Control of Penicillin Fermentation Processes

The combination of PyMS and ANN was used to measure the penicillin content in Penicillium chrysogenum strains and the ampicillin content in Escherichia coli samples (Goodacre 1995). Four P. chrysogenum strains were analyzed with PyMS. Data obtained using the standard back-propagation algorithm were subjected to sigmoidal squashing. Linear regression methods did

not provide accurate predictions.ANNs are highly capable of predicting ampicillin quantities and were accurate for values beyond the concentration data for which they were trained. Principal component analysis was effective in distinguishing between P. chrysogenum strains and identifying phenotypic differences in their growth stages. Sampling with homogenized agar plugs was found to speed up the analysis process.

Cephalosporin

Biotechnological production of cephalosporin

The production process of cephalosporin antibiotics is carried out with the fungus Cephalosporium. This process involves a number of steps, starting with the selection of the appropriate microorganism, creating the necessary environment for fermentation, carrying out the fermentation process, extracting and purifying the resulting product, and finally bringing it into drug form (Wilhelm 1991). The improvement of microorganisms through genetic engineering methods allows the production of cephalosporins with higher yields and new properties, thus improving the production processes in the pharmaceutical industry.Sometimes chromatography is used to determine the composition and purity of a substance. Nonlinear regression analysis can generate process parameter effects to determine optimum values. Multivariate calibration techniques can represent and optimize relationships between multiple process variables. Chemometric methods used in the production of cephalosporins from Cephalosporium fungi are important for monitoring, controlling and optimizing the production process. These methods can be used to determine product quality, improve process efficiency and reduce production costs (Cruz, Pan, Giordano, Araujo, and Hokka 2004). Spectroscopic analysis, for example, evaluates product quality by quickly determining the chemical structures and components of samples.These approaches foster efficiency, stability and better quality of cephalosporin production processes. Also, if there are continuous monitoring systems set up with controls on them as well, then any potential problems may get caught earlier on in the production process so that it doesn’t stop all together.

Chemometric Studies on Cephalosporins

pH-sensitive Bio-FETs have been developed for the analysis of glucose, urea and cephalosporin C and have been used in various biological systems For example, GOD-FETs for glucose analysis have been integrated into the EVA system and used to monitor glucose concentration in microbial cultivation processes. Urease-FET-FIA has been used to monitor urea concentration and in combination with GOD-FET-FIA to monitor urea and glucose concentration in the cultivation of S. cerevisiae. These sensors are suitable for online

monitoring and control of media component concentrations. However, experiments are required to determine the optimal conditions in different biological systems, as pH and buffer capacity vary and high substrate concentrations may require dilution (Brand 1991).

Optimal Control of Cephalosporin Fermentation Processes

Cephalosporin C biosynthesis was investigated by Cephalosporium acremonium. Higher productivity was achieved in continuous stirred tank bioreactors compared to batch reactors. The pH control increased cephalosporin C production. Experiments were performed with free cells and the typical time course of the bioprocess was determined. During the high growth rate, glucose is preferred, while sucrose is metabolized more slowly (Hokka 2001). In this phase, growth is somewhat inhibited, while a higher production rate is achieved. The kinetic model was elaborated using linear and non-linear regression analysis. The effective diffusivity of oxygen was determined and compared with values from the literature. The remaining kinetic constants were determined by solving non-linear differential equations. This method allowed the determination of the process behavior together with the concentration profiles of the components in the bioparticles.Industrial cephalosporin batch fermentation has some advantages for a "normal operating conditions" (NOC) model with fewer prediction parameters, requiring little memory and representing multidimensional data at the same time. A total of 20 groups of normal cephalosporin fermentations were used to develop the NOC models (Yuan 2009).

Chemometric Studies on Cephalosporin

Three common cephalosporin solutions, such as ceftriaxone, cefotaxime sodium and cefazolin sodium, were analyzed for quantification using Raman spectroscopy and chemometric methods (Lin 2013). Partial least-squares regression models were created on the basis of pre-processed spectral data. High correlation coefficients and low prediction errors indicate that Raman spectroscopy is a suitable method for the quantification of cephalosporin solutions. Pre-processed partial least squares (OSC) PLS models gave positive results in determining the concentrations of mixed triplet cephalosporin solutions. This study demonstrates that by combining Raman spectroscopy with the PLS regression technique, the concentrations of the components of cephalosporin mixtures can be accurately and rapidly determined.A boron-doped diamond electrode was used for the first time for the sensitive and selective analysis of cefixime, a third-generation cephalosporin, using the square-wave voltammetry technique (Keskin 2019). The effect of electrode pretreatment on the current response was investigated. The best signals were obtained by anodic and cathodic electrochemical pretreatment of the

electrode and subsequent polishing with a polishing pad. In a 0.1 mol dm^{-3} H_2SO_4 supporting electrolyte, Cefixime showed an irreversible and diffusion-controlled oxidation peak at +1.25 V (Ag/AgCl vs. 3 mol dm-3 NaCl). With the best instrumental conditions and pretreatment procedure, the linear calibration curve ranged between 2.2 × 10-6 mol dm^{-3} to 1.3 × 10^{-4} mol dm^{-3} having a detection limit of 5.9 × 10^{-7} mol dm^{-3}. This method can also be used for analyzing cefixime from pharmaceutical formulations when other methods fail because it gives consistent results and is ecofriendly in nature.Cephalosporins are the most commonly prescribed β-lactam antibiotics (Elbashir 2015). Spectrophotometry is probably the most suitable analytical technique for routine analysis as it is simple, inexpensive and widely used in quality control laboratories. In recent years, several papers have been presented on the development and validation of spectrophotometric methods for the analysis of cephalosporins in pharmaceutical formulations. Most of the methods reported are visible spectrophotometric methods. These methods are based on the formation of a colored product due to charge transfer and reaction of cephalosporins with oxidant reagents or ion pair formation. The methods have been used for the quantitative determination of the drug in pure form and in commercial preparations. Common excipients do not interfere with the determination.

VANCOMYCIN

Biotechnological production of Vancomycin

To produce vancomycin an effective antibiotic used to treat bacterial infections through biotechnology, various procedures should be followed. Initially, it is necessary to choose a proper strain of Streptomyces orientalis and create the right environment for fermentation. It is essential to check closely and control strictly the growth of bacteria as well as the amount of produced vancomycin in each stage during fermentation so that they will remain at their best condition always until fermentation completes. Once done with fermenting, purify collected vancomycins until forms pure enough are achieved. Therefore, different pharmaceutical preparations like tablets or injectable solutions can be made from them (Koller, Hesse, Salerno, Reiterer and Braunegg 2011).Biotechnology can make more of vancomycin than any natural method. Furthermore, genetic engineering may alter microorganisms so that they produce vancomycin more effectively or make the drug acquire novel characteristics. This is a key step in making pharmaceutical-grade vancomycin.

Chemometric Studies on Vancomycin

Streptomyces species are ubiquitous organisms of nature and can produce many different bioactive compounds. Among them, of great interest, are the glycopeptides, which form the

basis of drugs like vancomycin, effective to treat antibiotic-resistant staphylococcal infections. Vancomycin is vital in the fight against common and difficult-to-treat infections in hospitals. Vancomycin is usually produced by bacteria such as Amycolatopsis orientalis. To determine the optimal production conditions, various factors are evaluated and the interaction of these factors is studied by statistical analysis. For example, factors such as pH, temperature, size of the inoculum, agitation speed and aeration influence the efficiency of vancomycin production (Aly and Tolba 2021).By determining optimal production conditions, a valuable antibiotic such as vancomycin can be produced more efficiently. This is important to meet demand and reduce costs. However, given the complexity of the process and the naturally occurring diversity, continuous research and development is required to improve production efficiency (de Castro and Sanches 2017). Genetic engineering and improved culture media could yield antibiotics such as vancomycin more cheaply. Such developments pave the way to develop new ways of fighting against resistant bacteria, thus enabling more production and distribution of the life-saving drugs. Improved access to treatment will therefore be more easily acquired by patients treated for resistant infections.The study focused on the optimization of culture conditions for vancomycin production of strain Amycolatopsis orientalis KCCM-10836P. It was noted that pH and dissolved oxygen tension (DOT), which were established as most critical factors, was identified. It was determined that the production of vancomycin reached its maximum under the conditions of pH control at 7.0 and under DOT in the range of 20-30%. Using various carbon and nitrogen sources, different sources of carbon and nitrogen were tested. The highest production of vancomycin was achieved with the use of dextrin as the source of carbon. The nitrogen sources, in turn, shown a strong influence on the specific vancomycin content. The production of red metabolite was detected under low oxygen tension conditions. It was found that red metabolite production slowed down vancomycin production when DOT was below 20%. Ultimately, vancomycin production has been successfully transferred from a laboratory to pilot and plant scale. Thus, the strain A. orientalis KCCM-10836P has huge potential for commercial production of vancomycin. Further optimization of culture conditions and the choice of highly productive strains may bring increased productivity and efficiency in industrial vancomycin production (Oh and Lee 2007).

Chemometric Studies on Vancomycin

HPLC/UHPLC studies in this field are very limited. HPLC methods coupled with mass spectrometry or tandem mass spectrometry detectors are generally used for the detection of vancomycin in biological fluids or tissues. There is a method for the quantification of

vancomycin and ceftazidime in cerebrospinal fluid using an internal standard called thienol. This method gave detection times of 7 minutes and 11 minutes for vancomycin and ceftazidime, respectively. Quantification methods for vancomycin, imipenem and cefepime in human plasma were also developed.The primary standard used was cefuroxime and the analysis time was spread over 30 minutes. Theoretical plate numbers and symmetry factor values were measured for three solutes (benzoic acid, N,N-dimethylaniline and vancomycin) in chromatographic systems (using different stationary phases and mobile phase compositions). These measurements were performed to classify the systems and to investigate the possible variations of the columns and eluent compositions.The mobile phases consisted of acetonitrile or methanol as exchanger and K H_2PO_4-H_3PO_4 or triethylamine-H_3PO_4 as aqueous buffer. The organic content of the mobile phases was adjusted so that the log rf (logarithm of the retention factor) of the tested compounds was between 0.1 and 1.3 for all chromatographic systems and test compounds (Heberger 2005). The plate numbers and symmetry factors were analyzed by principal component analysis (PCA). The input data were organized into 13 x 28 data matrices for the plate numbers and symmetry factors separately for all compositions. Two principal components accounting for at least 98% of the total variance were retained in the model. This analysis showed which chromatographic systems (stationary and mobile phases) gave the same or similar chromatographic parameters (De Zan 2017).PCA provides a way to switch chromatographic systems and columns. Monofunctional test compounds provide only approximate information on the usefulness, classification and replacement of HPLC systems when multifunctional solutes are to be separated. Using PCA, it is possible to determine the potential trade-offs between chromatographic systems and columns. PCA shows which chromatographic systems (column and mobile phases) give the same or similar chromatographic parameters using three different types of test compounds.Characterization of Nonribosomal Peptide Antibiotic Solid Dispersion Formulation with Process Analytical Technology Sensors", the focus of the research was to characterize and evaluate the variability of an amorphous vancomycin (VCM) solid dispersion (SD) using a crystalline polyethylene glycol (PEG-6000) carrier (Khan 2013). For this purpose, it was aimed to determine the percentage values of the compositions using the non-destructive method of process analytical sensors (PAT). SD was prepared using heat fusion method and characterized in terms of physicochemical and spectral properties. Improved dissolution was observed in these formulations, while the crystallinity of PEG-6000 decreased, indicating that the drug is present in dissolved and dispersed form in the polymer. The homogeneity of the SD formulations was

also confirmed by chemical NIR imaging data. Principal component analysis (PCA) and partial least squares (PLS) methods were applied to the NIR and PXRD data to quantify the drug and carrier. The PLS models developed for both data sets had high correlation coefficients (>0.9934) and low mean square error and standard deviation values, indicating good predictive ability. The model based on NIR and PXRD was able to predict the amount of PEG-6000 two times more accurately than the VCM. In summary, the resolution of drug from SD increased with decreasing crystallinity of PEG-6000 and the chemometric models showed that the PAT sensor was suitable for simultaneous estimation of VCM and PEG-600 content."A method for the determination of two antibiotics prescribed for the treatment of nosocomial infections, linezolid and meropenem, in plasma and urine", using micellar liquid chromatography. This innovative method for determining the concentrations of linezolid and meropenem in plasma and urine uses crystalline polyethylene glycol (PEG-6000) as a carrier.The biological fluids, plasma and urine, were diluted in the mobile phase, filtered and injected directly without an extraction step (Heberger 2005). Both antibiotics were eluted in <15 minutes using a C18 column and a phosphate-buffered mobile phase in isocratic mode. Absorption was detected at 255 nm for linezolid and 310 nm for meropenem.
Using chemometric techniques, an analysis was performed to study the effect of the concentrations of sodium dodecyl sulfate and methanol on the retention times of these two chemicals in the chromatography.The method was highlighted as it requires only small amounts of toxic and volatile solvents and can be perform quickly. Consequently, this method can be used for the rapid and efficient determination of antimicrobial drugs in plasma and urine. The results of accuracy and precision were at an acceptable level and the method is suitable for routine analysis in a clinical laboratory

CONCLUSION

The quantitative and statistical aspects of all the investigated methods in the production and preparation of antibiotic species have the advantages of simplicity, precision, accuracy and ease of use and therefore the proposed methods can be used for quality control in the laboratories of production and dosage forms of all the mentioned antibiotic species. It has been shown that the chemometric procedures performed for all fermentation processes can be easily implemented in a comparative simulation and that the procedure can provide an accurate inference of quality variables such as biomass concentration, which is difficult to measure with online sensors. The relevant results of pattern recognition and refinement process optimization tests have shown that the optimal target, chemical efficiency, can be significantly increased by adapted

techniques. All the proposed methods have the advantages of simplicity, precision, accuracy and convenience for separation and quantification and can be used to study their dosage forms. Therefore, the proposed methods can be used for quality control of the indicated drugs in normal laboratories.

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BESLENME VE DİYETETİK BÖLÜMÜ ÖĞRENCİLERİNDE BESLENME DURUMU VE FİZİKSEL AKTİVİTE DÜZEYLERİNİN DEĞERLENDİRİLMESİ

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Özet
Bu araştırmanın amacı beslenme ve diyetetik bölümü öğrencilerinde beslenme durumu ve fiziksel aktivite düzeyleri arasındaki ilişkinin değerlendirilmesidir. Çalışma, Mayıs 2022-Temmuz 2022 tarihlerinde çalışmaya katılmayı gönüllü kabul etmiş, 18-25 yaşlarında 134 üniversite öğrencisi üzerinde yürütülmüştür. Çalışmaya dahil edilen tüm öğrencilere bir anket formu, 24 saatlik besin tüketim kaydı ve fiziksel aktivite formu uygulanmıştır. Verilerin değerlendirilmesinde SPSS 27.0 programı kullanılmıştır. Araştırmaya yaş ortalaması 21,7±2,5 olan 22 erkek ve 112 kız öğrenci olmak üzere toplamda 134 kişi katılmıştır. Katılımcıların %44'ü dördüncü sınıf öğrencilerinden oluşmaktadır. Beslenme için aylık ortalama bütçe değerlendirildiğinde %55,2'sinin 300-1000 TL cevabını verdiği görülmüştür. Öğrencilerin %71,6'sının üç ana öğün tükettiği, %40,3'ünün öğle öğününü atladığı, %42,5'inin hafta 1-3 kez dışarda yemek yediği, %47'sinin doğru beslenme bilgilerinin davranış durumlarını sıklıkla etkilediği, %42,5'inin etiket okuma alışkanlığının bazen olduğu belirlenmiştir. Öğrencilerin günlük ortalama su tüketimlerinin 1,8±0,7 litre olduğu tespit edilmiştir. Öğrencilerin %7,5'i fiziksel olarak aktif olmayanlardan, %63,4'ü fiziksel aktivite düzeyi düşük olanlardan ve %29,1'i fiziksel aktivite düzeyi yeterli olanlardan oluşmaktadır. Toplam fiziksel aktivite düzeyi ise 2546,2±2159,8 MET-dk/haftadır. Öğrencilerin enerji ve besin ögesi alım miktarları ile fiziksel aktivite düzeyleri arasında istatistiksel olarak anlamlı ilişki saptanmamasına rağmen ($p>0.05$) posa, A vitamini, E vitamini, B_1, B_2, B_6, folat, C vitamini, potasyum, kalsiyum, magnezyum ve demir alımının fiziksel olarak aktif olmayan öğrencilerde daha düşük düzeylerde olduğu tespit edilmiştir. Sonuç olarak bu kesitsel çalışmada yer alan beslenme ve diyetetik öğrencilerinin çoğunluğunun düşük fiziksel aktivite düzeyine olduğu sahip olduğu belirlenmiştir. Ayrıca beslenme durumları dikkate alındığında, öğün atlama, yeterli miktarda su içmeme, ev/yurt dışında besin tercih etme gibi bazı yanlış alışkanlıklara sahip oldukları saptanmıştır. Bu sonuçlar yeterli ve dengeli beslenme ile düzenli fiziksel aktiviteyi kapsayan sağlıklı yaşam tarzı konusunda bireylerin daha çok bilinçlendirilmesi gerektiğini göstermektedir. Ülkemizde özellikle beslenme ve sağlık alanında eğitim gören öğrencilerin yaşam tarzlarını değerlendirecek ve bu anlamda hatalı davranışların değişimi için müdahaleler planlayacak kapsamlı çalışmalara ihtiyaç duyulmaktadır.
Anahtar Kelimeler: Beslenme durumu, fiziksel aktivite düzeyi, sağlıklı yaşam, üniversite öğrencileri

EVALUATION OF NUTRITIONAL STATUS AND PHYSICAL ACTIVITY LEVELS IN NUTRITION AND DIETETICS DEPARTMENT STUDENTS

Abstract
This study aimed to evaluate relationship between nutritional status and physical activity levels in nutrition and dietetics department students. Study was conducted on 134 university students aged 18-25, who voluntarily agreed to participate between May and July 2022. A survey form, 24-hour food consumption record and physical activity form were applied. SPSS 27.0 program was used to evaluate data. A total of 134 people, 22 male and 112 female students, with an average age of 21.7±2.5, participated in research. 44% of participants are fourth grade students. 55.2% answered 300-1000 TL for average monthly budget for nutrition, 71.6% of the students consume three main meals, 40.3% skip lunch, 42.5% eat out 1-3 times a week, 47% say that correct nutrition information often affects their behavior and 42.5% of them sometimes had the habit of reading labels. Students' average daily water consumption was 1.8±0.7 liters. 7.5% of students are physically inactive, 63.4% are those with low physical activity levels, and 29.1% are those with sufficient physical activity levels. Total physical activity level is 2546.2±2159.8 MET-min/week. Intake of fiber, vitamin A, vitamin E, B_1, B_2, B_6, folate, vitamin C, potassium, calcium, magnesium and iron was significantly higher ($p>0.05$). It was found to be at lower levels in students who were not physically active. As a result, majority of nutrition and dietetics students in this cross-sectional study had low physical activity levels. In addition, they have some wrong habits such as skipping meals, not drinking enough water, and choosing to eat outside of home/dormitory. Individuals should be made more aware of a healthy lifestyle that includes adequate and balanced nutrition and regular physical activity. Comprehensive studies are needed to evaluate lifestyles of students, especially those studying in field of nutrition and health, and to plan interventions to change erroneous behaviors in this sense.
Keywords: Healthy life, nutritional status, physical activity level, university students

Giriş

Üniversite dönemi ergenliğin son dönemleri ile yetişkinliğin ilk döneminin başladığı bir geçiş dönemidir. Gençler aile ortamından ayrıldıklarında stres düzeyleri artmakta ve buna bağlı olarak beslenme durumları da değişmektedir. Dış etkenlerden daha fazla etkilenerek, kendi özgür seçimlerini ön plana çıkarmaya başlamaktadır (Akdevelioğlu & Yörüsün, 2019). Bu dönemde öğrencilerin yeni bir disipline uyum sağlamalarının yanı sıra, daha hızlı yaşam temposu da sağlıksız ve düzensiz beslenme davranışlarını artırmaktadır (Kartal ve ark., 2017). Bu bakımdan üniversite yaşamı, beslenme ve yaşam tarzı alışkanlıklarının oluştuğu önemli bir dönem olup, obezite ve buna bağlı kronik hastalıkların gelişiminde uzun vadeli sonuçlar doğurabilmektedir (Mahfouz ve ark., 2016; Kapinos ve ark., 2014). Üniversite döneminde öğrencilerin beslenme alışkanlıkları ve fiziksel aktiviteleri olumsuz etkilenebilmektedir (Calestine ve ark., 2017; Beaudry ve ark., 2019). Öğrenciler genellikle besinlerini kantinlerden, yemekhaneden ya da dışarıda bir restorandan temin etmektedirler. Kantinde bulunan yiyecekler genellikle hijyenik olmayan koşullarda pişirilmekte, pişirme işlemi sırasında da temel besin maddelerinin çoğu yok olmakta ve dolayısıyla öğrencilerin besin ögesi gereksinimlerini karşılayamamaktadır (Priya ve Sinha, 2020). Bu nedenle öğrencilerin üniversite döneminde sağlıksız ve enerji açısından yoğun besin tüketimini arttırıp, sağlıklı ve besin değeri açısından zengin besin alımını azaltması beslenme kalitelerinde genel bir düşüşe neden olmaktadır (Beaudry ve ark., 2019). Birçok çalışma, üniversite öğrencilerinin büyük bir kısmının kötü beslenme ve fiziksel aktivite eksikliği gibi sağlıksız yaşam tarzı davranışları ile beslenme durumlarının kötü olduğunu vurgulamaktadır (Blake ve ark., 2017; Calamidas ve Crowell, 2018; Bernardo ve ark., 2016; Deliens ve ark., 2013; Pengpid ve ark., 2015). Üniversite öğrencilerinin yetersiz beslenme ve yetersiz fiziksel aktivite durumlarına katkıda bulunan ortak faktörler arasında stres, yoğun programlar, alışılmış davranışlar ve sosyal medya yer almaktadır (Calamidas & Crowell, 2018; Sogari ve ark., 2018). Zemzemoğlu ve ark. (2019), sağlık bilimleri fakültesi öğrencileri arasında yüksek düzeyde ana öğün atlama ve fazla atıştırmalık tüketimi bulmuşlardır. Ayrıca Arslan'ın (2016) çalışmasında bu öğrencilerin fiziksel olarak aktif olmadığı saptanmıştır. Ayrıca yeterli su içmeme ve hazır besin tercih etme gibi alışkanlıkların da bu dönemde arttığı belirlenmiştir (Arslan ve ark., 2016).Beslenme ve Diyetetik Bölümü gibi sağlık ve besin ile ilgili programlara kayıtlı üniversite öğrencilerinin, çalışma alanları ve aldıkları derslerin niteliği göz önüne alındığında, akranlarına göre daha iyi beslenme alışkanlıklarına sahip olmaları düşünülmektedir. (Rivera Medina ve ark., 2020). Dolayısıyla bu öğrencilerin öğrenimleri sırasında edindikleri bilgileri, beslenme alışkanlıklarını

ve yaşam tarzlarını iyileştirecek şekilde uygulayabilmeleri beklenmektedir. Ancak Rizo-Baeza ve ark. (2014) tarafından İspanya Alicante Üniversitesi Beslenme ve Diyetetik Bölümü üniversite öğrencileri arasında yürütülen bir çalışma, makro ve mikro besin ögelerinin tüketiminin beslenme kurallarına uymadığını, beslenmeyle ilgili bilginin varlığının sağlıklı beslenme ve yaşam tarzına ilişkin karar almayı etkilemediğini göstermiştir (Rizo-Baeza ve ark., 2014).Geleceğin sağlık profesyonelleri olmak üzere sağlık ile ilgili bölümlerde eğitim gören üniversite öğrencileri aynı zamanda toplumda sağlıklı davranışları eğitmek ve teşvik etmekle de görevlendirileceklerdir. Beslenme ile ilgili programlara kayıtlı öğrencilerin de bu bağlamda, beslenme kavramlarının edinilmesi ve öğrenilmesi açısından diğer çalışma alanlarına göre avantajlı olmaları ve akademik programlarının bu konuda yeterlikler sağlaması nedeniyle sağlıklı beslenme alışkanlıklarını uygulama konusunda daha iyi bir konumda olmaları beklenmektedir. Ancak geleceğin sağlık profesyoneli olma yolunda eğitim alan üniversite öğrencilerinin beslenme ve fiziksel aktivite davranışları hakkında çok az şey bilinmektedir. Bu nedenle bu çalışmanın amacı, Beslenme ve Diyetetik Bölümü öğrencilerinde beslenme durumu ve fiziksel aktivite düzeyleri arasındaki ilişkinin değerlendirilmesidir.

Yöntem

Araştırmanın Yeri, Zamanı ve Örneklem Seçimi

Bu çalışma, Mayıs 2022-Temmuz 2022 tarihleri arasında Ankara Üniversitesi Sağlık Bilimleri Fakültesi, Beslenme ve Diyetetik Bölümü'nde eğitim almakta olan çalışmaya katılmayı gönüllü olarak kabul etmiş, 18-25 yaş arasındaki 134 öğrenci üzerinde yürütülmüştür. Çalışmaya gönüllü olmayan, 18 yaşının altında ve 25 yaşının üstünde, gebe ve emziklilik döneminde olan ve herhangi bir psikolojik hastalığı olup psikolojik ilaç kullanan bireyler dahil edilmemiştir.

Verilerin Toplanması

Çalışmaya dahil edilen tüm öğrencilere sosyo-demografik özelliklerini sorgulayan anket formu, günlük enerji ve besin ögesi alımını değerlendirmek için 24 saatlik geriye dönük besin tüketim kaydı, fiziksel aktivite düzeyini saptamak için Uluslararası Fiziksel Aktivite Anketi Kısa Formu uygulanmıştır.

Besin Tüketim Durumunun Saptanması

Katılımcıların günlük enerji ve besin ögesi alımları 24 saatlik hatırlatma yöntemi kullanılmasıyla oluşturulan besin tüketim kayıtlarından değerlendirilmiştir. Besin tüketim kayıtlarına dair verilerin değerlendirilmesinde Türkiye'de uygulanan beslenme programı beslenme bilgi sistemleri paket programı (BEBİS) programı ile katılımcıların günlük ortalama makro ve mikro besin ögeleri değerleri hesaplanmıştır

Uluslararası Fiziksel Aktivite Anketi

Uluslararası Fiziksel Aktivite Anketi (UFAA) 15-65 yaş aralığındaki katılımcıların fiziksel aktivite düzeylerini belirlemek amacıyla Craig ve ark. (2003) tarafından geliştirilmiştir (Craig, 2003). UFAA'nın Türkiye'de geçerlik ve güvenirlik çalışması Öztürk (2005) tarafından yapılmıştır. Bütün aktivitelerin değerlendirilmesinde her bir aktivitenin tek seferde en az 10 dk yapılıyor olması ölçüt alınmaktadır. Dakika, gün ve MET değeri çarpılarak "METdakika/hafta'' olarak bir skor elde edilmektedir. Fiziksel aktivite düzeyleri, fiziksel olarak aktif olmayan (<600 MET- dk/hafta), fiziksel aktivite düzeyi düşük (600 – 3000 METdk/hafta) ve fiziksel aktivite düzeyi yeterli olan (sağlık açısından yararlı olan) (>3000 METdk/hafta) şeklinde sınıflandırılmıştır (Öztürk, 2005).

Verilerin İstatistiksel Değerlendirilmesi

Veriler SPSS 27.0 (Statistical Pack age for the Social Sciences 27.0) programı ile analiz edilmiştir. Değişkenlerin normallik dağılımı kontrolünden sonra fiziksel aktivite düzeyi ile besin ögeleri alımı arasında farklılık olup olmadığını belirlemek için Tek Yönlü ANOVA testi kullanılmıştır. Tüm testler için anlamlılık düzeyi ($p<0,05$) olarak belirlenmiştir. Bu çalışma Ankara Üniversitesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulu'nun 25.04.2022 tarih ve 08/80 sayılı Etik Kurul Onayı ile gerçekleştirilmiştir.

Bulgular ve Tartışma

Oğur ve ark.'nın (2015) Beslenme ve Diyetetik Bölümü öğrencileri ile yaptıkları çalışmada kadın öğrenci popülasyonu erkeklerden fazla görülmüştür (Oğur & ark., 2015). Benzer şekilde Beslenme ve Diyetetik öğrencilerinin de dahil olduğu bir diğer çalışmada da kadın öğrencilerin sayısı daha fazladır (Andızoğlu, 2022). Katılımcıların genel özellikleri Tablo 1'de özetlenmiştir. Bu çalışmada yer alan öğrencilerin %16,4'ü erkek, %83,6'sı kız olarak saptanmıştır. Sonuçlar benzerlik göstermektedir. Kadın öğrenci sayısının fazla olmasının nedeni Beslenme Diyetetik Bölümü'nü tercih edenlerin daha çok kadın öğrenciler olmasından kaynaklı olabilmektedir. Beslenme ve Diyetetik öğrencilerinin beslenme durumlarının incelendiği bir diğer çalışmada katılımcıların çoğu dördüncü sınıftaki öğrencilerden oluşmaktadır. Yine aynı çalışmada yaş ortalaması erkeklerde 21.2±1.5 yıl ve kadınlarda 21.1±0.7 yıl olarak belirlenmiştir (İspir, 2022). Bu çalışmada da paralel bir şekilde katılımcıların %44'ü dördüncü sınıf öğrencilerinden oluşmaktadır. Öğrencilerin yaş ortalaması da 21,7±2,5 olarak belirlenmiş ve benzer sonuç çıkmıştır. Sonuçların benzer olması üniversite dönemi öğrencilerinin yaş ortalamalarının yakın olduğunu göstermektedir. Sağlık Bilimleri Fakültesi öğrencilerinde yapılan bir çalışmada öğrencilerin beslenme için aylık bütçelerinin

yarısını ayırdıkları bildirilmiştir (Aydemir ve ark., 2023). Bu çalışmada Beslenme için aylık ortalama bütçe değerlendirildiğinde %55,2'sinin 300-1000 TL cevabını verdiği görülmüştür. Sonuçlardaki bu farklılık öğrencilerin öğrencilerin okudukları şehirlerinin ekonomik durum farklılığı ile bütçe olanaklarının kısıtlı olmasına bağlı olduğu düşünülebilir.

Tablo 1. Öğrencilere ilişkin özellikler

	Toplam (n:134)	
	n	**%**
Cinsiyet		
Erkek	22	16,4
Kız	112	83,6
Sınıf		
1	18	13,4
2	19	14,2
3	38	28,4
4	59	44
Beslenme için ayrılan aylık ortalama bütçe		
<300 TL	31	23,2
300-1000 TL	74	55,2
1000-2500 TL	26	19,4
2500-5000 TL	3	2,2
>5000 TL	-	-
Yaş	21,7±2,5	

Sağlıklı diyetler hazır beslenme olan batı diyetine doğru değişmekte ve bu beslenme geçişinden en çok etkilenen popülasyonlardan biri üniversite öğrencileridir (Costa Silva Zemdegs ve ark., 2011; Baldini ve ark., 2009). Bireylerin 18-24 yaş aralığı, sıklıkla öğün atladıkları, yanlış ve sağlıksız beslenme alışkanları ile davranışa sahip olduğu yetişkinliğe geçiş dönemi olarak bilinmektedir (Horacek ve diğerleri, 2002; Rinaldi ve diğerleri, 2012). Tekirdağ'da Beslenme ve Diyetetik öğrencileriyle yapılan bir çalışmada 3 ana öğün tüketenlerin sayısının 2 ya da 1 ana öğün tüketenlere oranla daha fazla olduğu bildirilmiştir. Aynı çalışmada öğle ana öğünü atlayanların sayısı da kahvaltı ve akşam yemeği ana öğününü atlayanlardan fazla bulunmuştur (Torpil, 2021). Benzer şekilde Beslenme ve Diyetetik öğrencileriyle yapılan diğer çalışmalarda da en çok atlanılan ana öğün öğle öğünü olarak saptanmıştır (Smail, 2022; Özüpek & Arslan, 2021). Üniversite öğrencileri ile yürütülen başka bir çalışmada öğrencilerin 3 ana öğün tükettikleri görülmüştür (Sönmez 2021). Üniversite öğrencilerinde yapılan benzer bir çalışmada öğrencilerin çoğunluğu öğle öğününü atladığını bildirmişlerdir (Tözün ve ark., 2017). Katılımcıların sağlıklı yaşam biçimi alışkanlıkları Tablo 2'de gösterilmiştir. Bu çalışmada

öğrencilerin %71,6'sının üç ana öğün tükettiği, %40,3'ünün öğle öğününü atladığı görülmüştür. Öğrencilerin öğle zaman aralığında daha çok dışarıda oldukları ve bu zamanın ders saatine denk gelmesiyle öğle öğünlerine yeterince özen gösteremedikleri bu sonuçlar ile ilişkilendirilebilir. Çiçekli'nin (2022) yaptığı çalışmada öğrenciler arasında haftada 1-3 kez dışarda yemek yiyenlerin sayısı daha fazla saptanmıştır (Çiçekli, 2022). Bu çalışmada da benzer şekilde %42,5'inin hafta 1-3 kez dışarda yemek yediği bulunmuştur. Çalışmanın sonuçları birbirine paralellik göstermektedir. Yapılan bir çalışmada Sağlık Bilimleri Fakültesi öğrencilerinde doğru beslenme bilgilerine erişildiğinde davranış değişikliği durumuna evet diyenlerin hayır diyenlere kıyasla daha fazla olarak bildirilmiştir (Smail, 2022). Bu çalışmada katılımcıların %47'sinin doğru beslenme bilgilerinin davranış durumlarını sıklıkla etkilediği belirlenmiştir. Kişilerin dahil oldukları toplumda beslenme bilgi düzeyleri ile alışkanlıklarının, etkileşimde oldukları kişilerin değerleri ve eğitim düzeyleri ile ilişkili olup bu parametrelerin kişilerin davranışlarını da etkilediği düşünülebilir. Üniversite öğrencileriyle yapılan bir çalışmada beslenme eğitimi dersi alanların besin etiketine her zaman okudukları bildirilmiştir (Ayaz ve ark., 2021). Beslenme ve Diyetetik Bölümü'nde okuyan kız öğrencilerle yapılan bir çalışmada da benzer şekilde besin etiketi okuyanların sayısının okumayanlara göre daha fazla olduğu saptanmıştır (Garipoğlu ve ark., 2019). Bu çalışmada da benzer çıkarımlar elde edilerek, katılımcıların %51,5'inin etiket okuma alışkanlığına evet cevabının verildiği görülmüştür. Beslenmeye dair ders veya eğitimi alma durumunun öğrencilerin motivasyonunu ve bilgi düzeylerini artırarak besin etiketi kullanımını geliştirerek bu konuda farkındalıklarını artırmış olabileceği düşünülebilir. Günlük su tüketim miktarı kişilerin yaşına, sahip oldukları fiziksel aktiviteye, bireysel sağlık durumlarına ve hava koşullarına göre değişmekle birlikte genelde 1,5-2 litre su tüketmek önerilmektedir (Akbulut, 2017; Bach-Faig 2011). Sağlık Bilimleri Fakültesi öğrencilerinde yapılan bir çalışmada öğrencilerin günlük su tüketimlerinin 1632.22±767.86 mililitre olduğu saptanmıştır. Beslenme ve diyetetik öğrencileriyle yapılan bir diğer çalışmada da günlük su tüketimi 1473,78±675,8 mililitre bulunmuştur (Çiçekli, 2022). Bu çalışmada günlük ortalama su tüketimlerinin 1,8±0,7 litre olduğu belirlenmiştir. Günlük su tüketimi belirtilen referans aralığında olup, sonuçlardaki farklılıklar öğrencilerin yaşadığı yere bağlı iklim koşulları ile öğrencilerin bireysel olarak su yerine tüketmeyi tercih ettikleri kahve, çay gibi diğer sıvı tüketimlerinden kaynaklı olabilir.

Tablo 2. Öğrencilerin Sağlıklı Yaşam Biçimi Alışkanlıkları

		n	%
Günlük ana öğün sayısı	2 öğün	38	28,4
	3 öğün	96	71,6
Gün içerisinde atlanılan ana öğün	Sabah	36	26,9
	Öğle	54	40,3
	Akşam	3	2,2
	Öğün Atlamıyorum	41	30,6
Ev/yurt dışında dışarıda yemek yeme sıklığı	Her gün	6	4,5
	Haftada 1-3 kez	57	42,5
	Haftada 4-6 kez	34	25,4
	Ayda 1 kez	14	10,4
	Ayda 2-3 kez	21	15,7
	Hiç	2	1,5
Doğru beslenme bilgilerinin davranışı etkileme durumu	Her zaman	26	19,4
	Sık sık	63	47,0
	Nadiren	44	32,8
	Hiçbir zaman	1	0,8
Etiket okuma bilgisi	Evet	69	51,5
	Hayır	8	6,0
	Bazen	57	42,5
Günlük su tüketimi (litre)		1,8±0,7	

Haftada en az 150 dakika orta şiddette yapılan fiziksek aktivite Dünya Sağlık Örgütü tarafından önerilmektedir (World Health Organization, 2020). Ancak dünya çapında bu öneri uygulanamamakta ve fiziksel hareketsizlik tüm dünyada farklı yaş gruplarında artan sorun haline gelmektedir. Fiziksel aktivite ve buna bağlı olarak beslenme sorunlarının da olmasıyla birlikte obezite ve diğer hastalıkların oluşma riski artmaktadır. (Fagaras ve diğerleri, 2015). Beslenme ve Diyetetik öğrencileri ile yapılan bir çalışmada öğrencilerin %4,4'ü her gün, %52,5'i haftada 1 gün veya daha az sıklıkla fiziksel aktivite düzeyine sahip olduğu görülmüştür (Çiçekli, 2022). Yapılan prospektif bir kohort çalışmasında da fiziksel aktivitedeki en fazla azalmanın, üniversite yıllarında olduğu bildirilmiştir (Kwan ve ark., 2012). Beslenme ve Diyetetik öğrencileriyle yapılan bir diğer çalışmada öğrencilerinin %19.8'inin minimal oranda aktif olduğu saptanmıştır (İspir, 2022). Öğrencilerin Uluslararası Fiziksel Aktivite Anketi'nden (UFAA) elde edilen fiziksel aktivite düzeyleri ve puanları Tablo 3'te belirtilmiştir. Öğrencilerin %7,5'i fiziksel olarak aktif olmayanlardan, %63,4'ü fiziksel aktivite düzeyi düşük olanlardan

ve %29,1'i fiziksel aktivite düzeyi yeterli olanlardan oluşmaktadır. Bu çalışma sonuçlarıyla paralel olarak Downes'in (2015), yaptığı çalışmada üniversite öğrencilerinin fiziksel aktivite düzeylerinin yetersiz olduğunu saptamıştır (Downes, 2015). Çalışmaların sonucu benzer çıkmış olup, üniversite öğrencilerinin yeteri düzeyde fiziksel aktivite yapmadığı ve sağlığı geliştirme bakımından fiziksel aktivite düzeylerinin yetersiz olduğu görülmüştür. Bunun nedeni olarak çalışmada sayıca fazla olan son sınıf öğrencilerinin iş yükü ve sorumluluklarının daha fazla olması ile çalışma saatlerinin artmış olması, fiziksel aktiviteye zaman ayıramama olarak gösterilebilir. Sağlık bilimleri öğrencilerinin fiziksel aktivite durumlarına bakılan bir çalışmada öğrencilerin %80.3'ünde önerilen 3000 MET-dk/hafta altında aktivite skoruna sahip olduğu görülmüştür. Bu çalışmada toplam fiziksel aktivite düzeyi ise 2546,2±2159,8 MET-dk/hafta olarak saptanmıştır. Benzer şekilde çıkan sonuçlar için öğrencilerin fiziksel aktivite ile ilgili farkındalıklarının az ve fiziksel aktivitenin sağlık üzerine etkisini gözardı ettikleri söylenebilir.

Tablo 3. Öğrencilerin Uluslararası Fiziksel Aktivite Anketi'nden (UFAA) elde edilen fiziksel aktivite düzeyleri ve puanları

	n	%
Fiziksel olarak aktif olmayan	10	7,5
Fiziksel aktivite düzeyi düşük olan	85	63,4
Fiziksel aktivite düzeyi yeterli olan	39	29,1
Toplam fiziksel aktivite (MET-dk/hafta)	2546,2±2159,8	
Şiddetli fiziksel aktivite (MET-dk/hafta)	375,2±1225,8	
Orta düzeyde şiddetli fiziksel aktivite (MET-dk/hafta)	314,8±1019,9	
Yürüme (MET-dk/hafta)	1288,7±1301,7	
Oturma süresi (dk)	567,5±262,8	

Sağlıklı bir yaşam tarzının temelini oluşturan etmenler arasında beslenme ve düzenli fiziksel aktivite önemli rol oynamaktadır. Fiziksel aktivitenin enerji tüketimini artırma yönünde olumlu etkisi bulunmaktadır ancak beslenme alışkanlıklarında ve buna bağlı olarak besin ögesi alımlarında neden olduğu değişiklikler ile ilgili kesin kanıtlar bulunamamıştır (Amatori ve ark., 2020; Küçükcankurtaran, 2024). Üniversite öğrencilerinde beslenme durumu ve fiziksel aktivite düzeyinin incelendiği bir çalışmada fiziksel aktivite düzeyi ile sağlıklı beslenme arasında bir ilişki bulunamamıştır (Özen, 2019). Yapılan bir başka çalışmada günlük tüketilen sebze ve meyve ile orta düzeyde yapılan fiziksel aktivitenin birbiriyle doğru orantılı bir ilişki olduğu görülmüştür (Duan ve ark., 2017). Diğer çalışmalarda da tüketilen toplam yağ, protein, karbonhidrat ile fiziksel aktivite düzeyi arasında negatif bir ilişki saptanmıştır Matvienko ve ark., 2001; Laska ve ark., 2016; Heeren ve ark., 2018). Öğrencilerin besin ögeleri alımları ile

fiziksel aktivite düzeyleri arasındaki ilişki Tablo 4'te belirtilmiştir. Öğrencilerin enerji ve besin ögesi alım miktarları ile fiziksel aktivite düzeyleri arasında istatistiksel olarak anlamlı ilişki saptanmamasına rağmen ($p>0.05$) posa, A vitamini, E vitamini, B_1, B_2, B_6, folat, C vitamini, potasyum, kalsiyum, magnezyum ve demir alımının fiziksel olarak aktif olmayan öğrencilerde daha düşük düzeylerde olduğu tespit edilmiştir. Üniversite öğrencilerinde bu konuda yapılan çalışamlarda bulunan farklılıkların nedeni öğrencilerin yeterli ve dengeli tüketim yapma imkânı bulamama ve fiziksel olarak aktif olabilecekleri sürenin kısıtlılığından kaynaklanabilir. Ayrıca çalışmaya katılan öğrencilerin özellikleri, besin tüketim kaydı ve fiziksel aktivite düzeyini saptamak için kullanılan yöntemlerin çeşitliliği de bu farklılığı oluşturabilir.

Tablo 4. Öğrencilerin besin ögeleri alımları ile fiziksel aktivite düzeyleri arasındaki ilişki

	Aktif olmayan	Düşük aktivite	Yeterli aktivite	p
Enerji (kkal)	1436,6 ± 437,2	1635,8 ± 463,5	1497,7 ± 466	0,184
Protein (g)	65 ± 24,1	77,8 ± 43,2	69,9 ± 33,7	0,429
Protein (%)	17,2 ± 4,7	17,6 ± 4,3	17 ± 3,3	0,790
Yağ (g)	70,5 ± 24,2	78,6 ± 44,6	73,4 ± 39,8	0,735
Yağ (%)	41,5 ± 9,2	37,7 ± 9,1	38,5 ± 8,2	0,422
Karbonhidrat (g)	158,8 ± 63,1	195,2 ± 84,3	188,5 ± 95,2	0,449
Karbonhidrat (%)	41,1 ± 9,3	44,2 ± 10,5	44,5 ± 8,3	0,606
Lif (g)	13,2 ± 5,1	20,1 ± 15,9	18,4 ± 15,7	0,392
Vitamin A (µg)	809,8 ± 268,1	1226,6 ± 2673,3	1212,7 ± 1025,1	0,851
Vitamin E (mg)	6,9 ± 3,7	11 ± 9,1	10,8 ± 8,3	0,359
Vitamin B1 (mg)	0,7 ± 0,4	1 ± 0,6	0,9 ± 0,6	0,453
Vitamin B2 (mg)	1,4 ± 0,6	1,6 ± 1,2	1,4 ± 0,8	0,614
Vitamin B6 (mg)	1 ± 0,4	1,4 ± 0,8	1,3 ± 0,9	0,294
Folat (µg)	228,7 ± 125,6	298,2 ± 186,6	288 ± 160,5	0,496
Vitamin C (mg)	62,4 ± 32,8	106,3 ± 111,2	79,5 ± 60,7	0,186
Sodyum (mg)	3115,3 ± 1738	4145,8 ± 5692,9	2857,5 ± 1232,4	0,329
Potasyum (mg)	2162,2 ± 812	2612,2 ± 1586,8	2476,3 ± 1476	0,643
Kalsiyum (mg)	730,7 ± 262,8	764,9 ± 386,9	755,5 ± 397,1	0,962
Magnezyum (mg)	224,8 ± 67,3	300,6 ± 168,7	281,8 ± 164,3	0,357
Demir (mg)	9,1 ± 3,6	11,7 ± 6,8	10 ± 5,1	0,227
Çinko (mg)	10,2 ± 3,9	11,9 ± 8,1	9,9 ± 4,5	0,301

Sonuç ve Öneriler

Sonuç olarak, bu çalışmaya katılan Beslenme ve Diyetetik öğrencilerinin çoğunluğunun fiziksel aktivite düzeylerinin düşük veya yetersiz olduğu belirlenmiştir. Öğün atlama, ev/yurt dışında beslenme ve su tüketimleri de göz önüne alındığında, öğrencilerin beslenme durumlarının

yeterli olmadığı ve sağlıksız beslenme alışkanlıklarına sahip oldukları gözlemlenmiştir. Bu sonuçlar, dengeli ve sağlıklı beslenmeye daha fazla odaklanıldığı günümüzde, üniversite öğrencilerinin edindikleri bilgi ve alışkanlıklarının kendilerine doğru bir şekilde uygulayamadıklarını göstermektedir. Üniversite öğrencileri gibi genç ve iyi eğitimli grupların nispeten daha iyi sağlık davranışları sergilemesi beklenmektedir. Ülkemizde özellikle beslenme ve sağlık alanında eğitim gören öğrencilerin yaşam tarzlarını değerlendirecek ve bu anlamda hatalı davranışların değişimi için müdahaleler planlayacak kapsamlı çalışmalara ihtiyaç duyulmaktadır.

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BİTKİSEL BAZLI FERMENTE İÇECEKLERİN DUYUSAL ÖZELLİKLERİNİN DEĞERLENDİRİLMESİ

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Özet
Bitkisel sütler son yıllarda vegan ve vejetaryen beslenmenin popüler olmasıyla birlikte merak duyulan besinler arasında yer almaktadır. Bu çalışmada, badem, soya ve yulaf sütü esaslı fermente içeceklerin farklı depolama süreleri sonucunda duyusal özelliklerinin değerlendirilmesi amaçlanmıştır. Fermantasyonda Streptococcus thermophilus, Lactobacillus delbrueckii, Lactobacillus acidophilus (NCFM®), Bifidobacterium lactis(HN019™) bakteri türleri kullanılmıştır. İnkübasyonu tamamlanan örnekler 21 gün süre boyunca 4±1°C'de depolanmıştır. Duyusal analiz aşaması için çalışmaya 10 kadın, 10 erkek olmak üzere 20 sağlıklı panelist katılmıştır. Ayrıca analiz öncesinde yoğurt, süt ürünleri ve bitki bazlı süt tüketim alışkanlıkları üzerine bir sıklık anketi ile besin neofobi ölçeği uygulanmıştır. Elde edilen veriler SPSS27 programı kullanılarak analiz edilmiştir. Tat puanları değerlendirildiğinde, kadın bireylerin 1. günde fermente soya sütüne kıyasla fermente yulaf sütüne daha yüksek puan verdiği, 7.günde erkeklerin fermente badem ve yulaf sütüne kıyasla fermente soya sütüne daha düşük puan verdiği belirlenmiştir($p<0,05$). Ayrıca 7. günde fermente inek ve soya sütünde kadınların erkeklere kıyasla önemli düzeyde daha yüksek puan verdiği saptanmıştır ($p<0,05$). Renk puanları değerlendirildiğinde, 7. günde kadınların fermente yulaf sütüne kıyasla fermente soya sütüne daha fazla puan verdiği, 14. günde kadınların fermente yulaf sütüne kıyasla fermente inek sütüne daha fazla puan verdiği belirlenmiştir($p<0,05$). Koku puanları değerlendirildiğinde, erkeklerin 1. günde fermente inek ve yulaf sütüne kıyasla soya sütüne daha fazla puan verdiği, 7.günde fermente badem sütüne kıyasla fermenet inek ve soya sütüne daha fazla puan verdiği, 21.günde fermente yulaf sütüne kıyasla fermente soya sütüne daha fazla puan verdiği saptanmıştır($p<0,05$). 14. günde ise fermente yulaf sütünde kadınların erkeklere kıyasla daha fazla puan verdiği belirlenmiştir($p<0,05$). Asidik tat puanlarında 1. günde fermente yulaf sütünde kadınların erkeklere kıyasla daha fazla puan verdiği saptanırken, 7. günde fermente soya sütünde kadınların erkeklere kıyasla daha fazla puan verdiği belirlenmiştir($p<0,05$). Fermente bitkisel bazlı içeceklerde aroma özelliklerinin kullanılmasının duyusal açıdan tercih edilebilirliği arttıracağı düşünülmektedir.
Anahtar Sözcükler: Besin tüketim sıklığı, bitkisel sütler, duyusal analiz, neofobi ölçeği.

EVALUATION OF THE SENSORY PROPERTIES OF PLANT-BASED FERMENTED BEVERAGES

Abstract
Plant milks are interest as vegan and vegetarian diets have become popular in recent years. This study aimed to evaluate sensory properties almond, soy and oat milk-based fermented beverages as a result of different storage periods. Streptococcus thermophilus, Lactobacillus delbrueckii, Lactobacillus acidophilus(NCFM®), Bifidobacterium lactis(HN019™) were used in fermentation. Incubated samples were stored at 4±1°C for 21 days. For sensory analysis 20 healthy panelists, 10 women and 10 men, participated in study. In addition, a frequency survey and a food neophobia scale were applied. Data obtained was analyzed using SPSS27 program. In taste scores, it was determined that females gave higher scores to fermented oat milk compared to fermented soy milk on 1st day, and men gave lower scores to fermented soy milk compared to fermented almond and oat milk on 7th day ($p<0.05$). Women gave significantly higher scores than men on fermented cow and soy milk on 7th day($p<0.05$). In color scores, on 7th day, women gave more points to fermented soy milk than to fermented oat milk, and on 14th day, women gave more points to fermented cow's milk compared to fermented oat milk($p<0.05$). In odor scores, men gave more points to soy milk compared to fermented cow and oat milk on the 1st day, more points to fermented cow and soy milk than fermented almond milk on the 7th day, and more points to fermented soy milk compared to fermented oat milk on the 21st day. ($p<0.05$). On 14th day, women gave higher scores to fermented oat milk than men($p<0.05$). In acidic taste scores, women gave more points than men to fermented oat milk on 1st day, while women gave more points than men to fermented soy milk on 7th day($p<0.05$). Aroma properties in fermented plant-based beverages can increase sensory preferability.
Keywords: Food consumption frequency, neophobia scale, plant milks, sensory analysis.

Giriş

Son yıllarda, küreselleşmenin artışıyla birlikte hayvansal besinlere talepte de hızlı bir artış meydana gelmiştir. Önümüzdeki on yılda küresel et proteini tüketimindeki büyümenin, büyük ölçüde gelir ve nüfus artışına bağlı olarak 2018-2020 ortalamasına kıyasla 2030 yılına kadar %14 oranında artması öngörülmektedir. Sığır eti, domuz eti, kümes hayvanları ve koyun etinden sağlanacak protein miktarının 2030 yılına kadar sırasıyla %5,9, %13,1, %17,8 ve %15,7 artacağı tahmin edilmektedir (OECD/FAO, 2021). Küresel ortalama kişi başına et talebinin ise 2020-2022 temel döneminden 2032'ye kadar %2 oranında artması beklenmektedir. Ayrıca 2032 yılına kadar kişi başı balık, et ve süt ürünleri tüketiminin sırasıyla %14, %12 ve %12 oranında artması beklenmektedir. Bu oranlar, tahıl tüketimindeki %0,5'in altındaki büyümeyle zıt şekilde ilerlemekte ve beslenme değişikliğinin ciddi boyutlarını vurgulamaktadır (OECD/FAO, 2023). Dünyamız bir yandan hayvansal besin tüketiminde artış ve bunun beraberinde getirdiği çevre, sağlık, ekonomik vb. birçok sorunla karşı karşıyayken bir yandan da besine ulaşılabilirlik, besin yoksunluğu, besin güvencesizliği gibi kavramlarla mücadele etmektedir. Diğer yandan gelişmiş ülkeler başta olmak üzere dünya genelinde hem sağlığın korunması hem de meydana gelebilecek olumsuz çevresel etkileri önlemek için hayvansal kaynaklı besinlerin üretimine yönelik taleplerde azalma gözlenmiştir. Tüm bunlar sonucunda hem üreticiler hem de tüketiciler sağlıklı ve sürdürülebilir alternatif besin üretimlerine yönelmiştir. Sağlıklı ve sürdürülebilir diyetler arasında vejetaryen ve vegan diyetleri de saymak mümkündür. Vejetaryen ve vegan beslenme günümüz post modern dünyasında ivme kazanmaya devam etmektedir. Bununla birlikte vejetaryen ve vegan besinlere talepler artış göstermekte ve besin sanayisinde de sağlıklı ve sürdürülebilir beslenmenin sağlanması için adımlar atılmaktadır (Henchion et al., 2017). Bu noktada özellikle sağlıklı beslenmenin sağlanması, hastalıkların önlenmesi ve vücudun iyilik halinin devam ettirilmesinde fonksiyonel besin kavramı ön plana çıkmaktadır. Fonksiyonel bileşiklerden probiyotiklerin fermente besin üretiminde kullanımı yeni değildir, ancak son zamanlarda besin sanayisindeki üretim amaçları hayvanların korunması, organoleptik iyileştirmeler ve sağlığın korunmasına doğru ilerlemiştir (Saad et al., 2013). Fonksiyonel besin örneklerinden bazıları ise yararlı etkiler sağlayan mikroorganizmaları içermesi nedeni ile insan mide-bağırsak sistemi ve insan sağlığı üzerinde olumlu etkiler yaratmaktadır. Şimdiye kadar, probiyotik ürünlerin en büyük kısmı hayvan sütünden yapılan fermente besinlerle tüketicilere sunulmaktadır (Mäkinen et al., 2016). Bitkisel bazlı fermente içecekler, süt ürünleri içermeyen alternatifler arasında önemli bir segmenti temsil etmekte ve hayvansal kaynaklı süt alerjileri ve etik kaygıları olan birçok tüketicinin ihtiyaçlarını

karşılamaktadır (Phillips & Williams, 2011). Bu kapsamda son zamanlarda bitkisel süt endüstrileri önem kazanmıştır. Bitkisel sütler, beslenme ve sağlık yararlarının yanı sıra prebiyotik bileşikler içerdiğinden, bu sütler sinbiyotik ürünler üretmek için önemli kaynaktırlar (De Souza Oliveira et al., 2009). Bitkisel sütlerden elde edilen fermente içecekler genellikle farklı hammaddelerden (örn. kurubaklagiller, yağlı tohumlar, tahıllar veya pseudo tahıllar) elde edilen sulu özütlerin, bu malzemelerin parçalanması ve homojenleştirilmesinden kaynaklanan inek sütüne benzer görünüm ve kıvama sahip olacak şekilde fermente edilmesiyle elde edilmektedir (Sethi et al., 2016). Fermente içeceklerin üretiminde kullanılan bitkisel bazlı kaynaklar arasında soya fasulyesi, protein miktarı, kalitesi ve fonksiyonel özellikleri nedeniyle özellikle son yıllarda popüler hale gelmiştir. Ayrıca, soya sütünün fermente içecek yapımında yaygın olarak kullanılan laktik asit bakterilerinin (LAB) gelişimi için iyi bir substrat olduğu gösterilmiştir (Chou & Hou, 2000). Soya, bitki bazlı içecek üretiminde en yaygın kullanılan substrat olmasına rağmen, günümüzde hindistan cevizi, badem, kenevir ve çeşitli tahıllar (örneğin yulaf, karabuğday ve pirinç) bitki bazlı içeceklerin üretiminde kullanılmaktadır. Badem, tekli ve çoklu doymamış yağ asitleri, fitosteroller, polifenoller, proteinler, vitaminler ve mineraller ile diyet posası açısından zengin olup bu bileşiklerin çoğu antioksidan özelliklere sahiptir. Bu antioksidan özellikleri ile plazmada düşük dansiditeli lipoprotein (LDL) oksidasyonunu önleyerek lipid profili ve inflamatuvar süreçler üzerinde olumlu etkiler sağlamaktadır (Jones et al., 2011; Liu, 2012). Badem sütünün ve badem sütünden elde edilen fermente içeceklerin kardiyovasküler hastalıklar, tip 2 diyabet, obezite ve bazı kanser türleri gibi kronik hastalıkların gelişme riskini azalttığı öne sürülmektedir (Kamil & Chen, 2012). Yulaf ve diğer bitkisel sütlerin de sağlık üzerine olumlu etkileri bulunmaktadır (Paul et al., 2020). Tüm bu bilgiler ışığında yapılan çalışmada, badem, soya ve yulaf sütlerinin fermantasyonu ile elde edilen fermente içeceklerin farklı depolama süreleri sonucunda duyusal analizlerinin gerçekleştirilmesi amaçlanmıştır.

Materyal ve Metod

Çalışmada kullanılacak bitkisel sütler çalışma öncesinde yapılan bir ön çalışma niteliğindeki araştırma ile belirlenmiştir. Bu kapsamda vegan ve vejetaryen bireylerin en sık tükettiği badem, soya ve yulaf sütü olmak üzere 3 bitkisel süt çeşidinin bu çalışmada kullanılmasına karar verilmiştir. Bu aşamadan sonra ise bu çalışmada aynı ticari markaya ait badem sütü, soya sütü ve yulaf sütü olmak üzere 3 çeşit bitkisel süt, kontrol grubu olarak aynı markanın olmadığı için farklı marka yarım yağlı inek sütü kullanılmıştır. Tüm sütlerin seçiminde son kullanma tarihinin birbirine benzer olmasına dikkat edilmiştir. Sütlerden fermente içecek üretimi ve

kimyasal analizler Ankara Üniversitesi Ziraat Fakültesi Süt Teknolojisi laboratuvarında yapılmıştır. Çalışmanın duyusal analiz aşaması için Ankara Üniversitesi Rektörlüğü Etik Kurulu 25.04.2022 tarihli, 08 sayılı toplantı ve 87 sayılı karar sayısı sonucunda gerçekleştirilmesinin uygun olduğuna karar verilmiştir. Sütlere ilişkin etiket bilgileri Tablo 1'de belirtilmiştir.

Tablo 1. Kullanılan sütlerin etiket bilgileri

	Soya sütü (100 ml)	**Badem sütü (100 ml)**	**Yulaf sütü (100 ml)**	**İnek sütü (100 ml)**
Enerji (kkal)	39	22	46	44
Karbonhidrat (g)	2,5	2,4	7,2	4,8
Şeker (g)	2,5	2,4	3,3	4,8
Protein (g)	3,0	0,4	0,3	2,9
Yağ (g)	1,7	1,1	1,5	1,5
Doymuş yağ (g)	0,3	0,1	0,1	1,1
Posa (g)	0,7	0,4	1,5	-
Tuz (g)	0,13	0,14	0,09	0,19

Starter Kültür

Çalışmada kullanılan bütün mikroorganizma çeşitleri Danisco markasının VEGE 053 LYO 200 DCU kültüründen temin edilmiştir. Kültür içeriği Streptococcus thermophilus, Lactobacillus delbrueckii (Lactobacillus delbrueckii subsp. bulgaricus, Lactobacillus delbrueckii subsp. lactis) Lactobacillus acidophilus (NCFM®), Bifidobacterium lactis (HN019™) bakteri türlerinden oluşmaktadır.

Örneklerin Hazırlanması ve Fermantasyon

Marketten alınan sütler analize başlanacağı aşamada temin edilmiştir. Tüm sütlere ilk olarak 90 °C'de 10 dakika ısıl işlem uygulanmış ve pastörizasyon işlemi gerçekleştirilmiştir. Daha sonra fermantasyon için 43 °C'de aseptik koşullarda 100 ml süte 0,5 g oranında bakteri suşları eklenmiştir. Bu aşamadan sonra elde edilen karışımlar 100 ml'lik polietilen tabanlı sert plastik kaplara doldurulmuş ve örnekler pH değerleri 4,6 düzeyine gelene kadar inkübasyona bırakılmıştır (Mühlhansová et al., 2015).

Fermente İçeceklerin Depolanması

İnkübasyonu tamamlanmış örnekler 20±1°C oda sıcaklığında 30 dakika süre ile bekletilerek ön soğutma işlemine tabi tutulmuş ardından da 21 gün süresince 4±1°C'de buzdolabı koşullarında

depolanmıştır. Buzdolabında 4±1°C sıcaklıktaki depolanmış örneklerin analiz işlemleri depolama aşamasının 1., 7., 14. ve 21. günlerinde yapılmıştır. Her bir depolama süresi sonrasında örnekler bekletilmeden direkt olarak analizleri gerçekleştirilmiştir.

Duyusal Analiz

Çalışmanın duyusal analiz aşaması Ankara Üniversitesi Sağlık Bilimleri Fakültesi Besin Kimyası laboratuvarında yürütülmüştür. Çalışmada duyusal analiz testleri için 18–50 yaş aralığında 10 kadın, 10 erkek olmak üzere toplam 20 sağlıklı, sigara içmeyen, gönüllü panelist seçilmiştir. Duyusal analizden önce panelistlere testin nasıl ve ne amaçla yapılacağı konusunda bilgi verilmiştir. Testlerin sessiz ve havalandırılabilir bir ortamda ve 10:30–11:30 saatleri arasında yapılmasına dikkat edilmiştir. Ayrıca bireylerin seçimi için acı, tatlı, tuzlu ve ekşi olmak üzere dört temel tada duyarlılıkları duyusal analiz testinden önce değerlendirilmiştir. Tat alımlarının değerlendirilmesinde duyusal analiz testi olarak görsel analog skala (VAS) kullanılmıştır. Testler sırasında panelistlere ağızlarını çalkalamaları için su ve ağız dokusunu değiştirmesi için çok şekerli ve tuzlu olmayan bir bisküvi verilmiştir. Daha sonra çalışmanın esas bölümüne geçilmiş olup bitkisel ve hayvansal sütlerden elde edilen fermente içecek örneklerinde duyusal analizi için örneklerin her biri üç basamaklı farklı sayılarla kodlanmış olarak panelistlere sunulmuştur. Örneklerin her biri 10 g'lık şeffaf kaplarda her bir oturumda 4 örnek (1.,7.,14.,21. gün süresince depolama işlemlerinden sonra elde edilen bitkisel ve hayvansal fermente içecek örnekleri) 4 oturum şeklinde panelistler tarafından değerlendirilmiştir. Panel üyeleri fermente içecekleri hedonik skala testine göre değerlendirmiş ve panelistlerden formda belirtilen toplam kabul edilebilirlik, renk, yapı, görünüş, tat, koku, asidik tat parametrelerinin her birini 1 "hiç beğenmedim" ile 9 "çok fazla beğendim" arasında olacak şekilde puanlandırmaları istenmiştir. Buna ek olarak duyusal analiz değerlendirmesine katılan panelistlere analiz öncesinde yoğurt, süt ürünleri ve/veya bitki bazlı süt tüketim alışkanlıkları üzerine bir sıklık anketi ve bir besin neofobi ölçeği uygulanmıştır. Besin neofobi ölçeğinin Türkçe geçerlilik ve güvenilirliği çalışması 2020 yılında Duman vd. tarafından yapılmıştır (Duman et al., 2020). Ölçeğin orjinali ise 1992 yılında Pliner ve Hobden tarafından besin neofobisini tanımlamak için psikometrik bir araç olarak geliştirilmiştir. Besin neofobi ölçeği, on maddeden oluşan 7 puanlı likert tipi ölçek, kesinlikle katılmıyorumdan (1 puan) kesinlikle katılıyoruma (7 puan) doğru her bir seçenekte 1'er puan artacak şekilde düzenlenmiş olup 10-70 puan aralığında değer almaktadır (1, 4, 6, 9 ve 10. sorular ters skorlanmaktadır). Yüksek puanlar yeni besin korkusunu, düşük puanlar yeni besinlerden hoşlanmayı göstermektedir (Pliner & Hobden, 1992). Yeni besin korkusu, bireylerin besin çeşitliliğinin

azalmasına neden olmanın yanında yeni besinlere karşı tutum ve tat memnuniyeti üzerinde de önemli bir etmen olmaktadır. Bu nedenle bu çalışmada, besin neofobi ölçeği ve tüketim sıklığı anketi, duyusal analiz aşamasında bireylerin herhangi bir besini denemeye karşı fobisinin olup olmadığını belirlemek ve bunun yanında bireylerin hayvansal ve bitkisel süt ve ürünleri tüketim alışkanlıklarını değerlendirmek amacıyla uygulanmıştır. Duyusal analiz aşaması gerçekleştirilirken kullanılacak malzemelerin steril olmasına ve her katılımcıya özel olmasına özen gösterilmiştir. Ayrıca, katılımcıların kahvaltı yapmaları ne aç ne de tok olmamaları gerektiği vurgulanmış ve panelden önce bu ilkeler açısından sorgulanmıştır. Verilerin gizliliğinin onam formunda belirtildiği gibi tamamen gizli tutulacağı ve başka bir kişi ile paylaşılmayacağı beyan edilmiştir.

İstatistiksel Analiz

Çalışmada yürütülen tüm analizler iki tekrarlı olarak gerçekleştirilmiştir. Çalışmanın istatistiksel değerlendirmesinde ise kullanılacak örneklerin normallik dağılımları, örnek sayısına uygunluğu açısından Shapiro–Wilk Testi ile değerlendirilmiştir. Tüm grupların karşılaştırılmasında one-way ANOVA testi, ikili karşılaştırmalar arasındaki farklar için ise post hoc Tukey testi kullanılmıştır. Yapılan analizler sonucunda nicel değişkenler ortalama ve standart sapma (SS) değerleri ile gösterilmiştir. Elde edilen veriler SPSS (Statistical Package for the Social Sciences) 26 paket programı kullanılarak analiz edilmiştir. İstatistiksel olarak $p<0,05$ değeri önemlilik düzeyini ifade etmektedir.

Bulgular ve Tartışma

Fermente süt örneklerinin 21 gün depolama süresince görünüş puanları Tablo 2'de gösterilmiştir. Görünüş puanlarında cinsiyete ve depolama süresine göre önemli sonuçlar elde edilmemiştir ($p>0,05$).

Tablo 2. Fermente süt örneklerinin 21 gün depolama süresince görünüş puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	5.92±2.06 [a]	6,31 ± 1,7 [a]	4,92 ± 1,8 [a]	5,23 ± 2,24 [a]	0.270
	Kadın(n:10)	6.08±2.14 [a]	6,69 ± 1,38 [a]	5,69 ± 2,21 [a]	6,08 ± 1,61 [a]	0.594
	Toplam (n:20)	6.00± 2,06 [a]	6,50 ± 1,53 [a]	5,31 ± 2,02 [a]	5,65 ± 1,96 [a]	0.141
7.gün	Erkek (n:10)	5.38±2.22 [a]	5,46 ± 2,26 [a]	5,23 ± 2,01 [a]	5.00 ± 2,08 [a]	0.950
	Kadın(n:10)	6.23±2.24 [a]	6.00 ± 2.00 [a]	5,77 ± 1,48 [a]	4,46 ± 1,9 [a]	0.100
	Toplam (n:20)	5,81 ± 2,23 [a]	5,73 ± 2,11 [a]	5,50 ± 1,75 [a]	4,73 ± 1,97 [a]	0.209
14.gün	Erkek (n:10)	5,85 ± 2,03 [a]	5,46 ± 2,03 [a]	5.00 ± 1,91 [a]	5.00 ± 2,12 [a]	0.664
	Kadın(n:10)	6,54 ± 1,51 [a]	6,23 ± 1,79 [a]	5,69 ± 1,93 [a]	5,23 ± 1,24 [a]	0.195
	Toplam (n:20)	6,19 ± 1,79 [a]	5,85 ± 1,91 [a]	5,35 ± 1,92 [a]	5,12 ± 1,7 [a]	0.147
21.gün	Erkek (n:10)	5,31 ± 2,75 [a]	5,77 ± 1,88 [a]	4,92 ± 2,25 [a]	5.00 ± 1,83 [a]	0.758
	Kadın(n:10)	6,31 ± 1,6 [a]	5,92 ± 1,75 [a]	5,85 ± 2,03 [a]	5,08 ± 1,71 [a]	0.363
	Toplam (n:20)	5,81 ± 2,26 [a]	5,85 ± 1,78 [a]	5,38 ± 2,16 [a]	5,04 ± 1,73 [a]	0.417

Fermente süt örneklerinin 21 gün depolama süresince tat puanları Tablo 3'te gösterilmiştir. Tat puanları değerlendirildiğinde, kadın bireylerin 1. günde fermente soya sütüne kıyasla fermente yulaf sütüne daha yüksek puan verdiği, 7.günde erkeklerin fermente badem ve yulaf sütüne kıyasla fermente soya sütüne daha düşük puan verdiği belirlenmiştir($p<0,05$). Ayrıca 7. günde fermente inek ve soya sütünde kadınların erkeklere kıyasla önemli düzeyde daha yüksek puan verdiği saptanmıştır ($p<0,05$).

Tablo 3. Fermente süt örneklerinin 21 gün depolama süresince tat puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	4,08 ± 2,84 [a]	2,69 ± 1,84 [a]	4,62 ± 2,18 [a]	4,69 ± 1,89 [a]	0.094
	Kadın (n:10)	5 ± 3,58 [ab]	3,62 ± 2,33 [a]	5,54 ± 2,57 [ab]	6,23 ± 1,96 [b]	0.097
	Toplam (n:20)	4,54 ± 3,2 [ab]	3,15 ± 2,11 [a]	5,08 ± 2,38 [b]	5,46 ± 2,04 [b]	**0.007***
7.gün	Erkek (n:10)	4,62 ± 2,33 [ab*]	3,62 ± 2,06 [a*]	6,15 ± 2,23 [b]	5,85 ± 1,63 [b]	**0.011***
	Kadın (n:10)	6,77 ± 1,48 [a]	5,46 ± 1,9 [a]	5,38 ± 2,9 [a]	5,54 ± 1,2 [a]	0.245
	Toplam (n:20)	5,69 ± 2,2 [a]	4,54 ± 2,16 [a]	5,77 ± 2,57 [a]	5,69 ± 1,41 [a]	0.118
14.gün	Erkek (n:10)	4,62 ± 2,81 [a*]	4,85 ± 2,23 [a]	5,85 ± 2,38 [a]	5,46 ± 2,07 [a]	0.543
	Kadın (n:10)	6,92 ± 1,66 [a]	5 ± 2,27 [a]	5,46 ± 1,98 [a]	5,31 ± 1,6 [a]	0.060
	Toplam (n:20)	5,77 ± 2,55 [a]	4,92 ± 2,21 [a]	5,65 ± 2,15 [a]	5,38 ± 1,81 [a]	0.518
21.gün	Erkek (n:10)	3,77 ± 2,55 [a]	4,46 ± 2,22 [a]	6 ± 2,12 [a]	5,62 ± 1,89 [a]	**0.049***
	Kadın (n:10)	5 ± 2,24 [a]	5,46 ± 1,45 [a]	5,92 ± 2,53 [a]	6,08 ± 1,75 [a]	0.532
	Toplam (n:20)	4,38 ± 2,43 [a]	4,96 ± 1,91 [ab]	5,96 ± 2,29 [b]	5,85 ± 1,8 [ab]	**0.025***

Fermente süt örneklerinin 21 gün depolama süresince renk puanları Tablo 4 'te gösterilmiştir. Renk puanları değerlendirildiğinde, 7. günde kadınların fermente yulaf sütüne kıyasla fermente soya sütüne daha fazla puan verdiği, 14. günde kadınların fermente yulaf sütüne kıyasla fermente inek sütüne daha fazla puan verdiği belirlenmiştir ($p<0,05$).

Tablo 4. Fermente süt örneklerinin 21 gün depolama süresince renk puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	6 ± 2,27 [a]	6,62 ± 2,22 [a]	4,85 ± 1,72 [a]	4,77 ± 2,13 [a]	0.079
	Kadın (n:10)	6,69 ± 2,21 [a]	6,77 ± 1,3 [a]	6,15 ± 2,23 [a]	5,77 ± 1,48 [a]	0.477
	Toplam (n:20)	6,35 ± 2,23 [a]	6,69 ± 1,78 [a]	5,5 ± 2,06 [a]	5,27 ± 1,87 [a]	**0.034***
7.gün	Erkek (n:10)	5.46±2.60 [a]	5,38 ± 1,76 [a]	5,46 ± 1,98 [a]	5,31 ± 1,49 [a]	0.997
	Kadın (n:10)	6.31±1.97 [a]	6 ± 1,78 [a]	5,31 ± 1,65 [ab]	4,23 ± 1,24 [b]	**0.014***
	Toplam (n:20)	5,88 ± 2,30 [a]	5,69 ± 1,76 [a]	5,38 ± 1,79 [a]	4,77 ± 1,45 [a]	0.151
14.gün	Erkek (n:10)	5,62 ± 2,5 [a]	5,62 ± 1,94 [a]	5 ± 2,38 [a]	4,62 ± 1,85 [a]	0.581
	Kadın (n:10)	6,85 ± 1,41 [a]	6,46 ± 1,76 [ab]	5,54 ± 1,9 [ab]	4,85 ± 1,72 [b]	**0.019***
	Toplam (n:20)	6,23 ± 2,08 [a]	6,04 ± 1,87 [ab]	5,27 ± 2,13 [ab]	4,73 ± 1,76 [b]	**0.025***
21.gün	Erkek (n:10)	6,08 ± 2,56 [a]	5,85 ± 1,82 [a]	5,38 ± 2,14 [a]	5 ± 1,53 [a]	0.548
	Kadın (n:10)	6,38 ± 1,89 [a]	6 ± 1,58 [a]	5,62 ± 2,33 [a]	4,85 ± 1,63 [a]	0.205
	Toplam (n:20)	6,23 ± 2,21 [a]	5,92 ± 1,67 [a]	5,5 ± 2,2 [a]	4,92 ± 1,55 [a]	0.088

Fermente süt örneklerinin 21 gün depolama süresince koku puanları Tablo 5 'te gösterilmiştir. Koku puanları değerlendirildiğinde, 7. günde kadınların fermente yulaf sütüne kıyasla fermente soya sütüne daha fazla puan verdiği, 14. günde kadınların fermente yulaf sütüne kıyasla fermente inek sütüne daha fazla puan verdiği belirlenmiştir ($p<0,05$).

Tablo 5. Fermente süt örneklerinin 21 gün depolama süresince koku puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	4,77 ± 1,88 [a]	6,62 ± 1,61 [b]	4,38 ± 1,98 [ab]	4,69 ± 1,55 [a]	**0.009***
	Kadın (n:10)	5,85 ± 2,15 [a]	5,23 ± 2,95 [a]	4,54 ± 2,37 [a]	5,15 ± 1,82 [a]	0.575
	Toplam (n:20)	5,31 ± 2,05 [a]	5,92 ± 2,43 [a]	4,46 ± 2,14 [a]	4,92 ± 1,67 [a]	0.085
7.gün	Erkek (n:10)	5,77 ± 1,83 [a]	6,23 ± 2,01 [a]	3,85 ± 1,68 [b]	4,54 ± 1,33 [ab]	**0.003***
	Kadın (n:10)	6,15 ± 2,15 [a]	5,62 ± 2,53 [a]	4,77 ± 1,92 [a]	4,62 ± 1,8 [a]	0.222
	Toplam (n:20)	5,96 ± 1,97 [a]	5,92 ± 2,26 [a]	4,31 ± 1,83 [b]	4,58 ± 1,55 [ab]	**0.002***
14.gün	Erkek (n:10)	5,15 ± 2,12 [a]	5,62 ± 1,66 [a]	4,46 ± 1,85 [a]	4,23 ± 1,69 [a]	0.213
	Kadın (n:10)	6,54 ± 2,22 [a]	4,92 ± 2,18 [a]	5,15 ± 2,03 [a]	5,46 ± 1,27 [a*]	0.175
	Toplam (n:20)	5,85 ± 2,24 [a]	5,27 ± 1,93 [a]	4,81 ± 1,94 [a]	4,85 ± 1,59 [a]	0.190
21.gün	Erkek (n:10)	4,54 ± 2,26 [ab]	6 ± 1,29 [a]	4,23 ± 1,36 [ab]	4,08 ± 1,71 [b]	**0.023***
	Kadın (n:10)	5,38 ± 1,5 [a]	5,38 ± 2,14 [a]	5,08 ± 1,66 [a]	5,38 ± 1,66 [a]	0.960
	Toplam (n:20)	4,96 ± 1,93 [a]	5,69 ± 1,76 [a]	4,65 ± 1,55 [a]	4,73 ± 1,78 [a]	0.137

Fermente süt örneklerinin 21 gün depolama süresince yapı (kıvam) puanları Tablo 6 'da gösterilmiştir. Yapı (kıvam) puanlarında cinsiyete ve depolama süresine göre önemli sonuçlar elde edilmemiştir (p>0,05).

Tablo 6. Fermente süt örneklerinin 21 gün depolama süresince yapı (kıvam) puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	5,23 ± 2,01 [a]	6,85 ± 1,46 [a]	5,69 ± 2,21 [a]	5,62 ± 2,14 [a]	0.199
	Kadın (n:10)	6,08 ± 1,55 [a]	6,77 ± 1,09 [a]	5,54 ± 2,22 [a]	5,85 ± 2,12 [a]	0.361
	Toplam (n:20)	5,65 ± 1,81 [a]	6,81 ± 1,27 [a]	5,62 ± 2,17 [a]	5,73 ± 2,09 [a]	0.609
7.gün	Erkek (n:10)	5,38 ± 2,5 [a]	6,08 ± 1,5 [a]	5,15 ± 2,12 [a]	5,08 ± 1,93 [a]	0.590
	Kadın (n:10)	6,08 ± 1,66 [a]	5,85 ± 1,52 [a]	5,31 ± 1,6 [a]	5,15 ± 1,57 [a]	0.408
	Toplam (n:20)	5,73 ± 2,11 [a]	5,96 ± 1,48 [a]	5,23 ± 1,84 [a]	5,12 ± 1,73 [a]	0.280
14.gün	Erkek (n:10)	5,46 ± 2,11 [a]	5,92 ± 1,38 [a]	4,92 ± 2,02 [a]	5,08 ± 2,02 [a]	0.548
	Kadın (n:10)	6,54 ± 1,51 [a]	6,31 ± 1,65 [a]	6 ± 1,41 [a]	5,08 ± 1,71 [a]	0.105
	Toplam (n:20)	6 ± 1,88 [a]	6,12 ± 1,51 [a]	5,46 ± 1,79 [a]	5,08 ± 1,83 [a]	0.123
21.gün	Erkek (n:10)	5,69 ± 2,02 [a]	5,62 ± 1,56 [a]	5,69 ± 1,7 [a]	5,23 ± 2,17 [a]	0.909
	Kadın (n:10)	6,08 ± 1,38 [a]	6,15 ± 1,68 [a]	6,08 ± 2,06 [a]	5,62 ± 1,8 [a]	0.855
	Toplam (n:20)	5,88 ± 1,7 [a]	5,88 ± 1,61 [a]	5,88 ± 1,86 [a]	5,42 ± 1,96 [a]	0.730

Fermente süt örneklerinin 21 gün depolama süresince asidik tat puanları Tablo 7 'de gösterilmiştir. Asidik tat puanlarında 1. günde fermente yulaf sütünde kadınların erkeklere kıyasla daha fazla puan verdiği saptanırken, 7. günde fermente soya sütünde kadınların erkeklere kıyasla daha fazla puan verdiği belirlenmiştir (p<0,05).

Tablo 7. Fermente süt örneklerinin 21 gün depolama süresince asidik tat puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	5,31 ± 2,02 [a]	4,54 ± 1,85 [a]	4,31 ± 1,89 [a]	4,31 ± 2,18 [a]	0.686
	Kadın (n:10)	5,46 ± 2,88 [a]	4,77 ± 2,05 [a]	5 ± 2,86 [a]	6,31 ± 1,65 [a*]	0.079
	Toplam (n:20)	5,38 ± 2,43 [a]	4,65 ± 1,92 [a]	4,65 ± 2,4 [a]	5,31 ± 2,15 [a]	0.295
7.gün	Erkek (n:10)	4.62 ± 2.29 [a]	4.31 ± 1.55 [a]	5.77 ± 2.31 [a]	5.31 ± 1.93 [a]	0.266
	Kadın (n:10)	6,23 ± 1,74 [a]	5,77 ± 1,74 [a*]	5,23 ± 2,8 [a]	5,23 ± 1,74 [a]	0.548
	Toplam (n:20)	5,42 ± 2,16 [a]	5,04 ± 1,78 [a]	5,5 ± 2,53 [a]	5,27 ± 1,8 [a]	0.864
14.gün	Erkek (n:10)	5,15 ± 2,03 [a]	4,85 ± 1,46 [a]	4,62 ± 2,33 [a]	4,85 ± 2,41 [a]	0.932
	Kadın (n:10)	6,38 ± 1,61 [a]	5,46 ± 1,71 [a]	5,69 ± 2,21 [a]	4,92 ± 1,71 [a]	0.245
	Toplam (n:20)	5,77 ± 1,9 [a]	5,15 ± 1,59 [a]	5,15 ± 2,29 [a]	4,88 ± 2,05 [a]	0.426
21.gün	Erkek (n:10)	4,15 ± 2,23 [a]	5,15 ± 1,41 [a]	5,23 ± 2,2 [a]	4,69 ± 2,21 [a]	0.518
	Kadın (n:10)	5,54 ± 1,98 [a]	5,85 ± 1,07 [a]	5,54 ± 2,9 [a]	5,38 ± 2,22 [a]	0.956
	Toplam (n:20)	4,85 ± 2,19 [a]	5,5 ± 1,27 [a]	5,38 ± 2,53 [a]	5,04 ± 2,2 [a]	0.656

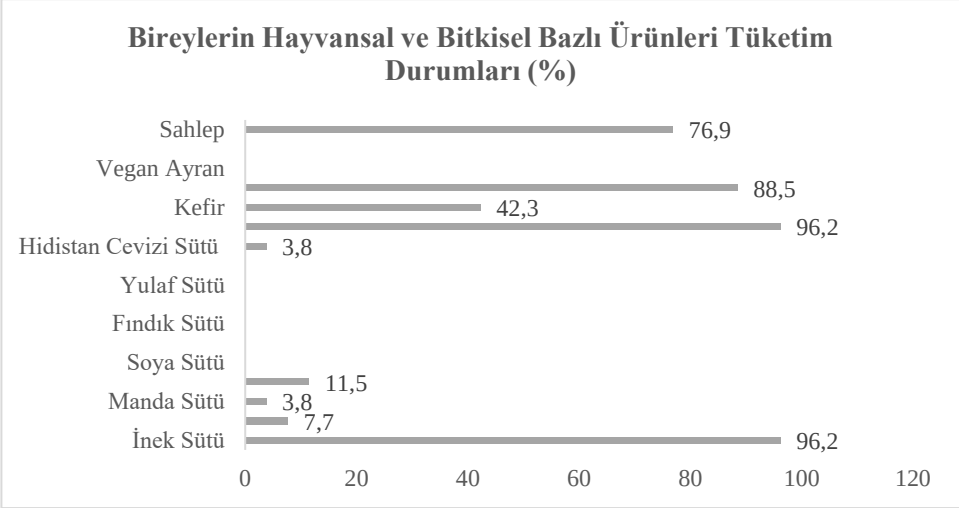
Fermente süt örneklerinin 21 gün depolama süresince toplam kabul edilebilirlik puanları Tablo 8 ’de gösterilmiştir. Toplam kabul edilebilirlik puanlarında cinsiyete ve depolama süresine göre önemli sonuçlar elde edilmemiştir (p>0,05).

Tablo 8. Fermente süt örneklerinin 21 gün depolama süresince toplam kabul edilebilirlik puanları

Depolama süresi		Fermente Süt Örnekleri				
		İnek sütü	Soya sütü	Badem sütü	Yulaf sütü	p
1.gün	Erkek (n:10)	4,92 ± 2,25 [a]	4,38 ± 2,06 [a]	5,46 ± 1,98 [a]	5,15 ± 1,82 [a]	0.588
	Kadın (n:10)	5,38 ± 2,84 [a]	5,38 ± 1,85 [a]	5,23 ± 2,09 [a]	6,08 ± 1,32 [a]	0.737
	Toplam (n:20)	5,15 ± 2,52 [a]	4,88 ± 1,99 [a]	5,35 ± 2 [a]	5,62 ± 1,63 [a]	0.627
7.gün	Erkek (n:10)	5,38 ± 1,94 [a]	4,92 ± 1,38 [a]	6,15 ± 2,03 [a]	6,08 ± 0,86 [a]	0.180
	Kadın (n:10)	6,69 ± 1,55 [a]	5,92 ± 1,93 [a]	5,62 ± 2,26 [a]	5,38 ± 1,12 [a]	0.268
	Toplam (n:20)	6,04 ± 1,84 [a]	5,42 ± 1,72 [a]	5,88 ± 2,12 [a]	5,73 ± 1,04 [a]	0.616
14.gün	Erkek (n:10)	5.54 ± 1.81 [a]	5.31 ± 1.65 [a]	5.77 ± 1.48 [a]	5.54 ± 1.51 [a]	0.912
	Kadın (n:10)	6,69 ± 1,55 [a]	6 ± 1,68 [a]	5,69 ± 1,75 [a]	5,23 ± 1,59 [a]	0.158
	Toplam (n:20)	6,12 ± 1,75 [a]	5,65 ± 1,67 [a]	5,73 ± 1,59 [a]	5,38 ± 1,53 [a]	0.452
21.gün	Erkek (n:10)	4,62 ± 1,66 [a]	5,38 ± 1,66 [a]	5,77 ± 1,79 [a]	5,31 ± 1,65 [a]	0.379
	Kadın (n:10)	5,69 ± 1,65 [a]	6,08 ± 1,12 [a]	6,08 ± 1,85 [a]	5,62 ± 1,45 [a]	0.802
	Toplam (n:20)	5,15 ± 1,71 [a]	5,73 ± 1,43 [a]	5,92 ± 1,79 [a]	5,46 ± 1,53 [a]	0.350

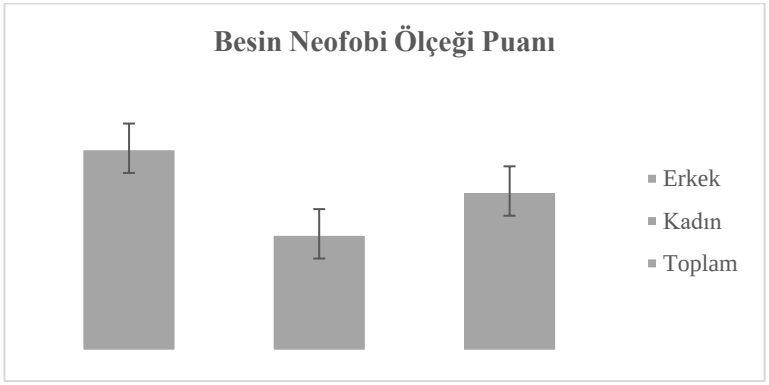
Duyusal analize katılan bireylerin hayvansal ve bitkisel bazlı ürünleri tüketim durumu Şekil 1’de gösterilmiştir. Hayvansal ve bitkisel bazlı ürünleri tüketim durumu için her gün, haftada 5-6, haftada 3-4, haftada 1-2, 15 günde 1 ve ayda 1 yanıtlarını veren bireyler arasında çoğunluk yüzdeleri göz önünde bulundurulduğunda, bireylerin %34,6’sının haftada 3-4 kez yoğurt,

%38,5'inin haftada 1-2 inek sütü ve %34,6'sının ayda bir dondurma tükettikleri belirlenmiş ve genel olarak bireylerin çoğunluğunun hayvansal süt ve ürünlerini tükettikleri görülmüştür. Bireylerin bitkisel süt tüketimleri incelendiğinde ise bireylerin %3,8'inin ayda bir hindistan cevizi sütü tükettiği görülmüş ancak diğer bitkisel süt tüketimlerinin olmadığı saptanmıştır.



Şekil 1. Duyusal analize katılan bireylerin hayvansal ve bitkisel bazlı ürünleri tüketim durumu

Duyusal analize katılan bireylerin besin neofobi ölçek puanları Şekil 2'de gösterilmiştir. Erkeklerin besin neofobi ölçek puan ortalaması 36,23±6,04 iken, kadınların besin neofobi ölçek puan ortalaması 33,61±8,95 puan olarak belirlenmiştir. Erkekler ve kadınların besin neofobi ölçek puanları arasında önemli farklılık belirlenmemiştir (p=0,392). Toplam besin neofobi ölçek puan ortalaması ise 34,92±7,60 olarak saptanmıştır. Elde edilen puanlar incelendiğinde duyusal analize katılan bireylerin besin neofobisinin düşük olduğu saptanmıştır.



Şekil 2. Duyusal analize katılan bireylerin besin neofobi ölçek puanlarının değerlendirilmesi

Besin nefobi ölçeği sorularının dağılım yüzdeleri Şekil 3'te belirtilmiştir. Çoğunluk cevaplar değindirildiğinde "sürekli yeni ve farklı besinler seçerim/denerim" sorusuna % 53,8'inin az

katıldığı, "yeni besinlere güvenmem" sorusuna %23,1'inin katılmadığı ve %23,1'inin ise yansız olduğu, "yemeğin içinde ne olduğunu bilmezsem onu tüketmem" sorusuna %29,9'unun katıldığı, "farklı ülkelere özgü yemekleri severim" sorusuna %38,5'inin az katıldığı, "etnik besinler, yemek için fazla garip görünüyorlar" sorusuna %30,8'inin yansız olduğu, "yemek davetlerinde yeni besinler denerim" sorusuna %46,2'sinin katıldığı, "daha önce yemediğim şeyleri yemeye korkuyorum" sorusuna %34,6'sının katılmıyorum, "tüketeceğim besinler konusunda çok titizim" sorusuna %30,8'inin az katılıyorum, "neredeyse her şeyi yerim" sorusuna %30,8'inin az katılıyorum ve "yeni etnik restoranları denemekten hoşlanırım sorusuna %46,2'sinin katılıyorum cevabını verdiği belirlenmiştir.



Şekil 3. Besin neofobi ölçeği sorularının dağılım yüzdelerinin değerlendirilmesi

Duyusal analize katılan bireylerin besin neofobi ölçek puanları Şekil 2'de gösterilmiştir. Erkeklerin besin neofobi ölçek puan ortalaması 36,23±6,04 iken, kadınların besin neofobi ölçek puan ortalaması 33,61±8,95 puan olarak belirlenmiştir. Erkekler ve kadınların besin neofobi ölçek puanları arasında önemli farklılık belirlenmemiştir (p=0,392). Toplam besin neofobi ölçek puan ortalaması ise 34,92±7,60 olarak saptanmıştır. Elde edilen puanlar incelendiğinde duyusal analize katılan bireylerin besin neofobisinin düşük olduğu saptanmıştır.Duyusal ya da hedonik olarak da adlandırılan tüketici kabul edilebilirlik testleri, duyusal çekiciliğe dayalı olarak bir ürünün beğenilme derecesini değerlendirmek için kullanılan analizlerdir (Fiorentini et al., 2020). Soya sütünün fermasyonu ile duyusal analiz sonuçlarını değerlendiren çalışmalar incelendiğinde; yapılan bir çalışmada, soya sütünün fermantasyonu ve 15 günlük depolanması sonucunda duyusal analiz sonuçlarına göre en yüksek puanın yapı ve doku alanına verildiği

belirlenirken, renk, koku, tat ve genel kabul edilebilirlik puanlarının düşük olduğu saptanmıştır. Ayrıca yapı ve doku puanları dışındaki puanlamalarda depolama süresiyle puanlarda azalmaların olduğu belirlenmiştir ($p<0,05$) (Almghawesh et al., 2022). Yapılan bir diğer çalışmada, ise soya sütüne ayrı ayrı olmak üzere %2'lik FOS ve %2'lik inülin ilavesi yapılmış ve yoğurt kültürü ile fermente edilerek 4 °C'de 1, 7, 21 ve 28 gün depo edilmiştir. Duyusal analiz sonuçlarına göre FOS takviyesi yapılan örnekler inülin takviyeli örneklerle karşılaştırıldığında önemli ölçüde daha gelişmiş duyusal özelliklerin sağlandığı belirtilmiştir. İnülin ilaveli örneklerde ise ST-LA ve ST-LR kombinasyonları kullanılarak yapılan örnekler maksimum duyusal puanı almıştır. İncelenen tüm örnekler arasında görünüm ve doku puanlarında önemli bir fark bulunmazken ($p>0,05$) FOS katkılı örneklerin, inülin katkılı örneklere kıyasla daha iyi görünüm ve tekstür skoruna sahip olduğu saptanmıştır ($p<0,05$) (Mishra & Mishra, 2018). Bir başka çalışmada, soya sütü ve hindistan cevizi sütü ilavesi ile yapılan kombinasyonlar sonucunda duyusal analiz sonuçları incelenmiş ve aroma, kıvam ve kabul edilebilirlik için en yüksek puanlar soya sütüne %30 hindistan cevizi sütü ilave edilen kombinasyonda saptanırken, renk ve tat için sade soya sütü daha yüksek puan almıştır ($p<0,05$) (Kolapo & Olubamiwa, 2012). Badem sütünün fermasyonu ile duyusal analiz sonuçlarını değerlendiren çalışmalar incelendiğinde; Türkiye'de yapılan bir çalışmada, badem sütünün *S. thermophilus, Lb. delbrueckii subsp. bulgaricus, L. acidophilus* ve *Bifidobacterium animalis subsp. lactis* bakterileri ile fermantasyonu gerçekleştirilmiş ve 4±1 °C'de 21 gün süresince depolanmıştır. Depolama günleri karşılaştırıldığında ise panelist değerlendirmelerinde genel olarak istatistiksel olarak önemli farklar saptanmamıştır ($p>0,05$) (Yilmaz-Ersan & Topcuoglu, 2022). İspanya'da yapılan bir çalışmada, badem sütü *L. reuteri* ve *S. thermophilus* ile fermente edilmiş ve 4 °C'de 28 gün boyunca depolanmıştır. Çalışmada numuneler ne kadar uzun süre depolanırsa o kadar asidik olacağı belirtilmesine rağmen duyusal analiz sonuçlarına göre panelistler, 1 gün boyunca saklanan numunelerin, 28 gün boyunca saklananlara göre önemli ölçüde daha asidik ve daha az tatlı olduğunu ifade etmişlerdir. Bu tartışmalı sonuç ise fermente ürünlere keskin ve asidik kokuları aktardığı görülen *L. reuteri* suşunun neden olduğu uçucu asetik asidin sentezi dikkate alınarak açıklanmıştır. Bu asit esas olarak fermantasyonun başlangıcında oluşmakta ve 28 gün depolamadan sonra, uçucu hale gelmesi nedeniyle asetik asidin olumsuz etkisi ortadan kalkmış olabilir şeklinde yorumlanmıştır. Depolama süreleri ve genel kabul edilebilirlik arasında önemli farklılık belirlenmemiştir ($p>0,05$) (Bernat et al., 2015). Türkiye'de yapılan bir çalışmada, fermente badem sütü portakal suyu ilaveleri ile kombine edilmiş ve duyusal analiz sonucuna göre %30 portakal suyu ilave edilen

kombinasyona göre ilave yapılmayan fermente badem sütünün kıvam, renk, asitlik, aroma, genel kabul edilebilirlik puanları önemli düzeyde düşük olarak saptanmıştır ($p<0,05$) (Duran & Cevik, 2022). Yulaf sütünün fermasyonu ile duyusal analiz sonuçlarını değerlendiren çalışmalar incelendiğinde; yapılan bir çalışmada, *Streptococcus salivarius sub sp. thermophilus, L. acidophilus* ve *Bifidobacterium bifidium* suşlarıyla fermente edilen yulaf sütü 4 °C'de 21 gün boyunca depolanmıştır. Duyusal analiz sonuçlarına göre fermente yulaf ve inek sütünde renk ve görünüş açısından önemli farklılık belirlenmezken ($p>0,05$) fermente yulaf sütünde kıvam puanları inek sütüne kıyasla daha yüksek saptanmıştır ($p<0,05$). Ayrıca inek sütünün yulaf sütüne göre daha fazla tat, koku ve genel kabul edilebilirlik puanlarına sahip olduğu saptanmıştır ($p<0,05$). Depolama süresine göre ise inek ve yulaf sütünün genel duyusal kalitesinin ilk 7 gün artış gösterdiği daha sonrasında ise azaldığı belirtilmiştir ($p<0,05$) (El-Batawy et al., 2019). Yapılan bir başka çalışmada, deve sütüne yulaf sütü eklenmesiyle yapılan kombinasyonlarda *S. thermophilus, L. acidophilus* ve *Bifidobacterium bifidum* bakterileri ile fermantasyon gerçekleştirilmiş ve 4±1 °C'de 10 gün süresince depolanmıştır. Deve sütüne kıyasla %40 yulaf sütünün ilave edilmesi duyusal analiz sonuçlarını olumlu yönde etkileyerek daha yüksek puanların elde edilmesi ile sonuçlanmıştır ($p<0,05$) (Atwaa et al., 2020). Türkiye'de yapılan bir çalışmada, yulaf sütü ve inek sütü farklı kombinasyonlarda karıştırılarak *Lactococcus spp* ve *Lactobacillus spp*. bakterileri ile fermente edilmiş ve 4±1 °C'de 21 gün boyunca depolanmıştır. Depolama sonrası genel olarak değerlendirildiğinde %60 ile en fazla yulaf sütü oranı ile yapılan kombinasyonun diğer kombinasyonlara kıyasla tüm duyusal analiz değerlendirmelerinde daha düşük puana sahip olduğu saptanmıştır ($p<0,05$) (Dinkçi et al., 2015). İnek sütünün fermasyonu ile duyusal analiz sonuçlarını değerlendiren çalışmalar incelendiğinde; Yunanistan'da yapılan benzer bir çalışmada, *S. thermophilus, Lb. delbrueckii* ve *Lactobacillus casei* bakterileri ile fermente edilmiş ve 4 °C'de 28 gün depolama işlemi gerçekleştirilmiştir. Duyusal analiz sonuçlarına göre fermente inek sütünde en yüksek puan sırasıyla viskozite, genel kabul edilebilirlik ve renk alanlarına verilmiştir. Keçi sütüne göre yapılan kıyaslamada inek sütünün genel olarak daha düşük puanlar aldığı belirlenmiştir ($p<0,05$) (Dimitrellou et al., 2019). Kanada'da yapılan bir çalışmada, soya sütü ilaveli inek sütleri *Lactobacillus rhamnosus GR-1* bakterisi ile fermente edilmiş ve 4 °C'de 30 gün depolama işlemi gerçekleştirilmiştir. Duyusal analiz sonuçlarına göre görünüş ve doku açısından soya ilavesiz fermente inek sütü en yüksek puanı alırken ($p<0,05$), lezzet ve kabul edilebilirlik açısından soya ilavesiz fermente inek sütü ve soya sütü ilaveli fermente inek sütleri benzer puanlar almışlardır ($p>0,05$) (Fatima & Hekmat, 2020). Yapılan bir başka çalışmada,

100:0, 75:25, 50:50, 25:75 ve 0:100 oranlarında soya sütü ilaveli inek sütü *L. acidophilus* NCFM, *B. lactis* HN019 ve yoğurt bakterileri ile fermente edilmiş ve 4 °C'de 21 gün boyunca depolanmıştır. Örnek kombinasyonlarından 0:100 ve 100:0 (inek sütü:soya sütü) oranlarının, depolama süresine göre en düşük ve en yüksek toplam duyusal puana sahip olduğu belirlenmiştir. genel olarak ise her bir kültür kompozisyonu için 50:50 oranının kullanılması duyusal analiz açısından en uygun seçenek olarak kabul edilmiştir (Mohammadi et al., 2017).

Bu çalışmada duyusal analiz değerlendirmesinden önce bireylerin hayvansal ve bitkisel bazlı ürünleri tüketimi ile bu ürünlere karşı neofobi durumlarının olup olmadığını belirlemedeki amaç ise Türk toplumunun damak tadına uzak olarak nitelendirilebilecek fermente bitkisel bazlı içeceklerin duyusal analiz sonuçlarında yanlış değerlendirilmelerin dışlanmasını sağlamaktır. Yapılan bu çalışmada, elde edilen puanlar incelendiğinde ise duyusal analize katılan bireylerin besin neofobisinin düşük olması çalışma tasarımı ile paralellik göstermiştir.

Sonuç ve Öneriler

Özellikle son yıllarda bitkisel süt tercihlerine yönelim ile bu bireyler evlerinde bitkisel sütlerden fermente içecek ve yoğurt üretimi gibi besinler elde etmektedirler. Bu bireyler bu yolla kendilerine alternatif fonksiyonel bir içecek ürettiklerini ifade etmektedirler. Bu çalışma sonuçlarına göre, duyusal analiz sonuçları ve panelist yorumlarına göre fermente bitkisel içecek üretiminde tüketici açısından aroma içeriğine sahip bakteri suşlarının kullanılmasının tüketici seçimi için daha iyi olacağı düşünülmektedir. Fermantasyon aşaması her ne kadar ürünün duyusal özelliğinde iyileşmeler sağlasa da bitkisel sütler Türk damak kültürüne temel olarak yabancı besinlerdir. Bu nedenle fermente bitkisel içecek elde edilirken aroma içeriğine sahip bakteri suşlarıyla fermantasyon işlemi gerçekleştirilebilir. Ayrıca bitkisel sütler birbirleri ile belirli oranlarda karıştırılarak duyusal açıdan daha iyi fermente içeceklerin üretimi sağlanabilir. Ayrıca depolama süresi ile fermente içeceklerde ekşimsi bir tat ve koku oluşumunun gerçekleşmesinden dolayı depolama süresinin çok uzun tutulmaması gerekmektedir. Ayıca bu çalışma yürütülürken ülkemizde toplumun kolayca ulaşabildiği market alanlarında fermente bitkisel içeceklerin bulunmadığı ve bunun yanında bitkisel süt çeşitlerinin de oldukça sınırlı olduğu görülmüştür. Toplumumuzda vegan ve vejetaryen bireylerin sayısı gün geçtikçe artmaktadır. Bu bireylerin besin ve besin ögesi açısından çoğunlukla yetersizlik durumları ile karşılaşmaları da göz önüne alınarak ticari olarak fermente bitkisel ürünlerin üretiminin yapılmasının hem bu bireyler hem de sanayide yeni bir sektör açısından faydalı olabileceği düşünülmektedir. Bu çalışmanın bu anlamda literatüre önemli bir katkı sağlayacağı düşünülmektedir.

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BETONDA SÜRDÜRÜLEBİLİRLİK: PUZOLANİK ÇİMENTO ESASLI MALZEMELERİN AVANTAJLARININ ARAŞTIRILMASI

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Özet
Beton üretiminde, geleneksel Portland çimentosu (PC) yerine puolanik malzemelerin (SCM'ler) kullanılması, hem karbon dioksit (CO_2) emisyonlarının önemli ölçüde azalmasını sağlar hem de sürdürülebilirliğe önemli katkı sağlar. Beton, küresel konut ihtiyaçlarına yanıt veren temel bir yapı malzemesidir ve yıllık üretimi 10 milyar m^3'ü aşmaktadır, suyun ardından en çok üretilen ve tüketilen ikinci madde konumundadır. Çimento, su, agrega ve çeşitli kimyasal katkı maddelerini içeren beton, hidratasyon reaksiyonları sonucunda zamanla katılaşır ve dayanıklılık kazanır. Taze betonun zorunluluğu, belirlenen yükleri karşılamak için optimum işlenebilirlik özelliklerine ve yeterli basınç dayanımına sahip olmasıdır. Bununla birlikte, geleneksel betonda birincil bağlayıcı malzeme olarak Portland Çimentosu'na (PC) yaygın olarak kullanılması, CO_2 emisyonlarının artışına önemli ölçüde katkıda bulunarak çevre ve sağlık risklerinin meydana gelmesine sebep olur. Bu olumsuz etkinin azaltılması için çimento esaslı ürünlerde PC'lerin SCM'lerle değiştirilmesi ve sürdürülebilir uygulamalara doğru bir değişim gerekmektedir. Çeşitli endüstriyel işlemlerden elde edilen yüksek fırın cürufu (GBFS), silis dumanı (SF) ve uçucu kül (FA) gibi atık puzolanik malzemeler, PC üretiminin çevresel etkisinin azaltılmasında önemli bir rol oynar. Bu atık malzemelerin beton karışımlarına entegre edilmesi, inşaat sektöründe sürdürülebilirliğin ve çevresel sorumluluğun geliştirilmesi yönünde önemli bir adımdır.
Anahtar Kelimeler: Beton, karbon azaltımı, tamamlayıcı çimentolu malzemeler

SUSTAINABILITY IN CONCRETE: EXPLORING THE BENEFITS OF POZZOLANIC CEMENTITIOUS MATERIALS

Abstract
In concrete production, the use of pozzolanic materials (SCMs) instead of traditional Portland cement (PC) not only significantly reduces carbon dioxide (CO2) emissions but also contributes significantly to sustainability. Concrete, a fundamental building material addressing global housing needs, boasts an annual production exceeding 10 billion m^3, positioning itself as the second most produced and consumed substance after water. Concrete, consisting of cement, water, aggregate, and various chemical additives, solidifies and gains strength over time through hydration reactions. The imperative for fresh concrete lies in possessing optimal workability properties and sufficient compressive strength to meet designated loads. However, the prevalent reliance on Portland Cement (PC) as the primary binding material in conventional concrete significantly contributes to heightened CO_2 emissions, posing environmental and health risks. Mitigating such impact necessitates a shift towards sustainable practices, emphasizing the substitution of PCs with SCMs in concrete formulations. Critical pozzolanic materials like blast furnace slag (GBFS), silica fume (SF), and fly ash (FA), derived from various industrial processes, play a pivotal role in curbing the environmental impact of PC production. Integrating these waste materials into concrete mixtures is a critical stride towards fostering sustainability and environmental responsibility in the construction industry."
Keywords: Concrete, carbon reduction, supplementary cementitious materials

Introduction

In accelerated industrialization and heightened energy demands, reliance on fossil fuels raises critical environmental concerns. Utilizing waste materials in various applications presents an avenue for achieving sustainable development, concurrently improving the quality of life by mitigating environmental pollution. Concrete, a ubiquitous construction material in structures ranging from residences and shopping malls to bridges and dams, underscores the need for a paradigm shift toward sustainability in the construction industry. Heightened societal emphasis on sustainable practices, escalating demands, decreasing resource availability, and the imperative to reduce carbon dioxide (CO_2) emissions, necessitates innovative approaches within the construction sector (Hasanbeigi et al. 2012; Yang et al. 2015; Gartner & Hirao 2015). The cement sector, contributing approximately 5% of global anthropogenic CO_2 emissions, underscores the urgency to address sustainability issues arising from CO2 emissions in Portland cement (PC) production (Andrew 2018). The conventional use of fossil fuels in PC production results in the release of 1 ton of CO_2 per ton of clinker produced, necessitating transformative measures (Justnes 2012). A compelling strategy involves replacing a portion of cement in concrete with mineral additives, such as ground granulated blast furnace slag (GBFS) or silica fume (SF), both possessing latent hydraulic properties. This approach significantly mitigates CO_2 emissions from cement production, contributing to environmental preservation and sustainability (Saranya et al. 2018; Shin et al. 2016; Song et al. 2022). Globally, PC production reached approximately 4 billion tons in 2015, with Turkey contributing 75 million tons, resulting in an annual release of 60 million tons of CO_2 (Özcan & Güngör 2019). Supplementary Cementitious Materials (SCMs) are pivotal in concrete production, serving as secondary binders alongside PC. Implementing fly ash (FA) as a percentage replacement for PC influences various fresh and hardened concrete properties, including workability, hydration characteristics, and mechanical strength (Han et al. 2022; Wang 2019; Zhang et al. 2014). A schematic representation of the benefits of FA in concrete mixes is shown (Figure 1).

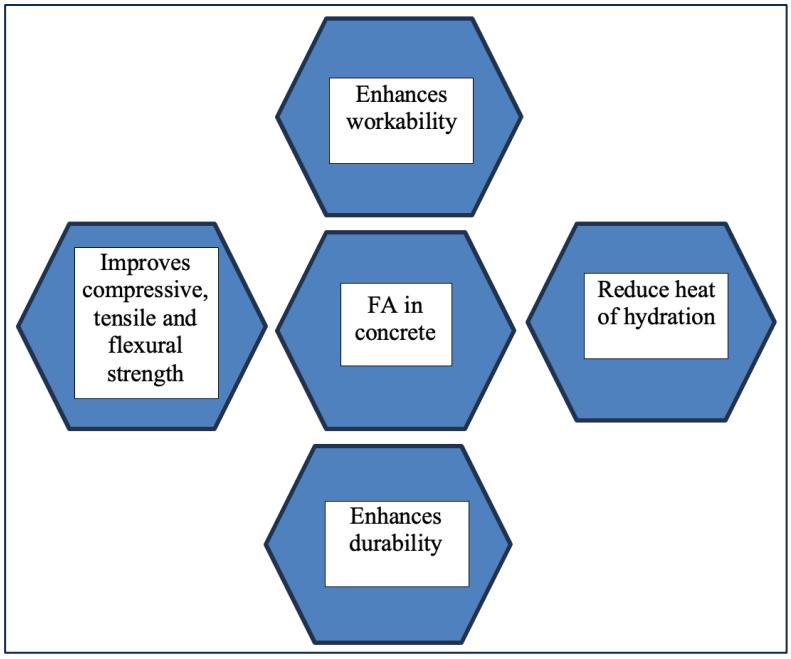


Figure 1. A shematic representation of the benefits of FA in concrete mixes

Fly ash (FA) reacts with lime from cement hydration, forming an additional binding gel that enhances concrete compactness, reduces permeability, and augments durability (Nath & Sarker 2011; O'Brien et al. 2009). Moreover, Supplementary Cementitious Materials (SCMs), including FA, significantly impact compressive strength, modulus of elasticity, and time-dependent deformations in concrete, influencing properties such as creep and shrinkage (Johari et al. 2011). Durability aspects, including resistance to acids, sulfates, alkali-aggregate reaction, repeated freeze-thaw cycles, and reinforcement corrosion, are also profoundly influenced by SCMs, varying based on their type and pozzolanic activity (Limbachiya et al. 2012; Wang et al. 2021; Jiang et al. 2022). As an artificial pozzolan, FA consists of glassy, spherical granular particles that enhance concrete strength and durability through a hydration reaction with slaked lime (Ebrahimi et al. 2017; Diamond 1986). The integration of SCMs emerges as a transformative strategy, redefining the landscape of concrete production to align with sustainable principles and mitigate the environmental impact associated with traditional practices.The construction industry is undergoing a transformative shift towards sustainable practices, and a key player in this evolution is the strategic integration of supplemental cementitious materials (SCMs). These materials, including fly ash, slag, and silica fume, are gaining prominence for their significant contributions to environmental conservation and improved concrete performance. SCMs are valuable alternatives to traditional Portland cement (PC), the primary binder in concrete production. By incorporating these materials into concrete

mixtures, the industry can address environmental concerns, particularly the high carbon dioxide (CO2) emissions associated with PC production. Reducing CO_2 emissions aligns with global sustainability goals, marking a crucial step towards creating environmentally responsible structures.The importance of SCMs lies in their environmental benefits and their positive impact on concrete properties. Concrete blended with SCMs exhibits enhanced durability, reduced permeability, and improved resistance to harsh environmental conditions. These improvements contribute to the longevity and resilience of structures, reducing the need for frequent maintenance and repairs. Fly ash, a byproduct of coal combustion is a commonly used SCM. Its incorporation in concrete not only diverts waste from landfills but also enhances workability, mitigates the risk of alkali-silica reaction, and improves sulfate resistance. Similarly, ground granulated blast furnace slag (GGBFS), a byproduct of iron production, contributes to concrete strength development, reduces heat of hydration, and enhances resistance to aggressive chemicals. Silica fume, an ultrafine byproduct of silicon and ferrosilicon alloy production, is another noteworthy SCM. Its addition to concrete enhances compressive strength, reduces permeability, and provides resistance to chloride ion penetration. Using silica fume is particularly advantageous in marine structures and environments with high chloride concentrations. In conclusion, adopting SCMs in the construction industry represents a significant stride towards sustainability and improved concrete performance. By reducing reliance on traditional binders like PCs and incorporating these innovative materials, the industry can meet the growing demand for environmentally responsible practices while ensuring the longevity and resilience of structures. As the construction sector prioritizes sustainability, SCMs emerge as indispensable elements in shaping an industry's greener and more robust future.

Conclusion

Concrete, a widely-used building material known for its strength and affordability, is facing serious challenges due to its reliance on Portland cement (PC). The production of PC is a major contributor to carbon dioxide (CO_2) emissions, harming the environment and increasing production costs. To address these issues, there's a recent push to reduce the use of PC in concrete and explore alternatives that are both environmentally friendly and cost-effective. Materials like ground granulated blast furnace slag (GBFS), fly ash (FA), and silica fume (SF) from industrial waste are gaining attention as potential substitutes for PC in concrete. This shift not only helps in reducing CO_2 emissions but also opens up avenues for creating concrete that's more sustainable. Researchers, the construction industry, and end-users are actively involved

in adopting these eco-friendly practices. It's essential to delve into the detailed properties, advantages, and potential challenges of using GBFS, FA, and SF in concrete to ensure environmentally conscious production. Beyond just mitigating environmental impact, the move towards sustainable concrete production could fundamentally change construction practices, aligning with global sustainability goals. Concrete mixes enriched with GBFS, FA, and SF not only meet rigorous standards but also offer superior qualities such as increased durability, strength, and resistance to environmental factors. These benefits extend beyond the construction site, making substantial contributions to reducing carbon footprints, lessening environmental harm, and enhancing overall well-being. As awareness grows and industry practices evolve, the momentum towards sustainable concrete production is poised to significantly impact the future of construction. Collaborative efforts involving researchers, industry players, and end-users are vital in driving this shift towards widely adopting environmentally friendly and economically viable concrete formulations. Embracing this change isn't just an option; it's a collective responsibility towards building a sustainable future for the construction industry and the planet.

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MODERN İNŞAAT UYGULAMALARINDA RENKLİ BETONUN ROLÜ VE ÖNEMİNİN DEĞERLENDİRİLMESİ

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Özet
Renkli beton, estetik uygulamalardan ortaya çıkan bir malzemedir ve beton matrisi içinde pigmentler kullanılarak elde edilmektedir. Sağlam ve aşınmaya dayanıklı bir tabaka sağlamanın ötesinde, görsel olarak çekici bir yüzey elde edilmektedir. Genellikle beton renklendirme için iki yöntem kullanılır. İlk yöntem, betonun üzerine renklendiricilerin, genellikle toz halindeki pigmentlerin, taze betona eklenmesini içerir ve ardından baskı kalıplar kullanılarak desenler oluşturulur. Alternatif yöntem ise renklendiricilerin geleneksel beton karışımına, agregalar, kum, çimento, su ve katkı maddeleri içeren karışıma doğrudan entegre edilmesini içermektedir. Baskı betondan farklı olarak, bu teknik toz halindeki pigmentleri gerektirir ve genellikle demir ve krom oksit gibi inorganik minerallerden oluşmaktadır. Diğer taraftan, ikinci yaklaşım renklendiricilerin ve renkli çimento çeşitlerinin kullanılmasına izin verir ve yapı uygulamalarında geleneksel gri çimento kullanımından farklı alternatifler tanımaktadır.
Anahtar Kelimeler: Renkli beton, baskı beton, renklendiriciler, toz pigmentler

ASSESSING THE ROLE AND SIGNIFICANCE OF COLORED CONCRETE IN MODERN CONSTRUCTION PRACTICES

Abstract
Colored concrete emerges from aesthetic applications employing pigments within the concrete matrix. Beyond providing a robust wear-resistant layer, it achieves a visually appealing surface. Generally, two methods are employed for concrete coloring. The first involves pressing concrete, where layers of colorants, typically powdered, are introduced to fresh concrete before employing texturing molds. The alternative method is directly integrating colorants into the conventional concrete mixture comprising stone aggregates, sand, cement, water, and additives. In contrast to stamped concrete, this technique necessitates powdered pigments, typically inorganic minerals such as iron and chromium oxides. Alternatively, the second approach allows for the use of pigments and colored cement varieties, deviating from the conventional gray cement in construction applications.
Keywords: Colored concrete, pressing concrete, colorants, powdered pigments.

Introduction

Global surges in demand for construction projects have positioned concrete as the most extensively utilized building material (Shah et al., 2021; Li et al., 2022; Naik, 2020; Kishore & Gupta, 2020; Chyliński et al., 2022). Beyond its utilitarian applications, concrete serves as a prominent architectural material within the construction industry, demonstrating not only versatility but also aesthetic potential. Traditional concrete production incorporates gray cement, while the inclusion of white cement and pigments expands avenues for color customization. Colored concrete finds widespread applications in sculpture, surface reliefs, exterior facades, the manufacturing of interior architectural products, and the design of park and garden furniture (Karagüler, 2002; Karagüler, 2003; Özkul, 2005).The term 'architectural concrete' refers to the transparency of the produced concrete or reinforced concrete element on the outer surface without requiring an additional coating layer. This type of concrete, often referred to as 'exposed concrete,' is prominently visible on the outer shell of buildings. In specific construction applications, 'exposed concrete' is also utilized within the interior of buildings. The introduction of pigments to architectural concrete enables the creation of desired colors and textures (Sharifi & Sheibani, 2022; Utesena & Pernicova, 2022; Arruda Junior et al., 2022). In the production of colored concrete, aesthetic considerations become pivotal alongside conventional concrete's expected workability, strength, and durability properties. Various aspects, including the impact of pigments on cement setting, color stability, resistance to environmental conditions, effects on mechanical properties, and resilience against factors like heat and freezing-thawing, gain significance in colored concrete (Sharifi & Sheibani, 2022; Utesena & Pernicova, 2022). Beyond these properties, attention to the formwork system and mold release agents is crucial for achieving visually appealing colored concrete applications (Arruda Junior et al., 2022). Research in this domain has delved into the effects of mineral pigments on the compressive strength of colored concrete, with a focus on the role of an improved color palette in current urban environments (Sharifi & Sheibani, 2022). Another study explored the color stability of colored concrete over time, depending on the type of pigment used (Utesena & Pernicova, 2022). Additionally, a study investigated the use of red mud and kaolin waste in the production of a new building material, specifically a pozzolanic pigment for colored concrete and mortar (Arruda Junior et al., 2022). These academic endeavors collectively contribute valuable insights into the aesthetic and performance dimensions of colored concrete, reflecting its increasing popularity in the construction industry (Shah et al., 2021; Li et al., 2022; Naik, 2020; Kishore & Gupta, 2020; Chyliński et al., 2022; Karagüler,

2002; Karagüler, 2003; Özkul, 2005; Sharifi & Sheibani, 2022; Utesena & Pernicova, 2022; Arruda Junior et al., 2022).

Exploring Colored Concrete Applications: A Concise Overview

Colored concrete has become a favored building material in contemporary architectural practices, attracting attention for its pronounced aesthetic potential. Integration of color pigments into the concrete mix expands the palette beyond conventional gray tones, offering a spectrum of colors that substantially enhance the visual appeal of architectural endeavors (Tau et al., 2023; de Sousa et al., 2020; Assaad et al., 2022). The resultant color intensity of cured concrete is intricately influenced by various factors inherent in the concrete mix production process, notably the type and color of the cement employed. Parameters such as the quantity of aggregate, water-to-cement ratio, mold absorption, release agent type, and, in the case of colored concrete, the pigment dosage and color tone play pivotal roles in determining the outcome (Golshan et al., 2023; Jinnai, 2020; Saade & Assaad, 2022). The dosage of added pigment is typically expressed in terms of the weight of the binder, emphasizing precision in weight rather than volume. Misinterpretations or deviations in the bulk density of the pigment used during the addition process can lead to undesirable fluctuations in the resulting color intensity, underscoring the importance of meticulous dosage control (Jinnai, 2020; Saade & Assaad, 2022). Furthermore, due to its chemical composition, an often-overlooked component profoundly influences the concrete hardening process, thereby impacting the ultimate state of the concrete (Mahmud & Abdulrehman, 2021). This intricate interplay of variables underscores the need for a comprehensive understanding and precise management of factors contributing to concrete coloration, ensuring optimal aesthetic outcomes in architectural applications.

Conclusion

In contemporary construction practices, there has been a substantial upsurge in using pigments to design concrete structural elements, enhancing conventional concrete's aesthetic appeal. Colored concretes derived from these pigments find extensive application, particularly in self-compacting concretes, repair mortars, and paving and curb stones adorning parks and gardens. The prevalence of colored concrete, particularly in Arab and Gulf countries, is noteworthy in today's construction landscape, attributed to elevated living standards, cutting-edge construction techniques, and a growing preference for intricate works and decorative elements among end-users. Despite the evident advantages of colored concrete, scientific research in this domain remains relatively scarce compared to other engineering disciplines. Structural-colored concrete emerges as a material offering unique aesthetic qualities, disrupting the monotony of

traditional buildings and proving more cost-effective as a finishing surface. The exploration of such specialized concretes is inherently innovative, given the need for more research, particularly concerning durability. The capacity to imbue concrete with hues spanning yellow, orange, red, blue, and green enhances structural attractiveness and presents captivating design opportunities. This study delves into various examples elucidating the evolving use and development of colored concrete in construction applications. By emphasizing the aesthetic and economic dimensions, it underscores the transformative impact of colored concrete in breaking traditional design paradigms and contributing to a more visually dynamic built environment.

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FRENCH AND THE IMAGE OF AMIR TEMUR INTERPRETATIONS IN UZBEK LITERATURE

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ABSTRACT

Introduction and Purpose: The place of great historical figures in the world civilization, their activities on the page of history have become the basis for analysis and interpretations in different periods. In the course of historical development, leaders of mankind have emerged in different eras. This proves that they have a strong spirit of humanity, worldliness, and the spirit of convincing the people to follow their thoughts and views. Therefore, it is necessary to note that the great historical figures who left a significant mark in the history of the world have their place in the civilization of a certain era. Materials and Methods: It should also be noted that the life of historical figures in this process is complex, full of socio-political conflicts, and emerged in the background of contradictions. The place, knowledge, and potential of the historical figures of this period are leading in the structure of civilization, which prepares the ground for the analysis and interpretation of their skills in this process, which will be studied by the peoples of the world centuries later. Studying long-term historical processes, drawing analytical conclusions, analyzing the processes of creating the artistic image of the great historical figures of a certain nation, their recognition by the peoples of the world, and the ability to deeply understand their place in a certain historical situation are comparable. based on the example of analysis.Marcel Brion was considered a talented person who perfectly knew and understood not only French history and literature, but also world history, as well as the history of Turkic peoples. In the process of creating the image of historical figures who contributed to the creation of great history in their time, first of all, they study their history, activities, their place in social and political life, get acquainted with historical sources, and conduct long research. Along with the high assessment of the creator's research in the process of studying history and the activities of historical figures, it is shown in the example of analysis that Marcel Brion is one of the talented people who was able to reasonably and correctly assess the activities of people in world history. Starting from 1924, Marcel Brion published his first exercises in magazines such as Le Feu, L'Art vivant, Fortunio. In his early creations, the tradition of understanding man, reasonable interpretation of his psychology, analysis of unique qualities in the process of historical period and environment was leading. Together with his colleagues, he also founded the magazine Les Cahiers du Sud. There are reasons why this magazine is a leader not only in France, but also in world civilization. During the time of Marcel Brion, the magazine became famous not only in the West, but also in the world. The main reason for this is that it is also famous for expressing reasonable views, analyses, concepts, dialectic unity between life and man.The image of Amir Temur and his artistic expression are leading in the work of Marcel Brion. In the historical novels of the writer, the complex and conflicting characteristics of the era, the artistic expression of the concepts of governance and humanity are based on leadership. We tried to justify that the historical events, the life and complexities of the people of Shaqr were revived on the basis of very real events. At the core of the works of Marcel Brion's work, the artist's skill in creating an artistic expression of historical reality is based on the example of

analysis. The talented master of Uzbek literature Muhammad Ali skill in creating the image of Amir Temur and the Timurids is comparatively analyzed on the example of the works of Marcel Brion. This allowed to analyze the poetic features of Uzbek literature, which is a component of world literature, based on the example of historical works.
Key words: history, life, image, analiz, creativity.

Introduction: In the history of Danya, the activities of great historical figures, their actions on the pages of history are represented not only by historical sources, but also by their interpretation in artistic and journalistic spheres. It is not for nothing that the artistic image of people who have taken an important place in the development of society is interpreted in epic works. The artistic image of figures from the history, together with the artistic reproduction of their various characteristics, became the basis for interpreting their spiritual world.In the interpretation of the figure of a historical figure and his artistic character, space and time, i.e., the historical function of the chronotope, also lead, because the historical figure also acts in a certain space and time. The artistic expression of this movement deepens in the chronotope. The artistic expression of the historical truth is embodied on the basis of the characteristics of the historical scene, and it requires a perfect study of the life of a person, his activity on the stage of history.In the novel "Menkim, Sahibqiron - Jahangir Temur" by the mature representative of French literature, it is based on the peculiarities of the artistic interpretations of the image of the historical figure, to show that Amir Temur's activity, his struggles, and his life full of hardships are interpreted. In the work, the understanding of a person in the series of historical events is to reveal the creative skill in the artistic expression of reality aimed at illuminating his character traits.The main feature arising from the article is to study, analyze, and draw reasonable conclusions about the expression of the image of great historical figures in world literature based on the artistic inkosi of historical reality in the artistic interpretations of the image of Amir Temur in the interpretation of Marcel Brion. The author's well-studied history of Movarounnahr and Khorasan, which is the basis for the artistic interpretation of the character of Amir Temur by the creator and historian, and the analysis of the basis for the incorporation of reasonable images into the artistic text.

Review of literature: world novels, direct historical novels have their own views on the chronotope, its artistic function in the text, and world literary scholars have their own views. In particular, the theoretical views of world scientists such as H. Meyerhof [1], A. James, W. Heffernan [2], J. Guller [3], M. Atkins [4] should be noted. Also, theoretical views analyzing various artistic features of the chronotope have been noted. M. Vukanovicand, L. Grmusa [5] analyzed the dialectical unity of the chronotope, epic space and time in the novel, while N. Bemong, P. Scholars such as Borghart [6] noted the concepts of the role of space and time in the formation of the character of the historical Shavs. Russian scientists such as M.M.Bakhtin [7], E.Meletinsky [8], V.E.Khalizev [9] analyzed the characteristics of the poetics of the chronotope in the work of art, while Uzbek scientists U. Jurakulov's researches talk about the

characteristics of the chronotope in the poetic interpretation of the creator. Yuritsa [10], and B. Toraeva analyzes the artistic functions of chronotope in modern novels [11]. A.N. Nasirov in his monograph "Artistic and vital reality" revealed the features of the chronotope in the artistic expression of historical reality [12; 13; 14]. Also, in historical novels, the individual characteristics of the artistic era [15], in the comparative-typological content [16; 17] analyzed poetic features consisting of forms, categories and methods of epic time [18; 19]. Based on the creative concept of the author of the historical novel and the general poetic concept of his work, he analyzed and made theoretical conclusions based on the role of the artistic era in the formation of the character of the hero of the work [20].It is possible to observe the unique interpretations of the character of the master Amir Temur, because in the interpretations of the novel "Jahongir Temur" by the French historian, scientist and writer Marcel Brion, the artistic expression of the truth of history is skillfully illuminated. It can be justified that the artistic expression of the interpretations in the writer's novel is skillfully interpreted [21].

The main part. It is a work covering the life and activities of our great grandfather Amir Temur from the history pages of the French historian, scientist, writer Marcel Brion. In the work, Amir interprets the period from Temur's childhood to the last moments of his life. In the novel, his mental and spiritual image is reasonably revealed. At the heart of this, it can be observed that the environment of the period in which the hero of the work lived is also interpreted very reasonably.In the novel, Marcel Brion, speaking of the birth of Amir Temur, his father's views on his child, it is not without reason that he pays serious attention to the specific customs and traditions of the peoples of the East: "My father's name is Turagai, the city of Kesh He was one of the owners. He was a person who gained special respect and attention among the residents of the city. He had a dream some time before I was born, in which an angel came to him and put a sword in his hand. My father took the sword and swung it over his head, and they woke up immediately" [21, p. 3]. As the work begins with these interpretations, one can observe the originality of its interpretations. From the first pages of the work, it is not for nothing that it begins with the centuries-old customs and principles of the people of Shaqr. Mahmud Tragai's dream also brought a unique artistry to the work. It is inextricably linked with the father's dream, the interpretation of its reasons, and the birth of Amir Temur more than a year later.Character centers the system of events and the components of the plot. The personality of the hero is formed according to the direction of the will. The meaning and content of the image achieves social status at the intersection of interests and needs. Therefore, human nature is such that he always feels helpless in the face of objective reality. The social essence determines the lifestyle

and living space of each character. Rather, society's demands and requirements, or fate's judgment, play an important role in the formation of human character. The complete and full-blooded nature of the artistic character depends on the pathos of a number of aesthetic criteria. In our opinion, the poet's poetic skill is manifested in the impartial description of images on the border of possibility and impossibility, dream and dream, ideal and the most complicated situations of life.A serious development in the psyche of the hero goes back to defining characteristic points. A person who realizes his identity becomes a member of a progressive society. A writer infuses a simple observation with a profound and extraordinary generalization through the medium of description. It seems that the image of Shogosim, who is firm in his beliefs and life views, has become a criterion of spiritual maturity. His character acquires its own depth. It also becomes a defining feature of spiritual maturity. In fact, only a person who loves life with all his being will appreciate it and feel its value. Living life consciously prevents mistakes and defects.In the novel, Maresel Brion embodies his life ideas with the help of a clear human image. The author illuminates the very personal, unique inner world of his characters. It elevates the true expression of the spiritual world to the level of the main goal. While interpreting the youth period of Amir Temur, the artist reveals very reasonable factual images, which proves that Marcel Brion studied this period perfectly. Let's pay attention to the author's interpretations: "The idea to further strengthen the power, to further strengthen the power of the ruler of the land of Movarounnahr arose because of my passion for hunting. Autumn month of 757 AH. I am twenty one years old. We went hunting in the desert. I sent some of my soldiers and ordered them to make a circle across the desert and drive the wild birds towards the center. I, along with several military commanders, occupied the places where the birds fled. This place was north-west of Samarkand. I did not know that this place belongs to the "Kurultoy" tribe" [pages 21, 39].If we look at the images, we can see that based on Marcel Brion's forms of expression, the interpretations that serve to reveal the unique characteristics of Amir Temur are leading. Because the development of the next events in the novel is human I made it my goal to make plans for such military operations that would cover at least two or three years. So that I don't have to wait for spring to return to Movarounnahr in the winter season and go on a trip again... On the sixth day of my arrival in Samarkand, I went out into the desert. After building a camp, I began to prepare warriors for the military expedition to be carried out in the land of the Kipchaks" [21, page 165].In the interpretations of the novel, we can see that Amir Temur is a thoughtful person, in his views, he respects and protects the people around him, strictly controls every situation of the army, looks at their situation and gives them wider opportunities.

We observe that he responds to a person with his human qualities.In the interpretations of Marcel Brion, along with humanity, the need to make very responsible decisions for military actions was very well and reasonably absorbed into the development of events. Amir Temur wanted to leave Iran in the late fall in order to fight against the Mongols, but at the same time, he understood very well how difficult it was to walk through the mountains and desert deserts with soldiers in cold weather. He orders to return to Samarkand. A week after arriving in Samarkand, he leaves for the desert to prepare for battle. The fact that he makes a firm decision in such situations, taking into account the opinions of the officials, shows his human qualities.Marcel Brion's poetic skill is shown in clearly and truthfully defining the roots of the vices that are forming in the nature of the hero. In the novel, the human existence and the spirit of the time are expressed consistently and deeply, holistically and completely. The novel reveals the mental world of the hero in detail, and also expresses a conscious creative attitude to reality. The integrity of the work is ensured by the combination of details with memories, the author's point of view is mixed with the speech of the hero, and the depth of the philosophical and journalistic scope. Reality brings the reader into the inner world of the hero and gradually guides him to the social essence. At first glance, the novel seems like a psychological work, because the interpretations, expressions, and experiences of Amir Temur are very reasonable.

Conclusion: Marcel Brion illuminates the artistic character of the writer's character, the conflicts in his inner world through an internal monologue. This testifies to the poetic skill of the writer. Although we observe unique interpretations of the inner monologue in the prose, we can witness that the writer effectively used the inner monologue to describe the psyche of the hero in his time.Marcel Brion poetically interprets the social environment of the 14th century, the spirit of the era, based on artistic criteria, through the conflict and struggle of the characters in the plot of the work of art, the conflicts between the hero and the environment, and in his psyche. Through the spiritual world of the hero, he creates the image of the king and scientist Ulugbek, who is a part of history. By developing the spiritual and spiritual world of man, he summarizes the philosophical concepts of life, society and historical period.

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STUDENTS IN THE PROCESS OF INDEPENDENT EDUCATION FORMING KNOWLEDGE SKILLS

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Abstract
In the process of globalization, humanity's attitude to life and existence is formed and various features emerge. In this process, the activities of students, their role in the development of society, and the formation of knowledge skills are being expressed in different ways. Today, the formation and development of various pedagogical technologies in the modern education also supports these views. As education is based on the process of formation of knowledge and skills, it is noted that it is necessary not to forget the existence of strict responsibility of the student in this process.In addition to modern principles of teaching, international strategies, new approaches, the introduction of the global and international education system into the scientific methodology, the essence of taking national traditions into account has been revealed. Also, priority aspects of the use of the international concepts of the pedagogue, the researches and experiences being conducted on a global scale, and the formation of the principles of a reasonable approach were analyzed. Because the formation of changes in the educational process on the basis of international standards, together with the expansion of students' opportunities for learning, the process of self-control, the need for the formation of skills, is based on the experiences of world pedagogy. .The use of modern educational technologies, based on their characteristics, the pedagogical and psychological aspects of the specific principles in the tradition of application to the educational process were also analyzed. Along with increasing the responsibility of the pedagogue in the educational process, along with the manifestation of potential, knowledge and talent, the possibilities of independent work and research skills in the student are approached from the pedagogical point of view.Analytical approach is also given to the need to pay serious attention to the formation of the ability of the teacher to acquire knowledge in the students with the help of educational tools, and to develop the ability to independently study, conduct research and experiments on specific topics. . In addition to a deep understanding of life and changes in society, the student's activity is especially noted for the importance of correctly and reasonably understanding the innovations in the field of education, enriching his views on this with the theoretical views of world pedagogy.One of the main features of today's integration process is the formation of a self-management system in the educational process, the development of skills in this regard, and the level of the acquired concepts at the level of international requirements. A student with self-control skills develops higher knowledge and skills than those who are focused only on the results of teacher control. This gives a wide opportunity for the student to learn the essence of learning, to become a mature specialist in his field, and to become a staff at the level of international requirements. In this article, it is emphasized that the formation of the ability of students to learn, which gives them a reasonable opportunity to understand the possibility of independent education.
Key words: pedagogue, motivation, skills, independent education.

Enter. Pupils and students will have the opportunity to form independent opinions, draw conclusions, and execute judgments. He will have a wider opportunity to perform independent work, to express his views in creative and analytical approaches, and to record his concepts in a reasonable manner. Each student should have a deep sense of responsibility, enrich their independent understanding of their views, and open a wide way to allow them to draw reasonable conclusions.The main activity of students in the process of completing independent educational tasks is to enable them to make independent conclusions, to express their concepts in a simple but reasonable way. It was based on the fact that it directly serves to ensure the student's activity and curiosity. To ensure that the student tries to record the concepts he will explain based on the speaking lesson.Literature review. In the main part of the literature on the topic, an attempt was made to pay serious attention to the processes of independent education, but the essence of this concept was not adequately explained. The characteristics of the art of oratory have been recorded since ancient times. In this work, attention is paid to the views about the specific principles of public speaking [1]. On the basis of the art of public speaking, the concept of recording is proved to be the embodiment of the concept of clear, expressive recording [2]. Approaching the views in the mentioned literature theoretically, we would like to note that it is necessary to be directly aware of the student's way of thinking, his oratory art [3]. In order to produce a highly qualified specialist, it is noted that it is necessary not only to train the student, but also to form the practice of independent work [4], familiarization with literature [5], drawing conclusions [6].Content. At the heart of today's changes in the field of education in the process of globalization, it is necessary to organize the independent work of the student into a certain system, to make him feel his activity at a high level. At the heart of any discovery is the fact that, together with the activity of a person, he has consciously decided that his independent research will lead him, which will give him a wide opportunity for fortune-telling.Serious reforms in Uzbekistan are becoming more visible in the field of education, which requires the persons who determine the development of the society directly to form the conscious and thinking of students, and also to form their sufficient knowledge and skills in such a process. Therefore, it is necessary to note the need to study the education system of France, England, the USA, Germany, Japan, which are the leading countries of the world, to introduce their most characteristic aspects in this field, to form cooperation with their leading experts, and it is necessary to note that today's development requires such aspects. . Reasonable thinking is necessary for the maturity of each person, for him to add his share to the development of society within the limits of his ability.

Education of young people is very important in the development of society. At the heart of this is the development of the future, the consistency and activity of the next generations, which is the basis for explaining the various features of the process. In addition to forming a logical consistency in all aspects of continuous education, which is the basis for ensuring the literacy of students, it is necessary to allow him to think independently. The main feature of this concept is the presence of advanced ideas in the student's views, regardless of the language he communicates.The main feature of the family education system in the Republic of Uzbekistan is to ensure the activity of each student, to comprehensively reveal the methods of independent analytical approaches in the study process. Because during the student's education, it is not limited to lectures, practicals, and seminars, but the most important of them is to take a serious look at their independent research, rulings and conclusions, while ensuring the logical consistency of each of the specified topics. The student's independent work, together with expanding the possibility of understanding the scope of the topics, allows him to enrich his thinking.Don't forget that independent education allows students to gain a deeper understanding of the activity of students and the effectiveness of their research on a given topic. It should not be forgotten that the goal is to give students a wider opportunity to think and make judgments. It is necessary to analyze the performance of daily activities on the basis of free concepts, and to pay serious attention to the main principles of their views when covering the specified topic. One of the criteria that determines the level of a student's adequate education requires a serious attitude to their independent research activities. It is one of the correct and sufficient methods of acquiring knowledge, together with determining the student's social activity, providing a basis for his independent views, research, familiarization with the text, analysis of the necessary topic, deep understanding of their characteristics and drawing conclusions based on the use of literature. It is also necessary for him to feel his responsibility.In addition to creating a wide opportunity for the student to get independent education, it is also important to create a wide opportunity for him, to constantly encourage his research in the way of creating knowledge and innovation. This, together with the expansion of the student's ability to think, creates conditions for an increase in self-confidence. Helping the student to be successful in his studies and research, making him confident in the knowledge he has received, will have a positive effect on his further work.A science teacher should not forget that every student is a person who provides the future, and should treat him from this point of view. This allows the student's respect for the teacher to increase, as well as his confidence in himself and his work in a dialectical unity. There is also a great content phenomenon in the communication between the

student and the teacher. Because paying attention to the logicality of each student's reasoning, reasonable thinking, the consistency and sequence of concepts, encouraging them in this process, gives a wide opportunity to increase their confidence. It is necessary to consistently listen to the student's thoughts and ensure that he does not deviate from the topic. It is also possible to give a reasoned statement of the scope of the specified topic, sometimes orally, sometimes in writing. The combination of these two situations, together with his independent views, allows his literacy to grow.

Summary. It is necessary to emphasize that every understanding of the student should be based on the textuality instilled in his views, and should also form the culture of communication. During the dialogue, it is necessary to pay serious attention to the student's eloquence, methods of conveying the scope of concepts, and not to forget to encourage them from time to time.

Paying serious attention to how a student learns independent tasks in the field of science, expands his thinking as well as the ability to understand science and draw logical conclusions. It should not be forgotten that the eloquence formed in the student in this process gives a wide opportunity to form all the processes of oral and written presentation of the topic. Because educational processes focused on a person prepare the ground for the enrichment of his concepts and are the basis for the rise of self-confidence.

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INFORMATION IN THE PROCESS OF ELECTRONIC EDUCATION METHODS OF ENSURING SECURITY

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ABSTRACT
In the following years, it became possible to generalize the reforms in the field of education in Uzbekistan with pedagogical achievements in the gradual development of world civilization, to understand the leading principles in a coherent manner, and to create an environment for the exchange of experiences. In this process, there is a need to establish concepts, news, their place in the information service in every field of education. It was specially noted that there is a need to further improve the continuous education system, to rapidly implement forms of education at the level of quality and meeting international standards. The essence of the reforms aimed at bringing out the educational process in harmony with the modern needs of the labor market is explained.Considering the essence of the changes in the world education system as the need to understand a person, the process of staffing preparation together with modern pedagogical technologies, with the understanding of its essence, is related to the process of formation. One of the unique principles of the effectiveness of the lesson was the generalization of the concepts arising from the conscious approach of the student.The changes in the basis of educational development show that non-traditional interactive teaching methods have also entered in organic unity with the traditional methodology. This, together with expanding the possibility of effective work of pedagogues, creates an opportunity for the introduction of the electronic education process. It is noted that the formation of attitudes towards the principles and principles of the national methodology, and the fact that it is changing based on the standards of education, made it possible to advance opinions based on analytical views on the basis of concepts in the field of global education.The benefits of the electronic education process require a deep understanding of its essence and justification of its methodological features. Analytical approach to situations such as the essence of views in the educational system of developed countries, a reasonable analysis of its methodological and educational features, drawing conclusions. In person-oriented education, emphasis is placed on increasing the attention of the teacher to the independent research of students, and the processes of providing remote evaluation based on the electronic system are also based on theoretical foundations and concepts. In this process, the principles of protection of information and its protection against attacks were expressed.It cannot be denied that the basis of information security in the e-learning process is the evaluation of the student, the result of his aspirations for research. In the process of continuous education along with the change in the essence of the views, it was felt that there is also a demand to move towards world education standards and to have a reasonable approach to its leading principles. One of the most characteristic aspects of the period. Discussions about educating talented and potential cadres and ensuring the perfection of the information system in the main educational process were also discussed.
Key words: training, characteristic, electronicization, trust, aspiration.

Enter. Long-term research shows that it cannot be denied that electronicization is the demand of the times, that it has its own principles. Because it is natural for a student who steps into a family educational institution to have great confidence and love for education. However, it is necessary to create an opportunity to further develop their activities, views, love for the image. Every student is looking for a scientific leader, a mentor who will try to open the knowledge and potential in him, and he is looking for him. It is necessary to take into account the unique talent of the student, his interest and love for his profession. This process also requires the meaningful grazing of every moment of the student. Because the views in the process of globalization, the integration system also bring about reforms in the current education system. In this regard, it should not be forgotten that a number of tasks such as the development and implementation of the electronic education system, its mechanism, strict control of information security have already formed as one of the global problems. Therefore, the merits of the electronic information system, the tradition of its formation on the basis of the established laws, and the exchange of experience with the developed educational system of the world are also required.

Literature review. The development of the electronic information system makes it possible to form its features on the basis of a wide range of possibilities. In the textbook "Psychology", E.G. Ghaziyev noted how difficult a task it is to describe a person and explain his character, and he emphasized that the process of globalization manifests its various characteristics, and in the process of information [1] and dissemination, it affects the psychology of a person. focused on [2]. In the textbook "Preschool Pedagogy" by F.R. Kadirova and others, it was noted that the role of the information system is incomparable in the early formation of the child [3], and the concepts that allow him to think correctly and logically [4] are recognized. The materials of the conference "Global Education and Development of Methodology" also touched on such issues to a certain extent. attention was paid to primary information [5].

The main part. In the following years, at the heart of the reforms in the field of education in Uzbekistan, the desire to prepare personnel responding to the era of globalization has increased. Therefore, measures are being developed to further improve the educational system, increase its quality and efficiency. In the educational system, opening up the inner potential of students, giving them a wide opportunity to think and express independent concepts, adapting their activities to the modern spirit, and enabling them to become individuals and experts who respond to the processes of integration. required. They were required to work on new projects,

to reveal the main features of the information system, to be able to justify its place in the process of globalization, and to be sure of its activity in this process.

Student's activity and its characteristics are at the heart of the development of reforms in the educational system. In 2017-2021, in the "Strategy of Actions" according to the five priority areas of the development of the Republic of Uzbekistan, further improvement of the continuous education system, increasing the possibilities of quality education services, continuing the policy of training highly qualified personnel in line with the modern needs of the labor market it was not without reason that the notions of continuation were firmly established. On the basis of these concepts, together with reforms in the education system, a number of issues such as further improvement of research and innovation activities, implementation of scientific and innovation achievements into practice were put forward.Indeed, today's globalization process requires modernization of all sectors. Therefore, in recent years, the introduction of traditional interactive methods into the field of education, in order to ensure its gradual development, makes it possible to improve the conditions of giving and receiving information. Based on this, it should be noted that the principles and principles of the national methodology are closely related to the new innovative teaching methods. The basis of modern education is the electronic information system, its functions play a leading role, which is manifested in an integral unity with the development of this field.As the reforms in the field of education are implemented, the need for effective and reasonable use of international concepts of education and the results of research conducted at the world level has emerged, which has also created an opportunity to study and implement the leading principles in the field of education of developed countries. Together with the production of the research results, it also creates the possibility to continue in a logical consistency. Today, it is necessary to note that the development of world science is closely related to the achievements in education, therefore, the strengthening of the information system has also formed its own principles.Information security also allows keeping electronic documents and their necessary aspects secret. On the basis of the reforms in the field of education, distance learning of the student has formed the need to ensure the proper operation of various information systems. Because the results of research in the field of education and the content of the content are the basis for improving these theoretical views and paying serious attention to them.

Summary. The excellence of any field of education is inextricably linked to its electronicization and demonstration of its security. It should not be forgotten that the concept of globalization is based on this concept. The development of human thinking, together with

the embodiment of the features of any era, is in a dialectic unity with the criteria determining the development of society in their views, reforms. This, in turn, is reflected in the distribution and reception of information together with the improvement of the electronic system.

In general, from the end of the 20th century to the first quarter of the 21st century, the rise of social reforms, the renewal of scientific networks allowed the updating of the characteristics of the information system. Each social reality sets specific goals and tasks for a certain science, which allows it to expand its features and express the uniqueness of its principles.

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SYNTHESIS, SPECTRAL CHARACTERIZATION, AND ANTIPROLIFERATIVE ACTIVITY OF A NOVEL THYMOL-LINKED IMINO COMPOUND

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ABSTRACT
In this study, a novel thymol-linked imino compound was synthesized and characterized using FTIR, NMR, and elemental analysis. The antiproliferative activity of this compound was tested against two human cancer cell lines. According to the *in vitro* cytotoxic activity results, although the synthesized compound had antiproliferative activity against both cell lines, its effect was found to be lower than cisplatin. IC_{50} values of this Schiff base molecule were obtained as 61.62 and 45.22 µM in A549 and MDA-MB-231 cell lines, respectively.
Keywords: Antiproliferative activity, Cancer, Thymol.

INTRODUCTION

The incidence and mortality rates of cancer vary by region, country, and type. The most common types of cancers worldwide include lung, breast, colorectal, prostate, and stomach cancers. However, the incidence and mortality rates of specific types of cancer vary by region and population. The number of new cancer cases diagnosed annually continues to increase globally. This increase is partly due to factors such as population growth, aging, changes in lifestyle habits (such as smoking, diet, and physical activity), and improvements in cancer detection and diagnosis.One class of extensively used organic chemicals is Schiff bases, or imines, which have a wide range of applications in pharmaceutical, organic, analytical, and bioorganic chemistry, among other domains [1,2]. Numerous biological actions, including antifungal, antibacterial, antimicrobial, genotoxic, antiviral, antioxidant, and anticancer properties, have been widely recognized [3-8]. Schiff bases have potential applications in optical switching devices, nonlinear optical devices, security, and trace inspection devices, in addition to various biological functions [9]. Thymol, scientifically referred to as 2-isopropyl-5-methylphenol is the predominant constituent found in thyme plants [10]. Thymol, a highly potent molecule, is as a fundamental synthetic precursor for the fabrication of a diverse array of pharmacologically active compounds [11]. Moreover, the substitution of a compound with an imine functional group greatly enhances the biologically active characteristics of Schiff bases, which are heavily reliant on their molecular configuration [9-11].In this study, a novel thymol-linked imino compound was synthesized by the reaction of 4-aminothymol and an appropriate aldehyde to determine its cytotoxic activity. Its structure was elucidated by FTIR, NMR, and elemental analysis. The antiproliferative activity of this compound was tested against two human cancer cell lines.

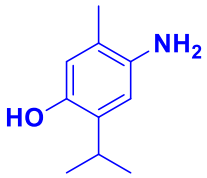
EXPERIMENTAL

Materials and Methods

All chemical substances and solvents used in the production of the desired compounds and laboratory experiments were obtained from commercial vendors such as Merck, Sigma-Aldrich, Across Organics, and Thermo Fisher Scientific, and were employed without the need for supplementary purification. The melting points of the synthesized compound was determined utilizing a DMP-100 digital melting point apparatus. Fourier-transform infrared spectroscopy (FT-IR) was conducted using a Perkin Elmer Spectrum 400 spectrometer. Attenuated total reflection (ATR), in combination with infrared spectrometry using a Fourier transform, was employed in the analyses. ^{1}H NMR and ^{13}C NMR spectra, were acquired in

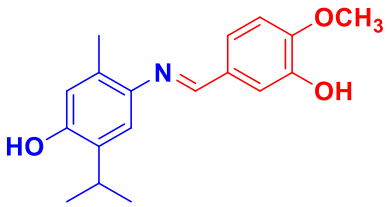
DMSO-d_6 solutions using a Bruker AVANCE III 400 MHz spectrometer. Tetramethylsilane served as an internal reference at frequencies of 400 MHz and 100 MHz for the ^{1}H NMR and ^{13}C NMR spectra, respectively. Elemental analysis was conducted using a Thermo Scientific Flash 2000 elemental analyzer.

Synthesis of 4-aminothymol



2-isopropyl-5-methylphenol (5.00 g) was dissolved in 25 mL EtOH, and 25 mL concentrated HCl was slowly added to the solution. After the mixture was cooled to 0 °C, $NaNO_2$ (3.60 g) was added and the mixture was stirred for 2 h. To obtain 2-isopropyl-5-methyl-4-nitrosophenol, the product was filtered, cleaned with cold water, and dried in a vacuum oven after exposed to open air. 2-isopropyl-5-methyl-4-nitrosophenol (1.00) g) was dissolved in 8 mL NH_4OH and 14 mL distilled water. C_2H_5NS (0.84 g) was then slowly added to the solution and stirred for 2 h at 25 °C. The product was filtered, washed with cold water, dried first in open air and then in a vacuum oven. Brown solid; yield: 72%; m.p. 180-181 °C (lit. [12] 177 °C).

Synthesis of 4-((3-hydroxy-4-methoxybenzylidene)amino)-2-isopropyl-5-methylphenol



Isovanillin (0.1 mmol) dissolved in EtOH (5 mL) was added dropwise to a solution of 4-aminothymol (0.1 mmol) dissolved in EtOH (5 mL). After refluxing the mixture for 6 h, the reaction was completed using TLC. The resulting solid was filtered, dried, and crystallized in ethanol. The targeted thymol-linked imino compound was obtained with yellowish color and 78% yield. M.p. 172-174 °C. FT-IR/ATR (ν_{max}, cm^{-1}): 3556 (O-H), 3068, 3004 $(C\text{-}H)_{aromatic}$, 2960, 2864 $(C\text{-}H)_{aliphatic}$, 1609 (C=N). ^{1}H NMR (400 MHz, DMSO-d_6, ppm): 9.27 (s, 1H, thymol–O*H*), 9.12 (s, 1H, Ar–O*H*), 8.32 (s, 1H, –C*H*=N), 7.43 (s, 1H, Ar–*H*), 7.27 (d, *J* = 8.1 Hz, 1H, Ar–*H*), 7.01 (d, *J* = 8.2 Hz, 1H, Ar–*H*), 6.85 (s, 1H, Ar–*H*), 6.64 (s, 1H, Ar–*H*), 3.82 (s, 3H, Ar–OCH_3), 3.16 (septet, 1H, thymol–C*H*$(CH_3)_2$), 2.21 (s, 3H, thymol–CH_3), 1.17 (d, *J* = 6.8 Hz, 6H, thymol–CH(CH_3)$_2$). ^{13}C NMR (100 MHz, DMSO-d_6, ppm): 150.74 (*C*=N), 156.36, 152.86, 147.17, 142.25, 132.77, 130.51, 130.44, 122.17, 116.96, 115.37, 113.74, and

112.07 (Ar*C*), 56.07 (O*C*H$_3$); 26.84 (*C*H(CH$_3$)$_2$), 23.05 (CH(*C*H$_3$)$_2$), 17.70 (*C*H$_3$); Elemental analysis for $C_{18}H_{21}NO_3$ (299.37 g/mol); Calculated, %: C, 72.22; H, 7.077; N, 4.68; Found, %: C, 72.39; H, 7.18; N, 4.81; S.

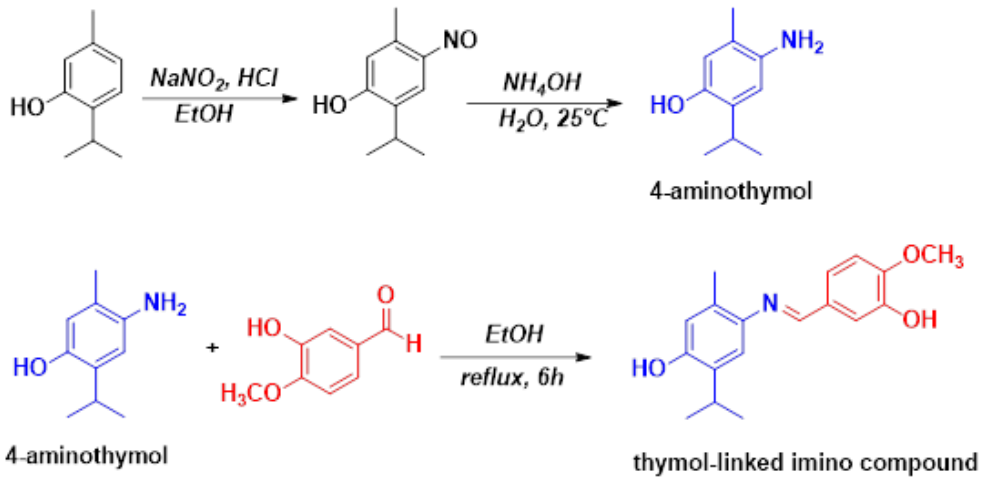
Antiproliferative activity studies

The antiproliferative activity studies were performed according to following the procedure of our previous studies [13, 14]. The human breast cancer cell line (MDA-MB-231; ATCC® HTB-26™) and the human lung cancer cell line (A549; ATCC® CCL-185™) were purchased from the American Type Culture Collection (ATCC, USA). Cancer cells were cultured in Dulbecco's modified Eagle's medium-high glucose (DMEM) supplemented with 10% fetal bovine serum (FBS) and %1 glutamax. The cells were seeded at a density of 5×10^3 cells/well in sterile 96-well plates. The MDA-MB-231 and A549 cells were exposed to different concentrations of compound (200, 100, 50, and 25 µM) for 72 h. The MTT solution was added to each well of the plates and incubated for another 2 h. Absorbance values were measured in the Elisa plate reader at 590 nm. IC_{50} values were calculated using GraphPad Prism Software 5.

RESULT AND DISCUSSION

Chemistry

In this study, we synthesized a new thymol-linked imino compound by reacting the 4-aminothymol compound synthesized in our previous study [10] with isovanillin in ethanol to investigate its antiproliferative activity. The synthesis of this compound is illustrated in Scheme 1. Thymol-linked imino compound underwent characterization through elemental analysis as well as spectroscopic techniques including FT-IR, ^{1}H, and ^{13}C NMR. The characterization data obtained exhibited a high level of compatibility with the corresponding molecular structure.



Scheme 1. Synthesis pathway of target compound

FT-IR spectroscopy

The primary vibrational bands that were most prominent in the FT-IR spectra of the thymol-linked imino compound detected stretching of the O-H bond (3556 cm^{-1}) and the stretching of the C=N bond in the imine group (1609 cm^{-1}) (Figure 1). In addition, asymmetric and symmetric stretching of the C-H band of the aromatic ring of this compound was observed at 3068 cm^{-1} and 3004 cm^{-1}, respectively, while asymmetric and symmetric stretching of the C-H band of the aliphatic group was observed at 2960 cm^{-1} and 2864 cm^{-1}, respectively (Figure 2).

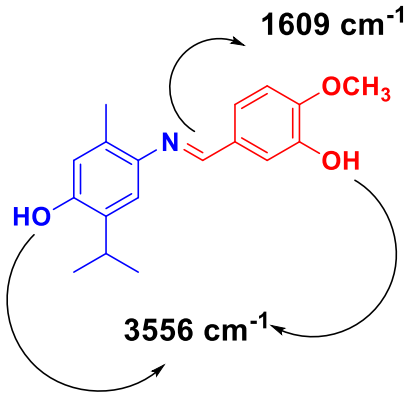


Figure 1. Display of important data for FT-IR on the structure of the target compound

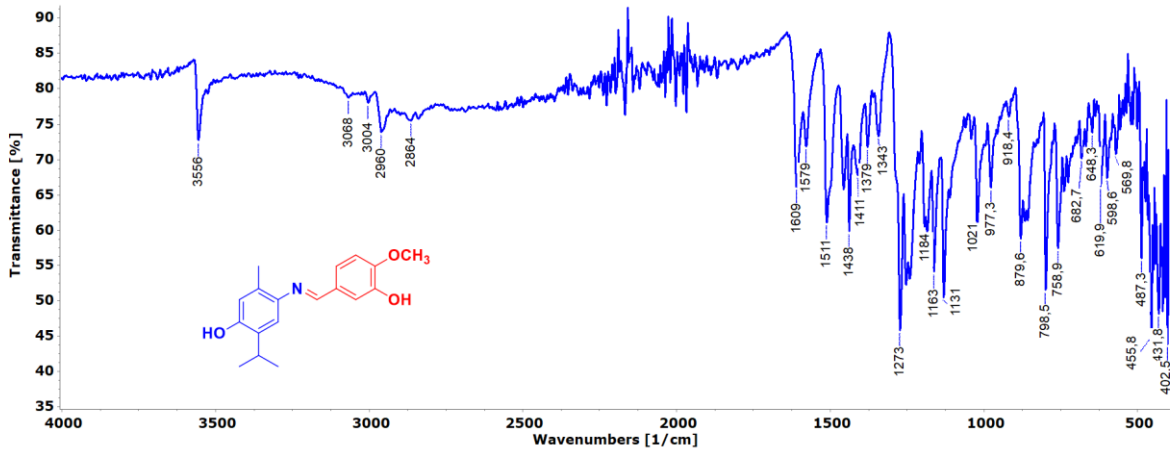


Figure 2. FT-IR spectra of Schiff base derivative

NMR spectroscopy

In the ^{1}H NMR spectra of the Schiff base derivative, it was determined that the proton of the azomethine CH=N, which serves as the most distinctive characteristic denoting the creation of a Schiff base, exhibited resonance as a singlet at δ 8.32 ppm. Furthermore, the proton of the –

O*H* group within the thymol framework in the structure was observed to resonate at δ 9.27 ppm, while the methyl protons (–C*H*$_3$) exhibited resonance at δ 2.21 ppm. Additionally, the protons of the isopropyl group (–C*H*(CH$_3$)$_2$ and –CH(C*H*$_3$)$_2$) resonated at δ 3.16 and 1.17 ppm, respectively (Figure 3). The protons (Ar-*H*) of the aromatic rings resonated within the range of δ 6.64 to 7.43 ppm. The protons of O*H* and OC*H*$_3$ groups of isovanillin were found to be resonant at δ 9.12 ppm and δ 3.82 ppm, respectively (Figure 4).

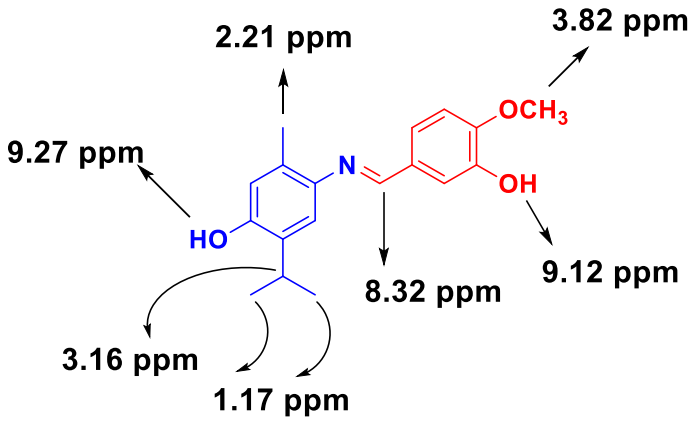


Figure 3. ^{1}H NMR demonstration on the structure of the target compound

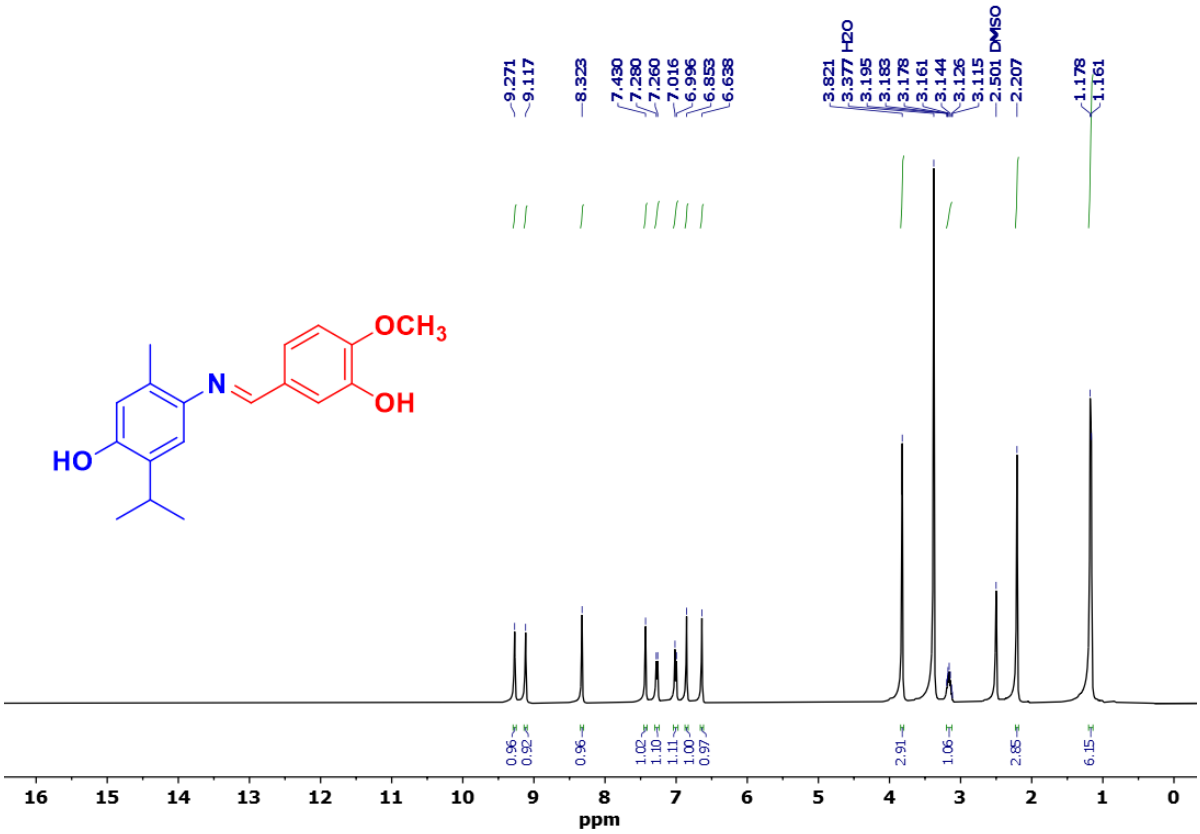


Figure 4. ^{1}H NMR spectra of Schiff base derivative

In the ^{13}C NMR spectra of the compound, the carbon atom with the *C*H=N functional group exhibited a resonance at δ 150.74 ppm (Figure 5). Additionally, the aromatic carbons (Ar-C) displayed resonances between δ 112.07 and δ 156.36 ppm. Furthermore, the methyl carbon (–CH_3) of thymol demonstrated resonance at δ 17.70 ppm, in contrast to the methoxy carbon (–OCH_3) of isovanillin, which showed resonance at δ 56.07. In addition, isopropyl carbons (–*C*H(CH_3)$_2$ and –CH(*C*H_3)$_2$ of thymol) exhibited resonances at approximately δ 27 and δ 23 ppm, respectively (Figure 6).

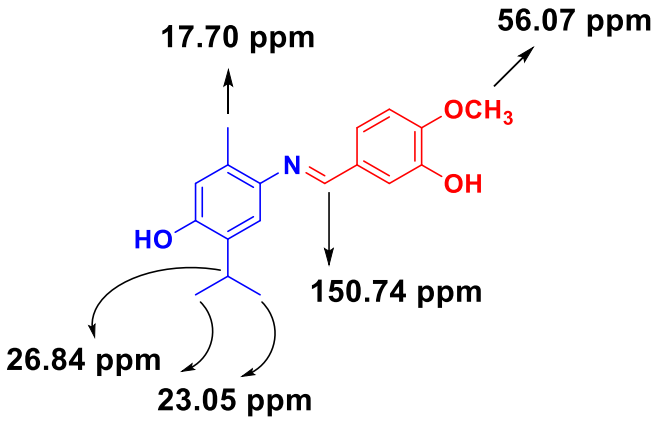


Figure 5. ^{13}C NMR demonstration on the structure of the target compound

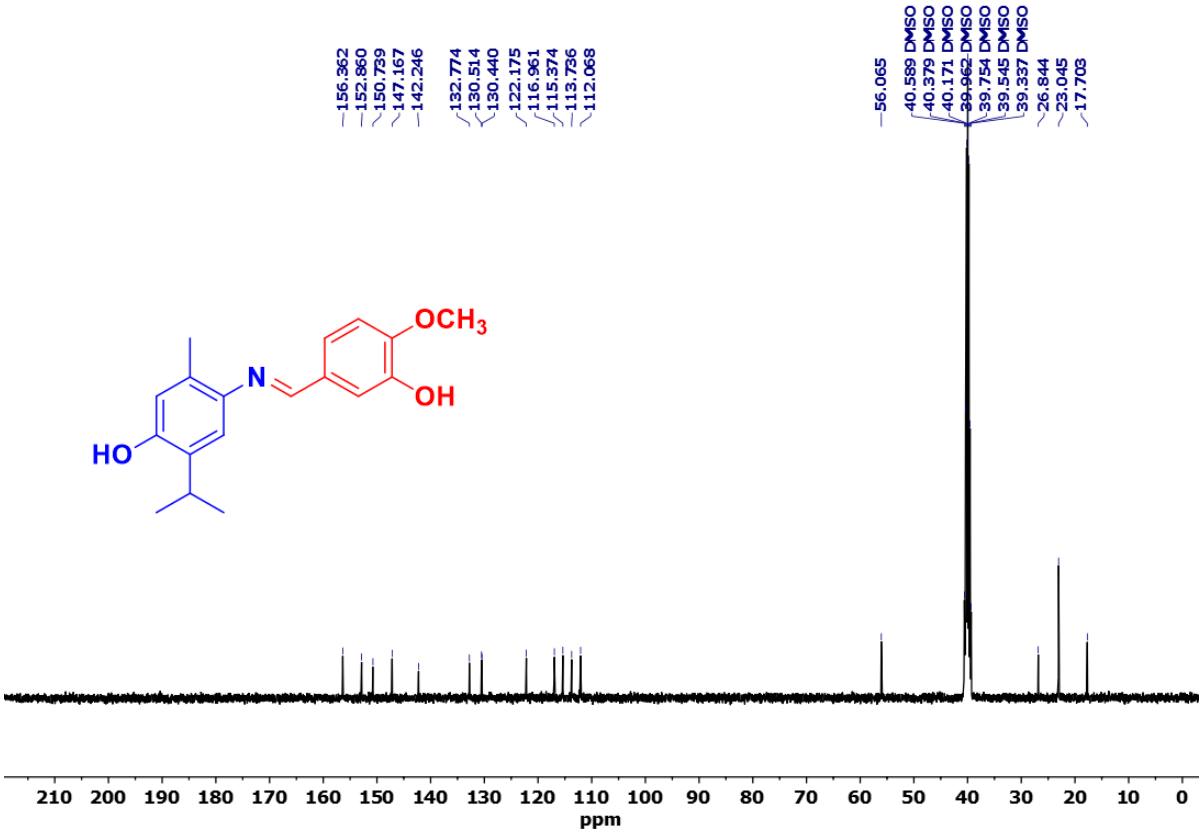


Figure 6. ^{13}C NMR spectra of Schiff base derivative

Antiproliferative Activity Studies

Schiff base derivative was evaluated for its cytotoxicity at 200, 100, 50, and 25 µM µM concentrations in cancer cell lines for 72 h using the MTT assay method. The results are presented in Table 1.

Table 1. IC_{50} results for compounds against human cancer cell lines

Compounds	**IC_{50} (µM)**	
	A549	**MDA-MB-231**
Schiff base derivative	61.62	45.22
Cisplatin	13.22	8.36

According to the IC_{50} values obtained, this compound had antiproliferative activity and an effect comparable to that of the positive control in the A549 and MDA-MB-231 cell lines, with IC_{50} values of 61.62 and 45.22 µM, respectively. As can be seen in Table 1, the synthesized compound showed lower effectiveness than cisplatin against both cell lines.

CONCLUSION

A synthesized new compound was synthesized, characterized using different spectroscopic methods. This new molecule was tested in two cancer cell lines, and the results demonstrated that the compound had antiproliferative activity against A549 and MDA-MB-231 cells. Studies on this compound will continue to be conducted and tested against different cancer cell lines.

ACKNOWLEDGMENTS

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A NOVEL FLUORINE-CONTAINING HYDRAZONE COMPOUND: SYNTHESIS, STRUCTURAL AND *IN VITRO* CYTOTOXICITY STUDIES

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ABSTRACT
In this study, a novel fluorine-containing hydrazone compound was synthesized via the reaction of 4-fluorobenzoic hydrazide with an appropriate aldehyde. The structure of the compound was elucidated using elemental analysis and spectroscopic methods such as FT-IR, ^{1}H, and ^{13}C NMR. The cytotoxic activity of this molecule was tested in a human lung cancer cell lineafter 72 h of incubation. The results showed that the fluorine-containing hydrazone compound had a cytotoxic effect on the A549 cell line with an IC_{50} value of 137.80 µM.
Keywords: Hydrazone, Cancer, Cytotoxic activity.

INTRODUCTION

Lung cancer is a type of cancer that begins in the lungs. It is one of the most common types of cancer and a leading cause of cancer-related death worldwide. There are two main types of lung cancer: non-small cell lung cancer (NSCLC) and small cell lung cancer (SCLC). Non-small-cell lung cancer (NSCLC) accounts for approximately85% of all lung cancer cases. It includes several subtypes such as adenocarcinoma, squamous cell carcinoma, and large cell carcinoma. Small cell lung cancer (SCLC) is less common, but tends to grow and spread more aggressively than NSCLC.Hydrazone derivatives, a versatile class of organic compounds, are renowned as an essential compound class in organic chemistry and widely utilized in diverse domains within the field [1]. Hydrazones with the general chemical formula R1CO-NH-N=CR1(H)R2 have gained significant attention in recent times because of their effectiveness as reactive agents in the creation and production of novel compounds [2]. The compounds in question, which are produced through the reaction of hydrazine with aldehydes or ketones in appropriate organic solvents, sometimes in the presence of an acid catalyst, can be readily identified using elemental analysis and established spectral techniques. These compounds can function as both nucleophiles and electrophiles and can undergo various reductive and oxidative changes. [3]Recently, the attention of medicinal chemists has focused on hydrazones owing to their biological activities [4,5]. Their significance has increased in recent years because they are frequently utilized in the synthesis and discovery of biologically active molecules in medicinal chemistry [6]. Numerous studies have reported that these compounds possess a wide range of biological activities, including antioxidant, anti-bacterial, anticonvulsant, analgesic, antimicrobial, anti-HIV, anti-tubercular, anticancer, antidepressant, and so on [7-15]. In this study, a novel fluorine-containing hydrazone compound was synthesized via the reaction of 4-fluorobenzoic hydrazide with an appropriate aldehyde. The structure of the compound was elucidated using elemental analysis and spectroscopic methods such as FT-IR, ^{1}H, and ^{13}C NMR. The cytotoxic activity of this molecule was investigated in a human lung cancer cell line *in vitro* for 72 h.

EXPERIMENTAL

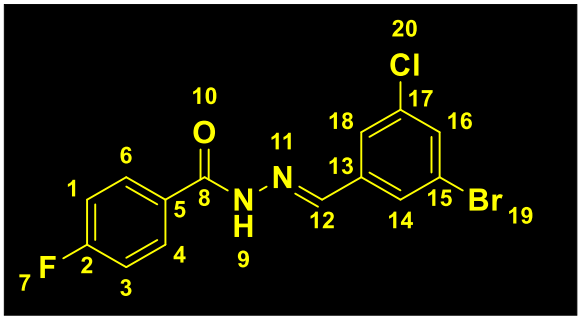
Materials and Methods

All starting materials (4-fluorobenzoic hydrazide (CAS No.: 456-06-4), 3-bromo-5-chlorobenzaldehyde (CAS No.: 188813-05-0), and solvents employed in this investigation were obtained from Sigma-Aldrich and Merck. These were used without additional refinement for all the experiments. The progression of the reactions was observed using TLC plates, which

were subjected to UV light (254 nm) for identification of the spots. The melting point of synthesized hydrazone compound was assessed using a DMP-100 digital melting point apparatus and were not corrected. FT-IR spectra were recorded on a Perkin Elmer Spectrum 400 spectrometer with ATR (Attenuated Total Reflectance). ^{1}H and ^{13}C NMR spectra were recorded on a Bruker Avance III 400 MHz spectrometer using DMSO-d_6 as the solvent and tetramethylsilane as an internal standard at 400 MHz and 100 MHz, respectively. Elemental analyses (C, H, N) were performed using a Thermo Scientific Flash 2000 elemental analyzer.

Synthesis of N'-(3-bromo-5-chlorobenzylidene)-4-fluorobenzohydrazide

3-Bromo-5-chlorobenzaldehyde (1 mmol) and 4-fluorobenzoic hydrazide (1 mmol) were dissolved in ethanol (10 mL). Following reflux of the reaction mixture for approximately 4 h under constant stirring, it was allowed to cool to ambient temperature. Subsequently, the resulting crude product was removed via filtration, meticulously rinsed multiple times with diethyl ether, and finally crystallized using ethanol to obtain the hydrazone derivative (Scheme 1). White solid, 81% yield, mp. 219-220 °C. Anal. Calcd. for $C_{14}H_9BrClFN_2O$: C, 47.29; H, 2.55; N, 7.88%. Found: C, 47.41; H,2.38; N, 7.97%.



Scheme 1. Open structure of hydrazone compound

FT-IR spectroscopy

FT-IR (ATR, cm^{-1}) υ_{max}: 3169 (N-H str.), 3062, 2949 (aromatic C-H str.), 1660 (C=O str., hydrazone), 1601 (C=N str., imine) (Figure 1).

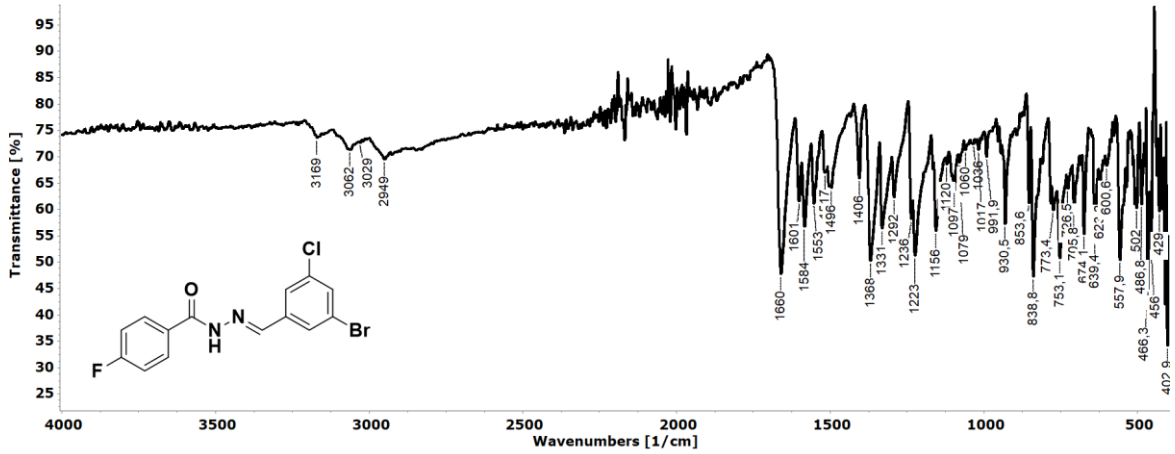


Figure 1. FT-IR spectra of hydrazone compound

[1]H NMR spectroscopy

[1]H NMR (400 MHz, DMSO-d_6) δ (ppm): 12.16 (N**H**CO, H9), 8.32 (s, 1H, –C**H**=N, H12), 8.00 (t, *J* = 6.8 Hz, 2H, aromatic protons, H4 and H6), 7.91 (s, 1H, aromatic proton, H16), 7.79 (d, *J* = 9.5 Hz, 2H, aromatic protons, H1 and H3), 7.38 (t, *J* = 8.7 Hz, 2H, aromatic protons, H14 and H18) (Figure 2).

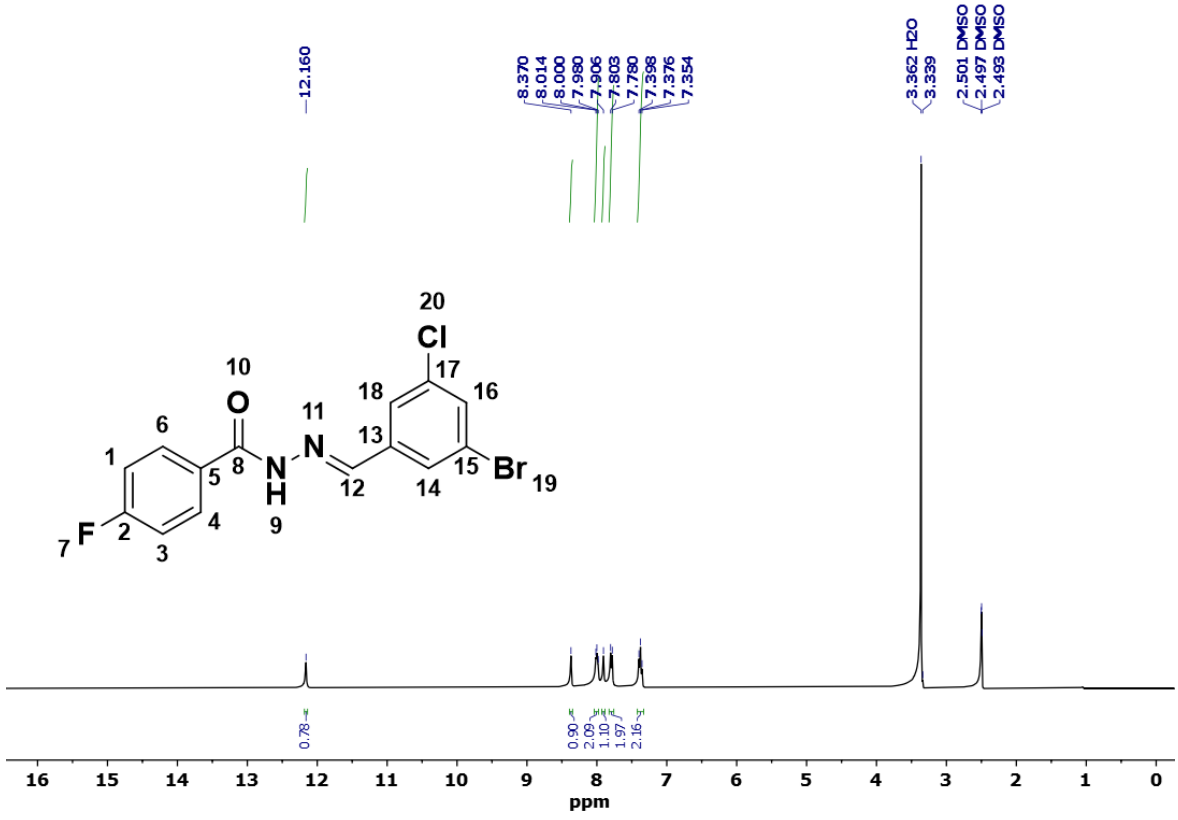


Figure 2. [1]H NMR spectra of hydrazone compound

^{13}C NMR spectroscopy

^{13}C NMR (100 MHz, DMSO-d_6) δ (ppm): 165.97 (C=O, C8), 162.76 (ArC$_{ipso}$ to F, C2), 144.97 (CH=N, C12), 138.69, 135.18, 132.16, 130.99, 129.97, 128.57, 126.18, 123.20, 116.06 (ArC, C1, C3, C4-6, C13-18) (Figure 3).

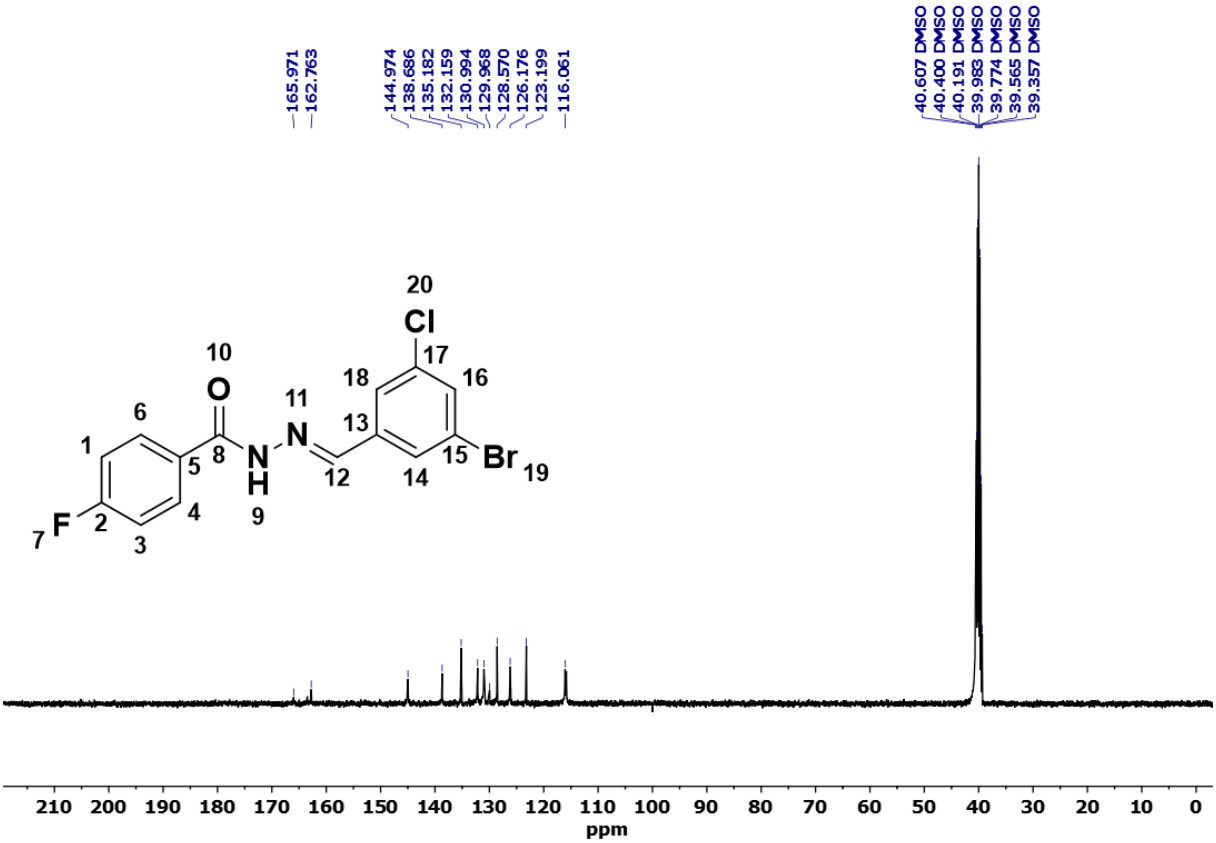


Figure 3. ^{13}C NMR spectra of hydrazone compound

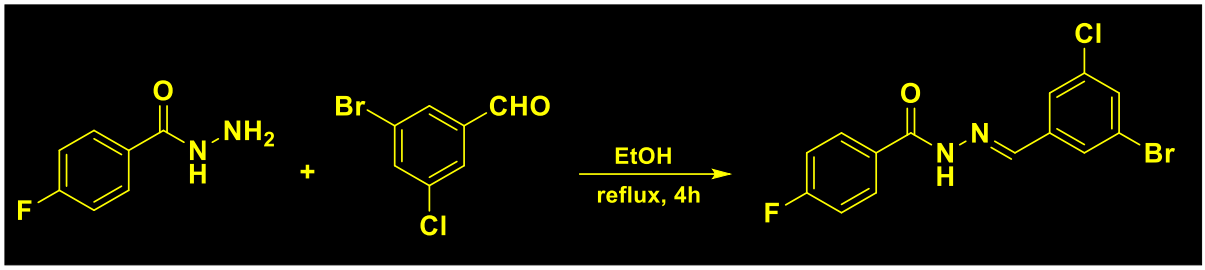
Cytotoxic Activity Studies

The cytotoxic activity studies were performed according to the procedure described in our previous studies [16, 17]. The human lung cancer cell line (A549; ATCC® CCL-185™) was purchased from American Type Culture Collection (ATCC, USA). Cancer cells were cultured in Dulbecco's modified Eagle's medium-high glucose (DMEM) supplemented with 10% fetal bovine serum (FBS) and %1 glutamax. The cells were seeded at a density of 5×10^3 cells/well in sterile 96-well plates. A549 cells were exposed to different concentrations of compound (200, 100, 50, and 25 µM) for 72 h. The MTT solution was added to each well of the plates and incubated for another 2 h. Absorbance values were measured in the Elisa plate reader at 590 nm. IC_{50} values were calculated using GraphPad Prism Software 5.

RESULT AND DISCUSSION

Chemistry

In this study, a new hydrazone compound was obtained by the condensation of 3-bromo-5-chlorobenzaldehyde with the corresponding 4-fluorobenzoic hydrazide (Scheme 2). The structure of thesynthesized compound was elucidation using FT-IR, ^{1}H- and ^{13}C- NMR spectroscopic techniques, and elemental analyses (C, H, and N). Elemental analyses (C, H, and N) were suitable for the proposed structures of the synthesized target compounds.



Scheme 2. Synthesis of new hydrazone compound

Spectroscopic Analysis

The FT-IR spectrum of the hydrazone compound exhibited a peak at 3169 cm^{-1}, which can be attributed to the N-H stretching band. The presence of C=N absorption bands in the 1601 cm^{-1} region provides strong evidence for the formation of an azomethine group (–NH-N=CH–). Furthermore, the occurrence of a distinct and strong band in the 1660 cm^{-1} range, corresponding to C=O, confirms the hydrazone nature of the target compound (Figure 4).

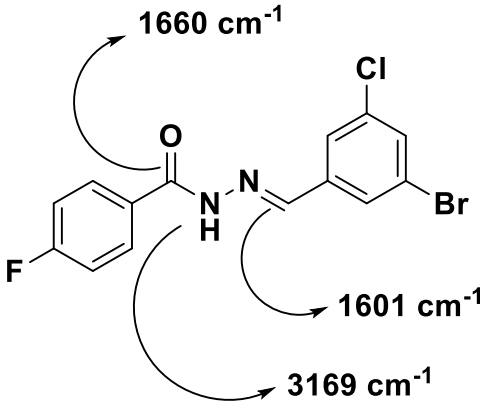


Figure 4. Display of important data for FT-IR on the structure of hydrazone compound

In the ^{1}H NMR spectrum of the hydrazone derivative, the proton belonging to the NH proton resonated as a singlet at 12.16 ppm. Another proof of the successful synthesis of hydrazone compound was the disappearance of the proton peaks of the free amino group of the hydrazide

compound. The proton peaks belonging to –NH-N=CH–resonated at 8.32 ppm and singlet, as expected in the target compound. The aromatic protons of the benzene ring resonated between 7.38 and 8.00 ppm. The ^{13}C NMR spectrum of the target compound showed that the C=O carbon in the carbonyl group resonated at 165.97 ppm, and the aromatic carbons resonated in the range of 162.76-116.06 ppm. Resonance of the carbon atom of the –C=N group in the range of 144.97 ppm (Figure 5).

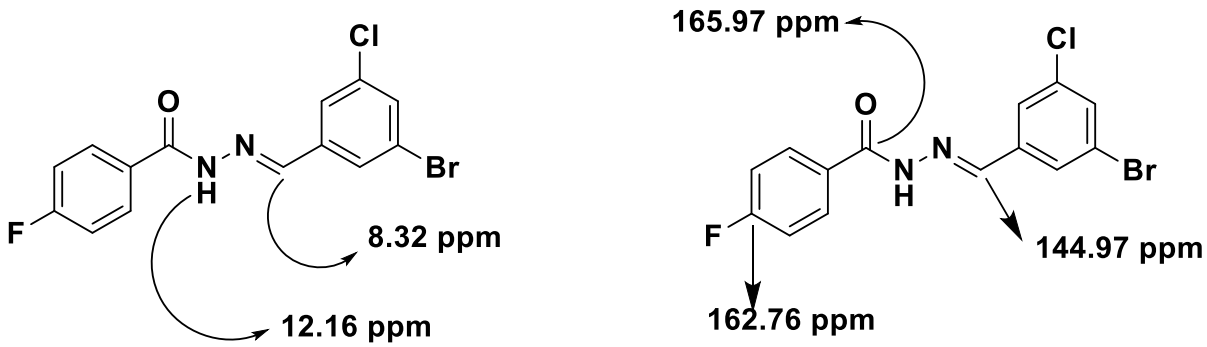


Figure 5. ^{1}H and ^{13}C NMR demonstration on the structure of hydrazone compound

Cytotoxic Activity Studies

The cytotoxicity of hydrazone and cisplatin was evaluated at concentrations of 200, 100, 50, and 25 µM in a lung cancer cell line for 72 h using the MTT assay. The results are presented in **Table 1**.

Table 1. IC_{50} results for compounds against human lung cancer cell line

Compounds	**IC_{50} (µM)**
	A549
Hydrazone compound	137.80
Cisplatin	13.22

IC_{50} (half maximal inhibitory concentration) refers to the concentration of a compound that inhibits biological processes or responses by 50%. This compound has a high IC_{50} value of 137.80 µM, indicating that relatively high concentrations are required to achieve 50% inhibition of the biological response. According to the results in the table above, cisplatin was almost ten times more effective against the A549 cell line than the hydrazone compound.

CONCLUSION

In this study, a novel fluorine-containing hydrazone compound was prepared from 4-fluorobenzoic hydrazide and 3-bromo-5-chlorobenzaldehyde. This compound was

characterized using elemental analysis, FT-IR, ^{1}H NMR, and ^{13}C NMR. This molecule was tested against a human lung cancer cell line for 72 h incubation time. The results showed that the fluorine-containing hydrazone compound had a cytotoxic effect on the A549 cell line with an IC_{50} value of 137.80 μM.

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PROJE UYGULAMA DERSİ ÖZYETERLİK DÜZEYİNİN BELİRLENMESİNDE BİLİMSEL ARAŞTIRMA METODOLOJİSİNİN ROLÜ

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Özet

Bu araştırmanın temel amacı Afyonkarahisar Sağlık Bilimleri Üniversitesi Tıp Fakültesi öğrencilerinin Proje Uygulama dersine ilişkin öz yeterlilik düzeylerini belirlemek ve bu ders ile öğrencinin başka bir ders olan Bilimsel Araştırmalar dersine yönelik tutumları arasındaki ilişkiyi ortaya koymaktır. Araştırmada, Bilimsel Araştırma Öz Yeterlilik Ölçeği ve Bilimsel Araştırma Yöntemleri Tutum Ölçeği kullanıldı. Verilerin değerlendirilmesinde Student-t testi, Mann-Whitney U testi ve Yapısal Eşitlik Modellemesinden yararlanıldı. Araştırmaya toplam 155 öğrenci katıldı. Öğrencilerin %64,5'i Bilimsel Araştırma Yöntemleri dersinin Proje Uygulama dersine faydalı olduğunu bildirdi. Proje Uygulama dersinin Bilimsel Araştırma Yöntemleri dersi tarafından pozitif yönde ve anlamlı düzeyde açıkladığı ve bu sonuçların istatistiksel olarak anlamlı olduğu görüldü.

Anahtar Kelimeler: Öz-yeterlik, Bilimsel Araştırma Yöntemleri, Yapısal Eşitlik Modellemesi

PROJECT IMPLEMENTATION COURSE THE ROLE OF THE SCIENTIFIC RESEARCH METHODOLOGY IN DETERMINING THE SELF-EFFICACY LEVEL

Abstract
The main purpose of this research is to determine the self-efficacy levels of Afyonkarahisar Health Sciences University Medical Faculty students concerning the Project Implementation course, and to reveal the relationship between this course and the student's attitudes toward another course, namely, Scientific Research Methods. In the study, Scientific Research Self-Efficacy Scale and Scientific Research Methods Attitude Scale were used. Student-t test, Mann-Whitney U test, and Structural Equation Modelling were used in the evaluation of the data. A total of 155 students participated in the research. 64.5% of the students stated that the Scientific Research Methods course is beneficial to the Project Implementation course. It was seen that the Project Application course was explained positively and significantly by the Scientific Research Methods course and these results were statistically significant.
Keywords: Self-efficacy, Scientific Research Methods, Structural Equation Modeling

INTRODUCTION

Research, learning, and teaching are the needs of every society and they play a big role in spreading scientific services and improving society (Salehi & Ahanchian, 2012). The desire to solve social problems in a healthier way is one of the most important reasons for conducting scientific research (Aslan & Karagül, 2016). At universities, the Scientific Research Methods course is taught at undergraduate, postgraduate, and doctorate degreesStudents who take this course at the undergraduate level are worried about whether the gains they have gained from the course in business life will work for them (Murtonen et al., 2008). Undergraduate and graduate students think that they will encounter problems in many subjects such as being inadequate in the literature review, data collection, and data analysis. Scientific Research Methods course; The basic concepts of research include research types, research features, research methods, research processes, data collection and analysis methods, report writing, and interpretation of research results. Students who attend the Scientific Research Methods course generally acquire skills such as accessing information, determining the characteristics of the research, knowing the ways of accessing the data, and determining the research stages (Kurt et al, 2011). The main purpose of this research is to determine the self-efficacy levels of Afyonkarahisar Health Sciences University, Medical Faculty students concerning the Project Implementation course and to reveal the relationship between this course and the students' attitudes towards another course, namely, Scientific Research Methods.

MATERİALS AND METHODS

While Afyonkarahisar Health Sciences University, Faculty of Medicine students who are enrolled in their 4th, 5th, and 6th year comprise the population, the sample of this project consists of the students who take the Project Implementation course and want to participate in the studyThe Scientific Research self-efficacy scale developed by Tuncer et al. Was used to determine the students' self-efficacy levels in the Project Application Study course (Tuncer & Ozeren, 2012). This scale consists of 12 items in total. These 12 items include four sub-dimensions: 2 of them "Literature", 2 of them "Method", 3 of them "Discussion" and 5 of them "Suggestion and Reference". The scale of attitude towards the Scientific Research Methods course developed by Yaşar consists of 20 items in total. These 20 items include four sub-dimensions: 6 of them are the importance of scientific research, 5 of them are cognitive "Self-confidence", 5 of them are positive attitude "Interest", and 4 of them are daily life-professional relationship "Occupational" (Yaşar, 2004). Student t-test, Mann-Whitney U test and Structural Equation Modeling were used to evaluate the data. Structural Equation Modeling is a frequently

used statistical method in modeling causal relationships between variables. Especially in health sciences (medicine, nursing, psychiatry, etc.), economics, social sciences, behavioral sciences (sociology, psychology, education, management, marketing, etc.) and sports sciences, it is used in the analysis of causality in evaluating the relationships between variables and in testing theoretical models (Doğan, 2015). A value of $p < 0.05$ was accepted for statistical significance. SPSS (version 20) package program and AMOS (21.0) were used to evaluate the data.

FİNDİNGS AND DİSCUSSİON

A total of 155 students (75 males, 80 females) with a mean age of 22.63 ± 1.5 years participated in the study. 33.5% of the students stated that their most important aim in this lesson was to conduct scientific research and 64.5% of them stated that the Scientific Research Methods course was beneficial for the Project Application Study course. Self-efficacy scores of students who think that the Scientific Research Methods course is beneficial are significantly higher than other students ($p < 0.05$). As can be seen from Table 1, the students who think that the Scientific Research Methods course is beneficial for the Project Application Study course; The scores of the importance of scientific research, cognitive self-confidence (ability to succeed), positive attitude (research-oriented) and daily life-professional relationship sub-dimensions are significantly higher than the other students ($p < 0.05$).

Table 1. Scores of the Sub-dimensions of the Attitude Scale Towards the Scientific Research Methods Course

Do you think that the Scientific Research Methods course is beneficial for the project implementation work?			
Sub-Dimensions	**Yes (100)** $\bar{x}$**±SD**	**No (55)** $\bar{x}$**±SD**	**P**
Importance	3.34±0.85	2.74±0.69	<0.05
Cognitive Self-confidence	3.61±0.79	2.98±0.80	<0.05
Positive Attitude	3.16±0.88	2.47±0.66	<0.05
Daily Life-Professional relationship	3.34±0.85	2.74±0.69	<0.05

SD: Standard Deviation

Confirmatory Factor Analysis was conducted to determine whether the factor structures in the original form of the scales were verified within the framework of this study. The Goodness of Fit values obtained as a result of the Confirmatory Factor Analysis performed on the attitude scale of the Scientific Research Methods course (CMIN / DF = 2.66, GFI =0.77, CFI =0.89, NFI =0.84, AGFI =0.71 and RMSEA =0.10) has been calculated. In addition, the goodness of

fit values obtained as a result of the confirmatory factor analysis for the Scientific Research self-efficacy scale (CMIN / DF = 4.97, GFI =0.79, CFI =0.89, NFI =0.87, AGFI =0.66 and RMSEA =0.16) was calculated. According to the confirmatory factor analysis results regarding the validity of the scales; It can be said that the values of the goodness of fit indices of the model created are at an acceptable level (Meydan & Şeşen, 2011). As a result of these analyses, it can be said that the factor structures in the original form of the scales were also confirmed for this study, in other words, this scale has sufficient validity. The goodness of fit values obtained as a result of the structural equation modeling created to determine the effect of the attitude of the Scientific Research Methods course on the Project Application Study course was calculated as CMIN / DF = 2.28; GFI =0.71; CFI =0.87; NFI =0.79; AGFI =0.66; It was found that RMSEA =0.09. According to these results, it can be said that the values obtained are at an acceptable level.According to the results regarding the structural equation model, it was seen that the Project Application Study course was explained positively and significantly (β= 0.81, $p < 0.05$) by the Scientific Research Methods course and these results were statistically significant. According to these results, it can be said that as the positive attitude towards the Scientific Research Methods course increases, the self-efficacy levels of the Project Application Study course increase.Many studies have been conducted in education, psychology, sociology and generally social sciences (Baloğlu, 2003; Çoğaltay, 2016; Lei, 2008; Baki, 2017; Boswell, 2013; Zeidner, 1991). However, no such study was found in Medical Faculties. In these studies, it was stated that students developed a negative attitude toward the scientific research course. In the study, 56.1% of the students participating in the study stated that they would not choose this course if the course was elective. This high rate of students shows their negative attitude towards this course. Lei stated that high-level research anxiety reduced the sense of self-efficacy and caused people to develop negative attitudes toward research (Lei, 2008). In the study conducted by Ravazi et al., They stated that there is a significant negative relationship between research anxiety and self-efficacy. They stated that research anxiety among graduate students may have a negative effect on their performance in different ways (Razavi et al., 2017). Research anxiety can reduce the quantity and quality of students 'scientific productivity and cause students' burnout and dissatisfaction, and anxiety towards research can affect personal life and even cause physical and mental health deterioration.According to the results, it was observed that as the positive attitude towards the Scientific Research Methods course increased, the self-efficacy levels of the Project Application Study course increased. In most studies, it is stated that taking research methods courses encourages individuals to do research and increases

their research self-efficacy levels, and individuals with high research self-efficacy are very willing to participate in research in the future (Saraçoğlu et al., 2005). It has been observed that the students who are interested in the Scientific Research Methods course, who are aware of the importance of the research and have a positive view, have the power to succeed in this course and associate it with their daily life, have higher self-efficacy in the Project Application Study course. Therefore, it is thought that emphasizing the importance of the Scientific Research Methods course to students, will increase their interest in this course and contribute to the training of students who show a positive attitude towards scientific culture. Academic education should prepare students with an understanding of the skills they need in society and their future work life (Murtonen et al., 2008).

CONCLUSİON AND RECOMMENDATİONS

Considering the result regarding the structural equation model, it was observed that as the positive attitude towards the Scientific Research Methods course increased, the self-efficacy levels of the Project Implementation Study course increased. Based on the fact that the students develop positive attitudes towards the areas they are interested in and love, we think that this course will shed light on the relevant parties in order to determine the deficiencies, if any, and to make the necessary arrangements against these deficiencies in order to make this course more useful. For this reason, is thought that the faculty members' attitudes towards the Scientific Research Methods course and turn towards activities that increase positive attitudes towards the effect of their approach to this course on students will have positive contributions to students.

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TÜRKİYE'DE ÇOCUK, ERGEN VE GENÇ YETİŞKİNLERDE İNTİHAR MORTALİTE TRENDLERİ

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Özet
Bu çalışmada, Türkiye'de 2009-2022 yılları arasında çocuk, ergen ve gençlerde intihara bağlı mortalitenin cinsiyet ve yaş gruplarına göre trend analizini incelemeyi amaçladık. Araştırmada kullanılan veriler Türkiye istatistik Kurumu resmi internet sitesinde yer alan ölüm veri tabanından elde edildi. Yaşa özel mortalite oranlarının değerlendirilmesinde üç farklı yaş grubu (<15, 15-19, 20-24) dikkate alındı. Joinpoint Regresyon Analizi kullanılarak intihar mortalite trendleri tahmin edildi. Yıllık yüzde değişim ortalama yıllık yüzde değişim ve bunlara ait güven aralıkları verildi. 2009-2022 döneminde yaklaşık 47.000 kişi intihar nedeniyle hayatını kaybetti. Bunun dörtte biri <24 yaş grubundadır. Joinpoint Regresyon Analizi'ne göre, erkeklerde <15 yaş grubunda periyod boyunca istatistiksel olarak anlamlı azalma görülürken (p=0.013), 20-24 yaş grubunda ise periyod boyunca istatistiksel olarak anlamlı artış görüldü (p<0.001). Kadınlarda <15 yaş grubunda periyod boyunca istatistiksel olarak anlamlı azalma, 15-19 yaş grubunda ise 2020 yılına kadar anlamlı azalma (p=0.001) sonrasında ise anlamlı olmayan artış görüldü. Bu yaş grubunda intihar düşünceleri hızla gelişebilir ve bu nedenle kriz hizmetlerinin yaygın olarak mevcut olması gerekir.
Anahtar kelimeler: Joinpoint Regresyon Analizi; intihar; mortalite

SUICIDE MORTALITY TRENDS IN CHILDREN, ADOLESCENTS AND YOUNG ADULTS IN TURKEY

Abstract
This study aims to analyze the trend analysis of suicide-related mortality among children, adolescents, and young people in Turkey between 2009 and 2022 by gender and age groups. The data used in the study were obtained from the mortality database on the official website of the Turkish Statistical Institute. Three different age groups (<15, 15-19, 20-24) were considered in the evaluation of age-specific mortality rates. Suicide mortality trends were estimated using Joinpoint Regression Analysis. Annual percentage change, average annual percentage change, and their confidence intervals were given. Approximately 47,000 people died by suicide in the period 2009-2022. A quarter of these were in the <24 age group. According to the Joinpoint Regression Analysis, there was a statistically significant decrease in the <15 age group in males over the period ($p=0.013$), while there was a statistically significant increase in the 20-24 age group over the period ($p<0.001$). In females, there was a statistically significant decrease in the <15 age group throughout the period a significant decrease in the 15-19 age group until 2020 ($p=0.001$), and a non-significant increase thereafter. Suicidal thoughts can develop rapidly in this age group and therefore crisis services should be widely available.
Keywords: Joinpoint Regression Analysis; suicide; mortality

GİRİŞ

İntihar dünya çapında önemli bir halk sağlığı sorunu olarak kabul edildiğinden intihara ilişkin epidemiyolojik çalışmalar çok sayıdadır. Dünya genelinde her yıl 703.000 kişi intihar nedeniyle hayatını kaybetmektedir. Sadece yüksek gelirli ülkelerde değil, dünyanın tüm bölgelerinde görülen küresel bir olgudur. 2019 yılında küresel intiharların %77'den fazlası düşük ve orta gelirli ülkelerde meydana gelmiştir. İntihar, 15-29 yaş grubunda dördüncü önde gelen ölüm nedenidir (WHO, 2021). Çocuklar ve ergenler arasında intihar oranları artmaya devam etmektedir; Amerika Birleşik Devletleri'nde 15 ila 19 yaş arası ergenlerde ikinci önde gelen ölüm nedenidir (Benton ve ark., 2021). Garnett ve arkadaşları intihar oranlarının 15-24 yaş arası erkeklerde 2020 ile 2021 arasında önemli ölçüde arttığını ifade etmiştir (Garnett ve Curtin, 2023). Gerstener ve arkadaşları Ekvator'da 1990 ile 2017 yıllarını kapsayan çalışmalarında, 10-14 yaş arası genç erkeklerde, kızlarda, ergen erkeklerde ve genç yetişkinlerde artış olduğunu bildirmişlerdir (Gerstener, 2019). Bosna'da 2010 ile 2020 yılları arasında en büyük artışların 15 ila 29 yaş arası gençler arasında meydana geldiği vurgulanmıştır (Cilovic-Lagarija ve ark., 2021). Milena ve Irena'nın 2022 yılında dünya genelinde yaptıkları çalışmada, dünyanın birçok ülkesinde intihar ölümlerinde azalma eğilimi gözlendiğini ama bazı ülkelerde de arttığını, erkeklerde 10-19 yaş grubundaki yaşa özel intihar ölüm oranlarının, tüm yaş gruplarında kadınlara göre iki ila üç kat daha yüksek olduğunu belirtmişlerdir (Ilic ve Ilic, 2022).Becker ve arkadaşları, ruhsal hastalığı olan çocuk ve ergenlerde intihar riski 3 ila 12 kat daha yüksek olduğunu, mobingin de intihar riskini artırdığını bildirmiştir. Ayrıca, çocuklara ve ergenlere antidepresan ilaçların uygulanmasının intihar eğilimini artırdığına dair kanıtlar olduğunu ifade etmiştir (Becker ve Correll, 2020).Depresyon, duygu durum bozukluğu gibi tıbbi bozuklukların geçmişi ve bilişsel bozulmanın intihar için önemli risk faktörleri olduğu belirlenmiştir, ancak sosyokültürel faktörlerin de intihar epidemiyolojisinde önemli bir rol oynadığı göz önünde bulundurulmalıdır (Pompili ve ark., 2015). Yüksek gelirli ülkelerde her kadın ölümü başına üç erkek ölümü, düşük gelirli ve orta gelirli ülkelerde ise her iki kadın ölümü başına üç erkek ölümü oranıyla, riskte önemli cinsiyet dengesizlikleri bulunmaktadır.Bu çalışmada, Türkiye'de 2009-2022 yılları arasındaki intihara bağlı mortalitenin cinsiyet ve yaş gruplarına göre trend analizlerinin yapılması amaçlandı.

MATERYAL VE METOT

Veriler Türkiye İstatistik Kurumu ölüm veri tabanından elde edildi (TÜİK,2022). Uluslararası Dünya Sağlık Örgütü Uluslararası Hastalık Sınıflandırması (ICD-10)'na (World Health Organization, 2004) göre X60-X84 (intihar ve kasıtlı kendine zarar verme) kodları dikkate

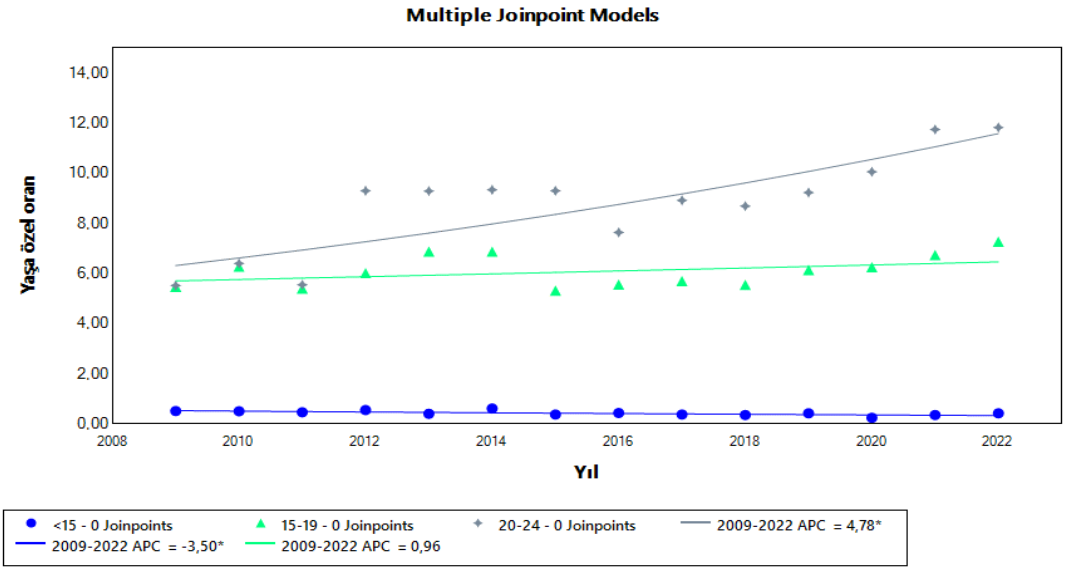
alındı. Cinsiyete göre, farklı yaş grupları (<15, 15-19, 20-24) için yaşa özel oranlar hesaplandı. Yaşa özel oranlar 100,000 kişi başına ölüm olarak ifade edildi. Verilerin değerlendirilmesinde Joinpoint Regresyon Analizi (JRA) kullanıldı. JRA, iki değişken arasındaki ilişkiyi, parçalı doğrusal bir regresyon aracılığıyla açıklayan istatistiksel bir modelleme tekniğidir. Bu teknik, epidemiyolojik çalışmalarda mortalite veya insidans serilerindeki trendleri modellemekte yaygın olarak kullanılmaktadır. JRA'da değişim noktası "joinpoint" olarak tanımlanmış ve 2000 yılında Kim ve arkadaşları bu değişim noktalarının bulunmasında Lerman tarafından önerilen Grid Serch metodu kullanılmıştır (Kim ve ark., 2000). İstatistiksel olarak anlamlı olan her bir değişim noktası için yıllık yüzde değişin (YYD), ortalama yıllık yüzde değişim (OYYD, tüm kırılma noktalarındaki YYD değerlerinin ortalamasıdır) ve bunlara ait %95 güven aralıkları hesaplandı. Analizler, ABD Ulusal Kanser Enstitüsü tarafından hazırlanan Joinpoint Regresyon Programı (versiyon 4.9.1.0–2021) kullanılarak gerçekleştirildi (National Cancer Institute, 2021). P<0.05 değerini istatistiksel olarak anlamlı kabul edildi.

BULGULAR

Türkiye'de, 2009-2022 döneminde yaklaşık 47,000 kişi intihar nedeni ile hayatını kaybetmiştir. Bunların yaklaşık %75'i erkektir. Bu dönemde <25 yaş grubunda ise intihar mortalite sayısı 11,700 kişidir. Bu toplam intihar ölümlerinin dörtte birini oluşturmaktadır. Ülkemizde bu yaş grubunda intihar mortalite oranı erkeklerde kadınlardan yaklaşık olarak 2 kat daha fazladır (Tablo 1).Yaş gruplarına göre değerlendirildiğinde erkeklerde <15 yaş grubunda periyod boyunca istatistiksel olarak anlamlı düşüş gözlenirken (p=0.013), 20-24 yaş grubunda ise periyod boyunca istatistiksel olarak anlamlı artış gözlemlendi (p<0.001) (Şekil 1, Tablo 2).

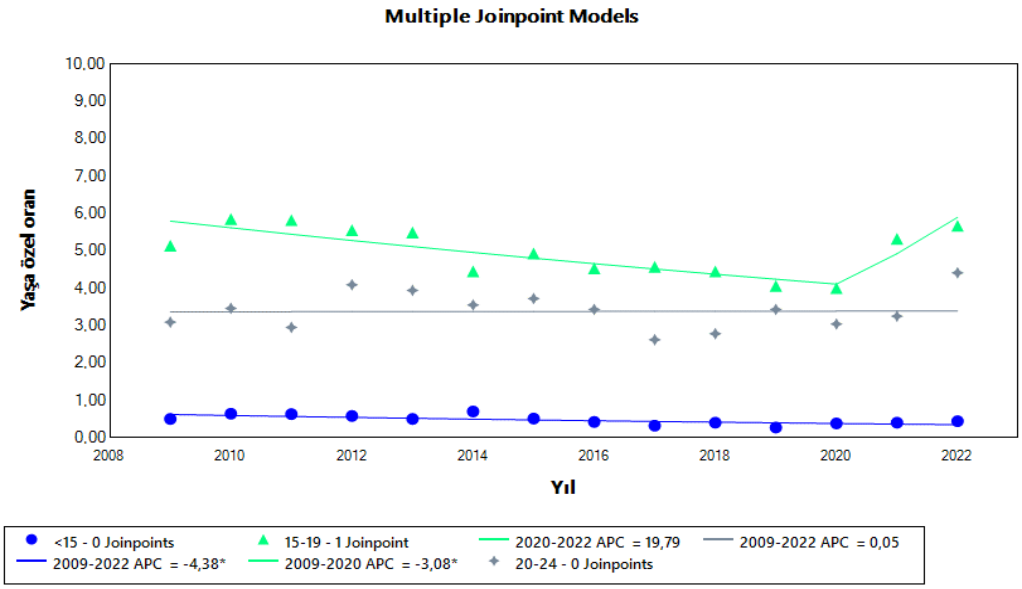
Tablo 1. Çocuk, ergen ve genç yetişkinlerde intihar ölüm sayıları, Türkiye (TÜİK, 2022)

Yıl	<15		15-19		20-24		Toplam		Erkek/Kadın
	Erkek	Kadın	Erkek	Kadın	Erkek	Kadın	Erkek	Kadın	
2009	49	46	175	156	177	95	401	297	1,4
2010	48	59	202	179	205	106	455	344	1,3
2011	45	58	175	179	176	90	396	327	1,2
2012	53	53	198	173	293	124	544	350	1,6
2013	39	46	229	173	294	120	562	339	1,7
2014	59	64	230	141	298	109	587	314	1,9
2015	36	47	180	158	300	115	516	320	1,6
2016	42	39	189	146	248	107	479	292	1,6
2017	36	30	191	145	294	83	521	258	2,0
2018	34	37	183	139	291	89	508	265	1,9
2019	41	25	200	125	313	111	554	261	2,1
2020	23	35	200	121	343	99	566	255	2,2
2021	34	37	216	161	405	107	655	305	2,1
2022	40	41	236	174	401	143	677	358	1,9
Total	579	617	2804	2170	4038	1498	7421	4285	1,8



Şekil 1. Erkeklerde Yaşa Göre İntihar Mortalite Trendleri, Joinpoint Regresyon Analizi

Sonuçları, 2009–2022.Kadınlarda, <15 yaş grubunda periyod boyunca yıllık yüzde 4.4'lük istatistiksel olarak anlamlı düşüş gözlendi. Yine 15-19 yaş grubunda 2020 yılına kadar anlamlı düşüş (p=0.001) sonrasında ise anlamlı olmayan artış gözlendi. 20-24 yaş grubunda ise periyod boyunda bir değişim gözlenmedi (Şekil 2, Tablo 1).



Şekil 2. Kadınlarda Yaşa Göre İntihar Mortalite Trendleri, Joinpoint Regresyon Analizi Sonuçları, 2009–2022.

Tablo 2. Cinsiyet ve Yaş Gruplarına Göre Joinpoint Regresyon Analizi Sonuçları, 2009-2022

	OYYD (GA%95) (2009-2022)	Trend 1		Trend 2	
		Period	YYD (GA%95)	Period	YYD (GA%95)
Erkek					
<15	-3,5 (-6,1;-0,9) (**p=0.013**)	-	-	-	-
15-19	1.0 (-0,5;2,4) (p=0.170)	-	-	-	-
20-24	4,8 (2,6;7,0) (**p<0.001**)	-	-	-	-
Kadın					
<15	-4,4 (-7,2;-1,5) (**p=0.006**)	-	-	-	
15-19	0,11 (-3,0;3,4) (p=0.934)	2009-2020	-3,1 (-4,5;-1,6) (**p=0.001**)	2020-2022	19,8 (-4,1;49,6) (p=0.099)
20-24	0,1 (-2,2;2,3) (p=0.960)	-	-		-

YYD: Yıllık Yüzde Değişim; OYYD: Ortalama Yıllık Yüzde Değişim; GA: Güven Aralığı

TARTIŞMA

Elde edilen sonuçlar, erkeklerde periyod boyunca intihar mortalite oranında anlamlı artışlar olduğunu, kadınlarda ise 2019 yılına kadar anlamlı düşüş sonrasında ise artış olduğu gösterdi. Erkeklerde intihar mortalite oranının kadınlardan yaklaşık iki kat daha fazla olduğu görüldü.

Ekvador'da 25 yaş altı nüfusta intihar önemli bir halk sağlığı sorunudur ve 1990 ile 2017 yılları arasında özellikle çocuklar ve 15-24 yaş arası erkekler arasında artış göstermiştir (Gerstner, 2019). Doğan ve arkadaşlarının 2015 yılında yapmış olduğu çalışmada, 15-24 yaş grubunda dönem boyunca kadınlarda ortalama yıllık %4.9'luk anlamlı düşüş, erkeklerde ise 1987-2005 yılları arasında yıllık %4.9'luk artış sonrasında ise yıllık %2.5'lik düşüş gözlenmiştir (Doğan ve Toprak, 2015). İntihar, çoğunlukla erkeklerde görülen önemli bir halk sağlığı sorunudur. Dünya çapında yaşa özel intihar oranı erkeklerde kadınlara göre 2,3 kat daha yüksekti. Erkek:Kadın intihar oranlarının 1'den büyük olması, intihar oranlarının erkeklerde kadınlara göre daha yüksek olduğunu göstermektedir (WHO, 2021). Ülkemizde ise bu yaş grubunda intihar mortalite oranı erkeklerde kadınlardan yaklaşık olarak iki kat fazladır ve benzer sonuçlar elde edilmiştir. Kadınlar toplamda erkeklere göre yaklaşık iki kat fazla intihar girişiminde bulunmakla birlikte ölümle sonuçlanan intiharlarda erkeklerin gerisinde kalmaktadır (Kırcı, 2017). Özellikle toplumsal baskılar nedeniyle kadının kendini ifade etmesinde sesini yükseltmesinde rahat olmadığı ülke ve topluluklarda intihar girişimi bir imdat çığlığı olarak öne çıkmaktadır. Erkekler, gerçekten ölmeye kararlı olarak girişimde bulunmakta, aynı zamanda ateşli silah, motorlu araç kullanma gibi intihar yollarına daha kolay ulaşmalarından erkeklerde kadınlardan iki kat fazla başarılı intihar görülmektedir. Geleneksel erkekliğin, erkek kırılganlığı için önemli bir risk faktörü olduğu ve duygusal dışavurum, yardım arama isteksizliği veya alkol kullanımı gibi uyumsuz başa çıkma stratejilerini teşvik ettiği gösterilmiştir. Bu temel erkek eğiliminin, farklı toplumsal koşullar nedeniyle psikososyal stresi artırdığı görülmüştür (Möller, 2002). Ekonomik durgunluğun uzun süreli etkisi işsizlik ve iş güvensizliği sorununu ortaya çıkarmaktadır. Durgunluk veya ekonomik kriz yaşayan ülkelerde, erkeklerde intihar oranları artma eğilimi göstermektedir. Bu faktörlerin doğrudan veya dolaylı olarak depresyon, anksiyete, aşırı içki gibi ruh sağlığı sorunlarına ve daha sonra intihar davranışına yol açabileceği ileri sürülmektedir (Haw ve ark., 2014). Kavaklı, yaptığı çalışmasında bölgesel farklılıkların intiharda önemli rol oynadığını, 15-19 yaş grubunda Güneydoğu Anadolu, 20-24 yaş grubunda ise İstanbul'da intihar olaylarının daha yüksek olduğunu ifade etmiştir (Kavaklı, 2023). Türkiye'de son yıllardan üniversitelerin artması, mezun sayılarında da bir artış meydana getirmiştir. Bu artışa rağmen yeterli istihdamın karşılanamaması, özellikle genç işsiz sayısında önemli bir yükseliş göstermiştir. Genç nüfusa sahip olan Türkiye'de bu durum genç işsizliğin artmasına ve bu yaştaki bireylerin hayat beklentilerinin düşmesiyle birlikte intihara yönelimi arttırmaktadır (Kavaklı, 2023).Batman'da 25 yaş ve altı bireylerle yürütülen bir çalışmada en önemli intihar nedenlerinden ilk iş hayatına

erken yaşta katılmak (çocuk işçiliği), diğeri ise erken yaşta evlilikler neticesinde çocuk gelin problemi olarak karşımıza çıkmaktadır (Komisyon, 2022). Duygusal ve davranışsal düzensizlik, teşhis grupları arasında tutarlı bir şekilde intihar davranışlarıyla ilişkilendirilmiştir ve akut ve kronik olarak bağımsız risk faktörleridir (Benton ve ark., 2022). İntihar eğilimi, altta yatan psikiyatrik bozuklukların varlığında daha sık ortaya çıksa da, akut stres tepkileri veya ergenlik krizlerinden de kaynaklanabilir (Becker ve Correll, 2020)

SONUÇ

Dünyanın birçok ülkesinde her iki cinsiyette de kaydedilen düşüş eğilimine rağmen, intihar nedeniyle ölüm oranları bazı popülasyonlarda artış eğilimi göstermektedir (Ilic ve Ilic, 2022). İntihardaki bu artışın önlenmesine yönelik daha etkili önlemler sağlamak amacıyla, daha fazla araştırma yapılarak bu olumsuz eğilimlerin nedenlerini açıklığa kavuşturmalıdır. İntihar, özellikle incelenen yaş grubunda ülkelerin gelecekteki üretken nüfusuna yönelik kayıplara yol açması nedeniyle önemi daha da artmaktadır. Bu yaş grubuna ilişkin alınması gereken tedbirlerin belirlenmesinde intiharın sosyal, kültürel, coğrafi ve yaşla ilgili değişkenleri olduğu unutulmamalıdır. Aile, eğitim, din, ekonomi, siyaset gibi toplumsal kurumların işlevselliklerini sağlamak, toplumsal değişim ve dönüşümlerde mevcudiyetlerini ve etkinliklerini muhafaza etmek, intiharları önlemek açısından değerlidir.

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7075 ALÜMİNYUM ALAŞIMLARINDA SOĞUK SPREY KAPLAMA ÖNCESİ YÜZEY İŞLEMLERİNİN AŞINMA DAYANIMINA ETKİSİ

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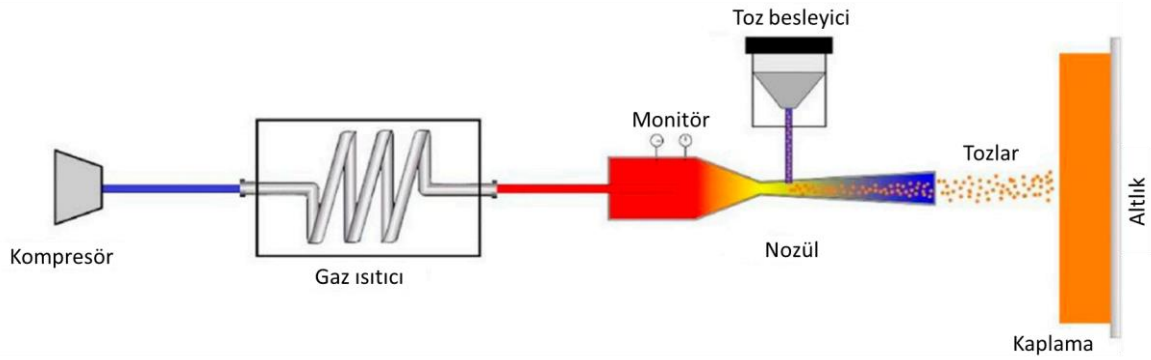
Özet
Alüminyum alaşımları yüksek özgül mukavemet avantajına sahip olsalar da düşük sertlik, aşınma ve korozyon dayanımları nedeniyle bazı uygulamalarda kullanımları sınırlıdır. Yüzey modifikasyonu ise alaşımların sertlik ve aşınma dayanımlarını geliştirmenin etkili bir yoludur. Bu doğrultuda, metal ve seramik içerikli kompozit ve fonksiyonel bir kaplama tabakasının çeşitli termal püskürtme yöntemleri ile yüzeye kaplanması uygulamanın tipine ve gerekliliklerine göre çeşitli avantajlar sağlayabilir. Yapılan çalışmada yüksek özgül mukavemeti ve endüstride sık kullanılması sebebi ile geliştirilmek üzere 7075 Al alaşımı numuneler tercih edilmiştir. Kaplama sırasında numunelerin ısıdan minimum etkilenmesini sağlamak için soğuk sprey yöntemi kullanılmış ve kaplama öncesi uygulanan yüzey işlemlerinin aşınma dayanımına sertlik ve morfolojiye etkisi değerlendirilmiştir. Yüzey işlemleri olarak cam bilye ve çelik bilye ile kumlama, zımparalama ve parlatma işlemleri kullanılmıştır. Kaplamalarda DYMET K714 kodlu Ni, Zn ve Al_2O_3 içerikli ticari tozlar kullanılmıştır. Kaplama sonrası numune morfolojileri Nikon marka Clemex Vision PE yazılımlı mikroskop kullanılarak incelenmiştir. Kaplama kalınlık ölçümleri yine aynı yazılım ve mikroskop kiti kullanılarak kesitlerden alınan görüntülerden yapılmıştır. Mikrosertlik testleri numunelerin enine kesitlerinden, altlık, ara yüzeyler ve kaplama tabakası olacak şekilde farklı bölgelerden alınarak gerçekleştirilmiştir. Sertlik testlerinde HCK-404SXV Dijital Mikro Vickers sertlik cihazı kullanılmış ve 500 gram yük altında ölçümler gerçekleştirilmiştir. Numunelerin aşınma testleri CSM tribometre ball-on disk aşınma cihazı kullanılarak gerçekleştirilmiştir. Aşınma testleri için Al_2O_3 aşındırıcı bilyeler numune yüzeyinde yük 10N olacak şekilde, 10cm/s kayma hızı ile ile kaydırılmıştır. Çalışma sonucunda zımparalama işlemi sonrasında kaplanan numunenin en yüksek sertliğe ve maksimum aşınma dayanımına sahip olduğu gözlemlenmiştir.
Anahtar Kelimeler: Alüminyum, Soğuk sprey, Yüzey işlemleri, Aşınma.

THE EFFECT OF SURFACE TREATMENTS ON WEAR RESISTANCE IN COLD SPRAY COATING OF 7075 ALUMINUM ALLOYS

Abstract
Although aluminum alloys have the advantage of high specific strength, their use in some applications is limited due to low hardness, wear, and corrosion resistance. Surface modification is an effective way to enhance the hardness and wear resistance of alloys. In this context, coating the surface with a composite and functional coating layer containing metal and ceramic components using various thermal spray methods can provide various advantages depending on the application type and requirements. In the conducted study, 7075 Al alloy samples were chosen for improvement due to their high specific strength and frequent use in the industry. The cold spray method was employed during coating to minimize the heat impact on the samples, and the effect of pre-coating surface treatments on wear resistance, hardness, and morphology was evaluated. Surface treatments such as sandblasting with glass beads and steel beads, sanding, and polishing were used. Commercial powders with the code DYMET K714 containing Ni, Zn, and Al_2O_3 were used in the coatings. Post-coating sample morphologies were examined using a Nikon Clemex Vision PE microscope with dedicated software. Coating thickness measurements were also performed using the same software and microscope kit from images taken from cross-sections. Microhardness tests were conducted on transverse sections of the samples, including the substrate, interfaces, and coating layers. HCK-404SXV Digital Micro Vickers hardness tester was used for hardness tests, and measurements were taken under a 500-gram load. Wear tests on the samples were carried out using a CSM tribometer ball-on-disk wear apparatus. For wear tests, Al_2O_3 abrasive balls were slid on the sample surface with a load of 10N and a sliding speed of 10cm/s. As a result of the study, it was observed that the sample coated after sanding had the highest hardness and maximum wear resistance
Keywords: Aluminum, Cold spray, Surface treatments, Wear.

Giriş - Introduction

Alüminyum alaşımı 7075-T651, yüksek mukavemet, hafiflik ve nispeten düşük maliyet gibi çeşitli avantajlar sunar ve otomobil ve uçak imalat endüstrilerinde kritik bir yapısal malzeme olarak yaygın şekilde kullanılmaktadır (Chen et al., 2019; Dursun and Sourtis, 2014). Bununla birlikte, yüzey oksidasyonu ve zayıf aşınma direnci genellikle yüksek sürtünme katsayısına ve şiddetli aşınmaya yol açar (Peng et al., 2018).Alüminyum alaşımlarının aşınma dayanımlarının geliştirilmesinde bir çok yüzey modifikasyon yöntemi ve kaplama malzemesi kullanılmaktadır. Metalik, oksitli veya yüzeyin sonradan oksitlendirilmesine yönelik, seramik ve hatta kompozit kaplamalar yapılarak alüminyum alaşımları ortamın aşındırıcı etkilerinden korunmak istenmiştir (Li et al., 2022; Duan et al., 2021). Farklı yöntemler arasında altlık malzemenin ısınmasını minimuma indirebilecek ve dolayısıyla istenmeyen oksit oluşumunu engelleyebilecek son yıllarda popüler olan bir yöntem ise soğuk sprey kaplama yöntemidir (Kim et al., 2023).Soğuk sprey kaplama sistemleri özellikle düşük basınçlı sistemlerde temelde genellikle kompresöre bağlı bir gaz ısıtıcı, süpersonik bir nozül ve bu nozüle direk olarak bağlı bir toz besleme sisteminden oluşur. Isıtılan gazlar kullanılarak tozlar bu nozülden aktarılır ve altlık yüzeylerine püskürtülür (Vaz et al., 2023). Soğuk sprey kaplama sistemine ait şematik bir gösterim Şekil 1'de verilmiştir.



Şekil 1. Soğuk sprey yöntemi şematik gösterimi (Vaz et al., 2023)

Bu çalışmada, 7075 alüminyum alaşım yüzeylerine iki farklı tür bilye ile kumlama işlemi, zımparalama ve parlatma yüzey işlemleri uygulandıktan sonra aynı koşullar altında K714 tozları ile soğuk sprey kaplama yapılmıştır. Farklı yüzey işlemi olarak parlatma, çelik ve cam bilye ile kumlama ve zımparalama işlemleri seçilmiş ve kaplama sonrası numuneler morfolojik ve mekanik özellik bakımından birbirleriyle karşılaştırılmıştır.

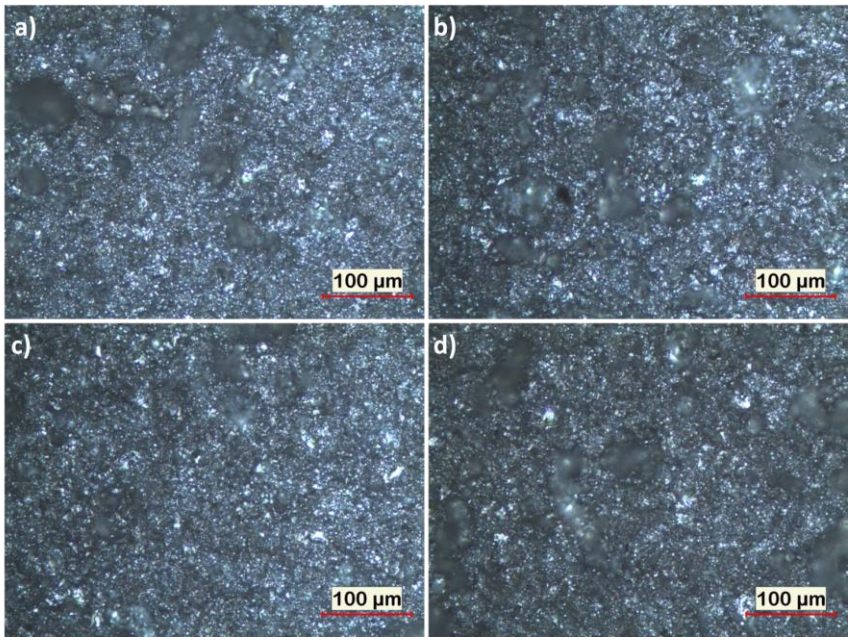
Malzeme ve Metot - Materials and Methods

7075 alüminyum alaşımları altlık malzeme olarak kullanılmak üzere 10x3cm^2 boyutlarında 5 mm kalınlıkta plakalar şeklinde kesilerek hazırlanmıştır. Alaşım yüzeylerine cam bilye püskürtme, çelik bilye ile kumlama, zımparalama ve parlatma işlemleri uygulanmış ve hazırlanan yüzeyler aynı şartlar altında kaplanmıştır. Kaplama yöntemi olarak soğuk sprey yöntemi tercih edilmiş ve kaplama işlemleri 500 ºC sıcaklıkta gerçekleştirilmiştir. Kaplama cihazı olarak DYMET 423 düşük basınçlı soğuk sprey ekipmanı kullanılmıştır. Kaplama işlemlerinde DYMET K714 kodlu Ni, Zn ve Al_2O_3 içerikli ticari tozlar kullanılmıştır. Tüm kaplama işlemlerinde toz besleme hızı 9 g/dk olarak belirlenmiştir.Kaplama sonrası numune morfolojileri Nikon marka Clemex Vision PE yazılımlı mikroskop kullanılarak 200X büyütmede incelenmiştir. Kaplama kalınlık ölçümleri yine aynı yazılım ve mikroskop kiti kullanılarak 50X büyütmede enine alınan kesitlerden gerçekleştirilmiştir. Yüzey pürüzlülük ölçümlerinde Mitutoyo Surftest SJ-310 kullanılmıştır. Mikrosertlik testleri numunelerin enine kesitlerinden, altlık, ara yüzeyler ve kaplama tabakası olacak şekilde farklı bölgelerden alınarak gerçekleştirilmiştir. Sertlik testlerinde HCK-404SXV Dijital Mikro Vickers sertlik cihazı kullanılmış ve 500 gram yük altında ölçümler gerçekleştirilmiştir.Numunelerin aşınma testleri CSM tribometre ball-on disk aşınma cihazı kullanılarak gerçekleştirilmiştir. Aşınma testleri için 6mm çapında Al2O3 bilye aşındırıcı eleman olarak tercih edilmiştir. Aşınma mesafesi olarak 200m belirlenmiş ve yük 10N olacak şekilde ayarlanmıştır. Aşınma yarıçapı 3,3 mm olacak şekilde hazneye yerleştirilen numuneler üzerinde bilye 10cm/s hız ile kaydırılmıştır.

Bulgular ve Tartışma - Findings and Discussion

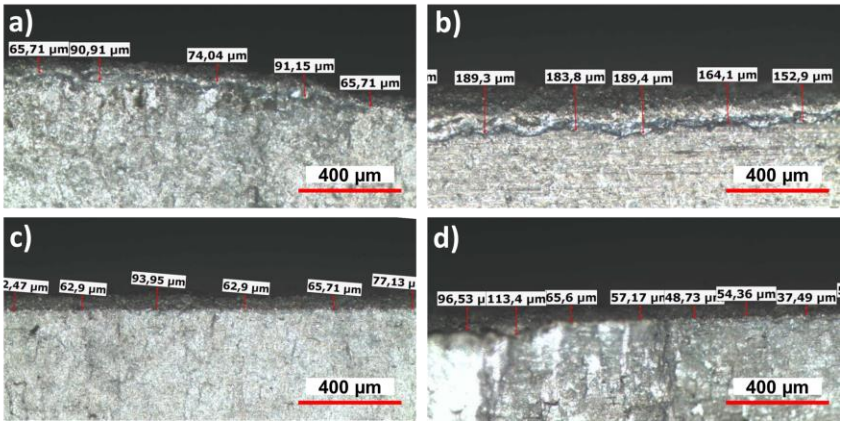
Kaplama sonrası yapılan pürüzlülük ölçüm sonuçlarına göre, cam bilyelerle kumlanmış, zımparalanmış ve parlatıldıktan sonra kaplanmış numunelerin yüzey pürüzlülük değerleri benzerlik göstermektedir. Bu değerler sırasıyla cam bilye ile kumlanan numune için 5,97 µm, zımparalandıktan sonra kaplanan numune için 5,8 µm ve patlatıldıktan sonra kaplanan numune için ise 6,27 µm olarak ölçülmüştür. Numuneler arasında yüzey pürüzlülüğündeki belirgin farkla öne çıkan numune 6,94 µm pürüzlülük değeri ile kumlandıktan sonra kaplanan numune olmuştur. Kaplama tozları soğuk sprey yöntemi ile püskürtüldüğünde, diğer termal sprey yöntemlerindeki gibi tam ergime sağlanmadan kaplama işlemi gerçekleştirilir. Tozlar süpersonik olarak adlandırılan bir kritik hıza ulaştıktan sonra yüzeye çarptırılır ve bu hızın etkisiyle plastik deformasyona uğrar (Assadi et al., 2016; Vinay et al., 2022). Başlangıçtaki yüzeyin pürüzlü olması kaplama sonrası yüzeyin pürüzlülük oranını etkileyebilir. Fakat soğuk sprey yönteminde atomsal boyutta düzenli bir birleşme söz konusu olmadığı için pürüzsüz ve

parlatılmış yüzeylerde dahi pürüzsüz bir kaplama yüzeyi elde etmek mümkün değildir. Daha yüksek hızla çarpan ve daha küresel şekle sahip olan, plastik deformasyonun daha kolay gerçekleşebileceği parçacıklar, kaplama sonrası daha yassı tanecikler olarak yapıda bulunacağından, pürüzlülüğü bir miktar azaltabilir (Gül et al., 2022). Vaz vd. (2023), çalışmalarında ise kumlanmış ve pürüzlendirilmiş yüzeylerde daha heterojen bir büyümeden söz edileceği için pürüzlülüğünde kaplama sonrası artmış olacağını vurgulamışlardır. Artan pürüzlülük ise daha efektif bir kaplama eldesini sağlayabilir Vaz vd., (2023). Kaplama sonrası yüzeylerden alınan mikroskop görüntüleri Şekil 2'de verilmiştir. Görüntüler alınan pürüzlülük ölçümlerini destekler niteliktedir.



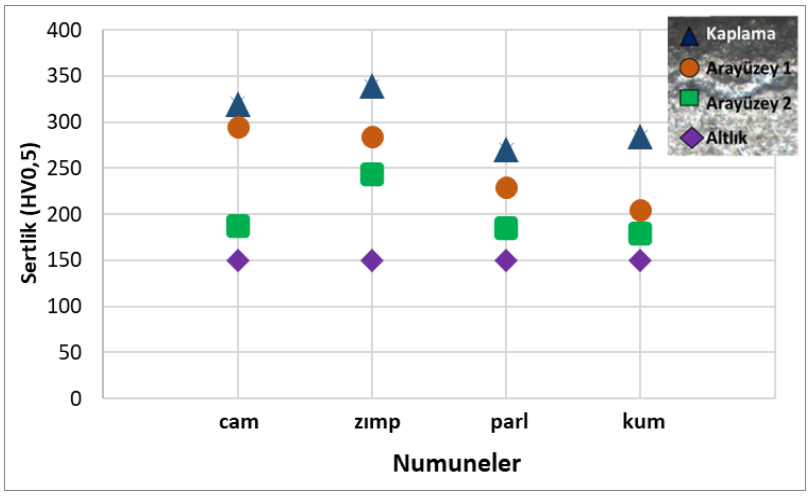
Şekil 2. Kaplanmış yüzeylerden alınan mikroskop görüntüleri a) cam, b) zımparalanmış, c) parlatılmış d) kumlanmış numune yüzeyleri (200X büyütme)

Kaplanmış numunelerin kesitlerinden alınan kaplama kalınlık ölçümleri Şekil 3'te verilmiştir. Alınan ölçümlere göre ortalama kaplama kalınlıkları ortalamaları cam bilye ile kumlanan numune için 67,6 µm, parlatıldıktan sonra kaplanan numune için 72,52 µm ve kumlama sonrası kaplanan numune için 77,5 µm olarak ölçülmüştür. Numuneler arasında yüzey pürüzlülüğündeki belirgin farkla öne çıkan numune ise zımparalandıktan sonra kaplanan numune olmuştur ve kaplama kalınlığı ortalaması 175,9 µm olarak ölçülmüştür. Zımparalanmış numunede kaplama tabakasının altında oksit tabakası olduğu düşünülen ikinci bir tabakaya rastlanmıştır. Bu tabakanın kaplama kalınlığını destekler nitelikte olduğu düşünülmektedir.



Şekil 3. Kaplanmış numune kesitlerinden gerçekleştirilen kaplama kalınlık ölçümleri a) cam, b)zımp, c)parl d)kum numune yüzeyleri (50X büyütme)

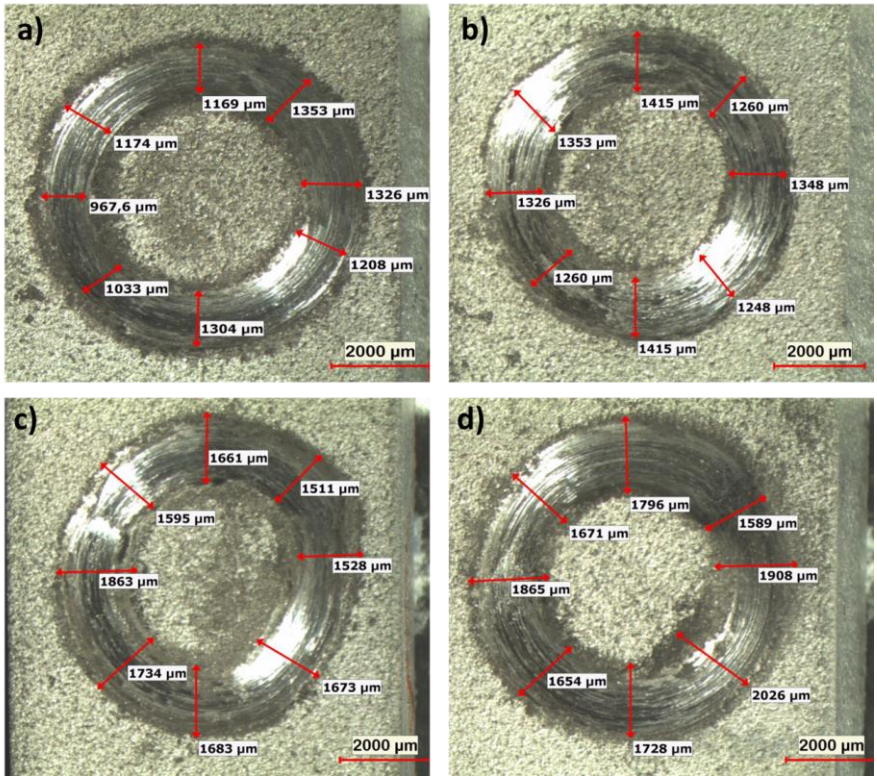
Kaplanmış numunelerin sertlik ölçümleri Şekil 4'te verilmiştir. Altlık WE43 Mg alaşımının sertliği 150 HV0,5 olarak ölçülmüştür ve tüm numunelerde ortalama bu değerdedir. Arayüzeylerden yapılan ölçümler ile de paralel olacak şekilde en yüksek sertlik zımparalanmış numunede gözlemlenmiş olup kaplama tabakası altında gözlemlenen oksit tabakası olduğu düşünülen tabakanın, ana kaplama yapısının sertliğini artırıcı nitelikte olmasıdır. Tüm kaplanmış numunelerin sertliği altlık malzemenin sertliğinden yüksek olmakla birlikte mikrosertlik ortalamaları cam bilye ile kumlanan numune için 320 HV0,5, parlatıldıktan sonra kaplanan numune için 270 HV0,5, kumlama sonrası kaplanan numune için 284 HV0,5 ve zımparalama sonrası kaplanan numune için 339 HV0,5 olarak ölçülmüştür.



Şekil 4. Numunelerin mikrosertlik grafiği

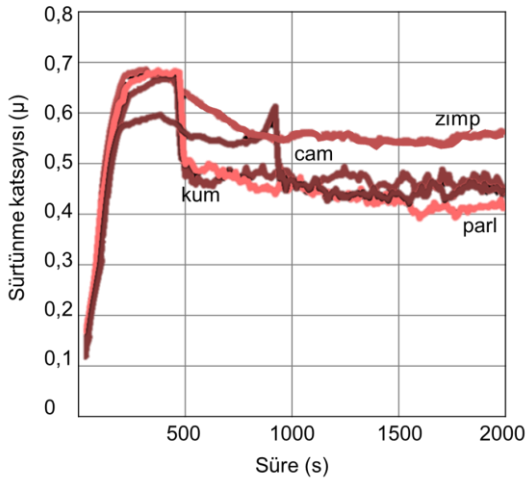
Aşınma testleri sonrası aşınma iz genişlik ölçümleri Şekil 5'te verilmiştir. Aşınma iz genişlikleri ortalamaları cam bilye ile kumlanan numune için 1191 µm, zımparalandıktan sonra

kaplanan numune için 1328 µm , parlatıldıktan sonra kaplanan numune için 1656 µm ve kumlama sonrası kaplanan numune için 1780 µm olarak ölçülmüştür. Minimum aşınma iz genişliği cam bilye ile kumlandıktan sonra kaplanmış numunede ve zımparalama sonrası kaplanan numunede gözlemlenirken, maksimum iz genişliği kumlandıktan sonra kaplanan numunede gözlemlenmiştir.

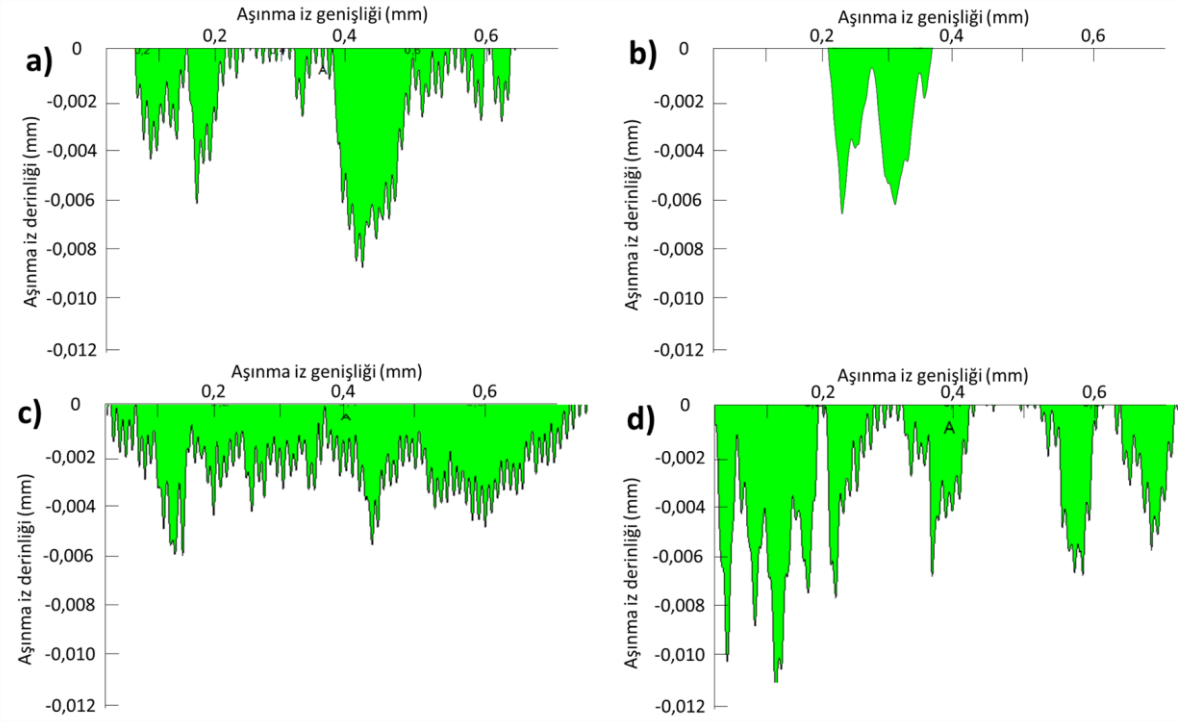


Şekil 5. Aşınma iz ölçümleri a) cam, b)zımp, c)parl d)kum numune

Aşınma sırasında kaydedilen sürtünme katsayısı değerlerinin zamanla değişimini gösteren grafik Şekil 6'da verilmiştir. Sürtünme katsayısı maksimum değere çıkan ve zaman içinde de diğer numunelerden açık ara fark ile yüksekte seyreden numune zımparalandıktan sonra kaplama işlemi uygulanan numune olmuştur. Aşınma iz genişliğinin daha az olması bu durumu desteklemekte olup bu numunede kaplama kalınlığının maksimum değerde elde edilmesinin olumlu bir etkisinden söz edilebilir. Minimum sürtünme katsayısı parlatıldıktan sonra kaplanan numunede elde edilmiştir. Aynı zamanda parlatıldıktan sonra kaplanan numune için, aşınma izi genişliğinin de fazla ölçülmesi ile birlikte değerlendirildiğinde, en düşük aşınma dayanımını sergilediği söylenebilir.



Şekil 6. Sürtünme katsayısı grafiği



Şekil 7. Aşınan alan grafikleri a) cam, b)zımp, c)parl d)kum numune yüzeyleri

Şekil 7, numunelerin aşınma testleri sonrası aşınma izlerinden alınan profil ölçümlerini göstermektedir. Parlatma ve kumlama işlemleri sonrası numunelerde maksimum aşınma ile hacim kaybı gözlemlenmiştir. Aşınma profillerine göre minimum aşınmanın zımparalanmış numunede olduğu söylenebilir. Hesaplanan hacim kayıpları sırasıyla cam bilye ile kumlanan numune için 0.0264 mm^3, zımparalandıktan sonra kaplanan numune için 0.0241 mm^3, parlatıldıktan sonra kaplanan numune için 0.0371 mm^3 ve kumlama sonrası kaplanan numune için 0.0446 mm^3 olarak hesaplanmıştır. Yüzey pürüzlülüğünün maksimum olduğu çelik bilye

ile kumlanmış numune grubunda fazla pürüzlülüğün abraziv aşınmayı tetiklemesi nedeni ile (Liang et al., 2018) daha büyük parçaların koparak kaplama tabakasından ayrıldığı düşünülmektedir. Bu durum aşınma sonrası hacim kayıplarının daha büyük boyutta olmasına neden olmuş ve kumlanmış ve parlatılmış numunede minimum aşınma dayanımı gözlemlenmesine neden olmuştur.

Sonuçlar ve Öneriler - Conclusion and Recommendations

7075 alüminyum alaşım plaka numuneler, DYMET K714 kodlu Ni, Zn ve Al_2O_3 içerikli ticari tozlar kullanılarak soğuk sprey yöntemi ile başarılı bir şekilde kaplanmıştır. Cam bilye ile kumlama, zımparalama, çelik bilye ile kumlama ve parlatma yüzey işlemleri sonrası aynı parametreler kullanılarak aynı ortam koşullarında kaplamalar gerçekleştirilmiş ve bu kaplamaların morfolojik özellikleri ve aşınma dayanımları arasındaki farklılıklar incelenmiştir. Gerçekleştirilen çalışma sonucunda en yüksek yüzey pürüzlülüğü çelik bilye ile kumlama sonrası kaplanan numunede gözlemlenmiştir. Tüm yüzeylerde homojen bir kaplama tabakası elde edilebilmiş olup zımparalama sonrası kaplanan numunede diğer numune gruplarına göre yaklaşık 2,5 kat kadar daha kalın bir kaplama tabakası elde edilebilmiştir. Yapılan tüm analizler sonrasında sertlik ve aşınma dayanımı en yüksek olan numune zımparaladıktan sonra kaplanan numune olmuştur.

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2024 AL ALAŞIMLARINA UYGULANAN SOĞUK SPREY ÖNCESİ YÜZEY İŞLEMLERİNİN AŞINMA DAYANIMINA ETKİLERİ

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Özet
Alüminyum alaşımları, hafifliklerinden dolayı pek çok sektörde geniş bir uygulama alanında kullanılmaktadır. Bununla birlikte, bazı uygulamalar alüminyum alaşımlarının aşınma direncinin iyileştirilmesini gerektirmektedir. Bu çalışmanın amacı, başlangıç yüzey koşullarının 2024 alüminyum alaşımı üzerindeki soğuk püskürtmeli kaplamaların aşınma direnci üzerindeki etkisini araştırmaktır. Farklı yüzey işlemleri uygulanmış (zımparalanmış, parlatılmış ve kumlanmış) parçaların üzerine ticari K-20-11 tozları 500 °C de püskürtülerek kaplanmıştır. Kaplamaların uygulanmasında N_2 gazı kullanılmış ve kaplama öncesi yüzey işlemleri farklılık gösteren tüm bu numuneler aynı şartlar altında kaplanmıştır. Yüzey pürüzlülükleri kaplama öncesi ve sonrası olacak şekilde yüzey profilmetresi kullanılarak incelenmiştir. Kaplama kalınlıkları kesitlerden alınan mikroskop görüntüleri üzerinden ölçülmüş ve yüzey pürüzlülüğünün kaplama kalınlığına etkisi tartışılmıştır. Numunelere kuru kayma koşullarında ball-on disk aşınma testi uygulanmış ve aşınma sonrası tüm numunelerin aşınma profilleri oluşturulmuştur. Aşınma profilleri kullanılarak hacim kayıpları hesaplanmış ve sürtünme katsayısı değişiklikleri ve aşınma profilleri birlikte tartışılmıştır. Numunelerin kaplama kalınlıkları parlatılmış, zımparalanmış ve kumlanmış numunelerde sırasıyla ortalama 87 µm, 228 µm ve 147 µm olarak ölçülmüştür. Aşınma direnci en yüksek olan numune kumlama işlemi sonrası kaplanan numune olmuştur. Sonuç olarak soğuk sprey kaplama uygulaması ile Al, Zn ve Al_2O_3 içerikli K-2011 ticari kodlu kaplama uygulaması ile 2024 alüminyum alaşımlarının kuru kayma koşullarındaki aşınma direnci geliştirilmiştir. Kumlama sonrası kaplanmış numunelerde parlatılmış ve sonrasında kaplanmış numuneler ile karşılaştırma yapıldığında gözlemlenen yaklaşık %33'lük bir aşınma dayanımı artışı mevcuttur.
Anahtar Kelimeler: 2024 Al Alaşımı, aşınma, kaplama, soğuk sprey.

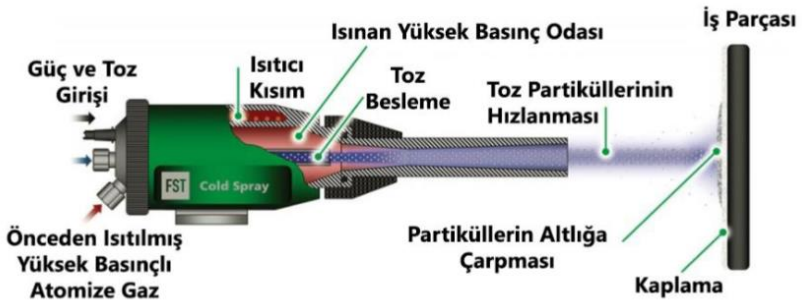
EFFECTS OF SURFACE TREATMENTS PRIOR TO COLD SPRAY ON THE WEAR RESISTANCE OF 2024 ALLOYS

Abstract
Aluminum alloys are widely used in various industries due to their lightweight properties. However, certain applications require the improvement of the wear resistance of aluminum alloys. The aim of this study is to investigate the effects of initial surface conditions on the wear resistance of cold-sprayed coatings on 2024 aluminum alloy. Parts with different surface treatments (sanded, polished, and shot-blasted) were coated with commercial K-20-11 powders at 500 °C using cold spraying. Nitrogen gas was used in the coating process, and all these samples with varying pre-coating surface treatments were coated under the same conditions. Surface roughness was examined using a surface profilometer before and after coating. Coating thicknesses were measured from microscope images of cross-sections, and the impact of surface roughness on coating thickness was discussed. Dry sliding ball-on-disk wear tests were conducted on the samples, and wear profiles of all samples were generated after the wear tests. Volume losses were calculated using the wear profiles, and changes in friction coefficients and wear profiles were discussed together. Coating thicknesses of the samples were measured as 87 µm, 228 µm, and 147 µm for polished, sanded, and shot-blasted samples, respectively. The sample with the highest wear resistance was the one coated after shot blasting. In conclusion, cold spray coating application with K-2011 commercial code, containing Al, Zn, and Al_2O_3, improved the wear resistance of 2024 aluminum alloys under dry sliding conditions. When compared to polished and subsequently coated samples, a significant increase of approximately 33% in wear resistance was observed in the samples coated after shot blasting.
Keywords: 2024 Al alloy, wear, coating, cold spray.

Giriş - Introduction

Alüminyum alaşımlarının sahip olduğu düşük yoğunluk, yüksek şekillendirilebilme kolaylığı, yüksek korozyon dayanımı, fiziksel ve mekanik özelliklerinin iyileştirilebilmesi özellikleri sayesinde endüstride yaygın olarak kullanılmaktadır (İpekoğlu, 2011). Tüm alüminyum alaşımları arasında Al/Cu (2XXX-serisi) alaşımları, uçak endüstrisinde sıklıkla gövde ve kapı kaplamaları, sırt yüzgeçleri ve pervaneler olarak kullanılan yüksek dayanımlı alaşımlardır. Ayrıca, alüminyum alaşımları, kuru sürtünme koşulları altında büyük sürtünme katsayılarına ve zayıf aşınma direncine yol açan adheziv aşınmaya eğilimlidir (Mehta et al., 2004). Hafiflik avantajı ve yüksek spesifik mukavemet özelliklerine karşın, gerçek koşullar altında, 2XXX serisi alüminyum alaşımlarının korozyon ve aşınma direnci düşük olarak nitelendirilmektedir (Long et al., 2017). Çeşitli yüzey işlemleri, alüminyum alaşımlarının yüzey özelliklerini iyileştirmenin etkili bir yoludur. Anotlama (Abdel-Gawad et al., 2019), fiziksel buhar biriktirme (PVD) (Bashir et al., 2017; Lu et al., 2018), elektrolitik biriktirme (Yin et al., 2016), sol-jel biriktirme (Yu et al., 2019), lazer kaplama (Ravnikar et al., 2013) ve plazma nitrürleme (da Silva Savonov et al., 2019) gibi teknikler kullanılarak Al alaşımları üzerinde koruyucu kaplamalar hazırlanmıştır.ğ Ancak bu yöntemlerin yüksek maliyet, karmaşık süreç, zayıf kontrol edilebilirlik ve uygulama zorluğu gibi çeşitli eksiklikleri vardır. Ayrıca çoğunda yüksek sıcaklıklar gerekir ve bu sıcaklıkların çoğu yapıda termal gerilmelere neden olmakta ve dikey ve yatay çatlak oluşumları nedeniyle kaplama-altlık ara-yüzeyini ve hatta kaplamanın kendisini negatif etkilemektedir.Soğuk sprey prosesi özellikle metalik toz parçacıkların çok yüksek hızla (süpersonik) ivmelendirilerek yüzeye çarpmaları sonucunda parçacıkların deformasyon kabiliyetine bağlı olarak yüzeyde birikmesine olanak sağlayan yeni bir kaplama prosesidir. Bu yüksek ivmelenme proses gazlarının (hava, azot, helyum ve karışım kombinasyonu) önce ısıtılması ve basınç altında sıkıştırılmasını takiben nozülden genleşerek çıkışı ile sağlanmaktadır (da Silva et al., 2017). Eklemeli imalat proseslerinden biri olarak da kabul edilen bu yöntem, diğer termal sprey kaplama yöntemlerine göre daha düşük sıcaklıklarda gerçekleştiği için zararlı termal etkilerin azaltılmasını sağlar. Kaplama tabakasını oluşturacak parçacıklar ve altlık malzeme arası arayüzlerdeki şiddetli plastik deformasyona atfedilen metalurjik bağlanma ve mekanik kilitleme, altlık üzerinde çökelme mekanizmaları ile gerçekleşir (Kim et al., 2023). Bu yöntemde diğer püskürtme yöntemlerinden farklı olarak yüksek kinetik enerji ve düşük termal enerji kullanılır. Böylece, kaplamalar daha kalın, termal gerilimler daha az olduğu için çatlaksız ve minimum oksidasyonla elde edilebilir. Püskürtme işlemi sırasında kullanılan sıcaklıklar, termal bozulmanın yanı sıra hammadde malzemesinin

oksidasyonunu da önler; Böylece kaplamalar pratik olarak oksitsizdir ve yeni fazların oluşumuna yol açabilecek kimyasal reaksiyonlar oluşmaz (da Silva et al., 2017; Kim et al., 2023). Şekil 1'de soğuk sprey prosesi şematik olarak gösterilmiştir.



Şekil 1. Soğuk Sprey Prosesi (da Silva et al., 2017)

Soğuk sprey prosesinde kullanılan kaplama malzemeleri metal ve alaşımları, sermetler, kompozitler ve polimer esaslı malzemelerdir. Sistem üreticileri tarafından endüstriyel açıdan yaygın olarak kullanılan malzemeler: WC-Co, CrC-NiCr, Al, Cu, Al_2O_3, SiO_2, SiC, Ni, Cr, Fe,B, C, Ti, Cr_2O_3, Zn, B_2O, TiO_2, WC, ZnB_2, (Ti+Ni), (C, Co, Fe, W), (C, Cr, Ni), (Al, Ni), (Al,Hf, Fe, Mg, Si, Ti, Y, Zr), epoksi reçineler, poliüretan ve bir çok termoplastik malzemeler olup altlık malzeme olarak metal ve alaşımlar,seramikler, cam, kağıt ve polimerler kullanılabilmektedir (Üstel and Altuncu, 2017)Yapılan çalışmada 2024 alüminyum alaşımları yüzeylerine farklı yüzey işlemleri uygulandıktan sonra aynı şartlar altında Al, Zn ve Al_2O_3 karışım tozları ile soğuk sprey kaplama işlemi uygulanmıştır. Yüzey işlemlerinin yüzey pürüzlülüğüne, kaplama kalınlıklarına ve numunelerin aşınma dayanımlarına etkileri incelenmiştir.

Malzeme ve Metot - Materials and Methods

Altlık numune olarak kimyasal bileşimi Tablo 1'de verilen 2024 alüminyum alaşımları kullanılmıştır. Alaşımlar 10x30 mm^2 yüzey alanı ve 4 mm kalınlıkta numunelere kesildikten sonra üç farklı gruba ayrılmıştır. Yüzeyleri parlatma, zımparalama ve kumlama işlemleri her bir gruba sırasıyla uygulanmıştır. Parlatma işlemi uygulanan grup numuneleri 1200 gride kadar zımparalanmış ve 3 µm'ye kadar parlatılmıştır. Zımparalama işlemi uygulanan grup 120 gride kadar zımparalanmıştır. Tüm zımpara izlerinin paralel ve tek yönde olması sağlanmıştır. Kumlama işlemi uygulanan numuneler 0,5 MPa basınç ile S330 ticari kodlu çelik kumlama bilyeleri kullanılarak kumlanmıştır. En son tüm numuneler ultrasonik temizleyici kullanılarak etanol ile 20 dakika temizlenmiştir.

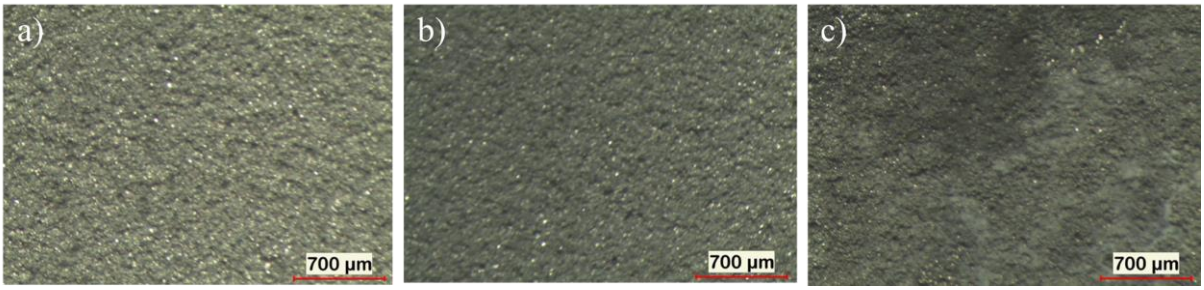
Tablo 1. 2024 Al alaşımının kimyasal içeriği

Element	Fe	Si	Cu	Cr	Mn	Mg	Zn	Diğer	Al
ağ.%	0,5	3,8-4,9	0,1	0,3-0,9	1,2-1,8	0,5	0,25	0,30	Kalan

Yüzey hazırlıkları tamamlanan numuneler aynı koşullar altında kaplanmıştır. Tüm numunelerin kaplanmasında içeriği ağ.%33- 37 Al, ağ.%38-42 Zn, ağ.%23-27Al_2O_3 olan K-20-11 ticari kodlu karışım tozlar kullanılmıştır. Sıcaklık 500 °C olarak ayarlanmış ve karışım toz besleme hızı dakikada 6g seçilmiştir. Kaplanmış numune yüzey ve kesitleri stereo mikroskopta incelenmiştir. Dikey kesitleri incelenen numunelerin kaplama kalınlıkları ölçülmüştür. Stereo mikroskop incelemelerinde Clemex yazılımlı Nikon optik mikroskop kullanılmıştır. Numunelerin kaplama öncesi ve sonrası yüzey pürüzlülükleri Mitutoyo Surftest SJ-310 kullanarak incelenmiştir. Numunelerin aşınma testleri CSM tribometre ball-on disk aşınma cihazı kullanılarak gerçekleştirilmiştir. Aşındırıcı eleman olarak 6mm çapında Al2O3 bilyeler kullanılmıştır. Yük 2N ve mesafe 50 m olacak şekilde belirlenmiş ve bilye kayma hızı 10cm/s olarak ayarlanmıştır. İz çapı 5mm'dir. Aşınma testleri sonrası oluşan aşınma iz profilleri stereo mikroskop ve pürüzlülük ölçüm cihazı ile incelenmiştir. Hacim kayıpları hesaplamaları için aşınma yolu dik kesilecek şekilde ölçüm yapılmış ve hesaplanmıştır.

Bulgular ve Tartışma - Findings and Discussion

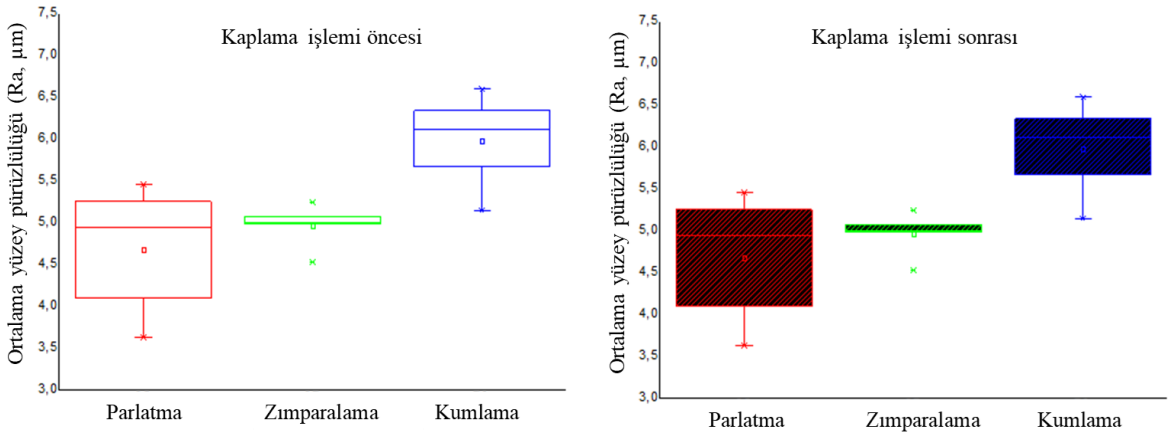
Kaplama işlemi sonrası numunelerin yüzey morfolojileri Şekil 2'deki gibidir. Tüm numune yüzeyleri homojen bir şekilde kaplanmış olup kumlama işlemi sonrasında kaplanan c numunesinde yükselti farkları nedeni ile oluşan bir kontrast farkı mevcuttur. Bu durum kaplama tabakasının daha pürüzlü elde edildiğinin bir göstergesi olarak düşünülebilir.



Şekil 2. a)Parlatma b)Zımparalama c)Kumlama işlemleri sonrası kaplanan numunelerin yüzeyi

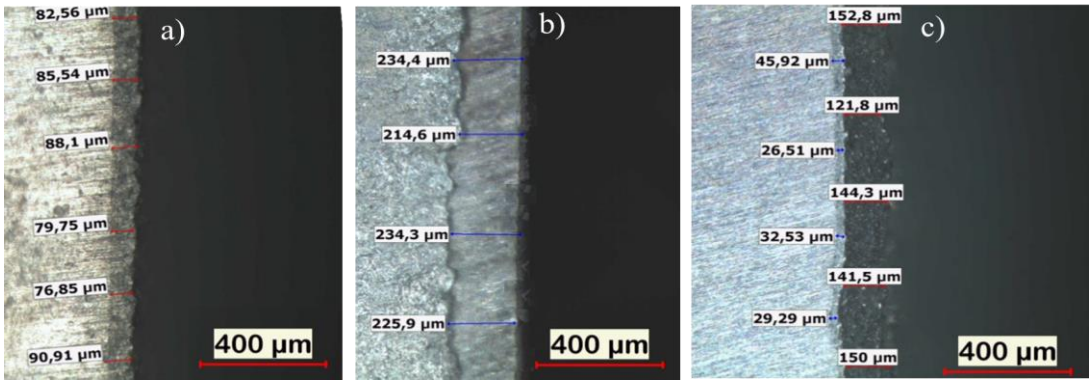
Kaplama öncesi ve sonrası yüzey pürüzlülük ölçüm grafikleri Şekil 3'te verilmiş olup stereo mikroskop ile elde edilen bulguları destekler niteliktedir. Beklenen şekilde en düşük yüzey pürüzlülüğü parlatılmış numunede elde edilmiştir. En yüksek yüzey pürüzlülüğü ise kumlanmış

numunededir. Kaplama işlemi sonrası yüzey pürüzlülükleri kaplama öncesine paralellik göstermektedir.

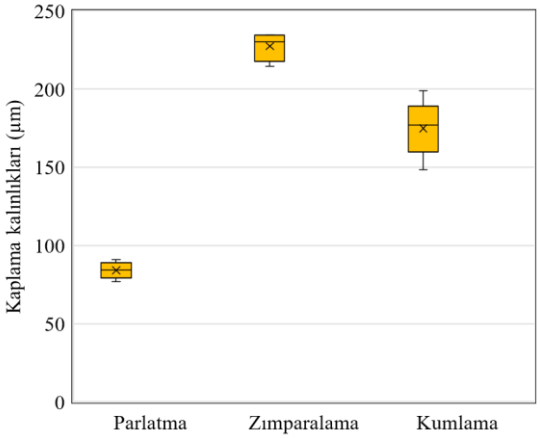


Şekil 3. Yüzey pürüzlülüğü grafiği

Numunelerin dikey kesitleri ve kaplama kalınlık ölçümleri Şekil 4'te verilmiştir. Kaplama kalınlıkları ortalaması grafiği ise Şekil 5'tedir. Parlatılmış numune arayüzeyi zımparalanmış ve kumlanmış numune ara yüzeylerine göre daha keskindir. Net bir geçiş bölgesi görülmemiştir. Yüzeyin parlatılmış olması sebebi ile yüzeyin kaplama parçacıklarına tutulumu diğer numunelere kıyasla daha az olmuş ve bu durum en düşük kaplama kalınlığının parlatılmış numunede gözlemlenmesine neden olmuştur. Yüzey pürüzlülüğünün en çok gözlemlendiği kumlama sonrası kaplanan numunelerde kalınlığı ortalama 33,5 µm olarak ölçülen bir geçiş bölgesi gözlemlenmiştir. Zımparalanmış ve kumlanmış numunelerin her ikisinde de altlık ve kaplama tabakası arasında keskin bir geçiş olmadığı ve bir geçiş bölgesi mevcut olduğu görülebilir. Bu durum metalurjik bağın daha kuvvetli olduğunun bir göstergesidir (Winnicki et al., 2015). Ayrıca uygulanan yüzey işlemleri kaplamaların yüzeye tutunabilirliğini kolaylaştırmış ve birikme verimliliğini de arttırarak kaplama kalınlığının parlatılmış numuneye göre daha fazla olmasını sağlamıştır. Parlatılmış numunedeki ortalama kaplama kalınlığı 83,9 µm olarak ölçülürken, zımparalanmış numune için bu değer 227,3 µm ve kumlanmış numune için 174,8 µm olarak ölçülmüştür.

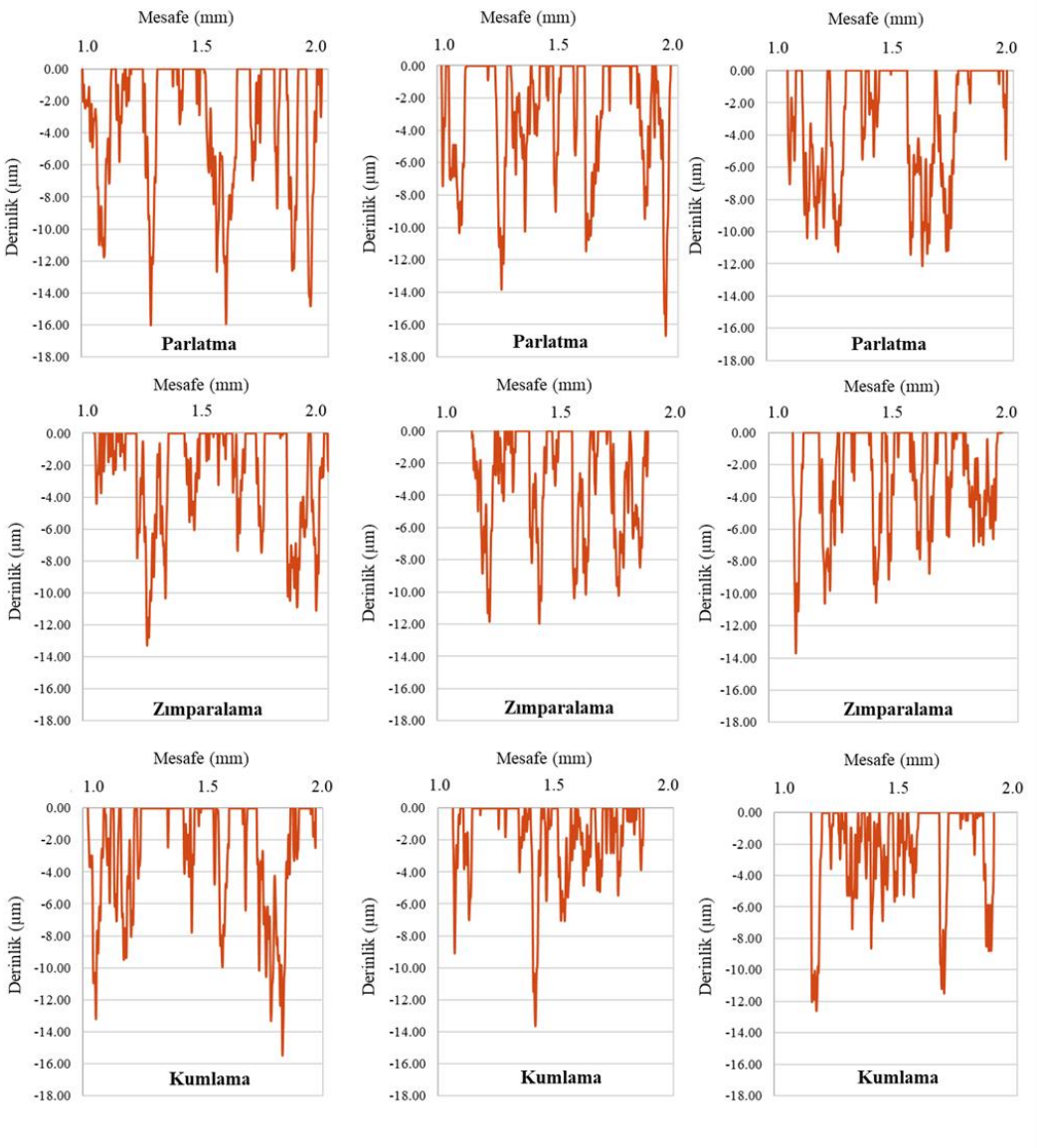


Şekil 4. a)Parlatma b)Zımparalama c)Kumlama işlemleri sonrası kaplanan numunelerin kaplama kalınlıkları



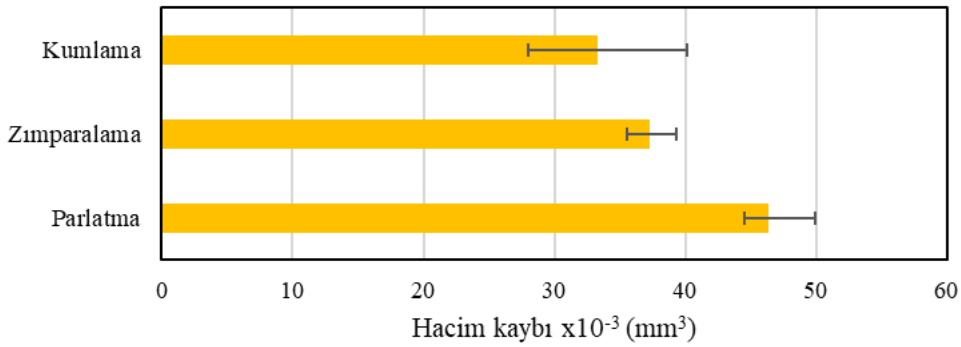
Şekil 5. Kaplama kalınlıkları grafiği

Aşınma sonrası numunelerin aşınma izleri profilometre ile ölçülmüş ve her bir yüzey işlemine ait numuneden üç farklı ölçüm alınarak aşınma izi profilleri çizilmiştir. Aşınma izi profil grafikleri Şekil 6'da verilmiştir. Aşınma iz derinliğinin en fazla gözlemlendiği profil parlatılmış ve kaplanmış numune yüzeyleri olmuştur. Aşınma iz genişlikleri de parlatılmış ve kaplanmış numunelerde daha fazla gözlemlenmiştir. Zımparalama ve kumlama yüzey işlemleri sonrası kaplanan numunelerde iz derinlik ve genişlikleri daha az gözlemlenmiştir.



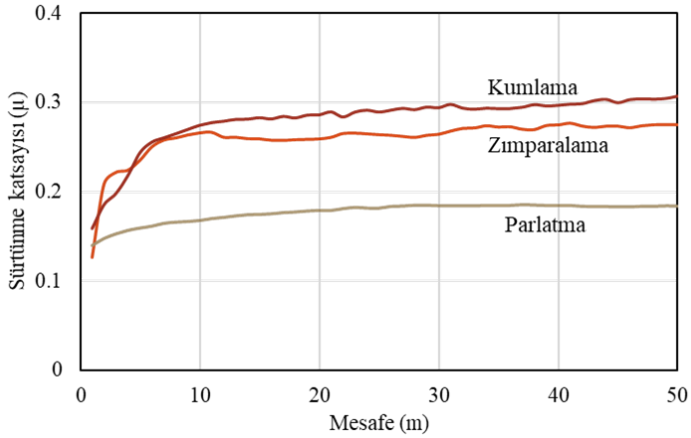
Şekil 6. Aşınma profilleri

Hacim kaybı hesaplamaları yapılmış ve Şekil 7'deki grafikte tüm numuneler için bir karşılaştırma yapılmıştır. Kaplama kalınlıklarının düşük olduğu gözlemlenen ve metalurjik bağın daha zayıf kurulduğu düşünülen parlatma sonrası kaplanmış numunelerde maksimum hacim kaybı gözlemlenmiştir. Her ne kadar kumlanmış numunelerin hacim kaybı hesaplamaları daha geniş bir aralıkta seyretse de, en az hacim kaybı ortalaması kumlanmış numunede ve sonrasında zımparalanmış numunede gözlemlenmiştir. Uygulanan yüzey işlemleri kaplamaların daha etkili olmasını sağlamış ve aşınma dayanımını arttırmıştır. Tek yönde yönlenmiş zımpara izlerinin aşınma dayanımına etkisine göre kumlama etkisi daha yüksek olmuş ve kumlama işlemi aşınmaya karşı daha dayanıklı kaplamaların elde edilmesini sağlamıştır.



Şekil 7. Hacim kaybı grafiği

Aşınma sırasında ölçülen sürtünme katsayıları grafiği Şekil 8'de verilmiştir. Grafik incelendiğinde tüm aşınma sonuçları ile de uyumlu olacak şekilde parlatılmış ve kaplanmış numune aşınmaya karşı yeterli direnci gösterememiş ve diğer yüzey işlemlerine göre daha düşük sürtünme katsayısı eldesine neden olmuştur. Maksimum sürtünme katsayısı kumlama sonrasında kaplanmış numunede gözlemlenmiştir ve bu durumda maksimum dayanımı kumlanmış numunenin sergilediği söylenebilir.



Şekil 8. Sürtünme katsayıları değişimi

Sonuçlar ve Öneriler - Conclusion and Recommendations

Gerçekleştirilen çalışma kapsamında zımparalama, parlatma ve kumlama yüzey işlemleri uygulanan 2024 Al alaşım numuneler üzerine Al, Zn ve Al_2O_3 içeren ticari K-20-11 karışım tozu 500 °C de soğuk sprey yöntemi kullanılarak kaplanmıştır. Kaplamaların yüzey pürüzlülüğü, kalınlığı ve aşınma direnci incelenmiştir. Çalışma sonucunda kumlama ve zımparalama sonrası kaplanan numunelerde sırasıyla 3 ve 4 kata kadar daha fazla kaplama kalınlığı elde edilmiş ve bu durum uygulanan yüzey işlemlerinin kaplamaların yüzeye tutunabilirliğini arttırması ile açıklanmıştır. Tüm numuneler içinde hem kaplama öncesi hem de kaplama sonrası maksimum yüzey pürüzlülüğü kumlanmış numunelerde elde edilmiştir.

Maksimum aşınma derinliği ve genişliği ve dolayısıyla maksimum hacim kaybı parlatma işlemi sonrasında kaplanan numunede gözlemlenmiştir. Sürtünme katsayısı değişimi de bunu desteklemektedir ve minimum sürtünme katsayısı parlatma sonrası kaplanan numunede gözlemlenirken maksimum sürtünme katsayısı kumlama işlemi sonrası kaplanan numunede gözlemlenmiştir. Tüm sonuçlar değerlendirildiğinde aşınma dayanımı en yüksek olan numune kumlandıktan sonra kaplanan numune olmuştur.

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THE ROLE OF ESTROGEN RECEPTORS IN MALIGNITIES

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Abstract
The main female sex hormone, estrogen, is in charge of secondary sexual traits that emerge during puberty and sexual maturity as well as the regulation of female reproductive system processes. In order to influence gene expression, estrogens attach to specialized receptors called estrogen receptors (ERs), which then trigger transcriptional processes and signaling events. These effects could be mediated by processes other than direct binding to DNA, such as the direct binding of estrogen receptor complexes to certain regions in gene promoters. In humans, estrogen receptors control a wide range of intricate physiological functions. Numerous conditions, such as those pertaining to reproduction, abnormalities of the bones, lung cancer, cardiovascular disease, gastrointestinal problems, urogenital tract diseases, neurological disorders, and cutaneous melanoma, can be brought on by aberrant ER signaling. The three most well-known ERs are ER alpha, ER beta, and novel G-protein coupled estrogen receptor 1. Differential expression of estrogen receptors in different cell lines, species differences, varied experimental methods, and indirect effects of estrogens can all account for the findings of experimental investigations. Estrogens have been linked to an increased risk of disease overall, elevated concerns around environmental estrogen exposure, and the pathophysiology of a number of malignancies. An overview of estrogen and its receptors is given in this text.
Keywords: Cancer, Antiandrogen, Malignancy, estrogen receptor alpha, estrogen receptor beta, signaling pathway, mediation, G-protein-coupled estrogen receptor 1

Introduction

One of the most significant female sex hormones is estrogen, a fat-soluble steroid hormone (Pepermans et al, 2021). It also affects a wide range of other physiological systems, such as the immunological, cardiovascular, and metabolic systems. It performs numerous vital physiological roles and is primarily produced by the adrenal cortex, testes, and ovaries. Since it has been established that estrogens and estrogen receptors contribute to the development and spread of several tumor types, including breast, ovarian, kidney, adrenal, prostate, testicular, lung, and colon cancers, interest in estrogens and estrogen receptors has grown (Aitken et al. 2004). In both sexes, the effects of estrogens and associated estrogenic compounds are intricate and varied.It is widely known to have a key part in the development of estrogen receptor-expressing breast cancers, but it also plays a significant role in a variety of other malignancies. It directly impacts tumor cells as well as the activity of other cells, including fibroblasts, in the tumor microenvironment. Numerous synthetic, natural, and medicinal compounds target the pathways that generate and react to estrogen (Arterburn and Prossnitz, 2024). In around 80% of cases of breast cancer, estrogen is also a major factor since it stimulates the growth of tumors, which is mostly estrogen-dependent (McDonnell et al, 2021; Haines et al, 2021). According to Soares et al. (2023), estrogens are also crucial in the occurrence and progression of several cancers, including ovarian, endometrial, and breast cancer.

Estrogens and ERs

Estrogen receptor α (ER-α) and estrogen receptor β (ER-β) are the two types of receptors that estrogens work on to carry out their physiological functions. Two distinct genes on separate chromosomes encode the proteins ER-α and ER-β (Ghodbane et al, 2013). The most prevalent estrogen receptor in the skin, ER-β is also present in the brain, colon, prostate, and other well-known estrogen-sensitive tissues such the uterus and mammary glands (Aitken et al, 2004). The antiproliferative effects of ER-β activation seem to be counterbalanced by ER-α's opposite action. According to Caruntu et al. (2016), recent research has determined that the balance between ER-α and ER-β expression is the primary determinant of estrogen signaling. It is well recognized that certain malignancies, like breast cancer, are estrogen-dependent. Hormones including progesterone and estrogen are known to be crucial in the development of this cancer (Hilton et al, 2018). Melatonin has been shown to suppress breast cancer cell growth in vivo as well as in vitro (Laborda et al., 2023). Eventually, it was discovered that melatonin caused cancer cells to undergo programmed cell death, or apoptosis, and decreased the growth of breast cancer cells (Bushra et al, 2011). Melatonin is believed to have this impact because it can lower

inflammation and oxidative stress, two things that are known to have a role in the development of cancer. A hormone with many oncostatin actions, melatonin is particularly useful in treating breast cancer (Gutic et al., 2023). By scavenging free radicals, it demonstrates antioxidant qualities and shields cells from oxidative damage caused by carcinogen-mediated deoxyribonucleic acid alterations. This delays the beginning of malignant transformation (Hilton et al, 2017). Melanoma incidence rates in females are comparable to those of breast cancer, indicating a potential involvement for female sex hormones in the development of melanoma in females (Ramadan et al, 2002). Simultaneously, a second study revealed that patients with melanoma were also at risk for breast cancer, and that women who had previously been diagnosed with breast cancer were more likely to develop melanoma (Hong et al, 2005). The association between ERs and melanoma is confirmed by the expression of ER-βs in several melanoma cell lines investigated (BLM, WM115, A375, WM1552) (Hamada et al., 2011).

Estrogen Receptor Signaling Mechanisms

Estrogen functions as a steroid hormone and has the ability to cross the plasma membrane to directly affect DNA sequences through interaction with intracellular ERα and ERβ. On the other hand, estrogen can work with GPER1, ERα, and ERβ to initiate intracellular signaling cascades. Because of differences in the cellular and molecular mechanisms that control gene expression, estrogen-mediated signaling events can be categorized as either genomic or non-genomic. Direct or indirect DNA binding can occur between estrogen-receptor complexes (Fuentes & Silveyla, 2019). Examples of genomic implications include the translocation of estrogen-receptor complexes into the cell nucleus and direct interaction with chromatin at specific DNA sequences known as estrogen response elements (EREs). More than one-third of human genes controlled by estrogen receptors have been reported to lack ERE sequence elements, despite the fact that EREs have been found in a variety of gene promoters and regulatory regions (O'Lone, Frith, Karlsson, & Hansen, 2004). Conversely, non-genomic impacts entail the indirect control of gene expression via a variety of intracellular signaling pathways.

Estrogens and Their Effects on Carcinogenesis

Over the world, 18.1 million new instances of cancer have been found; according to reports, breast cancer is the most common form to be identified, with more cases than colon cancer (2.3 million cases, 11.7%) (Hall and Filardo, 2023). The International Agency for Research on Cancer (IARC) of the World Health Organization recorded 685,000 deaths from breast cancer in 2020 and projects that by 2040, there would be 1 million fatalities and 3 million new cases (Arnold et al., 2022). It is noteworthy that the number of instances of breast cancer is rising

quickly in transitioning nations, despite the fact that the disease's death rate is still quite high (Abancens et al, 2020). The sharp rise in colon cancer, which has been linked to a significant hereditary component and a bias towards men, is equally worrisome (White et al, 2018). Although the exact causes of colon cancer in young adults are unknown, environmental factors such as inflammation, nutrition, and microbiome have been proposed (Sinicrope, 2022). The fact that this trend is in line with rising human exposure to environmental estrogens and rising rates of obesity in young people is equally worrisome (Newbold et al, 2009). Metabolic syndrome is linked to increased exposure to environmental estrogens (Agnoli et al, 2010; Zheng et al, 2023). A group of illnesses known as metabolic syndrome are known to have a role in the development of cancer, particularly malignancies of the breast and colon (Esposito et al., 2012; Chan et al., 2014). Estrogens have been linked to the pathogenesis of several cancers (Sun et al, 2018; Schouten et al, 2022), including colon and kidney cancer (Mori et al, 2021). They are effective against female reproductive cancer (Miyamoto and Shiozawa, 2019; Johansson et al., 2022), as well as lung (Chakraborty et al., 2010; Hsu et al., 2017), liver (Shi et al., 2014; Sukocheva, 2018; Carruba, 2021). Understanding the receptor-based processes by which endogenous and environmental estrogens promote their biochemical and biological effects is fundamentally required, regardless of the specific nature of the model underlying estrogen-induced carcinogenesis (Hall and Filardo, 2023).

Effects of Estrogen-Induced Carcinogenesis through Exposure to Environmental Estrogens

Endocrine disrupting chemicals (EDCs) are substances found in our environment that mimic estrogen. These compounds are referred to as xenoestrogens. Foods, plastics, food containers, cosmetics, and skin care items are common sources of xenoestrogens (Lóránd et al, 2010). Dietary phytoestrogens like genistein and daidzein, artificial environmental contaminants like bisphenol A, and 4-hydroxytamoxifen are a few specific instances of xenoestrogens (Hall and Filardo, 2023). Although EDCs have long been linked to carcinogenesis, there is disagreement regarding how much of a role they play in cancer (Morgan et al, 2017; Gonzalez et al, 2019). Bisphenols are widely utilized in the manufacturing of dental sealants, thermal invoice sheets, polycarbonate plastics, and plasticized linings in packaged foods (Porras et al, 2014; Russo et al, 2017). Research has demonstrated that BPA seeps into the environment and is found in over 95% of the population, with newborns and children having the greatest quantities found (Calafat et al, 2005; Lehmler et al, 2018). According to experimental data from a number of lab investigations, BPA has a "provocative effect" on the development of breast cancer (Seachrist

et al, 2016; Wang et al, 2017). Toxicologists' mechanistic hypotheses for monotonicity include the impact of high hormone concentrations on desensitized, weakened, or inactivated receptors.

Conclusion

Estrogens are important for both health and illness. There are sex hormones everywhere. Both sexes exhibit a balance of male and female hormones. It seems that estrogens have a significant impact on the growth and metastasis of many neoplasms. Many tumors contain estrogens, which are produced locally. The role of estrogen receptors in oncogenesis is not negligible. Hormones, receptors, and enzymes interact intricately in the complex process of estrogen activity; it is neither simple nor unidirectional. Numerous signaling channels are activated. Not just malignant tumors known to be hormone-dependent, such lung cancer, but also many other malignant tumors that are oncogenesis- and progression-related are influenced by sex hormones. The most often prescribed and successful cancer treatment is endocrine therapy. Additional reasons for the development of GPER-targeted cancer therapies include the rise in cancer cases worldwide, the known carcinogenic effect of environmental estrogens, their abundance in economically developed countries, and the significant role that GPER plays in metabolic syndrome, a health condition that promotes cancer. With great and exciting potential to offer a more comprehensive approach to endocrine therapy for breast cancer and other solid malignancies, GPER is still a "drug-free" therapeutic target in this field. Positive outcomes from these clinical trials should supplement current antiestrogen therapy techniques and maybe broaden our understanding of the patients who may benefit from it.

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KAMU EĞİTİM YAPILARININ (OKUL BİNALARININ) YAKLAŞIK MALİYETLERİ VE SÖZLEŞME BEDELLERİNİN TAHMİNİ İÇİN BİR MODEL ÖNERİSİ

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Özet
Bu çalışmada, okul binası maliyetlerinin ön tahmini için bir yöntem önerisinde bulunulmuştur. Bu amaçla, Kamu Kurumları tarafından ihaleye çıkılmış ve sonuç ilanı yayınlanmış 96 adet okul binasına ait projeler Elektronik Kamu Alımları Platformu (EKAP)'tan sağlanmıştır. Bu projeler 81 adet eğitim, 15 adet test verisi olacak şekilde ayrılmıştır. Projeler üzerinden eğitim yapılarının inşaat maliyeti çıktı vektörlerini etkileyebilecek; "Derslik Sayısı, Yapım Süresi, Toplam Kat Sayısı, Kat Yüksekliği, Bina Yüksekliği, Bina Yükseklik Sınıfı (BYS), Bodrum Yüksekliği, Deprem Tasarım Sınıfı (DTS), Zemin Sınıfı, Zemin Emniyet Gerilmesi, Yatak Katsayısı, Beton Sınıfı, Asansör Sayısı, Islak Alan, Radye Temel Yüksekliği, Kat Alanı, Bodrum Alanı, Toplam Alan" parametreleri belirlenerek modelleme ve analizlerde kullanılmıştır. Analizler "SPSS Statistics 26" yazılımı ile gerçekleştirilmiştir. Bu parametreler kullanılarak Regresyon Analizleri (RA) yapılmış ve eğitim yapılarının maliyetlerini tahmin etmek için denklemler geliştirilmiştir. Geliştirilen modellerle Yaklaşık Maliyetleri ve Sözleşme Bedelleri tahmin edilmeye çalışılmıştır. Oluşturulan denklemlerle tüm parametrelerin kullanıldığı model Yaklaşık Maliyet Bedeli için determinasyon katsayısı R^2=0.900, Sözleşme Bedeli için ise R^2=0.927 ile en iyi ilişki düzeyine sahip model olmuştur. Modelin kullanılması ile elde edilen yaklaşık maliyet tahminleri ve gerçek maliyetler arasında %17,5 düzeyinde hata oranı saptanmıştır. Tahmin edilen sözleşme bedelleri ile gerçek sözleşme bedelleri arasında ise %18,2 hata olduğu belirlenmiştir. Tahmin edilen sonuçlar ile gerçek sonuçlar arasındaki tutarlılığı kontrol etmek amacıyla Durbin-Watson kriteri kullanılmıştır. Sonuç olarak, farklı tip ve katsayılarına sahip okul yapılarının yaklaşık maliyetlerini ve sözleşme bedellerini %20'den düşük hata oranları ile tahmin edebilen bir yaklaşım oluşturulmuştur. Gerek kamu kuruluşları gerekse taahhütçü yapım firmaları bu modellemelerden istifade ederek zamansal tasarrufler sağlayarak gerçekçi maliyet tahminlerinde bulunabileceklerdir. Benzer çalışmaların veri adetleri arttırılarak yapılması, daha sonraki modellemelerde hata oranı minimizasyonu için bir çözüm olabilir.
Anahtar Kelimeler: Yapı Maliyeti Modeli, Çoklu Doğrusal Regresyon Modeli, Okul Binaları, Yapı Maliyeti Tahmini

A MODEL PROPOSAL FOR ESTIMATE THE APPROXIMATE COSTS AND CONTRACT FEES OF PUBLIC EDUCATION BUILDINGS (SCHOOL BUILDINGS)

Abstract
In this study, a method is proposed for the preliminary estimation of school building costs. For this purpose, the projects of 96 school buildings, which were put out to tender by public institutions and the result announcement was published, were provided from the Electronic Public Procurement Platform (EKAP). These projects are divided into 81 training data and 15 test data. The construction cost of educational buildings through projects may affect the output vectors; "Number of Classrooms, Construction Duration, Total Number of Floors, Floor Height, Building Height, Building Height Class (BYS), Basement Height, Earthquake Design Class (DTS), Floor Class, Ground Safety Stress, Bed Coefficient, Concrete Class, Number of Elevators, "Wet Area, Raft Foundation Height, Floor Area, Basement Area, Total Area" parameters were determined and used in modeling and analysis. Analyzes were carried out with "SPSS Statistics 26" software. Using these parameters, Regression Analyzes (RA) were performed and equations were developed to estimate the costs of educational structures. Approximate Costs and Contract Prices were tried to be estimated with the developed models. The model in which all parameters were used with the created equations was the model with the best correlation level, with the determination coefficient R^2=0.900 for the Approximate Cost Price and R^2=0.927 for the Contract Price. An error rate of 17.5% was found between the approximate cost estimates obtained using the model and the actual costs. It was determined that there was an 18.2% error between the estimated contract prices and the actual contract prices. The Durbin-Watson criterion was used to check the consistency between predicted results and actual results. As a result, an approach that can estimate the approximate costs and contract prices of school buildings of different types and coefficients with error rates lower than 20% has been created. Both public institutions and contracting construction companies will be able to make realistic cost estimates by benefiting from these modeling, providing time savings. Conducting similar studies by increasing the number of data may be a solution to minimize the error rate in subsequent modeling.
Keywords: Building Cost Model, Multiple Linear Regression Model, School Buildings, Building Cost Estimation

GİRİŞ

Maliyet, bir ürünün ortaya çıkması için yapılan harcamaların tümü olarak ifade edilmektedir. Yapı maliyeti ise, yapı ihtiyacının oluşmasından itibaren başlayan, yapımın inşa sürecindeki harcamaların toplamı olarak değerlendirilmektedir (Akınbingöl ve Gültekin, 2005).Maliyet tahminindeki en önemli amaç, kıt kaynakları en etkin şekilde kullanarak, değerlendirerek istenilen kalitede hizmet ya da ürünün sağlanması için gereken maliyeti belirleyebilmektir. Maksimum üretimin elde edilmesi ve projenin öngörülen kalitede tamamlanabilmesi için oluşacak harcamaların önceden doğru tahmin edilmesi ve aynı zamanda belirlenen maliyet limitleri içerisinde etkin bir maliyet kontrol sistemi ile denetlenmesi gereklidir (Kuruoğlu, Yönez, Topkaya ve Çelik, 2012). Yatırım kaynaklarının kısıtlı olduğu düşünüldüğünde, maliyet hesabının çok titiz çalışmalarla belirlenmesi, planlanması ve kontrol edilmesi gerekmektedir. Maliyet hesabının eksik ya da fazla tahmin edilmesi, bir inşaat projesinin uygulamasının maliyet açısından başarısız olmasına yol açabilir (Uğur,2007).İhale, birden çok istekli arasından bir hizmetin veya bir malın en uygun istekliye bırakma işlemidir. İşi oluşturan kalemlerin piyasa fiyatının tam olarak bilinmediği veya belirsiz olduğu durumlar için ihale, fiyat oluşturma sürecinde önemli bir rol oynamaktadır (Emek, 2002). Kamu ihalesi, devletin idari kurumlarının taleplerini karşılamak ve halkın ihtiyacını gidermek için mal, hizmet ve yapım işlerinin satın alınmasıdır. Bu ihaleler, ülkelerin ekonomilerini yakından ilgilendirdiği için ülkelerin geleceğinde önemli bir yer kaplamaktadır (Kömürcü, 2006). Türkiye'de, kamu hukukuna tâbi olan veya kamunun denetimi altında bulunan veya kamu kaynağı kullanan kamu kurum ve kuruluşlarının yapacakları ihaleler de uygulanacak esas ve usulleri belirlemek amacıyla 2002 yılında 4734 sayılı Kamu İhale Kanunu yürürlüğe girmiştir (www.ihale.gov.tr).

2.YAPI MALİYETİ HESAPLAMA YÖNTEMLERİ

Yapının inşa sürecindeki her aşamada maliyet tahmini için kullanılan maliyet modelleri, kullanım amaçları doğrultusunda farklı sınıflara ayrılabilirler. İlk olarak 1950'li yıllarda, Avrupa'da konut ve kamu yapıları üzerinde basit bir planlama şeklinde ortaya çıkan model kavramı, 1970 ve 1980'li yıllardan sonra yapılan çalışmalar neticesinde sınıflandırılmaya başlanmıştır. Bunlar; geleneksel modeller, tanımlayıcı modeller, gerçekçi modeller, enformasyon sistemi yaklaşım modelleridir (Akınbingöl ve Gültekin, 2005).

2.1. Geleneksel modeller

Geleneksel modeller; Analitik modeller, fonksiyonel elemanlara dayalı modeller, kaynaklara dayalı modeller, yapım birimlerine dayalı modeller olarak sıralanabilir (Akınbingöl ve Gültekin, 2005).

2.1.1. Analitik modeller

Yapı üretim sürecinde eldeki bilgilerin kapsamının çok düşük olduğu ilk çalışmalardan ön tasarıma kadar ki aşamalarda kullanılan modellerdir. Amaç, en hızlı şekilde en doğru maliyet hesaplaması yapılması ve kullanıcılara sunulmasıdır (Akınbingöl ve Gültekin, 2005).

2.1.2. Fonksiyonel elemanlara dayalı modeller

Elemanlara dayalı maliyet hesabı, yapı üretim sürecinin tasarım evresinde, maliyet planlaması ve kontrolünün yapılabilmesi için kullanılan bir maliyet hesabı türüdür (Uğur,2007).

2.1.3. Kaynaklara dayalı maliyet modelleri

Yapı üretim sürecinin yapım aşamasında kullanılan bu modeller yardımıyla şantiye organizasyonu sağlanarak, yapılan organizasyonlarla etkin bir şantiye yönetimi gerçekleştirilebilir. Modeller, yapılacak olan her bir işe ait işgücü, malzeme ve araç gereç listesinin oluşumunu belirleyerek bunların maliyetlerinin bulunmasını sağlamaktadır (Uğur,2007).

2.1.4. Yapım birimlerine dayalı modeller

Yapı üretim sürecinin yapım evresinde yapıyı oluşturmak için gerekli olan üretim birimleri ve işlemler yapım birimlerini oluşturmaktadır. Yapım birimlerine dayalı maliyet modeli de yapım birimlerinin uygulama projesi üzerinden ölçülen miktarlarıyla her birim için daha önceden belirlenmiş olan birim fiyatlarının çarpılıp elde edilen sonuçların alt alta toplanması ile yapının toplam maliyetinin hesaplanması ilkesine dayanır (Uğur,2007).

2.2. Gerçekçi modeller

Gerçekçi modellerin tahmin doğruluğunun miktarlara dayalı modellere göre daha azdır. Buna rağmen, miktarlara dayalı modeller gelişmelerini neredeyse tamamladıkları halde, gerçekçi modellerin gelişme potansiyellerinin çok yüksek olduğu ileri sürülmektedir (Akınbingöl ve Gültekin, 2005).

2. 3. Uzman sistemler

Bu modeller ile maliyet tahmini yapabilmek için veri tabanı ve bilgisayardan yararlanılır. Maliyet tahmininde başarılı olabilmek için de bu sistemlerin mutlaka uzman kişiler tarafından yönlendirilmesi gerekir(Akınbingöl ve Gültekin, 2005).

2.4. Tanımlayıcı modeller

Bu yaklaşım, maliyetleri miktarlar yerine tasarımın tanımlayıcı özelliklerine bağlamak fikrini temel alır. Tanımlayıcı modeller regresyon analizleri kullanılarak geliştirilmiştir. Regresyon analizini kullanma fikri, yapının maliyetini hem tasarım aşamasında belirlemek için hem de yüklenicinin yaklaşık maliyeti kestirebilmesi için geliştirilmiştir (Uğur,2007).

2.4.1. Regresyon Analizi

Regresyon; aralarında neden-sonuç ilişkisi olan iki veya daha çok sayıdaki değişkenin bir denklem yardımıyla ifade edilmesidir. Herhangi iki veya daha çok sayıda değişken arasındaki ilişkinin yönü veya büyüklüğü ise regresyon analizi ile belirlenir. Regresyon analizinde, kurulan regresyon denkleminin tahmini yapılarak modelde yer alan değişkenlere dair parametreler tahmin edilir ve bu şekilde bağımlı ve bağımsız değişkenler arasındaki ilişkiler matematiksel olarak ortaya konur. Burada bağımlı değişken bir tane olmasına karşın bağımsız değişkenlerin sayısı değişebilir. Tek bağımlı ve tek bağımsız değişkenden oluşan modellere basit regresyon modeli, tek bağımlı ve birden çok bağımsız değişkenin oluşturduğu modellere ise çoklu regresyon modeli adı verilir.Regresyon analizinde modeli oluşturan değişkenlere dair katsayılar tahmin edilir. Bu katsayılar ise bağımlı değişken ile bağımsız değişken arasındaki ilişkilerin yönünü ve büyüklüğünü gösterir. Regresyon analizi kısaca, aralarında neden-sonuç ilişkisi bulunan iki veya daha çok sayıda değişken arasındaki matematiksel ilişkileri ortaya koyan yöntemdir (Temurlenk ve Yıldız, 2020).

2.4.1.1. Doğrusal Regresyon Modeli

Regresyon analizi, temel olarak bir değişkenin başka değişkenler tarafından açıklandığı varsayımına dayanır. Burada bir değişken, aralarında neden-sonuç ilişkisi bulunan diğer değişkenler ile birlikte matematiksel olarak modellenir ve bu modele *regresyon modeli* adı verilir. Regresyon modeli fonksiyonel formda şu şekilde ifade edilebilir:

$$Y = \beta_0 + \beta_1 X \qquad (1.\ 1)$$

Eşitlik (1. 1)'de iki değişken arasındaki ilişkinin fonksiyonel formu gösterilmektedir. Bu değişkenler Y ve X değişkenleridir. Burada Y açıklanan veya bağımlı değişken olarak adlandırılırken X değişkeni açıklayıcı veya bağımsız değişken olarak isimlendirilmektedir. β_0 sabit katsayısını, β_1 ise Y ve X değişkeni arasındaki ilişkinin yönünü ve büyüklüğünü gösteren katsayısı temsil etmektedir (Temurlenk ve Yıldız, 2020).

2.4.1.1.1. Bağımlı ve Bağımsız Değişken

Bağımlı değişken kısaca bağımsız değişkenlere bağlı olarak değişen yani bağımsız değişkenler tarafından açıklanan değişkendir. Bağımsız değişken ise bağımlı değişkeni açıklayan değişkendir ve değişimi herhangi bir değişkene bağlı değildir. Eşitlik (1. 1)'de yer alan Y ve X sırasıyla bağımlı ve bağımsız değişkenleri temsil etmektedir. Yani bağımlı değişken olan Y bağımsız değişken olan X tarafından açıklanmaktadır (Temurlenk ve Yıldız, 2020).

2.4.1.1.2. β_0 ve β_1 Katsayıları

Modelde yer alan β_0 katsayısı sabit katsayıyı temsil etmektedir. Sabit katsayı temel olarak bağımsız değişkenin sıfır olduğu durumda bağımlı değişkenin alacağı değerdir. β_0 katsayısı güçlü teorik gerekçeler bulunmadığı takdirde doğrusal regresyon modellerinde yaygın biçiminde yer almaktadır. Öte yandan modelde yer alan β_1 katsayısı bağımsız değişken katsayısıdır ve bağımsız değişkendeki değişimin bağımlı değişkeni ne yönde ve ne düzeyde etkilediğini gösterir (Temurlenk ve Yıldız, 2020).

2.4.1.2. Çoklu Doğrusal Regresyon Modeli

Doğrusal regresyon analizi bağımlı ve bağımsız değişken/değişkenlerden oluşur. Eğer tek bağımsız değişken var ise basit doğrusal regresyon, iki ya da daha fazla bağımsız değişken var ise çoklu doğrusal regresyon adı verilmektedir. Regresyon analizinde değişkenler arasındaki ilişkinin fonksiyonel olarak anlamlandırılması ve modellenmesi hedeflenmektedir (Narin, Doğan, Bande, ve Genç,2023). Değişkenlerden birini veya değişkenin kategorisini önceden belirlenmiş düzeylerde tutma ve diğer değişkenin o düzeye göre nasıl değiştiğini inceleme kuralına dayanır. Regresyon, modern istatistiklerde bilinen değerleri kullanarak bilinmeyen değerleri bulmak olarak da yorumlanmaktadır (Akış, 2013). Çoklu regresyon eşitliğinde y bağımlı değişkeni, a sabit katsayıyı, $x1…n$ bağımsız değişkenleri ve $\beta1…n$ her bağımsız değişkenin katsayısını ifade eder.

$y=a+\beta1x1+\beta2x2+\cdots+\beta nxn$ (1. 2)

3.ARAŞTIRMA VE BULGULAR

3.1. Amaç ve Yöntem

Bu çalışmanın amacı, Türkiye'deki kamu eğitim yapıları yapım ihalelerinde, mimari ve statik projelerden seçilen, belirli sayıdaki parametre ile yaklaşık maliyet ve sözleşme bedelini hızlı ve kolay tahmin eden bir regresyon denkleminin bulunması ve parametre seçiminin önemini araştırmaktır.

Bu çalışma, yaklaşık maliyet ve sözleşme bedelinin gerçeğe yakın olarak tahmin edilmesi, uzun süren metraj yükünün hafifletilmesi konularında literatüre de katkı sağlayacaktır. Bu bağlamda bu çalışmanın yöntemi, iki adımdan oluşmaktadır ve aşağıda sıralanmıştır:

1. Birbirine benzer ve çok sayıda projelerin *Elektronik Kamu Alımları Platformu (EKAP) üzerinden temin edilmesi.*
2. Metraj çalışmalarının yapılması ve yaklaşık maliyet ve sözleşme bedellerinin güncellenmesi.
   a. 96 adet kamu eğitim projeleri üzerinden metraj çalışmalarının yapılması

b. Projelerin yaklaşık maliyet bedellerinin ve sözleşme bedellerinin TÜİK verilerine göre güncellenmesi.

3. Çoklu doğrusal regresyon yöntemi ile yaklaşık maliyet bedeli ve sözleşme bedelinin tahmin denkleminin bulunması:
   a. Bağımsız değişkenlerin bir birleri ile olan ilişkilerinin korelasyon analizleri ile incelenmesi ve regresyon veri setlerinin belirlenmesi,
   b. Korelasyon analizi sonucunda elde edilen veri setleri ile yaklaşık maliyet bedelleri ve sözleşme bedellerinin regresyon analizi ile tahmin edilmesi.
   c. Korelasyon analizleri sonucunda farklı değişkenler seçimi ile maliyet tahmininde yaklaşık maliyet bedeli ve sözleşme bedeli tahminlerinin hata oranının incelenmesi.

3.2. Bulgular

Türkiye'nin farklı illerinde *Elektronik Kamu Alımları Platformu (EKAP) üzerinden temin edilen* 2020 ile 2022 yılları arasında kamu kurumlarınca ihale edilmiş ve sözleşmesi imzalanmış 96 adet eğitim binası incelenmiştir. Yapılacak regresyon analizinde eğitim serisi olarak 81 adet proje, test amaçlı kullanılmak üzere 15 adet proje ayrılmıştır.

Her yıl gerçekleşen birim fiyat değişikliklerinden dolayı ihalesi yapılmış projeler arasında zamana bağlı maliyet farkı oluşmaktadır. Bu çalışmada zamana bağlı farkın ortadan kaldırılması adına her yıl TÜİK tarafından yayınlanan ve Tablo 1. 'de gösterilen bina inşaatı maliyet endeksi ve değişim oranları değişim oranları tablosu kullanılmıştır.Tablo 1. 'e göre 2023 yılı Ocak ayı ortalama maliyet oranı referans alınarak 2020-2022 yılları arasındaki her ay için ayrı ayrı katsayılar belirlenmiştir. Veri setindeki bütün projeler yaklaşık maliyet ve sözleşme bedelleri ihale edildikleri yıl ve aya göre bu katsayılar kullanılarak güncellenmiştir. Bu projelerin ihale yapıldığı yıllardaki ve güncellenmiş yaklaşık maliyet ve sözleşme bedeli rakamları Tablo 2. ve Tablo 3.' de gösterilmiştir.

Tablo 1. *Bina inşaatı maliyet endeksi ve değişim oranları (*www.tuik.gov.tr)

Yıl	Ocak	Şubat	Mart	Nisan	Mayıs	Haziran	Temmuz	Ağustos	Eylül	Ekim	Kasım	Aralık
						Endeks - Index						
2015	97,13	97,65	98,27	99,14	100,17	100,03	100,83	101,35	102,25	101,56	101,01	100,60
2016	108,19	108,12	109,39	110,26	112,11	111,60	111,52	111,90	112,19	113,06	115,83	118,90
2017	124,69	125,09	126,43	126,84	127,26	127,06	128,16	129,51	130,94	132,76	136,09	138,14
2018	144,92	146,60	149,08	152,10	156,58	160,17	162,78	172,71	182,87	182,57	176,85	173,57
2019	184,83	186,51	189,25	192,27	195,51	193,97	192,76	191,35	190,23	190,36	190,32	192,25
2020	202,04	202,34	202,34	204,08	206,85	208,46	210,43	216,30	220,87	227,47	234,07	240,35
2021	258,24	258,16	267,03	276,48	288,67	297,02	304,61	307,43	308,20	322,84	348,46	403,16
2022	464,60	491,20	538,26	571,22	593,87	614,46	654,13	667,06	677,52	700,80	709,02	719,25
2023	829,42	846,70	864,96	873,91	878,63	917,53	1061,35	1110,41				

Tablo 2. *Eğitim Seti*

Sıra No	Projenin İsmi	EKAP Numarası	Yaklaşık Maliyet (TL)	Sözleşme Bedeli (TL)	Güncellenmiş Yaklaşık Maliyet (TL) (2023 Ocak)	Güncellenmiş Sözleşme Bedeli (TL) (2023 Ocak)
1	Selim Bozkuş 2 Derslikli Okul Yapım işi	2020/ 329035	₺1,021,314.10	₺729,700.00	₺4.025.558,81	₺2.876.147,76
2	Mersin Tarsus Günyurdu Ortaokulu 16 Derslikli Bina İnşaatı	2020/ 342776	₺6,322,113.59	₺4,103,796.00	₺24.918.915,81	₺16.175.309,98
3	Bozkır 8 Derslikli Okul Binası	2020/ 383719	₺3,774,808.69	₺2,869,000.00	₺14.474.811,94	₺11.001.414,61
4	İstanbul İli Küçükçekmece İlçesi 12 Derslikli Halk Eğitim Merkezi Yapım İşi	2020/ 399854	₺11,092,394.94	₺7,862,000.00	₺41.654.612,27	₺29.523.701,91
5	Altınekin İlçesi 16 Derslik Anadolu Lisesi Yapım İşi	2020/ 472257	₺4,957,008.20	₺4,093,000.00	₺18.074.654,86	₺14.924.236,43
6	Nevşehir Merkez 16 Derslikli Mesleki Teknik Anadolu Lisesi Yapım İşi	2020/ 681344	₺11,337,320.39	₺9,139,000.00	₺36.413.414,95	₺29.352.808,94
7	Manisa Saruhanlı Azimli (B+Z+1) İlkokulu Yapım İşi	2021/ 651850	₺9,636,299.46	₺7,177,000.00	₺22.936.748,83	₺17.083.014,81
8	Sorgun 12 Derslikli Bilim Sanat Merkezi Binası Yapım İşi	2021/ 662228	₺7,275,061.61	₺6,448,000.00	₺17.316.425,42	₺15.347.816,56
9	Ilgın Atatürk 24 Derslik İlkokul Yapım İşi	2021/ 672352	₺10,370,741.86	₺10,488,000.00	₺24.684.901,32	₺24.964.004,36
10	Kavak Anadolu Lisesi Yapımı	2021/ 697755	₺14,248,394.86	₺10,397,000.00	₺29.313.185,00	₺21.389.720,56
11	Selçuklu Öğretmen Fethiye Onsun 32 Derslik İlkokul Yapım İşi	2021/ 718485	₺14,200,647.79	₺15,480,000.00	₺29.214.955,08	₺31.846.962,99
12	Tuzlukçu 8 Derslik Ortaokul Yapım İşi	2021/ 739104	₺5,512,081.77	₺6,150,000.00	₺11.339.991,22	₺12.652.378,71

13	Aydın İli Didim İlçesi 24 Derslikli Atatürk İlkokulu Ek Bina Yapım İşi	2021/ 744558	₺13,064,889.41	₺12,913,000.00	₺26.878.362,37	₺26.565.880,69
14	Sinop Türkeli İmam Hatip Ortaokulu(16 Derslik) Yapım İşi	2021/ 781382	₺10,833,936.25	₺12,656,936.25	₺22.288.628,35	₺26.039.081,42
15	Artvin Kemalpaşa İlçesi İlkokul ve Ortaokul Yapım İnşaatı	2021/ 900450	₺34,750,666.37	₺31,500,000.00	₺62.038.092,34	₺56.234.890,23
16	Manisa Köprübaşı 8 Derslikli Halk Eğitim Merkezi Yapım İşi	2022/ 74214	₺17,762,641.35	₺15,549,000.00	₺27.370.954,54	₺23.959.892,21
17	Ağrı İli Eleşkirt İlçesi Yanıkdere Köyü 4 Derslikli İlkokul Yapım İşi	2022/ 76912	₺2,956,400.85	₺2,311,000.00	₺4.555.601,37	₺3.561.085,01
18	Ağrı Merkez Taştekne Köyü 4 Derslikli İlkokul Yapım İşi	2022/ 77623	₺2,733,603.94	₺2,076,760.00	₺4.615.850,53	₺3.506.731,02
19	İlkadım İstasyon Ortaokulu Yapım İşi	2022/ 85979	₺21,227,950.37	₺16,870,000.00	₺32.710.746,84	₺25.995.458,33
20	Antalya Kepez Esentepe 24 Derslikli İlkokul Yapım İşi	2022/ 90520	₺28,850,368.32	₺28,230,000.00	₺44.456.345,43	₺43.500.402,41
21	Dazkırı İlçesi Kızılören Köyü 4 Derslikli Ortaokul Yapım İşi	2022/ 104707	₺2,609,234.35	₺2,175,000.00	₺4.405.845,18	₺3.672.615,02
22	Hamur İlçesi Karakozan Köyü 8 Derslikli İlkokul Yapım İşi	2022/ 139925	₺7,917,781.10	₺7,815,000.00	₺12.200.731,99	₺12.042.353,70
23	Amasya Merkez 12 Derslikli Tuğgeneral Hikmet Akıncı İlkokulu Yapım İşi	2022/ 510058	₺14,075,742.45	₺17,000,000.00	₺18.999.938,65	₺22.947.205,68
24	Yomra Merkez İlkokul İnşaatı Yapımı	2022/ 552400	₺28,043,333.11	₺31,416,000.00	₺43.212.762,14	₺48.409.799,58
25	Malatya Doğanşehir Karşıyaka Merkez 12 Derslikli Ortaokulu Yapım İşi	2022/ 555268	₺21,248,716.02	₺18,444,000.00	₺32.742.745,22	₺28.420.879,28
26	Ağrı İli Patnos İlçesi Alparslan Mahallesi 12 Derslikli İmamhatip Ortaokulu Yapım İşi	2022/ 573373	₺19,271,467.82	₺18,790,000.00	₺29.695.947,76	₺28.954.040,43
27	Isparta Gönen Güneykent Yunus Emre 8 Derslikli İlkokul İnşaatı Yapım işi	2022/ 578065	₺13,625,023.08	₺12,723,777.00	₺20.995.181,96	₺19.606.426,48
28	Ağrı İli Patnos İlçesi İnönü Mahallesi 16 Derslikli 75. Yıl Ortaokulu Yapım İşi	2022/ 580323	₺23,284,974.69	₺21,289,000.00	₺35.880.473,58	₺32.804.819,94
29	Afyonkarahisar Sandıklı Miralay Reşat Bey 16 Derslikli İlkokul Yapım İşi	2022/ 599172	₺16,592,094.02	₺16,283,000.00	₺25.567.225,17	₺25.090.933,49
30	Antalya Konyaaltı Çakırlar 16 Derslik İlkokul Yapım İşi	2022/ 623726	₺24,732,702.37	₺23,749,000.00	₺38.111.317,95	₺36.595.503,25
31	Antalya Kepez General Şadi ÇETİNKAYA İlkokulu Yapım İşi	2022/ 625536	₺ 45,588,409.64	₺ 45,487,000.00	₺57.804.929,79	₺57.676.344,98
32	Antalya Kepez Yeni Mahalle 32 Derslik İlkokul Yapım İşi	2022/ 635162	₺ 47,466,964.79	₺ 46,919,660.00	₺60.186.889,36	₺59.492.920,97

33	Gaziantep İli Şahinbey İlçesi Dayı Ahmet Ağa İlkokulu Ek Bina Şahintepe Mah. 349 ada 1 parsele 24 Derslik İlkokul Yapım İşi	2022/ 636291	₺ 21,903,191.66	₺ 19,456,000.00	₺27.772.683,15	₺24.669.707,12
34	İlimiz Merkez Atatürk Anadolu Lisesi Binası Yapım İşi	2022/ 638323	₺ 31,748,903.66	₺ 27,378,378.78	₺48.922.780,21	₺42.188.115,27
35	Malatya Doğanşehir Gedikağzı 8 Derslikli Mustafa Kemal İmam Hatip Ortaokulu Yapım İşi	2022/ 643647	₺ 18,791,425.85	₺ 16,717,000.00	₺28.956.237,56	₺25.759.696,32
36	Diyarbakır İli Kulp İlçesi Uzunova Mahallesi 212 Ada 21 Nolu Parselde 8 Derslikli Ortaokul yapım İşi	2022/ 658379	₺ 16,040,560.04	₺ 12,253,000.00	₺20.339.017,18	₺15.536.488,56
37	Elazığ Merkez 24 Derslikli İmam Hatip Lisesi Yapım İşi	2022/ 685257	₺ 20,158,630.32	₺ 18,545,000.00	₺25.065.168,29	₺23.058.786,17
38	Hafik 12 Derslikli Okul Yapım İşi	2022/ 691992	₺ 17,599,626.62	₺ 16,225,700.00	₺21.883.312,31	₺20.174.976,90
39	Altıeylül İlçesine 24 Derslikli İlkokul Yapım İşi	2022/ 693431	₺ 19,579,105.78	₺ 19,579,105.78	₺24.344.589,57	₺23.624.531,53
40	Sivas Merkez Kurtlapa 12 Derslikli Okul Yapım işi	2022/ 695001	₺ 20,054,438.30	₺ 19,400,000.00	₺24.935.616,31	₺24.121.890,08
41	Bandırma İlçesine 24 Derslikli İlkokul Yapım İşi	2022/ 712397	₺ 35,019,324.53	₺ 33,033,000.00	₺43.542.901,92	₺41.073.113,15
42	İzmir İli Bergama İlçesi 643 Ada 7 Parsel 24 Derslik Ortaokul Yapım İşi	2022/ 724543	₺ 38,419,956.94	₺ 32,545,000.00	₺47.771.236,00	₺40.466.335,10
43	Şırnak İli Silopi İlçesi 111 Ada 49 Parsel 24 Derslikli Ortaokul Yapım İşi	2022/ 752039	₺ 19,289,958.49	₺ 15,730,000.00	₺23.985.064,87	₺19.558.625,31
44	Yenimahalle İlçesi, (Yenibatı Mh 13384 Ada 28 Parsel) Ortaokul (32 Derslik) Yapım İşi	2022/ 761112	₺ 55,637,918.72	₺ 47,407,000.00	₺69.179.987,62	₺58.945.692,95
45	Bilecik Merkez 24 Derslikli İlkokul Bina Yapım İşi	2022/ 777106	₺ 30,502,947.97	₺ 28,433,000.00	₺37.341.709,63	₺34.807.679,27
46	Gaziantep İli Nizip İlçesi Fatih Sultan Mah Ortaokulu Fatih Sultan MAH 1538 ada 94 parsel 32 derslik ortaokul Yapım İşi	2022/ 800074	₺ 39,172,466.01	₺ 32,700,000.00	₺47.954.933,81	₺40.031.340,77
47	Çaykara Karaçam İlkokul ve Ortaokul İnşaatı Yapım İşi	2022/ 1112069	₺11,696,327.44	₺11,619,000.00	₺13.682.502,48	₺13.592.043,92
48	Akyazı Kuzuluk İlkokulu 16 Derslik Yeni Bina Yapım İşi	2022/ 1129907	₺22,843,656.56	₺22,344,600.00	₺26.722.780,21	₺26.138.977,93
49	Sinop Durağan İlçesi 4 Derslikli İlkokul Binası Yapım İşi	2022/ 1145373	₺14,731,171.57	₺12,355,000.00	₺17.232.699,11	₺14.453.025,44
50	Altıeylül 12 Derslikli Edip Gürcün İlkokulu Yapım İşi	2022/ 1147319	₺18,623,901.98	₺16,713,000.00	₺21.786.461,28	₺19.551.065,50

51	Elazığ Merkez 24 Derslikli Fatih Anadolu Lisesi Yapım İşi	2022/ 1150115	₺36,198,279.01	₺26,417,000.00	₺42.345.175,84	₺30.902.919,72
52	Malatya Üçbağlar Hacı İbrahim Işık 32 Derslikli İlkokul Yapım İşi	2022/ 1151197	₺41,288,031.82	₺38,418,999.00	₺47.612.261,87	₺44.303.769,41
53	Karatay Fevzi Çakmak 32 Derslikli İlkokul Yapım İşi	2022/ 1159441	₺35,434,674.06	₺34,400,000.00	₺41.451.901,72	₺40.241.527,74
54	Meram Kalfalar 32 Derslik Ortaokulu Yapım İşi	2022/ 1159448	₺35,532,274.56	₺32,305,000.00	₺40.974.875,45	₺37.253.268,13
55	Diyarbakır İli Kayapınar İlçesi Taban Mahallesi 154 Ada 4 Parselde 12 Derslikli İlkokul Yapım İşi	2022/ 1163306	₺21,120,484.73	₺15,421,000.00	₺24.355.582,13	₺17.783.087,69
56	Diyarbakır İli Kayapınar İlçesi Kaldırım Mahallesi 101 Ada 431 Parselde 8 Derslikli İlkokul Yapım İşi	2022/ 1163671	₺16,088,016.29	₺11,058,000.00	₺18.819.952,15	₺12.935.779,47
57	Susurluk 12 Derslikli Şerafettin Tunalı İlkokulu Yapım İşi	2022/ 1182770	₺17,828,680.69	₺16,813,000.00	₺20.559.561,12	₺19.388.305,12
58	Sındırgı 12 Derslikli Kurtuluş İlkokulu Yapım İşi	2022/ 1182883	₺19,062,193.70	₺16,667,000.00	₺21.982.015,57	₺19.219.941,80
59	Bursa İli Osmangazi İlçesi Yunuseli Mahallesi 8849 Ada 19 Parsel 32 Derslikli İlkokul Yapım İşi	2022/ 1199194	₺47,702,294.86	₺45,813,061.00	₺55.009.019,68	₺52.830.405,36
60	Bursa İli Yıldırım İlçesi Millet Mahallesi 3086 Ada 1 Parsel 32 Derslikli Ortaokul Yapım İşi	2022/ 1200774	₺52,764,920.28	₺46,912,000.00	₺60.847.104,87	₺54.097.672,63
61	Bursa İli Osmangazi İlçesi Emek Mahallesi 518 Ada 1 Parsel 32 Derslik İlkokul Yapım İşi	2022/ 1201929	₺36,704,767.18	₺32,363,000.00	₺42.326.962,80	₺37.320.152,19
62	Bursa İli Yıldırım İlçesi Şirinevler 32 Derslikli Ortaokul Yapım İşi	2022/ 1202204	₺32,993,060.65	₺30,887,000.00	₺38.046.721,40	₺35.618.068,18
63	Bursa İli Yıldırım İlçesi Millet Mahallesi 3065 Ada 5 Parsel 32 Derslikli Ortaokul Yapım İşi	2022/ 1202463	₺37,702,698.91	₺33,000,000.00	₺43.477.751,17	₺38.054.723,67
64	Bingöl Altınçağ 16 Derslikli Ortaokul Yapım İşi	2022/ 1206460	₺23,038,739.40	₺22,366,000.00	₺26.567.662,47	₺25.791.877,26
65	Hanönü 8 Derslikli Ortaokulu Binası Yapım İşi	2022/ 1208747	₺20,727,363.51	₺20,621,000.00	₺23.902.245,18	₺23.779.589,60
66	Başçiftlik Çok Programlı Anadolu Lisesi Yapım İşi	2022/ 1219402	₺17,322,391.55	₺16,360,660.00	₺19.975.721,93	₺18.866.678,65
67	Karatay Hacısadık Ortaokulu 32 Derslik Yapım İşi	2022/ 1230517	₺37,042,028.46	₺38,732,000.00	₺42.715.883,55	₺44.664.713,85
68	Tarsus 100 Yıl İlkokulu Yapım İşi	2022/ 1247968	₺30,306,745.60	₺28,880,000.00	₺34.948.934,22	₺33.303.649,08
69	Mersin Akdeniz Fevzi Çakmak 32 Derslik Okul İnşaatı Yapım	2022/ 1248332	₺46,044,311.83	₺37,370,049.00	₺53.097.077,68	₺43.094.148,13

70	Gönen 16 Derslikli Mehmet Çanakçı İlkokulu Yapım İşi	2022/ 1250375	₺19,270,325.27	₺17,733,000.00	₺22.222.027,37	₺20.449.224,69
71	Erdek 12 Derslikli Kapıdağ MTAL Yapım İşi	2022/ 1264907	₺19,062,178.42	₺18,213,000.00	₺21.981.997,95	₺21.002.747,95
72	Siirt İli Kurtalan İlçesi Aksöğüt Köyü 8 Derslik İlk-Orta Okulu Yapım İşi	2022/ 1284341	₺9,349,630.19	₺7,273,000.00	₺10.781.745,25	₺8.387.030,46
73	Mersin Toroslar Arpaçsakarlar 32 Derslik Ortaokul İnşaatı	2022/ 1295596	₺50,507,014.25	₺41,821,000.00	₺58.243.347,60	₺48.226.866,62
74	Mersin Yenişehir Cumhuriyet İlkokulu Bina	2022/ 1296202	₺46,257,833.94	₺36,940,000.00	₺53.343.305,70	₺42.598.227,04
75	Ereğli Aziziye 24 Derslik İlkokulu Yapım İşi	2022/ 1298030	₺24,245,858.84	₺23,260,000.00	₺27.959.680,55	₺26.822.814,32
76	Karesi 24 Derslikli Atatürk MTAL Lise Yapım İşi	2022/ 1298485	₺32,722,272.37	₺29,940,000.00	₺37.734.455,54	₺34.526.012,93
77	Bandırma 24 Derslikli İmam Hatip Lisesi Yapım İşi	2022/ 1298510	₺32,969,222.65	₺29,250,000.00	₺38.019.232,05	₺33.730.323,25
78	Çorum İskilip İlçesi Ebussud Efendi İlkokulu Yapımı İnşaatı	2022/ 1299346	₺18,029,054.38	₺19,376,000.00	₺20.790.626,74	₺22.343.888,66
79	Mersin Tarsus 100. Yıl Ortaokulu Yapım İşi	2022/ 1336676	₺30,001,902.75	₺29,990,000.00	₺34.597.397,54	₺34.583.671,60
80	Ordu İli Kumru İlçesi Şehit Neşe Eryetim İmam Hatip Ortaokulu Yapım İşi	2022/ 1339580	₺17,441,476.32	₺17,647,000.00	₺17.441.476,32	₺17.647.000,00
81	Mersin Yenişehir Dr.Kamil TARHAN Orta Okulu Yapım İşi	2022/ 1352397	₺30,240,371.36	₺25,921,000.00	₺34.872.393,21	₺29.891.408,86

Tablo 3. *Test Seti*

Sıra No	Projenin İsmi	EKAP Numarası	Yaklaşık Maliyet (TL)	Sözleşme Bedeli (TL)	Güncellenmiş Yaklaşık Maliyet (TL) (2023 Ocak)	Güncellenmiş Sözleşme Bedeli (TL) (2023 Ocak)
1	Yalova Teşfikiye 8 Derslikli İlköğretim Okulu Yapım İşi	2020/ 652247	₺5,144,773.67	₺4,145,000.00	₺17.754.017,80	₺14.303.914,71
2	Seyhan İlçesi Fatih Mehmet 24 Derslikli İlkokul Yapım İşi	2021/ 678349	₺11,549,480.83	₺9,645,600.00	₺27.490.588,27	₺22.958.886,39
3	Tunceli Merkez 12 Derslikli Ortaokulu Yapımı	2021/ 788903	₺14,732,311.59	₺12,289,000.00	₺30.308.745,61	₺25.282.127,15
4	Akyazı Alaağaç İlkokulu-Ortaokulu 8 Derslikli Yeni Bina	2021/ 872200	₺5,732,314.68	₺6,329,000.00	₺10.233.526,56	₺11.298.749,85
5	Dazkırı İlçesi Şerife Memiş UÇAR 4 Derslikli İlkokul Yapım İşi	2022/ 103527	₺2,753,214.86	₺2,594,800.00	₺4.648.964,72	₺4.381.471,94
6	Ağrı Merkez Cumhuriyet Mahallesi 12 Derslikli İlkokul Yapım İşi	2022/ 571617	₺20,821,311.83	₺18,485,000.00	₺32.084.146,06	₺28.484.057,33
7	Mersin İli Akdeniz İlçesi Ulubatlı Hasan 24 Derslikli Ortaokul Bina İnşaatı	2022/ 1123063	₺29,920,269.76	₺25,965,000.00	₺34.503.260,54	₺29.942.148,49
8	Malatya İli Battalgazi İlçesi Hatunsuyu Saray 4 Derslikli İlkokul Yapım İşi	2022/ 1151194	₺14,882,398.57	₺12,144,444.00	₺17.409.606,25	₺14.206.714,54
9	Bursa İli İnegöl İlçesi 1767 Ada 1 Parsel 32 Derslik Ortaokul Yapım İşi	2022/ 1191537	₺39,678,634.50	₺36,780,000.00	₺45.756.347,62	₺42.413.719,29
10	Bursa İli Gürsu İlçesi 217 Ada 5 Parsel 32 Derslik Ortaokul Yapım İşi	2022/ 1201569	₺40,502,163.31	₺34,850,000.00	₺46.706.019,18	₺40.188.094,54
11	Gürpınar İlçesi Atatürk İlkokulu 8 Derslik Yapımı ve Çevre Düzenleme İşi	2022/ 1211745	₺21,570,694.37	₺15,365,000.00	₺24.874.751,93	₺17.718.509,98
12	Burhaniye 12 Derslikli Şehit Yılmaz Kobak İlkokulu Yapım İşi	2022/ 1259556	₺20,764,093.35	₺18,649,000.00	₺23.944.601,05	₺21.505.531,57
13	Ereğli Mehmet Akif Mahallesi 24 Derslik İlkokulu Yapım İşi	2022/ 1297609	₺22,539,471.31	₺22,342,000.00	₺25.991.919,77	₺25.764.201,10
14	Bandırma 24 Derslikli Haydar Çavuş MTAL Lise Yapım İşi	2022/ 1298507	₺32,454,585.73	₺30,942,000.00	₺37.425.766,42	₺35.681.492,72
15	Ayvalık Altınova 12 Derslikli İlkokulu Yapım İşi	2022/ 1333690	₺20,099,949.64	₺17,182,000.00	₺23.178.728,16	₺19.813.826,12

3.3. Veri Setinin Oluşturulması

Bu bölümde 4734 sayılı Kamu İhale Kanununa göre ihale edilmiş Eğitim yapıları yapım projeleri hakkında bilgiler verilmiştir.

3.3.1. Analizlerde Kullanılan Projelerin Özellikleri

Bu çalışmada, 4734 sayılı Kamu İhale Kanununa tabi kurumlar tarafından 2020 ile 2022 yılları arasında ihale edilmiş ve sözleşmesi imzalanmış 96 adet eğitim yapısı yapım projesi kullanılmıştır.

3.3.2. Metraj Hesabı

Metraj hesabı, uygulama projelerinden her bir iş kalemi için ölçülen ölçümlerin yapılarak miktarların belirlenmesi işlemidir. Hem işi ihale eden kamu kurumu, hem de işi almak isteyen istekli tarafından yapının maliyetinin belirlenmesi için yapılan metraj çalışması, uzun zaman alan ve detaylı hesapların yapıldığı aşamadır.

Bu bölümde çalışmada kullanılacak veri setinin oluşturulması için yapılan metraj çalışmaları anlatılmıştır. Veri setinin oluşturulmasında, eğitim binaları maliyet modellemesi için uygun olduğu düşünülen metraj kalemleri seçilmiştir. Bu çalışma için yapı maliyetini etkilediği bilinen 18 adet ana metraj kalemi seçilmiş olup seçilen bu kalemler, veri setinin bağımsız değişkenlerini oluşturmaktadır. Bu bağımsız değişkenlerin özellikleri aşağıda anlatılmıştır.

3.3.2.1. Derslik Sayısı

Eğitim projelerindeki oluşacak yapılarda bulunan derslik sayılarıdır. Veri setinde en düşük 2 derslikli, en yüksek 32 derslikli yapı bulunmaktadır.

3.3.2.2. Yapım Süresi

Projelerin ihale dosyalarında bulunan ve ihaleyi yapan kurum tarafından inşaatın tamamlanması için öngörülen süresidir. Veri setindeki proje sürelerinin en azı 100 gün, en fazlası ise 750 gündür.

3.3.2.3. Toplam Kat sayısı

Projelerde tek bloktan oluşan binalar tercih edilmiştir. Veri setindeki projeler arasında bodrum kat dâhil minimum kat sayısı 1, maksimum kat sayısı ise 5'dir.

3.3.2.4. Kat yüksekliği

Bu bağımsız değişken projedeki bir binanın normal katları için belirtilen kat yüksekliğidir. Burada yüksekliğin ölçümü katların döşeme üstlerinden döşeme üstüne yapılmıştır. Veri setindeki projelerde minimum kat yüksekliği 3,20 m, maksimum kat yüksekliği 4,00 m'dir.

3.3.2.5. Bina yüksekliği

Bu bağımsız değişken binaların +0,00 kotu ile en üst katın döşeme üst kotu (çatı yüksekliği hariç) arasındaki farkı ifade etmektedir. Veri setindeki projelerde minimum bina yüksekliği 3,20 m, maksimum bina yüksekliği 20,50 m'dir.

3.3.2.6. Bina yükseklik sınıfı (BYS)

Bu bağımsız değişken, 2018 Deprem yönetmeliğine göre; Deprem etkisi altında tasarımda binalar yükseklikleri bakımından sekiz Bina Yükseklik Sınıfı'na (BYS) ayrılmıştır. Bu sınıflara giren binalar için tanımlanan yükseklik aralıkları, Deprem Tasarım Sınıflarına bağlı olarak belirlenmektedir. Veri setinde Bina Yükseklik Sınıfının sayısına göre isimlendirilmiştir. Veri setindeki en düşük değer 5, en yüksek değer 8'dir.

Tablo 4. *Bina Yükseklik Sınıfları ve Deprem Tasarım Sınıflarına Göre Tanımlanan Bina Yükseklik Aralıkları(https://www.resmigazete.gov.tr)*

Bina Yükseklik Sınıfı	Bina Yükseklik Sınıfları ve Deprem Tasarım Sınıflarına Göre Tanımlanan Bina Yükseklik Aralıkları [m]		
	DTS = 1, 1a, 2, 2a	DTS = 3, 3a	DTS = 4, 4a
BYS=1	HN >70	HN > 91	HN >70
BYS=2	56 > HN >70	70 > HN > 91	HN >70
BYS=3	42 > HN >56	56 > HN > 70	HN >70
BYS=4	28 > HN >42	42 > HN > 56	
BYS=5	17.5 > HN >28	28 > HN > 42	
BYS=6	10.5 > HN >17.5	17.5 > HN > 28	
BYS=7	7 > HN >10.5	10.5 > HN > 17.5	
BYS=8	HN <7	HN < 10.5	

3.3.2.7.Bodrum kat yüksekliği

Bu bağımsız değişken, projelerde doğal zemin kodu olan sıfır kotunun altında yer alan katların sayısını ifade etmektedir. Toplamda 16 adet yapının bodrum katı bulunmamaktadır. 80 adet yapının ise bodrum katı vardır. Veri setindeki projelerde minimum bodrum kat yüksekliği 0.00 m, maksimum bodrum yüksekliği ise 5,15 m' dir.

3.3.2.8.Deprem tasarım sınıfı

Bu bağımsız değişken, 2018 deprem yönetmeliğine göre tanımlanan Bina Kullanım Sınıflarına ve DD-2 deprem yer hareketi düzeyi için Kısa Periyot Tasarım Spektral İvme Katsayısına bağlı olarak, bu Yönetmelik'te deprem etkisi altında tasarımda esas alınacak Deprem Tasarım Sınıfları (DTS) belirlenecektir.

Tablo 5. *DD-2 Deprem Yer Hareketi Düzeyinde Kısa Periyot Tasarım Spektral İvme Katsayısı (https://www.resmigazete.gov.tr)*

DD-2 Deprem Yer Hareketi Düzeyinde Kısa Periyot Tasarım Spektral İvme Katsayısı (SDS)	Bina Kullanım Sınıfı	
	BKS = 1	BKS = 2, 3
SDS < 0.33	DTS = 4a	DTS = 4
0.33 < SDS < 0.50	DTS = 3a	DTS = 3
0.50 < SDS < 0.75	DTS = 2a	DTS = 2
0.75 < SDS	DTS = 1a	DTS = 1

Tablo 6. *Veri Setinde Deprem Tasarım Sınıfına göre tanımlanan değerler*

Deprem Tasarım Sınıfı (DTS)	Tanımlanan Değer
1a	**1**
2a	**2**
3a	**3**
4a	**4**
1	**5**
2	**6**
3	**7**
4	**8**

Veri setindeki en düşük değer 1, en yüksek değer 5'dir

3.3.2.9. Zemin sınıfı

Bu bağımsız değişken, zeminin dane çapı ve kıvamı esas alınarak belirlenen ve ZA ile ZF arasında değişen değerdir. Bu çalışmadaki projelerin zemin sınıfları, statik projelerde veya geoteknik raporlarda yer alan bilgilere göre belirlenmiştir. Veri setinde ZB ile ZE arasında değişen bütün zemin sınıflarını temsil eden projeler bulunmaktadır.

Tablo 7. *Zemin Sınıfı Değerleri(https://www.resmigazete.gov.tr)*

Yerel Zemin Sınıfı	Zemin Cinsi	Üst 30 metrede ortalama		
		(VS)30 [m/s]	(N60)30 [darbe/30 cm]	(Cu)30 [kPa]
ZA	Sağlam, sert kayalar	> 1500	-	-
ZB	Az ayrışmış, orta sağlam kayalar	760 - 1500	-	-
ZC	Çok sıkı kum, çakıl ve sert kil tabakaları veya ayrışmış, çok çatlaklı zayıf kayalar	360 - 760	> 50	> 250
ZD	Orta sıkı-sıkı kum, çakıl veya çok katı kil tabakaları	180 - 360	15 - 50	70 - 250
ZE	Gevşek kum, çakıl veya yumuşak-katı kil tabakaları PI > 20 ve w>% 40 koşullarını sağlayan toplamda 3 metreden daha kalın yumuşak kil tabakası (cu < 25 kPa) içeren profiller.	< 180	< 15	< 70
ZF	ZF Sahaya özel araştırma ve değerlendirme gerektiren zeminler: 1) Deprem etkisi altında çökme ve potansiyel göçme riskine sahip zeminler (sıvılaşabilir zeminler, yüksek derecede hassas killer, göçebilir zayıf çimentolu zeminler vb.), 2) Toplam kalınlığı 3 metreden fazla turba ve/veya organik içeriği yüksek killer, 3) Toplam kalınlığı 8 metreden fazla olan yüksek plastisiteli (PI > 50) killer, 4) Çok kalın (> 35 m) yumuşak veya orta katı killer.			

Tablo 8. *Veri Setinde Zemin Sınıfına göre tanımlanan değerler*

Zemin Sınıfı	Tanımlanan Değer
ZA	**1**
ZB	**2**
ZC	**3**
ZD	**4**
ZE	**5**
ZF	**6**

Veri setindeki en düşük değer 2, en yüksek değer 5'dür

3.3.2.10.Zemin emniyet gerilmesi

Bu bağımsız değişken, zemin sınıfı değişkeninde olduğu gibi projelerin yapılacağı zeminin yapısına göre farklılık gösteren, zeminin emniyetle taşıyabileceği en yüksek gerilme değeridir. Bu çalışmada zemin emniyet gerilmesi değerleri, statik projelerde veya geoteknik raporlarda bulunan bilgilere göre belirlenmiştir. Veri setinde maksimum 116 t/m^2, minimum 8,50 t/m^2 zemin emniyet gerilmesine sahip projeler yer almaktadır.

3.3.2.11.Yatak katsayısı

Projelerin yapılacağı zeminin yapısının belirlenmesi amacıyla hesap edilen bir diğer bağımsız değişken de yatak katsayısıdır. Bu değişken, binanın yapılması sonucunda zemine etki edecek ağırlığa karşı zeminde oluşan hacimsel değişim miktarını ifade eden değerdir. Bu çalışmada yatak katsayısı statik projelerde veya geoteknik raporlarda bulunan bilgilere göre belirlenmiştir. Veri setinde, yatak katsayısı maksimum 15000 t/m^3, minimum 1100 t/m^3 olarak değişmektedir.

3.3.2.12.Beton sınıfı

Bu bağımsız değişken, statik hesap ve projelerde yer alan beton sınıfı değeridir. Beton sınıfı statik hesaplarda kullanılan, küp ve silindir numuneler üzerinde yapılan deney sonuçları ile belirlenen ve betonun basınç dayanımını ifade eden bir değerdir. Veri setinde beton sınıfı C25, C30, C35 ve C40 olarak değişen projeler yer almaktadır. Analizlerde 25 değeri C25'i, 30 değeri C30'u, 35 değeri C35'i ve 40 değeri C40'ı ifade etmektedir.

3.3.2.13.Asansör sayısı

Bu bağımsız değişken, projedeki asansör sayısını göstermektedir. Analizlerde asansörü bulunmayan 7 adet yapı bulunmaktadır. 70 adet yapıda 1 asansör, 19 adet yapıda 2 asansör bulunmaktadır.

3.3.2.14.Islak alan

Mimari projelerde yer alan banyo ve WC alanları, ***"Islak Alan"*** olarak isimlendirilmektir. Bu bağımsız değişken, projede her bir katta yer alan ıslak alanların toplamı ile belirlenmiştir. Veri setindeki projelerde minimum ıslak alan 22,62 m^2, maksimum ıslak alan ise 387,91 m^2'dir.

3.3.2.15. Radye Temel tipi yüksekliği

Bu bağımsız değişken, statik projelerde yer alan temel çizim ve detayları esas alınarak belirlenmiştir. Veri setindeki en düşük değer 0,30 m, en yüksek değer ise 1,20 m'dir.

3.3.2.16.Kat alanı

Bu bağımsız değişken, veri setini oluşturan projelerin normal bir kata ait alanı ifade etmektedir. Bir binada farklı normal kat alanlarının olması durumunda en çok ortak olan normal katlardan birinin değeri alınmıştır. Veri setindeki projelerde minimum kat alanı 413,29 m^2, maksimum kat alanı ise 1270,32 m^2'dir.

3.3.2.17.Bodrum alanı

Bu bağımsız değişken, projelerin mimari ve statik hesapları sonucu belirlenen projelerde doğal zemin kodu olan sıfır kotunun altında yer alan katların alanını ifade etmektedir. Veri setinde bulunan projelerde bina oturum alanı minimum 0 m^2, maksimum 1427,60 m^2'dir.

3.3.2.18.Toplam inşaat alanı

Bu bağımsız değişken projede yer alan katların toplam inşaat alanını ifade etmektedir. Veri setinde kat alanı minimum 325,00 m^2, maksimum 9113,12 m^2'dır.

Yukarıdaki hesaplanmış 18 adet değişken kullanılarak Sözleşme Bedeli ve Yaklaşık Maliyet tahmini analizi yapılmıştır.

3.4. Çoklu Doğrusal Regresyon ile Model Oluşturulması

Yapılan modelleme çalışmasında; Derslik Sayısı, Yapım Süresi(Gün), Toplam Kat Sayısı, Kat Yüksekliği(metre), Bina Yüksekliği(+0,00 Kotundan itibaren (metre)), Bina Yükseklik Sınıfı**(BYS)**, Bodrum Yüksekliği(metre), Deprem Tasarım Sınıfı**(DTS)**, Zemin Sınıfı, Zemin Emniyet Gerilmesi(t/m^2), Yatak Katsayısı(t/m^3), Beton Sınıfı, Asansör Sayısı, Islak Alan(m^2), Radye Temel Yüksekliği(metre), Kat Alanı(m^2), Bodrum Alanı(m^2), Toplam Alan(m^2) değerleri bağımsız değişken olarak alınmış ve bu değişkenler ile projenin sözleşme Bedeli ve yaklaşık maliyet değerleri açıklanmaya çalışılmıştır. Yapılan çalışmada SPSS paket programı ile çoklu regresyon modeli kullanılmıştır. 81 adet Okul projesine ait regresyon analizi sonucunda aşağıdaki veriler elde edilmiştir.

Sözleşme Bedeli Regresyon Modeli

Sözleşme Bedeli = - 2349012.559 + 46452.464 * **(Derslik Sayısı)** - 277.169 * **(Yapım Süresi)** + 496947.262 * **(Toplam Kat Sayısı)** + 2021313.907 * **(Kat Yüksekliği)** - 445038.095(Bina Yüksekliği) - 2020336.669 * **(BYS)** - 2413730.060 * **(Bodrum Yüksekliği)** + 21079.829 * **(DTS)** + 196257.334 * **(Zemin Sınıfı)** - 34217.334 * **(Zemin Emniyet Gerilmesi)** + 207.823 * **(Yatak Katsayısı)** + 427461.327 * **(Beton Sınıfı)** + 5537494.092 * **(Asansör Sayısı)** + 16687.841 * **(Islak Alan)** + 9752894.338 * **(Radye Temel Yüksekliği)** - 2534.565 * **(Kat Alanı)** + 12246.067 * **(Bodrum Alanı)** + 3711.671 * **(Toplam Alan)**

Tablo 9. *Eğitim yapılarına ait Regresyon modeli tahmin sonuçları*

Sıra No	Projenin İsmi	Güncellenmiş Sözleşme Bedeli (TL)	Regresyon Denklemi ile tahmin edilen Sözleşme	Hata Oranı
1	Yalova Teşfikiye 8 Derslikli İlköğretim Okulu Yapım İşi	₺14.303.914,71	₺19.749.333.37	38.1%
2	Seyhan İlçesi Fatih Mehmet 24 Derslikli İlkokul Yapım İşi	₺22.958.886,39	₺30.063.223.09	30.9%
3	Tunceli Merkez 12 Derslikli Ortaokulu Yapımı	₺25.282.127,15	₺22.520.388.60	10.9%
4	Akyazı Alaağaç İlkokulu-Ortaokulu 8 Derslikli Yeni Bina	₺11.298.749,85	₺16.064.295.08	42.2%
5	Dazkırı İlçesi Şerife Memiş UÇAR 4 Derslikli İlkokul Yapım İşi	₺4.381.471,94	₺2.569.036.56	41.4%
6	Ağrı Merkez Cumhuriyet Mahallesi 12 Derslikli İlkokul Yapım İşi	₺28.484.057,33	₺30.083.289.02	5.6%
7	Mersin İli Akdeniz İlçesi Ulubatlı Hasan 24 Derslikli Ortaokul Bina İnşaatı	₺29.942.148,49	₺28.215.690.19	5.8%
8	Malatya İli Battalgazi İlçesi Hatunsuyu Saray 4 Derslikli İlkokul Yapım İşi	₺14.206.714,54	₺15.463.565.98	8.8%
9	Bursa İli İnegöl İlçesi 1767 Ada 1 Parsel 32 Derslik Ortaokul Yapım İşi	₺42.413.719,29	₺47.098.209.85	11.0%
10	Bursa İli Gürsu İlçesi 217 Ada 5 Parsel 32 Derslik Ortaokul Yapım İşi	₺40.188.094,54	₺44.822.007.71	11.5%
11	Gürpınar İlçesi Atatürk İlkokulu 8 Derslik Yapımı ve Çevre Düzenleme İşi	₺17.718.509,98	₺18.507.047.52	4.5%
12	Burhaniye 12 Derslikli Şehit Yılmaz Kobak İlkokulu Yapım İşi	₺21.505.531,57	₺24.547.419.40	14.1%
13	Ereğli Mehmet Akif Mahallesi 24 Derslik İlkokulu Yapım İşi	₺25.764.201,10	₺23.973.879.22	6.9%
14	Bandırma 24 Derslikli Haydar Çavuş MTAL Lise Yapım İşi	₺35.681.492,72	₺29.420.229.43	17.5%
15	Ayvalık Altınova 12 Derslikli İlkokulu Yapım İşi	₺19.813.826,12	₺24.386.985.98	23.1%
			ORTALAMA HATA DEĞERİ	18,20%

Tablo 10. *Eğitim Yapılarına ait İstatistiki veriler*

Model	Kareler Toplamı	Serbestlik Derecesi	Kareler Ortalaması	F	p
Regresyon Kareler Toplamı	13408311421886500,000	18	744906190104806,000	43,620	,000[b]
Artık Kareler Toplamı	1058793525979290,000	62	17077314935149,900		
Genel Kareler Toplamı	14467104947865800,000	80			

Hesaplamalar sonucunda F istatistiği değeri 43,620 olarak hesaplanmış. F tablosu yardım ile p değerinin p<0,05 olduğundan oluşturulan modelin anlamlı olduğu görülmüştür.

Tablo 11. *Eğitim yapılarına ait istatistiki veriler (Bağımsız Değişkenler Arasındaki İlişkiler)*

		Güncellenmiş Sözleşme Bedeli (TL)	Derslik Sayısı	Yapım Süresi (Gün)	Toplam Kat Sayısı	Kat Yüksekliği (mt)	Bina Yüksekliği (m) (+0,00 Kotundan)	Bina Yükseklik Sınıfı (BYS)	Bodrum Yüksekliği (mt)	Deprem Tasarım Sınıfı (DTS)	Zemin Sınıfı	Zemin Emniyet Gerilmesi (t/m²)	Yatak Katsayısı (t/m³)	Beton Sınıfı	Asansör Sayısı	Islak Alan (m²)	Radye Temel Yüksekliği (mt)	Kat Alanı (m²)	Bodrum Alanı (m²)	Toplam Alan (m²)
Güncellenmiş Sözleşme Bedeli (TL)	r	1,00	0,84	0,46	0,67	0,40	0,66	-0,49	0,49	0,12	-0,04	-0,03	-0,02	0,28	0,75	0,86	0,71	0,81	0,81	0,93
	p		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,15	0,37	0,38	0,45	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Derslik Sayısı	r	0,84	1,00	0,39	0,75	0,25	0,71	-0,42	0,51	0,15	0,00	-0,09	-0,08	0,31	0,64	0,77	0,63	0,68	0,76	0,89
	p	0,00		0,00	0,00	0,01	0,00	0,00	0,00	0,09	0,48	0,21	0,25	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Yapım Süresi (Gün)	r	0,46	0,39	1,00	0,52	0,29	0,47	-0,41	0,45	-0,01	0,09	-0,05	0,20	0,06	0,45	0,34	0,25	0,27	0,42	0,43
	p	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,48	0,22	0,34	0,04	0,30	0,00	0,00	0,01	0,01	0,00	0,00
Toplam Kat Sayısı	r	0,67	0,75	0,52	1,00	0,37	0,93	-0,68	0,77	0,18	0,01	-0,13	-0,12	0,25	0,60	0,64	0,59	0,35	0,68	0,72
	p	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,05	0,45	0,12	0,15	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Kat Yüksekliği (mt)	r	0,40	0,25	0,29	0,37	1,00	0,48	-0,45	0,38	0,12	-0,16	-0,11	-0,04	0,24	0,46	0,30	0,27	0,34	0,37	0,34
	p	0,00	0,01	0,00	0,00		0,00	0,00	0,00	0,14	0,08	0,17	0,38	0,01	0,00	0,00	0,01	0,00	0,00	0,00
Bina Yüksekliği (m)	r	0,66	0,71	0,47	0,93	0,48	1,00	-0,71	0,67	0,11	-0,05	-0,09	-0,12	0,28	0,62	0,62	0,56	0,38	0,63	0,70
	p	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,17	0,33	0,21	0,14	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Bina Yükseklik Sınıfı (BYS)	r	-0,49	-0,42	-0,41	-0,68	-0,45	-0,71	1,00	-0,49	0,09	-0,02	0,19	0,18	-0,41	-0,34	-0,49	-0,43	-0,15	-0,39	-0,42
	p	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,22	0,44	0,04	0,05	0,00	0,00	0,00	0,00	0,09	0,00	0,00
Bodrum Yüksekliği (mt)	r	0,49	0,51	0,45	0,77	0,38	0,67	-0,49	1,00	0,19	-0,07	-0,05	-0,06	0,29	0,47	0,53	0,47	0,30	0,79	0,55
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,04	0,26	0,32	0,28	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Deprem Tasarım Sınıfı (DTS)	r	0,12	0,15	-0,01	0,18	0,12	0,11	0,09	0,19	1,00	-0,39	0,07	0,27	-0,17	0,17	0,08	0,10	0,19	0,22	0,18
	p	0,15	0,09	0,48	0,05	0,14	0,17	0,22	0,04		0,00	0,27	0,01	0,06	0,06	0,24	0,18	0,05	0,03	0,05
Zemin Sınıfı	r	-0,04	0,00	0,09	0,01	-0,16	-0,05	-0,02	-0,07	-0,39	1,00	-0,33	-0,48	0,07	-0,17	-0,09	-0,08	-0,12	-0,07	-0,05
	p	0,37	0,48	0,22	0,45	0,08	0,33	0,44	0,26	0,00		0,00	0,00	0,26	0,07	0,21	0,25	0,14	0,26	0,34
Zemin Emniyet Gerilmesi	r	-0,03	-0,09	-0,05	-0,13	-0,11	-0,09	0,19	-0,05	0,07	-0,33	1,00	0,45	-0,01	-0,01	0,02	0,04	0,02	-0,01	-0,06
	p	0,38	0,21	0,34	0,12	0,17	0,21	0,04	0,32	0,27	0,00		0,00	0,45	0,46	0,42	0,37	0,42	0,46	0,29
Yatak Katsayısı (t/m³)	r	-0,02	-0,08	0,20	-0,12	-0,04	-0,12	0,18	-0,06	0,27	-0,48	0,45	1,00	-0,31	0,09	-0,13	-0,12	0,03	-0,04	-0,05
	p	0,45	0,25	0,04	0,15	0,38	0,14	0,05	0,28	0,01	0,00	0,00		0,00	0,21	0,12	0,13	0,38	0,37	0,34
Beton Sınıfı	r	0,28	0,31	0,06	0,25	0,24	0,28	-0,41	0,29	-0,17	0,07	-0,01	-0,31	1,00	0,01	0,31	0,38	0,11	0,29	0,23

	p	0,01	0,00	0,30	0,01	0,01	0,01	0,00	0,00	0,06	0,26	0,45	0,00		0,45	0,00	0,00	0,15	0,00	0,02
Asansör Sayısı	r	0,75	0,64	0,45	0,60	0,46	0,62	-0,34	0,47	0,17	-0,17	-0,01	0,09	0,01	1,00	0,63	0,47	0,73	0,66	0,78
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,07	0,46	0,21	0,45		0,00	0,00	0,00	0,00	0,00
Islak Alan (m²)	r	0,86	0,77	0,34	0,64	0,30	0,62	-0,49	0,53	0,08	-0,09	0,02	-0,13	0,31	0,63	1,00	0,69	0,72	0,76	0,87
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,24	0,21	0,42	0,12	0,00	0,00		0,00	0,00	0,00	0,00
Radye Temel Yüksekliği (mt)	r	0,71	0,63	0,25	0,59	0,27	0,56	-0,43	0,47	0,10	-0,08	0,04	-0,12	0,38	0,47	0,69	1,00	0,47	0,65	0,65
	p	0,00	0,00	0,01	0,00	0,01	0,00	0,00	0,00	0,18	0,25	0,37	0,13	0,00	0,00	0,00		0,00	0,00	0,00
Kat Alanı (m²)	r	0,81	0,68	0,27	0,35	0,34	0,38	-0,15	0,30	0,19	-0,12	0,02	0,03	0,11	0,73	0,72	0,47	1,00	0,71	0,88
	p	0,00	0,00	0,01	0,00	0,00	0,00	0,09	0,00	0,05	0,14	0,42	0,38	0,15	0,00	0,00	0,00		0,00	0,00
Bodrum Alanı (m²)	r	0,81	0,76	0,42	0,68	0,37	0,63	-0,39	0,79	0,22	-0,07	-0,01	-0,04	0,29	0,66	0,76	0,65	0,71	1,00	0,85
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,26	0,46	0,37	0,00	0,00	0,00	0,00	0,00		0,00
Toplam Alan (m²)	r	0,93	0,89	0,43	0,72	0,34	0,70	-0,42	0,55	0,18	-0,05	-0,06	-0,05	0,23	0,78	0,87	0,65	0,88	0,85	1,00
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,34	0,29	0,34	0,02	0,00	0,00	0,00	0,00	0,00	

Tabloya göre bazı değişkenler arasında yüksek güçte ilişkiler bulunmaktadır. Bu değişkenlerin aynı anda modele alınması çoklu bağıntı sorunu yaşanmasına neden olabilir. Bu nedenle oluşturulan modelde çoklu bağıntı kontrolleri yapılması gerekecektir.

Tablo 12. *Eğitim yapılarına ait istatistiki veriler (Otokorelasyon ve Çoklu Bağıntı Varsayımlarının Kontrolleri)*

Durbin-Watson	**1,523**
Collinearity (VIF)	
Derslik Sayısı	7.524
Yapım Süresi (Gün)	1.889
Toplam Kat Sayısı	32.216
Kat Yüksekliği (mt)	2.179
Bina Yüksekliği (m)	10.897
Bina Yükseklik Sınıfı(BYS)	3.301
Bodrum Yüksekliği (m)	10.720
Deprem Tasarım Sınıfı (DTS)	1.632
Zemin Sınıfı	1.981
Zemin Emniyet Gerilmesi (t/m²)	1.698
Yatak Katsayısı (t/m³)	2.340
Beton Sınıfı	1.913
Asansör Sayısı	3.905
Islak Alan (m²)	6.505
Radye Temel Yüksekliği (mt)	2.551
Kat Alanı (m²)	24.326
Bodrum Alanı (m²)	14.567
Toplam Alan (m²)	73.277

Otokorelasyon, oluşturulan modeldeki hatalar arasında ilişki olması durumudur. Regresyon modelinde otokorelasyon olmamalı, oluşturulan modeldeki hatalar rastgele olmalıdır. Bu durum Durbin-Watson testi ile kontrol edilir. Durbin-Watson testi sonucunun 2 civarında çıkması modelde otokorelasyon problemi olmadığını göstermektedir. Yapılan inceleme sonucunda 1,523 olarak tespit edilen Durbin- Watson sonucuna göre oluşturduğumuz modelde otokorelasyon probleminin olmadığı görülmektedir. Modelde çoklu bağıntı problemi olup olmadığını ise değişkenlere ait VIF değerine bakılarak incelenmektedir. VIF değerinin 10'un üzerinde olmaması gerekmektedir. Modele alınan 18 bağımsız değişken içinde VIF değerinin 12 değişkenin 10'un altında kaldığı görülmektedir. Bu sonuca göre modele alınan değişkenler arasında 12 değişken için çoklu bağıntı problemi olmadığı söylenebilir. Toplam Kat Sayısı, Bina Yüksekliği, Bodrum Yüksekliği, Kat Alanı, Bodrum Alanı ve Toplam Alan değişkenlerinde çoklu bağıntı problemi olduğu görülmektedir.

Tablo 13. *Eğitim yapılarına ait istatistiki veriler(Model anlamlılığı)*

Düzeltilmiş R^2	F	p
0.927	43,620	,000[b]

,000[b] :p<0,05 olduğunu ifade eder.

Sözleşme Bedeli değişkenini açıklamak için oluşturulan modelin anlamlı bir model olduğu görülmektedir (F:43,620, p<0,05). Anlamlı olan bu modelde bağımsız değişkenler, bağımlı değişkendeki değişimin %92,7 'sini açıklayabilmektedir.

Yaklaşık Maliyet Bedeli için Regresyon Modeli

Yaklaşık Maliyet Bedeli = - 2349012.559 + 46452.464 * **(Derslik Sayısı)** - 277.169 * **(Yapım Süresi)** + 496947.262 * **(Toplam Kat Sayısı)** + 2021313.907 * **(Kat Yüksekliği)** - 445038.095 * **(Bina Yüksekliği)** - 2020336.669 * **(BYS)** - 2413730.060 * **(Bodrum Yüksekliği)** + 21079.829 * **(DTS)** + 196257.334 * **(Zemin Sınıfı)** - 34217.334 * **(Zemin Emniyet Gerilmesi)** + 207.823 * **(Yatak Katsayısı)** + 427461.327 * **(Beton Sınıfı)** + 5537494.092 * **(Asansör Sayısı)** + 16687.841 * **(Islak Alan)** + 9752894.338 * **(Radye Temel Yüksekliği)** - 2534.565 * **(Kat Alanı)** + 12246.067 * **(Bodrum Alanı)** + 3711.671 * **(Toplam Alan)**

Tablo 14. *Eğitim yapılarına ait Regresyon modeli tahmin sonuçları*

Sıra No	Projenin İsmi	Güncellenmiş Yaklaşık Maliyet (TL)	Regresyon Denklemi ile tahmin edilen Yaklaşık	Hata Oranı
1	Yalova Teşfikiye 8 Derslikli İlköğretim Okulu Yapım İşi	₺17.754.017,80	₺21.922.242.40	23.5%
2	Seyhan İlçesi Fatih Mehmet 24 Derslikli İlkokul Yapım İşi	₺27.490.588,27	₺32.098.337.10	16.8%
3	Tunceli Merkez 12 Derslikli Ortaokulu Yapımı	₺30.308.745,61	₺25.447.991.92	16.0%
4	Akyazı Alaağaç İlkokulu-Ortaokulu 8 Derslikli Yeni Bina	₺10.233.526,56	₺18.925.837.07	84.9%
5	Dazkırı İlçesi Şerife Memiş UÇAR 4 Derslikli İlkokul Yapım İşi	₺4.648.964,72	₺3.599.820.94	22.6%
6	Ağrı Merkez Cumhuriyet Mahallesi 12 Derslikli İlkokul Yapım İşi	₺32.084.146,06	₺31.063.351.51	3.2%
7	Mersin İli Akdeniz İlçesi Ulubatlı Hasan 24 Derslikli Ortaokul Bina İnşaatı	₺34.503.260,54	₺31.371.867.31	9.1%
8	Malatya İli Battalgazi İlçesi Hatunsuyu Saray 4 Derslikli İlkokul Yapım İşi	₺17.409.606,25	₺19.396.878.43	11.4%
9	Bursa İli İnegöl İlçesi 1767 Ada 1 Parsel 32 Derslik Ortaokul Yapım İşi	₺45.756.347,62	₺50.840.134.38	11.1%
10	Bursa İli Gürsu İlçesi 217 Ada 5 Parsel 32 Derslik Ortaokul Yapım İşi	₺46.706.019,18	₺48.573.590.66	4.0%
11	Gürpınar İlçesi Atatürk İlkokulu 8 Derslik Yapımı ve Çevre Düzenleme İşi	₺24.874.751,93	₺20.487.483.32	17.6%
12	Burhaniye 12 Derslikli Şehit Yılmaz Kobak İlkokulu Yapım İşi	₺23.944.601,05	₺26.439.331.02	10.4%
13	Ereğli Mehmet Akif Mahallesi 24 Derslik İlkokulu Yapım İşi	₺25.991.919,77	₺26.703.014.36	2.7%
14	Bandırma 24 Derslikli Haydar Çavuş MTAL Lise Yapım İşi	₺37.425.766,42	₺31.760.801.94	15.1%
15	Ayvalık Altınova 12 Derslikli İlkokulu Yapım İşi	₺23.178.728,16	₺26.294.332.91	13.4%
		ORTALAMA HATA DEĞERİ		17.50%

Tablo 15. *Eğitim Yapılarına ait İstatistiki veriler*

Model		Kareler Toplamı	Serbestlik Derecesi	Kareler Ortalaması	F	p
1	**Regresyon Kareler Toplamı**	15804502379673800,00	18	878027909981875,00	39,47	,000[b]
	Artık Kareler Toplamı	1379190948240060,00	62	22245015294194,60		
	Genel Kareler Toplamı	17183693327913800,00	80			

Hesaplamalar sonucunda F istatistiği değeri 39,47 olarak hesaplanmış. F tablosu yardım ile p değerinin p<0,05 olduğundan oluşturulan modelin anlamlı olduğu görülmüştür.

Tablo 16. *Eğitim yapılarına ait istatistiki veriler (Bağımsız Değişkenler Arasındaki İlişkiler)*

		Güncellenmiş Sözleşme Bedeli (TL)	Derslik Sayısı	Yapım Süresi (Gün)	Toplam Kat Sayısı	Kat Yüksekliği (mt)	Bina Yüksekliği (m) (+0,00 Kotundan)	Bina Yükseklik Sınıfı (BYS)	Bodrum Yüksekliği (mt)	Deprem Tasarım Sınıfı (DTS)	Zemin Sınıfı	Zemin Emniyet Gerilmesi (t/m²)	Yatak Katsayısı (t/m³)	Beton Sınıfı	Asansör Sayısı	Islak Alan (m²)	Radye Temel Yüksekliği (mt)	Kat Alanı (m²)	Bodrum Alanı (m²)	Toplam Alan (m²)
Güncellenmiş Sözleşme Bedeli (TL)	r	1,00	0,83	0,41	0,66	0,39	0,65	-0,47	0,50	0,14	-0,06	-0,06	-0,05	0,31	0,77	0,84	0,72	0,81	0,82	0,93
	p		0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,30	0,29	0,32	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Derslik Sayısı	r	0,83	1,00	0,39	0,75	0,25	0,71	-0,42	0,51	0,15	0,00	-0,09	-0,08	0,31	0,64	0,77	0,63	0,68	0,76	0,89
	p	0,00		0,00	0,00	0,01	0,00	0,00	0,00	0,09	0,48	0,21	0,25	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Yapım Süresi (Gün)	r	0,41	0,39	1,00	0,52	0,29	0,47	-0,41	0,45	-0,01	0,09	-0,05	0,20	0,06	0,45	0,34	0,25	0,27	0,42	0,43
	p	0,00	0,00		0,00	0,00	0,00	0,00	0,00	0,48	0,22	0,34	0,04	0,30	0,00	0,00	0,01	0,01	0,00	0,00
Toplam Kat Sayısı	r	0,66	0,75	0,52	1,00	0,37	0,93	-0,68	0,77	0,18	0,01	-0,13	-0,12	0,25	0,60	0,64	0,59	0,35	0,68	0,72
	p	0,00	0,00	0,00		0,00	0,00	0,00	0,00	0,05	0,45	0,12	0,15	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Kat Yüksekliği (mt)	r	0,39	0,25	0,29	0,37	1,00	0,48	-0,45	0,38	0,12	-0,16	-0,11	-0,04	0,24	0,46	0,30	0,27	0,34	0,37	0,34
	p	0,00	0,01	0,00	0,00		0,00	0,00	0,00	0,14	0,08	0,17	0,38	0,01	0,00	0,00	0,01	0,00	0,00	0,00
Bina Yüksekliği (m)	r	0,65	0,71	0,47	0,93	0,48	1,00	-0,71	0,67	0,11	-0,05	-0,09	-0,12	0,28	0,62	0,62	0,56	0,38	0,63	0,70
	p	0,00	0,00	0,00	0,00	0,00		0,00	0,00	0,17	0,33	0,21	0,14	0,01	0,00	0,00	0,00	0,00	0,00	0,00
Bina Yükseklik Sınıfı (BYS)	r	-0,47	-0,42	-0,41	-0,68	-0,45	-0,71	1,00	-0,49	0,09	-0,02	0,19	0,18	-0,41	-0,34	-0,49	-0,43	-0,15	-0,39	-0,42
	p	0,00	0,00	0,00	0,00	0,00	0,00		0,00	0,22	0,44	0,04	0,05	0,00	0,00	0,00	0,00	0,09	0,00	0,00
Bodrum Yüksekliği (mt)	r	0,50	0,51	0,45	0,77	0,38	0,67	-0,49	1,00	0,19	-0,07	-0,05	-0,06	0,29	0,47	0,53	0,47	0,30	0,79	0,55
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00		0,04	0,26	0,32	0,28	0,00	0,00	0,00	0,00	0,00	0,00	0,00
Deprem Tasarım Sınıfı (DTS)	r	0,14	0,15	-0,01	0,18	0,12	0,11	0,09	0,19	1,00	-0,39	0,07	0,27	-0,17	0,17	0,08	0,10	0,19	0,22	0,18
	p	0,11	0,09	0,48	0,05	0,14	0,17	0,22	0,04		0,00	0,27	0,01	0,06	0,06	0,24	0,18	0,05	0,03	0,05
Zemin Sınıfı	r	-0,06	0,00	0,09	0,01	-0,16	-0,05	-0,02	-0,07	-0,39	1,00	-0,33	-0,48	0,07	-0,17	-0,09	-0,08	-0,12	-0,07	-0,05
	p	0,30	0,48	0,22	0,45	0,08	0,33	0,44	0,26	0,00		0,00	0,00	0,26	0,07	0,21	0,25	0,14	0,26	0,34
Zemin Emniyet Gerilmesi	r	-0,06	-0,09	-0,05	-0,13	-0,11	-0,09	0,19	-0,05	0,07	-0,33	1,00	0,45	-0,01	-0,01	0,02	0,04	0,02	-0,01	-0,06
	p	0,29	0,21	0,34	0,12	0,17	0,21	0,04	0,32	0,27	0,00		0,00	0,45	0,46	0,42	0,37	0,42	0,46	0,29
Yatak Katsayısı (t/m³)	r	-0,05	-0,08	0,20	-0,12	-0,04	-0,12	0,18	-0,06	0,27	-0,48	0,45	1,00	-0,31	0,09	-0,13	-0,12	0,03	-0,04	-0,05
	p	0,32	0,25	0,04	0,15	0,38	0,14	0,05	0,28	0,01	0,00	0,00		0,00	0,21	0,12	0,13	0,38	0,37	0,34
Beton Sınıfı	r	0,31	0,31	0,06	0,25	0,24	0,28	-0,41	0,29	-0,17	0,07	-0,01	-0,31	1,00	0,01	0,31	0,38	0,11	0,29	0,23
	p	0,00	0,00	0,30	0,01	0,01	0,01	0,00	0,00	0,06	0,26	0,45	0,00		0,45	0,00	0,00	0,15	0,00	0,02
Asansör Sayısı	r	0,77	0,64	0,45	0,60	0,46	0,62	-0,34	0,47	0,17	-0,17	-0,01	0,09	0,01	1,00	0,63	0,47	0,73	0,66	0,78
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,06	0,07	0,46	0,21	0,45		0,00	0,00	0,00	0,00	0,00
Islak Alan (m²)	r	0,84	0,77	0,34	0,64	0,30	0,62	-0,49	0,53	0,08	-0,09	0,02	-0,13	0,31	0,63	1,00	0,69	0,72	0,76	0,87
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,24	0,21	0,42	0,12	0,00	0,00		0,00	0,00	0,00	0,00
Radye Temel Yüksekliği (mt)	r	0,72	0,63	0,25	0,59	0,27	0,56	-0,43	0,47	0,10	-0,08	0,04	-0,12	0,38	0,47	0,69	1,00	0,47	0,65	0,65
	p	0,00	0,00	0,01	0,00	0,01	0,00	0,00	0,00	0,18	0,25	0,37	0,13	0,00	0,00	0,00		0,00	0,00	0,00
Kat Alanı (m²)	r	0,81	0,68	0,27	0,35	0,34	0,38	-0,15	0,30	0,19	-0,12	0,02	0,03	0,11	0,73	0,72	0,47	1,00	0,71	0,88
	p	0,00	0,00	0,01	0,00	0,00	0,00	0,09	0,00	0,05	0,14	0,42	0,38	0,15	0,00	0,00	0,00		0,00	0,00
Bodrum Alanı (m²)	r	0,82	0,76	0,42	0,68	0,37	0,63	-0,39	0,79	0,22	-0,07	-0,01	-0,04	0,29	0,66	0,76	0,65	0,71	1,00	0,85
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03	0,26	0,46	0,37	0,00	0,00	0,00	0,00	0,00		0,00
Toplam Alan (m²)	r	0,93	0,89	0,43	0,72	0,34	0,70	-0,42	0,55	0,18	-0,05	-0,06	-0,05	0,23	0,78	0,87	0,65	0,88	0,85	1,00
	p	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,05	0,34	0,29	0,34	0,02	0,00	0,00	0,00	0,00	0,00	

Tabloya göre bazı değişkenler arasında yüksek güçte ilişkiler bulunmaktadır. Bu değişkenlerin aynı anda modele alınması çoklu bağıntı sorunu yaşanmasına neden olabilir. Bu nedenle oluşturulan modelde çoklu bağıntı kontrolleri yapılması gerekecektir.

Tablo 17. *Eğitim yapılarına ait istatistiki veriler (Otokorelasyon ve Çoklu Bağıntı Varsayımlarının Kontrolleri)*

Durbin-Watson	**1,950**
Collinearity (VIF)	
Derslik Sayısı	7.524
Yapım Süresi (Gün)	1.889
Toplam Kat Sayısı	32.216
Kat Yüksekliği (mt)	2.179
Bina Yüksekliği (m)	10.897
Bina Yükseklik Sınıfı(BYS)	3.301
Bodrum Yüksekliği (m)	10.720
Deprem Tasarım Sınıfı (DTS)	1.632
Zemin Sınıfı	1.981
Zemin Emniyet Gerilmesi (t/m²)	1.698
Yatak Katsayısı (t/m³)	2.340
Beton Sınıfı	1.913
Asansör Sayısı	3.905
Islak Alan (m²)	6.505
Radye Temel Yüksekliği (mt)	2.551
Kat Alanı (m²)	24.326
Bodrum Alanı (m²)	14.567
Toplam Alan (m²)	73.277

Otokorelasyon, oluşturulan modeldeki hatalar arasında ilişki olması durumudur. Regresyon modelinde otokorelasyon olmamalı, oluşturulan modeldeki hatalar rastgele olmalıdır. Bu durum Durbin-Watson testi ile kontrol edilir. Durbin-Watson testi sonucunun 2 civarında çıkması modelde otokorelasyon problemi olmadığını göstermektedir. Yapılan inceleme sonucunda 1,950 olarak tespit edilen Durbin- Watson sonucuna göre oluşturduğumuz modelde otokorelasyon probleminin olmadığı görülmektedir. Modelde çoklu bağıntı problemi olup olmadığını ise değişkenlere ait VIF değerine bakılarak incelenmektedir. VIF değerinin 10'un üzerinde olmaması gerekmektedir. Modele alınan 18 bağımsız değişken içinde VIF değerinin 12 değişkenin 10'un altında kaldığı görülmektedir. Bu sonuca göre modele alınan değişkenler arasında 12 değişken için çoklu bağıntı problemi olmadığı söylenebilir. Toplam Kat Sayısı, Bina Yüksekliği, Bodrum Yüksekliği, Kat Alanı, Bodrum Alanı ve Toplam Alan değişkenlerinde çoklu bağıntı problemi olduğu görülmektedir.

Tablo 18. *Eğitim yapılarına ait istatistiki veriler(Model anlamlılığı)*

Düzeltilmiş R^2	F	p
0.900	39,470	,000[b]

,000[b] :p<0,05 olduğunu ifade eder.

Sözleşme Bedeli değişkenini açıklamak için oluşturulan modelin anlamlı bir model olduğu görülmektedir (F:43,620, p<0,05). Anlamlı olan bu modelde bağımsız değişkenler, bağımlı değişkendeki değişimin %90 'ını açıklayabilmektedir.

Tablo 19. *Eğitim yapılarına ait istatistiki sonuç verileri*

	Yaklaşık Maliyet	Sözleşme Bedeli
Hata Oranı	%17,50	%18,20
Düzeltilmiş R^2	0,900	0,927
Durbin-Watson değeri	1,950	1,523

SONUÇ

Bu çalışmada, Kamu Kurumları tarafından ihaleye çıkılmış ve sonuç ilanı yayınlanmış 96 adet okul binasına ait projeler Elektronik Kamu Alımları Platformu(EKAP)' tan indirilmiştir. Projeler 81 adet eğitim, 15 adet test verisi olacak şekilde ayrılmıştır. Yapım yılı maliyetleri TÜİK' ten elde edilen *Bina inşaatı maliyet endeksi ve değişim oranları* tablosuna göre 2023 yılı Ocak ayına çevrilmiş Yaklaşık Maliyet Bedeli ve Sözleşme Bedeli güncellenmiştir. Projeler üzerinden eğitim yapısının inşaat maliyeti çıktı değişkenini etkilediği bilinen; Derslik Sayısı, Yapım Süresi, Toplam Kat Sayısı, Kat Yüksekliği, Bina Yüksekliği, Bina Yükseklik Sınıfı(BYS), Bodrum Yüksekliği, Deprem Tasarım Sınıfı(DTS), Zemin Sınıfı, Zemin Emniyet Gerilmesi, Yatak Katsayısı, Beton Sınıfı, Asansör Sayısı, Islak Alan, Radye Temel Yüksekliği, Kat Alanı, Bodrum Alanı, Toplam Alan parametreleri belirlenmiş ve regresyon analizinde kullanılmıştır. Regresyon analizi "SPSS Statistics 26" yazılımı ile gerçekleştirilmiştir. Bu parametreler kullanılarak Regresyon Analizleri (RA) yapılmış ve eğitim yapılarının maliyetlerini tahmin etmek için formüller geliştirilmiştir. Geliştirilen formüllerle Sözleşme Bedeli ve Yaklaşık Maliyet Bedeli tahmin edilmeye çalışılmıştır. Elde edilen formüller ile test verisi olarak seçilen 15 eğitim projesinde hata oranları tespit edilmiştir. Geliştirilen

formüllerden tüm parametrelerin kullanıldığı model Sözleşme Bedeli için R^2=0.927, Yaklaşık Maliyet Bedeli için ise R^2=0.900 katsayısı ile en iyi ilişki düzeyine sahip modeller oluşmuştur. Tahmin edilen sonuçlar ile gerçek sonuçlar arasındaki tutarlılığı kontrol etmek amacıyla Durbin-Watson kriteri kullanılmıştır.Çoklu regresyon analizi için verilerin normal dağılması koşulu sağlanmış, çoklu bağlantı ve otokorelasyon sorunları olmadığı tespit edilmiştir($p<0,05$). Yaklaşık Maliyet Bedeli tahmini için yapılan regresyon modelinin sonucunda hesaplanan hata değeri ortalama % 17,50 hata oranı olarak bulunmuştur. Sözleşme Bedeli tahmini için yapılan regresyon modelinin sonucunda hesaplanan hata değeri ortalama % 18,20 hata oranı olarak bulunmuştur. Ancak farklılıkları da temsil edecek yeter sayıda örnekle çalışılması durumunda daha sağlıklı sonuç almak mümkündür.Sonuç olarak, farklı tip ve katsayılarına sahip okul yapılarının yaklaşık maliyetlerini ve sözleşme bedellerini %20'den düşük hata oranları ile tahmin edebilen bir yaklaşım oluşturulmuştur. Gerek kamu kuruluşları gerekse taahhüt eden yapım firmaları bu modellemelerden istifade ederek zamansal tasarruflar sağlayarak gerçekçi maliyet tahminlerinde bulunabileceklerdir. Benzer çalışmaların veri adetleri arttırılarak yapılması, daha sonraki modellemelerde hata oranı minimizasyonu için bir çözüm olabilir.

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DİJİTAL YAŞLILIK: YAŞLILARDA DİJİTAL OKURYAZARLIK VE TEKNOLOJİYE ADAPTASYON

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Özet
Ditijal teknoloji, günümüzde topluma katılımın önemli bir bileşeni haline gelmiştir. Yaşlı bireylerin bağımsızlıklarını korumalarına, bilgiye kolayca erişmelerine ve sosyal çevreleri ile bağlantıda kalmalarına yardımcı olması, dijital teknolojiyi yaşlı bireylerin toplumsal hayata katılımı için güçlü bir kolaylaştırıcı kılmaktadır. Yaşlı bireylerin sosyal katılımını teşvik eden teknoloji, zihinsel uyarımı artırarak yaşlı bireylerin bilişsel becerilerini sürdürmesine destek olmaktadır. Bir başka ifadeyle teknolojiye adapte olmanın yaşlı bireylerde sağlığın farklı boyutları üzerinde iyileştirici etkisi bulunmaktadır. Her ne kadar dijital teknoloji, yaşlı bireylerin yaşam kalitesini artırarak toplumda daha aktif bir rol oynamalarına yardımcı olsa da yaşlılar yeni teknolojileri öğrenmede zorluklarla karşılaşmakta ve daha fazla eğitime ihtiyaç duyabilmektedir. Yaşlıların teknolojiye adaptasyonunun önündeki zorluklar yaşlanmayla ilişkilendirilen bir dizi fiziksel, bilişsel, algısal ve psikolojik sorunu içermektedir. Bu zorluklar, yaşlı bireylerin teknolojiye adaptasyonunu güçleştirmekte, bu durum ise dijital uçurumun büyümesine neden olmaktadır. Yeni teknolojiler aynı zamanda, kişiler arası iletişimde ileri yaştaki bireyler ile gençler arasındaki en büyük iletişim engelini oluşturmaktadır. Dijital teknolojilerin yaşlı bireyler için barındırdığı potensiyel ve teknolojiye adapte olamamanın beraberinde getirdiği olumsuzluklar göz önünde bulundurulduğunda dijital okuryazarlığın yaşlılar için önemli bir ihtiyaç olduğu aşikardır. Bu bağlamda çeşitli dijital okuryazarlık aktiviteleri ile yaşlı bireylerin teknolojiye adaptasyonun desteklenmesi ve teknoloji kullanımının teşvik edilmesi gerekmektedir. Bu derleme bildirinin amacı, literatürdeki çalışmalar ışığında yaşlı bireyler arasında teknoloji kullanım yaygınlığının, yaşlı bireylerde teknoloji kullanmanın fırsatlar ile zorluklarının incelenmesi ve yaşlılara yönelik dijital okuryazarlık aktivitelerinin tartışılmasıdır.
Anahtar Kelimeler: Dijital okuryazarlık, yaşlılar, sosyal katılım, teknoloji kullanımı

DIGITAL OLD AGE: DIGITAL LITERACY AND ADAPTATION TO TECHNOLOGY IN THE ELDERLY

Abstract
Ditijal technology has become an important component of participation in society today. Helping older adults maintain their independence, easily access information, and stay connected to their social environment makes digital technology a powerful facilitator for older adults' participation in social life. Technology that encourages the social participation of older adults helps them maintain their cognitive skills by increasing mental stimulation. In other words, adapting to technology has a healing effect on different dimensions of health in older adults. Although digital technology helps older adults play a more active role in society by improving their quality of life, older adults face difficulties in learning new technologies and may need more training. Challenges to older adults 's adaptation to technology include a number of physical, cognitive, perceptual and psychological problems associated with aging. These difficulties make it difficult for older adults to adapt to technology, which causes the digital divide to widen. New technologies also create the biggest communication barrier between older adults and young people in interpersonal communication. Considering the potential of digital technologies for older adults and the negativities brought about by not being able to adapt to technology, it is obvious that digital literacy is an important need for the elderly. In this context, it is necessary to support older adults' adaptation to technology and encourage their use of technology through various digital literacy activities. The purpose of this review paper is to examine the prevalence of technology use among older adults, the opportunities and difficulties of using technology in older adults, and to discuss digital literacy activities for the elderly in the light of studies in the literature.
Keywords: Digital literacy, elderly, social participation, technology use

Giriş

Teknolojinin hızla gelişmesi toplumsal, ekonomik, kültürel ve sosyal dinamikleri etkilemiştir. Günümüzde birçok eylem dijital teknoloji kullanımına bağımlı hale gelmiştir. Bu durum, teknolojiyi bir ihtiyaçtan ziyade zorunluluk haline getirmiştir. Dünyanın demografik olarak yaşlandığı günümüzde, dijital teknoloji yaşlılık deneyimini dönüştürmekte ve yaşlı bireyler için birçok fırsat sunmaktadır. Sağlığın fiziksel, ruhsal ve sosyal boyutlarına sağladığı faydanın yanında dijital teknolojiler yaşlı bireylerin yaşam kalitesini artırmakta ve bağımsızlıklarını desteklemektedir. Diğer yandan teknoloji kullanımı yaşlılık döneminde bir zorluk olarak ortaya çıkmaktadır. Bu fırsatlar ve zorluklar ikileminde yaşlı bireylerin dijital teknolojiye adaptasyonu önemli bir araştırma ve tartışma konusu haline gelmektedir.

Dijital Dönüşümün Yaşlılar Üzerindeki Etkisi

Dijital teknoloji gelişimindeki baş döndürücü hız toplumun her kesimini etkilemektedir. Yaşlı nüfusun giderek artması, yaşlı bireylerin teknoloji ile etkileşimini ve dijital dönüşümün yaşlılar üzerindeki etkisini daha önemli hale getirmektedir. Yaşlanma ile azalan fiziksel ve bilişsel işlevlerin iyileştirilmesine yardımcı olmak, yaşlı bireylerin sosyal ilişkilerini sürdürmelerini sağlamak, bağımsız yaşamı desteklemek, bireylerin iyilik halini ve refahlarını korumak dijital teknolojinin yaşlanan dünya için barındırdığı fırsatlardandır. Yaşlı bireyleri dijital teknoloji kullanması, bireyin refahını iyileştirmekte, çevrimiçi etkinliklere katılma yaşlı bireylerin sosyal katılımını teşvik etmekte, böylelikle sosyal izolasyon ve yalnızlık duygusunu minimize etmektedir. Zira sosyal medya platformları ve video konferans ile görüşme uygulamaları yaşlı bireylerin aileleri, torunları, sosyal çevreleri ile etkileşim halinde olmalarını sağlamaktadır. Bilhassa bakım kurumunda kalan yaşlı bireyler aileleri ile daha az iletişimde kalma eğiliminde olabilmektedir. Bu noktada teknoloji, yaşlı bireylerin aileleri ile bağlantıda kalmaları için bir araç olabilmektedir. Yaşlı bireylerin sosyal izolasyonunu azaltarak aile bağlarını güçlendiren teknolojik ürün ve uygulamaları kullanmak, aynı zamanda yaşlı bireylerin teknolojiyi kullanma konusundaki özgüvenlerini artırabilmekte ve teknolojinin günlük yaşamın bir parçası olarak benimsenmesine katkı sunmaktadır. Dijital ortamda oyun oynanması yaşlıların motor becerilerini, algısal/bilişsel yeteneklerini ve duygusal/motivasyonel durumlarını geliştirmektedir (Nimrod, 2019; Szabo, Allen, Stephens, & Alpass, 2019; Wang, Hou, & Tsai, 2020). Bu fırsatlar göz önünde bulundurulduğunda dijital teknolojiyi kullanan yaşlı nüfusun katlanarak artması şaşırtıcı değildir (Anderson & Perrin, 2017). Türkiye İstatistik Kurumu tarafından gerçekleştirilen Hanehalkı Bilişim Teknolojileri Kullanım Araştırması verilerine göre 2017 yılında internet kullanan 65-74 yaş aralığındaki birey oranı %11,3 iken bu oran 2022

yılında %36,6'ya yükselmiştir (Türkiye İstatistik Kurumu, 2023). Her ne kadar yaşlılar arasında teknoloji kullanımı yaygınlaşsa da bu oran genç nüfusa kıyasla düşük kalmakta ve dijital bir uçuruma neden olmaktadır.

Yaşlıların Teknolojiye Adaptasyonunda Engeller

Yaşlı bireylerin teknoloji kullanımının önünde bir dizi güçlükler bulunmaktadır. Bunlardan ilki yaşa bağlı engellerdir. Yaşa bağlı engeller olarak nitelendirilebilecek olan görme problemleri, el becerisi ve hareketliliği ile ilişkili sorunlar, anlama güçlüğü, algılama sınırlılığı yaşlı bireyleri teknolojiyi kullanırken karşı karşıya kalabileceği engellerdendir. Bununla birlikte teknolojinin karmaşık olduğu algısı, teknik terimler, küçük yazılar bu engelleri artırabilmektedir. Bu engeller yaşlı bireyler ile teknoloji arasında bir bariyere neden olmaktayken diğer yandan teknoloji, yaşla ilişkili olan bu olumsuzlukların giderilmesinde önemli bir destek sunmaktadır. Yaşlı bireylerin güvenliğini ve bağımsız yaşamını kolaylaştıran teknoloji, yaşlı bireylerin sağlığını da desteklemektedir (Rogers, Stronge, & Fisk, 2005).Yaşlı bireylerin teknolojiye yönelik tutumları, bir diğer engeli oluşturmaktadır. Teknolojinin tehlikeli, güvensiz, pahalı, karmaşık, öğrenilmesi zor olarak algılanması yaşlı bireylerin teknolojiye adapte olma motivasyonunu düşürmektedir. Yaşlı bireylerin teknolojik ürünleri ve teknoloji kullanımı için eğitim almasına yönelik mali engeller, yeterli eğitim ve destek olanaklarının sınırlılığı yaşlı bireylerin teknolojiyi etkin bir biçimde kullanmalarının önündeki engellerden bir diğeridir. Ekonomik kısıtlılık nedeniyle teknolojik ürünlere erişememe, ekonomik engeller kapsamında değerlendirilebilmekte ve yaşlı bireylerde teknoloji kullanımını güçleştirmektedir (Özkan & Purutçuoğlu, 2010). İngiltere'de yapılan bir araştırmada 60-69 yaş aralığındaki bireylerin yarısında evde internet erişimi bulunurken bu oranın 70 yaş ve üstü kişilerde %17'ye düştüğü saptanmıştır. Yaşın artmasıyla birlikte evde internet erişim oranını düşüren tek unsur ekonomik maliyetler değildir. Yaşlı bireylerin bu tür dijital teknolojilerin kendileri ile ilgili olmadığı ve bu teknolojileri kullanarak herhangi bir kazanım sağlamayacaklarına yönelik algı ve tutumları da oranın düşmesi üzerinde etkilidir (Tuna Uysal, 2020).

Yaşlıların Teknolojiyle İlişkisini Güçlendirme: Dijital Okuryazarlık

Dijital okuryazarlık, teknolojiyi kullanmak için gerekli teknik bilginin ötesinde teknolojiye bilişsel, kültürel ve sosyal olarak uyum sağlamayı da içeren bir kavramdır. Kavramı ilk defa kullanan araştırmacı Paul Gilster, dijital okuryazarlığın sadece teknik becerilerle değil, aynı zamanda derinlemesine düşünme, eleştirel analiz yapma ve bilgiyi etkili bir şekilde kullanma yeteneğiyle ilişkili özel bir tür zihniyet olduğunu vurgulamıştır. Ona göre, dijital okuryazarlık sadece tuşlara basmayı öğrenmekle değil, aynı zamanda dijital ortamlarda bulunan bilgiyi

değerlendirme, yorumlama ve sentezleme becerisini içeren bir düşünce tarzını ifade etmektedir (Gilster, 1997).

Teknolojinin hızla geliştiği ve değiştiği günümüzde, bireylerin bu değişimlere uyum sağlamak amacıyla geliştirdiği beceriler dijital okuryazarlık olarak tanımlanmaktadır (Yıldırım, 2021). Dijital okuryazarlık becerileri, bireylerin teknolojiyi doğru ve faydalı bir biçimde kullanmalarını, böylelikle dijitalleşen dünyaya aktif bir şekilde katılmalarını olanaklı hale getirmektedir. Burada yola çıkarak dijital okuryazarlık, dijital çağda hayatta kalma becerisi olarak nitelendirilmektedir (Eshet-Alkalai, 2004). Yaşlı bireylerin teknolojinin faydalarından daha geniş anlamda yararlanabilmeleri ve dijital dünyaya entegre olabilmeleri için dijital okuryazarlık becerilerinin geliştirilmesi önemli bir önkoşuldur. Bu bağlamda öncelikli olarak yaşlı bireylerin temel teknoloji becerilerini öğrenmesi gerekmektedir. Telefon kullanma, bilgisayar kullanma, tablet kullanma temel düzeyde teknoloji becerilerini kapsamaktadır. Çevrimiçi güvenlik ve gizlilik ile ilgili konular da dijital okuryazarlık kapsamında yaşlı bireylere aktarılmalıdır. Yaşlı bireylerin aileleri ve sosyal çevreleri ile bağlantıda kalmasını sağlayan sosyal medya platformları, video konferans uygulamaları, çevrimiçi gruplar gibi araçların kullanılması da dijital okuryazarlık kapsamında desteklenmelidir.

Sonuç ve Öneriler

Yaşlı bireyler için teknolojiye adapte olmak ve buna olanak sağlayan dijital okuryazarlık, toplumların yaşlanma sürecinin beraberinde getirdiği zorluklarla başa çıkma ve yaşlı bireylerin refahını iyileştirme için kritik bir rol oynamaktadır. Yaşlı bireylerin dijital okuryazarlık becerilerinin geliştirilmesi için yaşlı bireylere özel, eğitim programları geliştirilmelidir. Bu eğitim programları ile birlikte yaşlı dostu teknolojik arayüzler geliştirilmelidir. Büyük yazı boyutunu, kolay okunabilir metin boşluklarını içeren bu arayüzler ile yaşlı bireylerin teknolojik uygulama ve ürünleri kullanmaları kolaylaşmaktadır. Yaşlı bireylere teknoloji kullanımı konusunda bireysel destek sunulmalıdır. Teknoloji ile ilgili soruları yanıtlamak, pratik becerilerin kazandırılmasına yardımcı olmak, güvenliğe ilişkin kazanımları sağlamak amacıyla bireysel destek sunulması önem arz etmektedir. Yaşlı bireylerin teknoloji kullanımına ilişkin araştırmalar oldukça kısıtlıdır. Dijital okuryazarlık ve teknoloji kullanımı ile ilgili araştırmalar ağırlıklı olarak genç popülasyon ile yürütülmektedir. Dünya nüfusunun hızla yaşlandığı ve teknolojinin yaşlanan nüfus için barındırdığı fırsatlar göz önünde bulundurulduğunda konunun yaşlı bireyler özelinde ele alınması gerekmektedir.

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YAŞLI HAKLARI PERSPEKTİFİNDEN GÜVENLİ KONUT

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Özet
İnsan Hakları Evrensel Beyannamesi'nin 25. Maddesine göre "herkesin kendisinin ve ailesinin sağlık ve refahı için beslenme, giyim, konut ve tıbbi bakım hakkı vardır." Barınma hakkı, insan hakları kapsamında kabul gören temel bir haktır. Bu hak, her bireyin yaşam kalitesini artırmak ve insan onuruna yakışır bir yaşam sürmesini sağlamak için temel bir ihtiyaç olan barınma ve konut edinme hakkını içermektedir. Günümüzde uluslararası arenada konut hakkı bir adım öteye taşınmış olup elverişli konut hakkı söylemi ön plana çıkmaktadır. Elverişli konut hakkı, her birey için önemli olsa da güvenli, erişilebilir ve uygun konut koşullarına sahip olmak yaşlı bireylerin yaşam kalitesi için oldukça önemlidir. Zira yaşlılık döneminde, yaralanma ve düşmelerin ağırlıklı olarak evde meydana geldiği, yaşın ilerlemesiyle birlikte karşılaşılan sağlık sorunları ve fiziksel kısıtlamalar göz önünde bulundurulduğunda konut güvenliğini yaşlı bireyler için daha hayati hale getirmektedir. Yaşlıların, bihassa yalnız yaşayan yaşlıların yaşadığı konutların yaşlı bireylerin fiziksel, bilişsel ve zihinsel fonskiyonları dikkate alınarak düzenlenmesi gerekmektedir. Konutu güvenli hale getirmek, yalnızca fiziksel güvenliği sağlamakla kalmayıp aynı zamanda yaşlı bireyin psikolojik ve sosyal iyilik halini desteklemektedir. Bu bildirinin amacı elverişli konut hakkını yaşlı hakları perspektifinden ele almak ve konutları yaşlı bireyler için güvenli hale getirmek amacıyla yapılabilecek ev içi düzenlenmelere ilişkin öneriler sunmaktır.
Anahtar Kelimeler: Yaşlı hakları, konut hakkı, konut güvenliği, erişilebilir konut

SAFE. HOUSING FROM ELDERLY RIGHTS PERSPECTIVE

Abstract
According to Article 25 of the Universal Declaration of Human Rights, "everyone has the right to food, clothing, housing and medical care for the health and well-being of herself/himself and her/his family." The right to shelter is a fundamental right accepted within the scope of human rights. This right includes the right to shelter and housing, which is a basic need to improve the quality of life of every individual and to enable them to live a life worthy of human dignity. Today, the right to housing has moved one step further in the international arena and the discourse of the right to adequate housing comes to the fore. Although the right to adequate housing is important for every individual, having safe, accessible and suitable housing conditions is very important for the quality of life of older adults. Considering that in old age, injuries and falls mainly occur at home, and the health problems and physical limitations encountered with advancing age, home security becomes more vital for older adults. The residences where the elderly, especially the elderly living alone, live should be arranged taking into account the physical, cognitive and mental functions of the older adults. Making the home safe not only ensures physical safety but also supports the psychological and social well-being of older adults. The aim of this paper is to discuss the right to adequate housing from the perspective of older adults' rights and to offer suggestions on domestic arrangements that can be made to make homes safe for older adults.
Keywords: Elderly rights, right to housing, housing security, accessible housing

Giriş

Demografik dönüşümün yaşandığı günümüzde yaşlı nüfusu giderek artmaktadır. Artan yaşlı nüfusu ile birlikte yaşlı bireylerin yaşam kalitesini ve refahını iyileştirmek için müdahale edilmesi gereken temel alanlardan birisini konut oluşturmaktadır. Yaşlı bireylerin konutları, güvenliklerini, sağlıklarını ve refahlarını doğrudan etkileyen bir faktördür. Bu bağlamda ele alındığında, güvenli konutlar yaşlıların sağlıklı ve mutlu bir yaşlılık dönemi sürmeleri için vazgeçilmez bir gerekliliktir. Yaşlı bireyler için güvenli konut, fiziksel ve sosyal olarak yaşlı bireylerin ihtiyaçlarına uygun, erişilebilir bir yaşam alanını ifade etmektedir. Fiziksel, sosyal ve duygusal ihtiyaçları göz önünde bulundurularak tasarlanmış güvenli konutlar, yaşlı bireylerin bağımsızlıklarını korumalarını ve yaşam kalitelerini artırmalarını sağlamaktadır.

Yaşlanan Dünya ve Konut Güvenliği

Konut, yaşlı bireyler için yalnızca barınmanın gerçekleştiği mekân değil, aynı zamanda yaşlı bireyin alışkanlık sağladığı, güven duyulması ve rahat edilmesi gereken bir yerdir. Konutun kalitesi yaşlı bireye sağladığı bağımsızlık ve gizlilikle ölçülmektedir (Topgül, 2023). Bağımsızlık yaşlı bireylerde konut planlamasında dikkat edilmesi gereken en önemli unsurlardan biridir. Nitekim konut düzenlemesinde, yaşlı bireylerin fiziksel yetenekleri göz önünde bulundurulmadıkça geleneksel uygulamalar yaşlı bireyler için bağımsızlık sağlamaya yetmemektedir (Kalınkara, 2016). Yaşlı bireylerin ihtiyaçları gözetilerek yapılan evlerin, yaşlanma sürecini destekleyecek biçimde yapılması önem arz etmektedir. Konut, yaşlı bireyler için önemli bir alandır. Yaşlılık döneminde sık rastlanan fiziksel kısıtlılıklar, sosyal izolasyon bireylerin bu yaşam döneminde evde daha fazla vakit geçirmesine neden olmaktadır. Konutların, yaşlı bireylerin değişen koşullarına erişilebilirlik, güvenlik ve bağımsızlık konusunda cevap vermesi gerekmektedir. Ev içinde bulunan soğuk, rutubet gibi çevresel tehditler ve uygun olmayan barınma ortamı yaşlı bireylerin sağlığını daha da kötüleştirmektedir. Bununla birlikte yaşlıların işlevsel kısıtlamaları ile ev içinde günlük yaşamı sürdürmede güçlükler ortaya çıkmakta, bu durum bağımsız yaşamı engellemektedir. Konut içindeki fiziksel uygunsuzluklar yaşlı bireylerde ev kazaları ve yaralanma riskini de artırmaktadır. Yaşlı bireylerin ev içinde dolaşırken veya tuvalet ya da banyoda kayma, düşme, merdivenlerden inip çıkarken düşme, günlük yaşam aktivitelerini yerine getirirken kaza geçirme ihtimalleri artmaktadır. Bu ihtimaller yaşlı bireyin evde bakım ihtiyacını veya kurum bakımına taşınmasını beraberinde getirmektedir (Topgül, 2023; Braubach & Power, 2011).

Temel Bir Hak Olarak Elverişli Konut Hakkı

Barınma hakkı, İnsan Hakları Evrensel Beyannamesi'nin 25. Maddesinde yer alan "yeterli yaşam standardı" hakkının bir bileşeni olarak tanınmıştır. İlgili maddede, herkesin kendisine ve ailesine sağlıklı ve yeterli bir yaşam standardını sağlayacak bir barınma hakkına sahip olduğunu belirtilmektedir. Barınma hakkı yalnızca barınacak bir yerin olması değil aynı zamanda konutun kalitesi, uygun maliyeti, erişilebilirliği, güvenliği gibi birçok unsuru içermektedir. Bireylerin barınma imkânı olsa bile eğer konut güvenli barınma imkanlarından yoksunsa bireyler ciddi sağlık sorunları başta olmak üzere çeşitli zorluklarla karşı karşıya kalmaktadır. Bu bağlamda elverişli konut hakkı, tüm ekonomik, sosyal ve kültürel haklardan yararlanılması için merkezi öneme sahiptir. Bir başka ifadeyle elverişli konut hakkı, çalışma, sağlık, sosyal güvenlik, oy kullanma, mahremiyet veya eğitim hakları da dahil olmak üzere çeşitli insan haklarından yararlanmanın bir önkoşulu olarak değerlendirilmektedir (Gutterman , 2023). Elverişli konut temel bir insan hakkı olmakla birlikte refahın önemli bir belirleyicisidir. Bu nedenle yaşlı bireylerin konut ve konut çevresinin iyileştirilmesi önemlidir. Konutun değerlendirilmesi ve yaşlı bireye uygun hale getirilmesi oldukça komplike bir durumdur. Zira bu değerlendirme ve düzenleme beklentilere, ihtiyaçlara ve ekonomik duruma göre farklılık göstermektedir. Yaşlı bireylerin birçoğunun uzun süre kendi evinde yaşamak istemesi nedeniyle, gerekli değerlendirme ve düzenlemelerin yapılarak konutun yaşlı bireye uygun hale getirilmesi gerekmektedir.

Güvenli Konut: Yaşlı Dostu Evlerin Özellikleri

Sağlıklı yaşlanma, ilerleyen yaşlarda bireyleri işlevselliklerini devam ettirmesi ile gerçekleşebilmektedir. Dünya Sağlık Örgütü tarafından yayınlanan Avrupa'da Yaş Dostu Ortamlar Politika Eylem Alanları El Kitabı'na göre yaş dostu ortamların üç bileşenin bir araya gelmesi ile oluşmaktadır. Bu bileşenler belediye hizmetleri, sosyal ortam ve fiziksel ortamdır. Topluluk, sağlık hizmetleri, iletişim ve bilgilendirme belediye hizmetlerinin kapsamına girerken; sivil katılım, istihdam, sosyal içerme, ayrımcılığın önlenmesi, sosyal katılım başlıkları sosyal ortam kapsamında değerlendirilmektedir. Fiziksel ortam ise dış ortamları, ulaşımı, hareketliliği, konutu kapsamaktadır (World Health Organization, 2017).

Dezavantajlı bir grup olarak nitelendirilen yaşlı bireylerin işlevsel kapasitelerini desteklemek üzere tasarlanmış yaşlı dostu konutlar, yaşam alanlarının yaşlıların işlevsel kapasitelerini göz önünde bulundurarak ve yeterli ulaşım araçlarının sağlanması yoluyla hareketliliklerini ve iletişimlerini kolaylaştıracak şekilde dizayn edilmektedir. Ev içinde yapılabilecek basit

düzenlemeler yaşlı bireylerin yerinde yaşlanma süresini uzatarak bağımsız yaşamını desteklemektedir (Rowles, 2018).

Sonuç ve Öneriler

Barınma hakkı, barınmayla eşit tutulan dar veya kısıtlayıcı bir anlamda yorumlanmamalıdır. Barınma hakkı, başını sokacak bir çatı ya da barınmayı yalnızca bir meta olarak görmek yerine bir yerde güvenlik, barış ve onur içinde yaşama hakkı olarak görülmelidir. Bu da konut değil aynı zamanda elverişli konut hakkına işaret etmektedir. Yaşlı dostu konutlar, yalnızca yaşlı bireylerin yerinde yaşlanmasını desteklemekle kalmayıp aynı zamanda yaşlı bireylerin ekonomik ve sosyal refahına katkı sunacaktır (Pynoos & Nishita, 2006). Yaşlıların mümkün olduğu kadar uzun süre kendi evlerinde yaşamaya devam etmelerine yardımcı olmak, bunun için gerekli konut düzenlemelerini yapmak, gerekli önlemleri almak, konutun yaşlıların işlevselliklerine uygun hale getirilmesi elverişli konut hakkına erişim için öncelikli eylem alanları olmalıdır. Yaşlı bireylerin sosyoekonomik durumları ve bağımsızlık derecelerine uygun çeşitli konut türlerinin geliştirilmesi amacıyla kamu finansmanı ve özel sektörle anlaşmalar sağlanmalıdır.

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SEMANTIC AND FUNCTIONAL CHANGE OF SHOPPING AND FASHION IN THE AGE OF CONSUMER CULTURE

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Abstract
The general course of consumption behaviour and shopping behaviour has undergone a significant change following the Industrial Revolution. Towards the end of the 19th century, when production was prioritised, consumption became the main paradigm, and practices that encourage consumption and create new needs became widespread. The culture industry, which has become dominant thanks to mass media, has prioritised the creation of new needs, and this has led to the formation of a sector called fashion. Fashion, which was previously only in a narrow framework and for those with high socio-economic opportunities, has become a phenomenon that shapes and directs the consumption behaviour of the masses through mass media. The most characteristic feature of fashion, which determines the creation of new needs and the way these needs are met, is change. Change is a value glorified by today's dominant mentality. Clothes, automobiles, houses, mobile phones, white goods, furniture, physical appearance and even people, friendships, values, emotions, beliefs, which are indicators of an individual's tastes and material power, are the objects of change. Therefore, fashion is about everything. In the context of all these, fashion, in the shortest terms, is what is temporary. Something becomes fashionable only for a certain/limited period of time and then quickly becomes obsolete. Essentially, the process of becoming obsolete begins with something becoming fashionable. The idea of obsolescence is what enables something to be fashionable and unfashionable, that is, the rapid change that takes place in this process, in other words, the fashion trend to start the next trend. With this research, the semantic change, formation and functioning of the concept of fashion will be discussed.
Keywords: Fashion, Obsolescence, Obsolescence, Consumption.

Introduction

Capitalism, culture industry, consumer culture, fashion, advertising... all these are situations and phenomena that have a direct and strong relationship with each other. They have enveloped individual and collective mentalities and all areas of individual and social life. Capitalism represents the most dominant phenomenon among them all. The others fulfil their functions under the influence and control of capitalism in a cause-and-effect relationship or in support of each other. To make a statement on fashion, the subject of this chapter, *fashion* cannot exist in its present meaning and function without *capitalist* mentality and practices. The *culture industry,* which is a sub-element of capitalism, makes use of *advertising* while creating and popularising fashion. The ultimate goal of all these is *the culture of consumption. Consumption culture* motivates *capitalist* mentality and practices.

Fashion And Consumption

Now we can ask our main question: *What is fashion?* There is no standard definition of fashion that is accepted by everyone. Because it can have different definitions according to its scope and function. For this reason, many definitions have been made. New definitions continue to be made. The meaning and function of fashion may differ in different social structures according to the dominant mentality and lifestyles there. For example, socioeconomic status and situations can significantly change the meaning and function attributed to fashion. Similarly, changes in the acceptance and understanding of "consumption" can lead to changes in the meaning and function of fashion. Nevertheless, by taking into account the common features and commonly accepted meanings of the definitions, some determinations can be made about what fashion is, even in a general sense. Fashion, in the most general sense, refers to what is accepted and/or used by a certain group of people at a certain time and in a certain place. For this reason, the definition of *style and form in force* in dictionaries is meaningful. The determination of the *rule that temporarily regulates the use and shapes of ornaments, clothing, furniture, etc.* expressed by another definition expresses one of the common views on the scope of fashion. Many more definitions can be expressed based on different dictionaries and encyclopaedias. The origin of the word fashion can be seen as the right starting point to determine the meaning of fashion in order to reach the result in a short way without wandering between definitions. According to the common opinion, the origin of fashion is *mod,* which is a statistical term. *Mode refers to the most* repeated number among the numbers in a certain sequence. Therefore, fashion refers to the *most repeated thing, the common thing.* It is important that fashion expresses the state of "prevalence". While a work, behaviour or appearance that is

done by a person or a few people in a society and is out of the ordinary may be considered strange, the fact that that thing *becomes widespread and* is done/adopted by many people can lead to the normalisation of that thing. This situation points to fashion. Of course, there are some important criteria that shape the transformation of something from being considered strange to being liked and widely adopted. Personalities who are respected by the society/mass and therefore are models are the most important tools of this transformation. For this reason, *the culture industry*, since it is the shortest and easiest way to include a product in the consumption process, first of all produces model personalities or "star" individuals with popular nomenclature, and through these, it puts its products on the consumption market. The product is easily accepted through "stars". There are significant differences between being a person respected by society in the traditional sense and being a "star", which is a phenomenon of modern times. In traditional society, reputation is a requirement of being an exceptional personality that is appreciated and admired by the members of the society in line with the value judgements of the society. For example, a person can be a respected artist of the society with his/her long-standing and outstanding achievements. In the traditional mentality and society, being an artist is a characteristic that is a combination of special talent, great labour and outstanding achievement. Today, however, being a "star" does not require special talent, labour and success. When mass media advertise a person as a "star", it is possible to become a "star". In fact, most of the time, a person with no special talent, labour and achievement can suddenly be remembered as a "musician", "singer", "voice artist", "model", "mannequin" .... However, this in no way means that the "artist" or other titles of that person will have a long-lasting continuity. A person can shine in one moment and fade away in the next. For example, a person chosen by the culture industry can become a "star" with a song and then disappear after fulfilling the functions expected of him/her by the culture industry. As no one knew before, no one remembers him/her after he/she fades out. This "star's" being remembered and continuing his/her "stardom" is related to and limited to what the culture industry expects from him/her.

There is a linear relationship between the role of the culture industry in producing "stars" and fashion, which is the most important motivational tool of consumption that capitalism wants to make uninterrupted. Because there is a strong relationship between *fashion* and *being widespread.* However, although the fact that something is preferred by many people is important for it to be fashionable, this feature may not be enough to ensure that what is desired to be widely consumed is fashionable. An example of this is the torn/worn jeans that are in fashion today. When the blouse was first invented in the USA, it was used by mine workers.

The blousins used by the workers and worn out during long periods of hard labour were not considered fashionable in any way. Moreover, despite the fact that they were worn by a large mass of workers. However, as relatively high status groups, especially young people, began to dress more widely, the torn jeans became fashionable. This was done through "star" personalities who were modelled. Through them, young people and even non-young people started to wear torn/worn jeans and this became a widespread consumption behaviour. People could be directed to the desire of owning torn/worn jeans by paying more for them than for the good ones. A similar situation can be said for "old" clothes. In the old times, the torn, worn, partially dismantled clothes that the poor had to wear were not fashionable although they were worn by the poor on a mass level. This condition of those items was a result of unfavourable economic conditions. Today, however, torn, frayed and partially dismantled clothes have become fashionable through role models and individuals with high socio-economic conditions have been made to wear torn and dismantled clothes. Perhaps patched clothes will soon face a similar situation. Of course, if the people or businesses who decide what is fashionable decide to do so.If one of the important references in determining the meaning of fashion is "mod", the other is *modus*, which means "unformed border" in Latin. *Modus* contributes to understanding the meaning of fashion as well as its function. As it is known, fashion is something that changes easily and does not remain fixed/the same in any way. In the shortest terms, fashion is something that is temporary. Something becomes fashionab/e only for a certain/limited period of time and then quickly becomes *obso/ete.* In fact, when something becomes fashionable, the process of becoming obsolete also begins. The idea of *obso/escence is* what enables a thing to become fashionable and unfashionable, that is, the rapid change that takes place in this process, in other words, the fashion trend to start the next trend. For example, objects physically wear out over time depending on their qualities and usage. This is an expected and familiar situation. However, the traditional mentality and the modern mentality's understanding of *obso/escence* do not refer to the same meaning. From the point of view of the traditional mentality, the obsolescence of an object is due to the fact that it is physically unable to fulfil its basic function and deteriorates. However, from the point of view of this mentality, the obsolescence of an item does not require that the item be immediately thrown away or considered as "rubbish". The *old* item can be repaired and used again and again. Understandings that control consumption, such as *waste* and *saving* with the limited means available, can contribute to transforming the *worn-out* item and maintaining its functionality, even if it has completed its actual useful life. In this respect, some familiar examples are clothes that are patched and worn, furniture that is repaired

and sweaters that are dismantled and put back into use by mopping. It is understandable for elderly individuals with a traditional mentality to continue to keep any item that has lost its function with the understanding that "it will be needed one day". Because from the point of view of this mentality, throwing away items that can be repaired or throwing away objects that have economic value is considered as "rubbish" and is considered as *waste.* Waste is a behaviour that should be avoided. Therefore, according to this view, every item, even if *it is old,* has a use value. This is the requirement of the mentality in which *consumption* is not a value, instead *saving is recognised* as a value.On the other hand, the meaning attributed to "obsolescence" by the modern mentality, which represents the transition from the *old* to *the new* and makes *change* a fundamental value in this context, is completely different from the meaning attributed by the traditional mentality. In the modern mentality, it is not the case that things lose their physical function, wear out and become unusable. The meaning attributed to *obsolescence* by the modern mentality is directly related to the course of development of the capitalist mentality. In the early 20th century, as a result of the replacement of the principle of *production* with the principle of *consumption,* "spending" rather than "saving" or "preserving" was encouraged, while values such as "frugality" began to be perceived as *stinginess.* The thrifty, wasteful individuals of the past have been replaced by individuals with the mentality of *"I consume, therefore Iexist"* and the masses formed by these individuals. Instead of *stability, permanence* and *order,* transience and *change* have become the basic principle. The idea of *impermanence* and *disposability* has been developed and reinforced through adverts that manifest themselves at every corner of daily life with calls to *bring the old and take the new.* Being "disposable" and "discontinuous", which comes with the idea of *obsolescence,* has become a feature that reveals itself in its full form not only in clothes, household appliances, cars, accessories, furniture and houses, but also in human relations and preferences. The minds are now dominated by a distinction between what is appropriate and inappropriate for the times and conditions. When this idea is engraved in the consciousness with the concepts of "new" and "change", individuals who are motivated by the discourses of infinite *freedom of choice can,* for a small reason, remove friends, people or relationships that they do not like or that are no longer useful from their agenda and minds, and continue their lives as if they had never happened by opening a new page. As in the Greek philosopher Heraclitus' statement that the *only thing that does not change is change itself, change/abandonment is at the* centre of the mentality of today's individuals and life in today's societies.

Fashion And Change

Change is a value glorified by today's dominant mentality. Clothes, automobiles, houses, mobile phones, white goods, furniture, physical appearance and even people, friendships, values, emotions, beliefs, which are indicators of the individual's tastes and material power, are objects of change. For today's individual, none of these have the importance and meaning to deserve to stay for a long time. Fashion is an important motivational tool that manages the process. Fashion keeps the desire for change alive through the understanding of *obsolescence* in a way that can be called continuous. Sociologist Roland Robertson (1938-2022) considered the adoption and spread of fashion as a five-stage process supported by social motivations. These stages consist of the following:

1) The adoption of what will become fashionable by agents, i.e. change leaders,

2) Social visibility and communicability,

3) Harmony within and between social systems,

4) Social cohesion and the market,

5) Becoming obsolete with the emergence of new fashion alternatives.

In addition, fashion represents the logic of planned obsolescence. Fashion is not only a necessity for the survival of the capitalist market, but also an important tool for the expansion of capital. Werner Sombart (1863-1941), who analysed the economic dimension of fashion within the capitalist system, defined fashion as the *favourite child of capitalism in* his work *Economy and Fashion* (Wirthschaft und Mode) published in 1902. According to him, fashion is a necessity to offer new fields and products to the capitalist market. It is a highly functional mechanism for making profit by making things, ideas, values, lifestyles, attitudes and behaviours, personalities, identities... constantly "obsolete". Within the scope of all these, the main characteristics of the fashion sector can be expressed under five headings:*Being short-lived:* Fashion products are generally short-lived. The life of a fashion product is expressed in weeks or months. Fashion is recognised as a temporary and cyclical phenomenon. For this reason, it is known that the life curve of fashion clothing products is shorter than other industries.*High variability:* The demand trend for fashion products is rarely constant or linear. Fashion products can be affected by seasons, famous people, trends.*Lowpredictability:* Due to the variability of demand, it is difficult to make sales and demand projections.*Highly motivated buying tendency:* Most of the purchasing decisions of consumers are made at the point of purchase. When the consumer encounters the product, he/she is encouraged to buy it.*Being similarising:* Today, although the fashion industry is multidimensional, multicultural, multicoloured and multivocal, as a result

of globalisation, clothing and fashion culture has evolved into a similar structure among countries. In this respect, brands such as Zara, Berschka, Pull&Bear, H&M, Stradivarius, Mango, Vero Moda, TopShop, Koton and Batik function as actors of similarity of appearance.Attitudes and behaviours, preferences and tendencies that can be considered within the scope of fashion have been one of the unchanging features of social life. In all societies, senior executives and the people around them, especially family members, members of the socio- economically high class, and especially women have had different and variable preferences from the majority of the society. Fashion is a sociological phenomenon related to power holders and rich people before the 19th century. In the first quarter of the 20th century, it gained a mass character with a form and scope unprecedented in history. Class fashion has been replaced by consumer fashion. Instead of a single type of fashion determined by the upper classes, a fashion understanding that tends to include all layers of society has emerged. In the 20th century, developments in mass communication technologies led fashion to become widespread and prestigious in a way never seen in any period of history. In the 20th century, the phenomenon of dressing has covered the whole social life in a way that goes beyond culture and has become a part of the material and spiritual dimension of consumer culture. Through mass media, it has become an element that mobilises social change as well as a mirror of social life. However, in addition to fashion shows, fashion blogs and fashion magazines, other channels that are as effective as them have emerged in the dissemination of fashion. One of these channels is fashion magazines. In addition, the internet and social media platforms have assumed important functions in terms of the opportunity to spread fashion trends rapidly and to deliver visual images to wider audiences. Fashion influencers and celebrities who are effective on platforms such as Instagram, YouTube and TikTok popularise a certain body type, clothing style and beauty standards in a short time and have a strong influence on their followers to adopt these idealised images.

Scope of Fashion

The most basic expression of fashion is recognised as *clothing, dress* and *ornamentation.* Clothes are the most classic and basic product of fashion. Being a manifestation of people's personality and character, clothes are an observable form of behaviour. However, although clothes are the most visible form of fashion, fashion is a broader phenomenon. It is related to many different material and non-material contexts. The most important tool and even lever of fashion is advertising. Every day people are bombarded by visual advertisements that encourage them to buy certain products or services, which in turn creates and popularises fashion.

However, these images also function as factors that influence attitudes, values, beliefs and behaviour. Fashion is inherently related to material contexts (furniture, architecture and automobiles, etc.) as well as non-material contexts (child-rearing techniques, art appreciation, etc.). In essence, fashion is not only concerned with the appearance of a person's body, but also with their behaviour, thoughts, feelings, emotions, knowledge, speech, agenda, interests... in short, the way they present themselves. For example, making personality analyses based on horoscopes, using slang words or gesticulating while speaking under the influence of some TV series and films can be things that are encountered as fashion elements. In this respect, the words of the famous fashion designer Coco Chanel (1883-1971) are important in terms of expressing the scope of fashion: *Fashion is not something that exists only in clothes, fashion is something in the air we breathe. It is a wind, you feel it coming, you smell it. Fashion is about ideas, lifestyles, what is happening.* The basis of fashion culture is capitalism, which is driven by an unlimited and irresponsible drive for material profit. The rulers of the capitalist mentality, who deliberately declare the contents of existing wardrobes *obsolete* and *outdated*, have succeeded in turning people into slaves dependent on themselves through fashion; they have first and foremost influenced young people and women. Nowadays, even young people who do not have enough money for a bagel to fill their bellies consider following fashion as an indispensable condition and try to follow fashion as much as possible. Young people with no economic means walk around hungry, they feel cold because they have no clothes to protect themselves from the cold, but they try to have something fashionable; sometimes it is perfume, sometimes it is a branded clothing, and lately most of the time it is a mobile phone. Because it is through these that the young person feels his/her existence and makes his/her peers feel it.

The modern mentality and lifestyle has placed the human being as the "subject" at the centre of the "God-centred" existence and lifestyle of the previous, traditional period. This subject, on the other hand, manifests the things constructed and characterised by the culture industry in all the units of the system at the centre of which it sits. For this reason, the mass society and its individuals value fragmentation instead of unity and harmony, pleasure and desire instead of reason. In addition, modernity prefers not the sacred but the profane embodied in itself. In this respect, while entering into a conflict with the sacred, it also presents itself as a taboo. This presentation manifests itself most clearly in fashion rituals. For example, the fact that fashion shows are presented in a ritual/ritual atmosphere, that fashion provides its followers with a belonging with transcendental references, that the members of this belonging display the appearance of a "faith community", that they think, dress and live in the same style... points to

fashion's effort to create a *sacred* space around itself. Through fashion, the profane is given a sacred spirit and appearance. For this reason, Barnard's definition that *fashionable clothing and clothing items are the most fetishproductsproducedandconsumedin capitalist society* is very meaningful. According to Andrew Greeley, an American clergyman, it is enough to visit any car fair today to watch a religious ritual. When one goes to the place where automobiles are exhibited, it will be seen that fashion presenters are treated as people with immunity like clergymen, and the products are treated as aesthetically and ethically indisputable taboos.

Conclusion

In addition to all these, the following should also be stated: The planned rapid *obsolescence of* consumer goods through fashion provides capitalist capital with billions of dollars every year. This makes capitalism always strong and effective. It is possible to clearly see how this process works in the individuals of the consumer society who see consumption as the only way of expressing themselves and use the brands they use instead of their identity. It would be misleading to see this as merely a situation that enables consumers to prefer the products they need. This operates through an idea/value that is embedded in the consciousness of consumers in their human relations and perspectives on life, and is reflected in their behaviour. The philosophy of *carpe diem,* which invites individuals to cut their ties with the past, not to take the future into account and to turn towards the present moment, and to enjoy the moment, drags consumers to further stages and contributes to the establishment of the *disposable* logic from products to human relations, from nature to working life.

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TRANSFORMATION PROCESS OF SHOPPING SPACES AND SHOPPING CENTRES

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Abstract
Among the places where people's shopping activities were shaped before the Industrial Revolution, the agora of Ancient Greece, the market area or city squares of the Middle Ages are important in terms of the functions they fulfil. In addition to being places where commercial activities were carried out and shopping was carried out to meet needs, they were also places where political or cultural activities were carried out and where individuals socialised extensively. They were the heart of social life. In fact, this situation has never completely ended, and especially city squares, with their increasingly narrower and shallower functions, have maintained the features they inherited from history until today, albeit in a diminishing form. However, with the Industrial Revolution, the first signs of change began to be seen in the primary space of production-consumption relations. In the first stage, department stores, which can be considered as the pioneers of shopping centres, started to be seen. These stores fulfilled important functions for a while as places where comfortable shopping could be done, where the products offered for sale were offered to the consumer under favourable conditions and exhibited to encourage consumption. As of today, shopping malls, which have become a centre of attraction with their many elements, are living centres that host many of the activities that individuals and masses feel the need for or feel the need for. These places have become places where the heart of urban life beats with their multifaceted functionality such as shopping, entertainment, eating and drinking, worshipping, doing sports, leisure time, watching movies in the cinema, spending time with friends, spending the weekend with the family, window shopping, socialising, following fashion with their units such as shops, cinema, bank, restaurant, patisserie, cafeteria, hairdresser, pharmacy, place of worship, entertainment or sports venue, playground. With these multifaceted functions, they appeal to all segments of the society from the highest income level to the lowest income level and attract everyone's attention. In this respect, they are micro spaces of daily life. With this research, the meaning and functions of shopping centres, which represent the last stage of the change process of shopping spaces, in the context of consumption culture will be discussed and evaluations will be made regarding the process.
Keywords: Shopping, Consumption, Shopping places, Shopping centres.

Introduction

The Industrial Revolution has an important place in the formation of the modern mentality and lifestyle, to put it in terms of shaping the process, disregarding the philosophical and scientific heritage of several centuries. The Industrial Revolution, which led to many changes in people's mentality and in their individual and social lives, and the urban life that accelerated and intensified thanks to it, significantly changed the production-consumption relations and caused these relations to be reflected in other areas of individual and social life, rather than being limited to the economic field as before. Changes in working life, the emergence of the traffic problem, new meanings attributed to consumption, the emergence of the concept of "leisure time" and proposals and initiatives regarding its content, the search for alternative spaces for the needs shaped by the new mentality and lifestyle... have been the determinants of radical changes and innovations in the course of humanity.

Emergence of Shopping Centres

Before the Industrial Revolution, among the places where people's shopping activities were shaped, the agora of Ancient Greece, the market area of the Middle Ages or the city squares are important in terms of the functions they fulfil. In addition to being places where commercial activities were carried out and shopping was carried out to meet needs, they were also places where political or cultural activities were carried out and where individuals socialised extensively. They were the heart of social life. In fact, this situation has never completely ended, and especially city squares, with their increasingly narrower and shallower functions, have maintained their features inherited from history until today, albeit in a diminishing form. However, with the Industrial Revolution, the first signs of change began to be seen in the primary space of production-consumption relations. In the first stage, *department stores,* which can be considered as the pioneers of shopping centres, started to be seen. These stores fulfilled important functions for a while as places where comfortable shopping could be done, where the products offered for sale were offered to the consumer under favourable conditions and exhibited to encourage consumption. The growth of cities, the increase and intensification of the population, the emergence of the traffic problem, the emergence of the concept of leisure time in general and holidays in particular due to the regulations in working life, the emergence of the need to engage in as many activities as possible in limited free time... all these have led to the inadequacy of city centres and the search for alternative spaces has emerged. Although the spaces that were the product of these searches responded to the needs, albeit with difficulty, until the 1950s, this was not found sufficient. Victor Gruen (1903-1980) was the planner of the

first shopping centre with its present form and function in the United States based on the existing problems and demands. According to him, there was a need for a place of escape for people who were overwhelmed by the traffic problem and the boredom of daily life. Due to the fact that the city centres had lost their functions to a great extent with the division of life and spatial construction into different activity areas in cities, he thought that there was a need for places where new social activities were concentrated and designed the first shopping mall. In 1954, he designed the first suburban open-air shopping facility called Northland Mall. In addition to shops, it was designed as a complex of apartment blocks, schools and health facilities, with its own large park and lake. This complex was never completed, but the idea of this complex space design was original. Victor Gruen continued to design new spaces with some additions and subtractions. The second mall Gruen designed was the Southdale Shopping Centre in Minnesota. He designed it as an enclosed space for both vendors and consumers, where social activities were carried out together, going beyond mere shopping activities. Others followed. By the mid-1970s he had designed more than fifty shopping centres in the USA. Each space was planned in more detail than the previous ones. Thus, he reached the shopping centre design that brings together the functions that the busy and complex lifestyle of today's modern city makes individuals feel the need or desired to feel in their daily lives under a single homogeneous roof.

Structural Features of Shopping Centres

As of today, shopping malls, which have become centres of attraction with their many elements, are living centres that host many of the activities that individuals and masses need or feel the need for. These places have become places where the heart of urban life beats with their multifaceted functionality such as shopping, entertainment, eating and drinking, worshipping, doing sports, leisure time, watching movies in the cinema, spending time with friends, spending the weekend with the family, window shopping, socialising, following fashion with their units such as shops, cinema, bank, restaurant, patisserie, cafeteria, hairdresser, pharmacy, place of worship, entertainment or sports venue, playground. With these multifaceted functions, they appeal to all segments of the society from the highest income level to the lowest income level and attract everyone's attention. In this respect, they are micro spaces of daily life.The main factor that is often unrecognised in the functioning of shopping malls is the phenomenon of *leisure time*, which is a product of the Industrial Revolution. While*production* and *work* were at the forefront in the early days of the Industrial Revolution, *leisure time* based on consumption was built as an important living space in the following period. Following the Industrial

Revolution, *working time* and *rest time* were completely separated from each other as two separate living spaces. However, in traditional life, working life and rest time were intertwined; there was no such separation. With this separation, the social structure based on production and work was replaced by a new social structure based on consumption and leisure time. Capitalism, which is the subject of the process, while reshaping production and consumption through its own paradigm, has designed that individuals who use their time for production should also have private time for consumption. Non-working time, which is created through regulations on working life, is designed as a field of activity based on consumption. For this reason, leisure time activities have been commodified and functioned as a tool of hegemonic planning rather than being seen as a time to spend leisure time resting. Consumption became the main activity of the process. In this respect, thanks to *the institution of leisure time* built under the conditions of the Industrial Revolution, *consumption* has ceased to be a means of sustaining life and has become an end in itself. This has functioned as an important means of dominating the understanding that people should *live to consume rather than consume to live.*Today, the act of shopping and consumption has social and symbolic contents such as having fun, leisure time, acquiring status, achieving an idealised lifestyle and obtaining prestige. In terms of the modern mentality, consumption has emphasised the meanings attributed to products rather than their properties and functions, and in some cases even completely. The "mass society", which is constructed with the help of mass media and is open to all kinds of manipulation, and whose sociality is questionable in every respect, has been transformed *into a society of consumption.* The *consumer society*, which is constructed with the desires of large companies engaged in mass production and through the advertising-fashion tools of mass media, gains meaning as the name of an extremely shallow and largely formal structure compared to the natural/real social structure. This structure is a structure whose main function is to consume, where not only consumption commodities but also identities, spaces, lifestyles, cultural elements, images, meanings, values, time and almost everything else are perceived as objects of consumption. Consumption has ceased to be the result of an act of shopping to satisfy mostly physiological needs and has become a phenomenon that is supported and directed through fashion and advertisements in line with the aims of the capitalist economy, and in which consumed objects are used as identity and status indicators. Both the constructor and the supporter of this phenomenon is the capitalist mentality. Just as every society has a culture, a culture has been invented for *the consumption society*, and unlimited consumption tendencies to obtain the symbols dressed in consumption objects, and the lifestyle shaped around consumption

behaviours that diversify every day have formed the basis of this culture. The modern urban individual has become the ideal type of *consumption society* and *consumption culture.* This individual consumes in order to have the sense of identity offered to him/her and to live according to who he/she wants to be perceived as.*Consumption culture* is a necessity of not seeing consumption activity only as the consumption of commodities. Consumption culture refers to a mentality and lifestyle related to the purpose and manner of obtaining the commodities consumed, the way they are used and the norms and value system emerging in this process. The use of an object because of its ability to satisfy a need and being found valuable in this respect is a very normal and routine feature in terms of human behaviour. Here, the subject is the human and the object is the product consumed. However, consumer culture gains meaning as the name of a situation that disrupts this hierarchy. In this case, people become objectified and things become subjectified. Karl Marx's (1818-1883) conceptualisations of alienation and fetishism are important as one of the first to recognise this situation. Another social scientist György Lukacs (1885-1971) made a similar evaluation while reaching the concept of *reification* through what Marx expressed with alienation and fetishism. Whatever the conceptualisations expressing the subversion of the hierarchy in question, what is expressed expresses the differentiation of the connection that should be in the relationship between man and things. In other words, while the thing produced for use becomes the basic reference of a system of values, the human being, who should be the subject, becomes objectified and ordinary. However, the thing that becomes subjective in consumer culture is essentially the thing produced by human beings for human beings. To give an example of how this happens; when a person sees a state-of-the-art technological product, if he starts to see that technological product as a value in itself, as a basic reference that will increase his own value if he owns it, rather than the feature related to the function of that product, this is a problematic relationship and corresponds *to the culture of consumption.* In Marx's conceptualisation, the person in this situation becomes "alienated" from his/her own essence/humanity, and the object that enables this alienation gains the quality of a fetish. In the same way, the fact that money, which is an intermediary in the purchase of commodities, becomes a measure of value is shaped according to the functioning of the process envisaged by the consumption culture. At this stage, it is meaningful that Ivan Illich (1926-2002) defines *consumer society as a* type of society in which life is organised around commodities and social progress is measured by the power of access to these commodities, or Zygmunt Bauman considers *consumer culture as a* type of society in

which the exchange value of commodities disappears and the function of commodities as indicators comes to the fore instead of their utility function.

Consumption Culture and Shopping Centres

For the modern and therefore urban individual, being different from everyone else, and demonstrating this difference with his appearance, especially in terms of clothing and attire, eating and drinking places, the tools and equipment he uses, and the social environment he is in contact with, constitutes one of the targeted goals of the idealised lifestyle. He strives to be different from those around him with the visible brand name of his clothing, the neighbourhood of his residence, the brand and model of his car, the country and region he goes on holiday, the popularity of the food he eats, the subjects he is interested in, his circle of "friends", the way he speaks... This situation leads to an endless struggle to *be recognisable,* and all their efforts are shaped on the axis of being different and staying different. As a result of the increased accessibility of consumption commodities and the tendency to spread to all segments of the society, the current situation of the socioeconomically upper segments has become questionable, which has necessitated the continuous reconstruction of *differentiation* tendencies through fashion, which triggers and accelerates *being different.* The widespread access to all kinds of clothes as a stage of this situation has pushed *the privileged segments* who tend to be different to expose themselves with a nudity in which only the genitals are covered, or to exhibit behaviours that reveal their differences through appearing in such art activities. The paradox of *differentiation* and *sameness leads to* an endless consumption motivation. In this respect, shopping malls function as spaces of the capitalist commodity system cycle *that* both *segregates* and *replicates.*As places where an *ostentatious* lifestyle is embodied in all its dimensions in accordance with *the* requirements *of the consumption culture,* shopping malls make life easier for the members of the consumption culture by offering all the products required by *ostentatious symbolic consumption as well as* products that will meet all the needs that can be considered as *compulsory* such as food and clothing. Offering a wide variety of products in different stores that meet all kinds of needs together allows people to shop in accordance with their lifestyles, identities and status. Special security personnel, devices and inspections create a safe environment and provide protection from external factors that may harm individuals. People have the understanding and confidence that they breathe in a highly controlled and disciplined life during their stay there. In shopping centres, it is clear where to enter and exit and what to do. These are dictated to individuals in the form of unwritten rules. In these places where individuals stay as long as they can, showcases create a visual space that they cannot break

away from. The perception that the individual can spend his whole life if he wants is successfully dictated. There is something for everyone. People's interests, feelings of pleasure and desires are constantly provoked. In addition to these, the fact that shopping malls offer colourful brands and different lives causes people to be psychologically affected; shopping malls function as a means to get away from external problems. Individuals numb their problems or take a break by visiting the colourful showcases in the shopping malls. In shopping centres, there is virtually "nothing to find", all stores and "needs" are waiting for their customers in magical boxes.

Shopping Centres and Religious Rituals

The fact that shopping malls have become a centre of attraction of consumption that constantly renews itself and does not lose anything from its attractiveness in this respect has been possible thanks to planning carried out in a highly rational manner. Among the objective, emotional and functional elements that make shopping malls the centres of attraction of consumption culture, the fact that they are gigantic and easily accessible places, their eye- catching showcases that stimulate feelings of need, the fact that they are offered with opportunities to meet many different needs at the same time, and the use of credit card shopping facilities that facilitate spending and transfer payments to the future are important attraction features. In a sense, the roads in shopping centres, which have the appearance and function of a micro city, constantly direct people to the stores depending on the architectural tricks that highlight the showcases of the stores and present them to the attention of the consumer. The arrangement of the space is realised in such a way that the individual will increase the time he/she will spend in the shopping mall and thus, he/she will feel the need by seeing what he/she does not need. The internal flow in the space is realised through labyrinth-like circulation areas, enabling consumers to encounter the maximum number of products and shopping opportunities. The escalators, which are located in the same direction but not end-to-end and used for vertical connection, are planned to allow people to walk around and thus see more stores. What is more important and interesting is that consumption is not directly presented in these spaces. Entertaining activities and shows are attached before and next to the consumption activity, and campaigns presented as special opportunities successfully fulfil the functions of directing consumption. Shopping in shopping centres is no longer just an act of purchasing. Entertainment, aesthetics, image and belonging have become effective elements of purchasing. With the addition of entertainment to the meaning of shopping, the distinction between shopping and entertainment has almost disappeared. Thus, consumption is transformed into an act of pleasure, a recreational activity.

With the establishment of shopping centres, shopping has become an effective element of purchases such as entertainment, aesthetics, image and belonging. With the addition of entertainment to the meaning of shopping, the distinction between shopping and entertainment has almost disappeared.

A lifestyle is offered to individuals in shopping centres. This is a lifestyle envisaged by capitalism and designed by the culture industry. The masses are directed towards the modern mentality and lifestyle through these places, the relations and transactions in these places. These spaces of production-consumption relations, which seem to put the human being at the centre, but where the intellectuals and representatives of the consumer culture are the subjects and the masses are the objects, are places where rationalism, hedonism, change, individualism, materialism, secularism... appear in accordance with the requirements of modernity. With these characteristics, they are concrete and functional examples of modernity's function of being an "anti-religion religion". Modernity, which is built on anti-religion (Catholicism/Church) and presents itself as a religion in many respects by taking its "enemy" as a model, transforms itself into a "religion of science" in educational institutions, a "religion of pleasure/entertainment" in daily life, or a belief/religion system of "sexuality", "violence", "physical power" ... in different places and environments. In this respect, Ivan Illich was one of the first and important figures to draw attention to the functions of shopping centres outside the production-consumption relationship. While defining the consumer society as a type of society in which life is organised around commodities and social progress is measured by the ability to access these commodities, he emphasised the "slavery of consumption", although the implication of "religion" is also quite strong in this determination. The American sociologist George Ritzer, on the other hand, used the term "religion" directly. As Ritzer expressed in his book *Enchanting the Disenchanted World,* shopping centres are the "cathedrals" of the "religion of consumption". He had no difficulty in finding traces of the forms and worship of the Abrahamic religions (Judaism-Christianity-Islam) in shopping centres. He likened shopping centres to places of pilgrimage. To extend his metaphor a bit; shopping malls function as the place of worship of the modern/secular individual. In the standardised rituals here, it is possible to find traces of the weekly prayers and pilgrimages of the three Abrahamic religions. Individuals who are believers *of the religion of consumption have* a feeling of spiritual emptiness if they do not visit the shopping centre one day a week, similar to the worship of Jews on Saturday, Christians on Sunday and Muslims on Friday. Due to the conditions of working life, this is usually at the weekend. This situation is important in terms of giving the shopping centre "visit" the form of

weekly worship. However, the similarity in question is by no means due to the fact that the visit in question is made once a week, but due to the meaning and function attributed to that "visit". The modern/secular individual, who is restless when he/she does not perform his/her "weekly worship^{M}, returns home after his/her "worship" in a state of "peace of mind". The relationship of the modern individual with shopping centres is also reminiscent of the pilgrimage rituals of the three Abrahamic religions. In the pilgrimage worship of all three religions, there are rituals such as walking around (tawaf) the object/place of pilgrimage (e.g. the Kaaba), venerating a certain building or object in the centre of the pilgrimage site with respect and love (contemplation/zikr), anointing the building or object in the centre of the pilgrimage site (Hajar al-Aswad) .... The modern individual also walks around the shops in shopping centres, which are the "cathedrals" of the "religion of consumption", admires the shop windows/items (reverence), anoints the objects (touching them, trying them on...) and leaves the place in a "purified" way.

Conclusion

Shopping centres are the *magical* places of today. It represents an association in which "magic", which is thrown out of life due to rationality and secularism, the basic principle of modernism, is also activated where necessary. Those who look into its "eyes" fall under its influence and follow it unconsciously. For this reason, George Ritzer (b.1940) likened being in places of consumption such as shopping malls to the situation of a child who imagines himself in a place where everything is made of sugar and can easily reach those candies, and emphasised the *fascinating* aspect of shopping malls. However, there is also a negative side to this; just like the spooky things, ghosts and witches in the child's imaginary space, there are things in this space that have the potential to turn beautiful dreams into nightmares. These are personal impossibilities that exceed the means and power of purchase and therefore can only be watched, which in turn leads to the destruction of the integrity of the psyche. This castle of dreams, where almost every product and service of the world of consumption can be accessed, represents the realm of nightmares with its unaffordability as well as its accessibility.

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APN POLİMERİ ÜZERİNDE PH ETKİSİNİN ARAŞTIRILMASI

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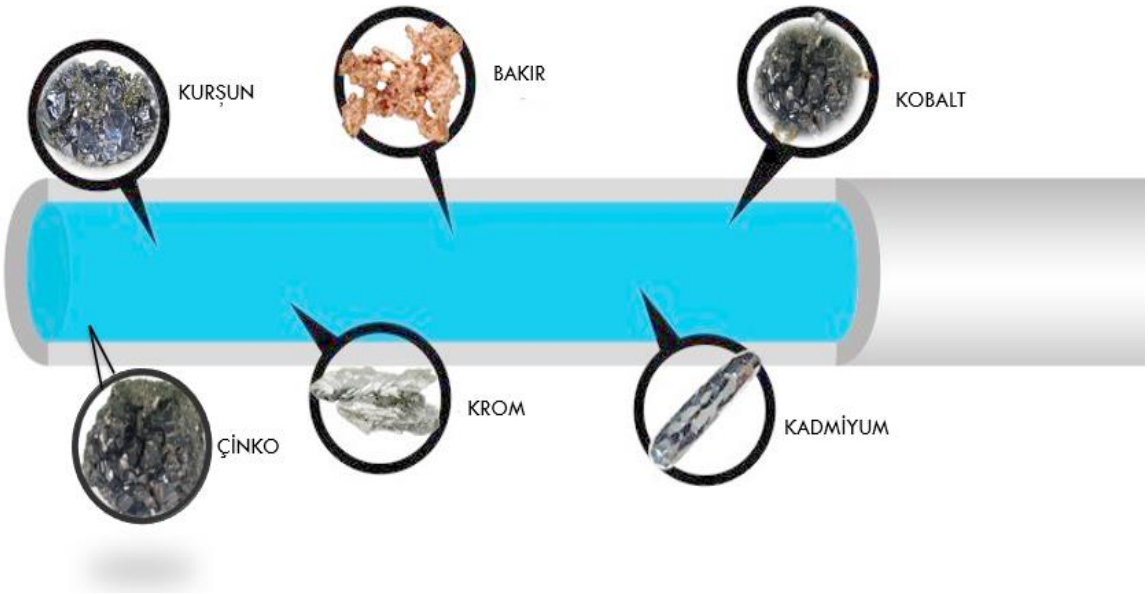
ÖZET
Ağır metallerin toksik özelliklerinden dolayı, atık sulardan uzaklaştırılması çevre ve insan sağlığı için oldukça önemlidir. Sulu ortamda ağır metal iyonlarının uzaklaştırılmasında kimyasal çöktürme, membran ile filtrasyon, iyon değişimi ve absorpsiyon gibi yöntemler kullanılmaktadır. Günümüzde çevre kirliliğinin nedenlerinden biri olan sulu ortamlardaki ağır metaller genellikle maden, metal ve kimya endüstrisi atık sularında bulunur. Zamanla doğal kaynak sularına karışan bu atık suların, ekolojik dengeyi bozduğu ve canlı organizma üzerinde zararlı etkiler bıraktığı gözlenmiştir. Ağır metaller içerisinde bakır, oldukça fazla çalışma yapılan toksik özelliğe sahip bir ağır metaldir.Bu çalışmada bakır (II) nitrat trihidrat '$Cu(NO_3)_2.3(H_2O)$' katısı ile hazırlanan ana stok çözelti kullanılmıştır. Stok çözelti 1000 ppm 250 mL olarak hazırlanmıştır. Hazırlanan stok çözelti seyreltilerek balon jojelere alınmıştır ve kalibrasyon grafikleri hazırlanmıştır. Cu(II) adsorpsiyonu APN polimeri kullanılarak incelenmiştir. 20 mL viallere 0,01 g APN polimeri tartılmıştır. Üzerlerine 1000 ppm Cu^{+2} çözeltisi eklenerek oda sıcaklığında 24 saat bekletilen çözeltiler UV-VIS absorpsiyon spektroskopisi kullanılarak 312 nm'de ölçüm alınmıştır. Ölçüm sonuçlarına bakıldığında APN polimerinin en iyi pH 4'te çalıştığı sonucuna varılmıştır.
Anahtar kelimeler: Ağır metaller, Cu(II), APN polimeri, Adsorpsiyon, UV-VIS spektroskopisi, pH

INVESTIGATION OF THE PH EFFECT ON APN POLYMER

ABSTRACT
The toxic properties of heavy metals necessitate their removal from wastewater for the protection of both the environment and human health. Various methods, including chemical precipitation, membrane filtration, ion exchange, and absorption, are employed for the removal of heavy metal ions in aqueous environments. Heavy metals in aquatic environments, which are a significant contributor to environmental pollution, are commonly found in wastewater from mining, metal, and chemical industries. It has been observed that the mixing of wastewater streams with natural water sources can disrupt the ecological balance and have harmful effects on living organisms. Among heavy metals, copper is a metal that has been extensively researched due to its toxic properties.In this study, a main stock solution was prepared using copper (II) nitrate trihydrate, which is also known as $Cu(NO_3)_2.3(H_2O)$. The stock solution was prepared at a concentration of 1000 ppm in 250 mL. The prepared stock solution was diluted and transferred into volumetric flasks, and calibration curves were prepared. The adsorption of Cu(II) was investigated using APN polymer. 0.01 g of APN polymer was weighed into 20 mL vials. Subsequently, 1000 ppm Cu^{2+} solution was added to the vials, and the solutions were left at room temperature for 24 hours. Measurements were taken at 312 nm using UV-VIS absorption spectroscopy. The results indicated that the optimal pH for APN polymer was 4.
Key words: Heavy metals, Cu(II), APN polymer, Adsorption, UV-VIS spectroscopy, pH

GİRİŞ

Atık sularda tespit edilen her türlü madde kimi zaman eser miktarda kimi zaman da belirli bir derişim üzerinde sağlık için zararlıdır. Zehirlilik etkisine sahip maddeler düşük konsantrasyonlarda bulunmaları halinde bile insan sağlığına zarar vererek hastalıklara ve hatta ölümlere neden olabilirler. Eser miktarda bile riskli olan bu maddeler arasında en önemli grubu ağır metaller oluşturur. Cd, Cr, Cu, Co, Pb ve Zn elementleri ağır metallere örnek olarak verilebilir.Doğadaki su kaynaklarının ağır metal kirliliği; insanlara, çevredeki diğer hayvanlara ve bitkilere toksik etkisi nedeniyle zarar vermektedir. Ağır metal numunelerinin ana kaynakları genellikle madencilik, metal kaplama, tekstil, kimya, otomotiv ve elektrikli cihaz imalatı gibi birçok endüstriden gelmektedir (Zalloum ve ark., 2008).



Şekil 1.1: Atık sularda bulunan ağır metaller

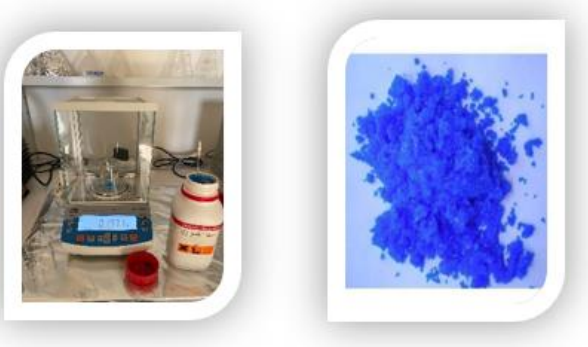
Toksik metal iyonlarının uzaklaştırılmasında adsorpsiyon, kimyasal çökeltme, fitoekstraksiyon, ters ozmoz, ultrafiltrasyon, elektrodiyaliz, solvent ekstraksiyonu ve iyon değişimi gibi birçok yöntem kullanılmaktadır. Adsorpsiyon, atık suların arıtımında uygulanabilen yüksek verimliliği, uygun hızı ve çalışma kolaylığı nedeniyle ağır metallerin gideriminde en çok tercih edilen yöntemlerden biridir. Çalışmamızda, atık sularda sıkça karşılaşılan ağır metallerden biri olan Cu(II) iyonunun giderimi adsorpsiyon yöntemiyle gerçekleştirilmiştir.Cu(II) iyonları canlı organizmaların yapısında ve vücut fonksiyonlarında önemli yere sahiptir. Fakat fazla miktarda Cu(II) iyonuna maruz kalınması durumunda olumsuz etkiler gözlemlenir. Aşırı Cu(II) iyonu alımı olumsuz etkileri; hepatit, karaciğer sirozu, böbrek

hastalığı, anemi, kemik bozuklukları ve parkinson gibi bir dizi hastalıkla ilişkilendirilir. USEPA tarafından belirlenen içme suyunda izin verilen maksimum limit 1,30 mg/L'dir. WHO'nun içme suyundaki Cu(II) iyonları için kısıtlaması ise 0,05 mg/L'dir. Bu nedenle Cu(II) iyonlarının tespiti ve uzaklaştırılması, su kalitesinin ve insan sağlığının kontrolünün sağlanması açısından önemlidir (ABD Çevre Koruma Ajansı Raporu, 2004). Atık su örneklerindeki Cu(II) iyonlarının incelenmesi ve adsorplanmasında uygulanabilecek yöntemlerin geliştirilmesi büyük önem taşımaktadır. Özellikle bu örneklerin spektrofotometrik yöntemler kullanılarak belirlenmesi; basitliği, kolay kullanımı ve düşük maliyetli teknolojilerin kullanılması nedeniyle pratik açıdan birçok avantaja sahiptir (Bereli ve ark., 2021). Tüm bunlar göz önüne alındığında sulardaki atık maddelerin temizlenmesi düşüncesi daha da yaygınlaşmaktadır. Çalışmamızda APN polimeri ile Cu^{+2} elementinin adsorpsiyonunu inceleyerek pH bağlı olarak nasıl çalıştığı gözlemlenmiştir.

2.ARAŞTIRMA VE BULGULAR

2.1. Deneysel Çalışmalar

Bu deneyde $Cu(NO_3)_2$ .3(H_2O) (Bakır (II) nitrat trihidrat) kullanılarak stok çözelti hazırlanmıştır.



Molekül Formülü: $Cu(NO_3)_2$ .3(H_2O)
Molekül Ağırlığı: 241.6 g/mol

Şekil 2.1.1: Bakır (II) nitrat trihidrat katısı

Stok çözelti hazırlamada kullanılacak pH 2,3,4 suları distile suya; asit(HCl) ve baz(NaOH) çözeltileri eklenerek hazırlanmıştır. Stok çözeltimiz 1000 ppm 250 mL olarak hazırlanmıştır. Bakır (II) nitrat trihidrat katısı beherde çözüldükten sonra 250 mL'lik balon jojede hazırlanan pH suları ile tamamlanmıştır. Hazırlanan stok çözeltiden balon jojelere çeşitli derişimlerde seyreltilerek kalibrasyon grafikleri incelenmiştir.



Şekil 2.1.2: Stok çözelti hazırlama aşaması

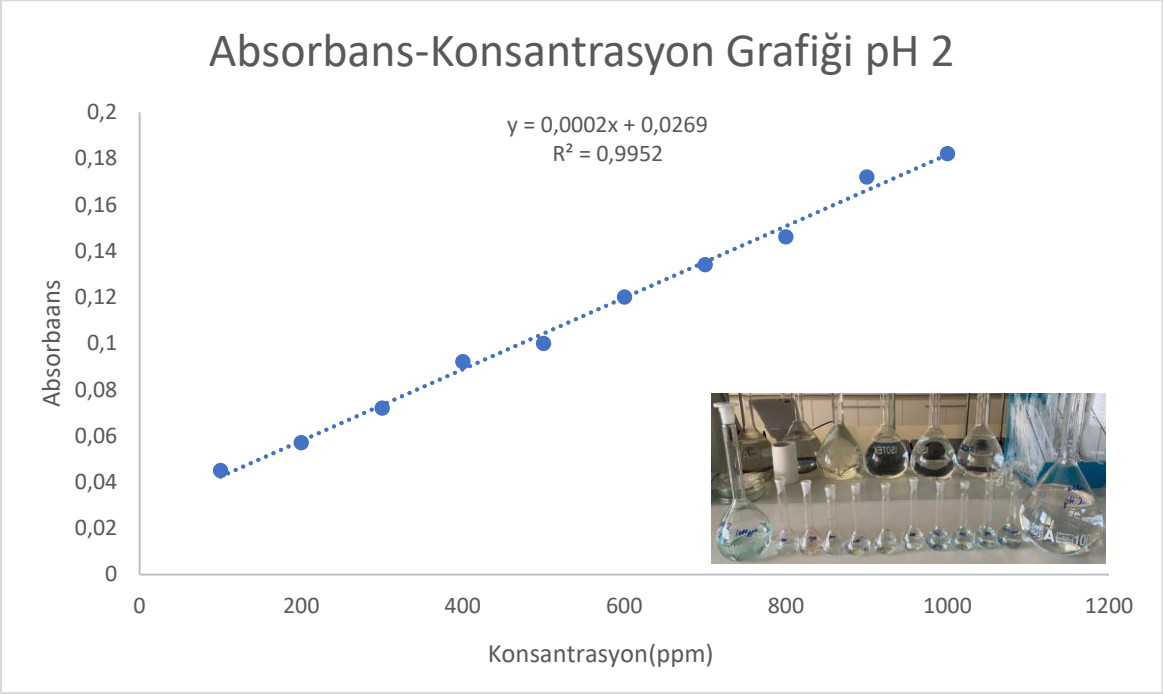
20 mL viallere 0,01 g APN polimeri tartılmıştır. pH 2, 3 ve 4 sularından 10 mL eklenerek oda sıcaklığında ve karanlık ortamda 24 saat bekletilen çözeltiler UV-VIS absorpsiyon spektroskopisi kullanılarak 312 nm'de ölçüm alınmıştır. pH 2,3 ve 4 için absorbans-konsantrasyon kalibrasyon grafikleri çizilmiştir.



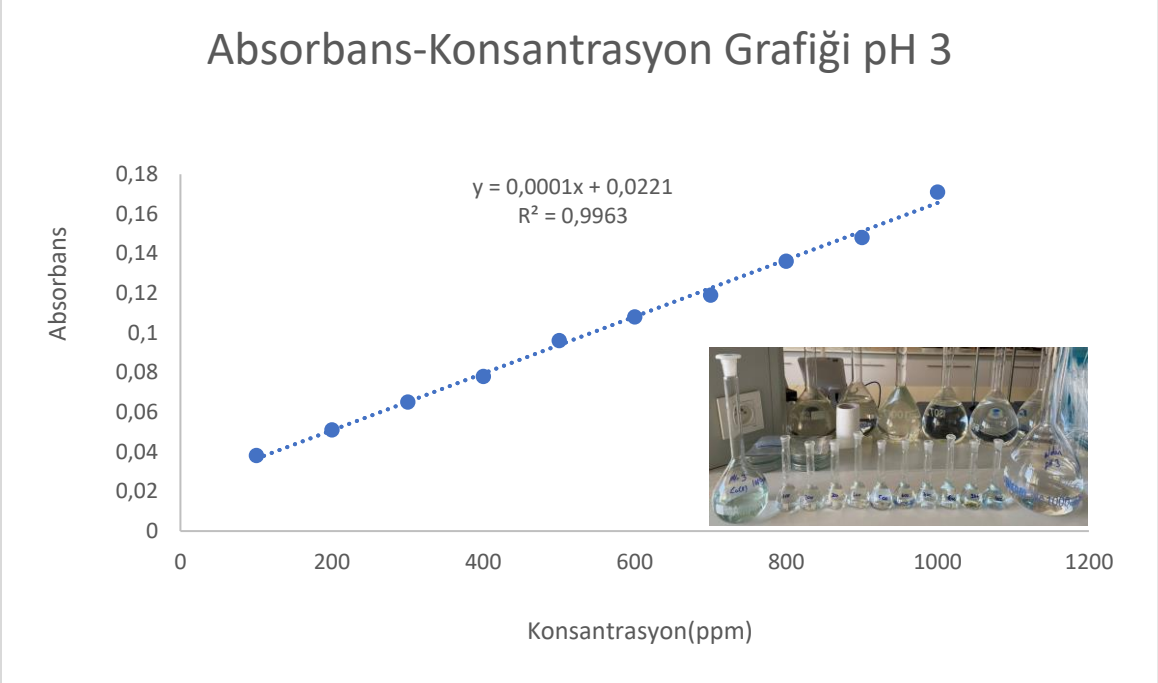
Şekil 2.1.3: APN polimeri UV-VIS absorpsiyon deney basamakları

2.2. Deneysel Bulgular

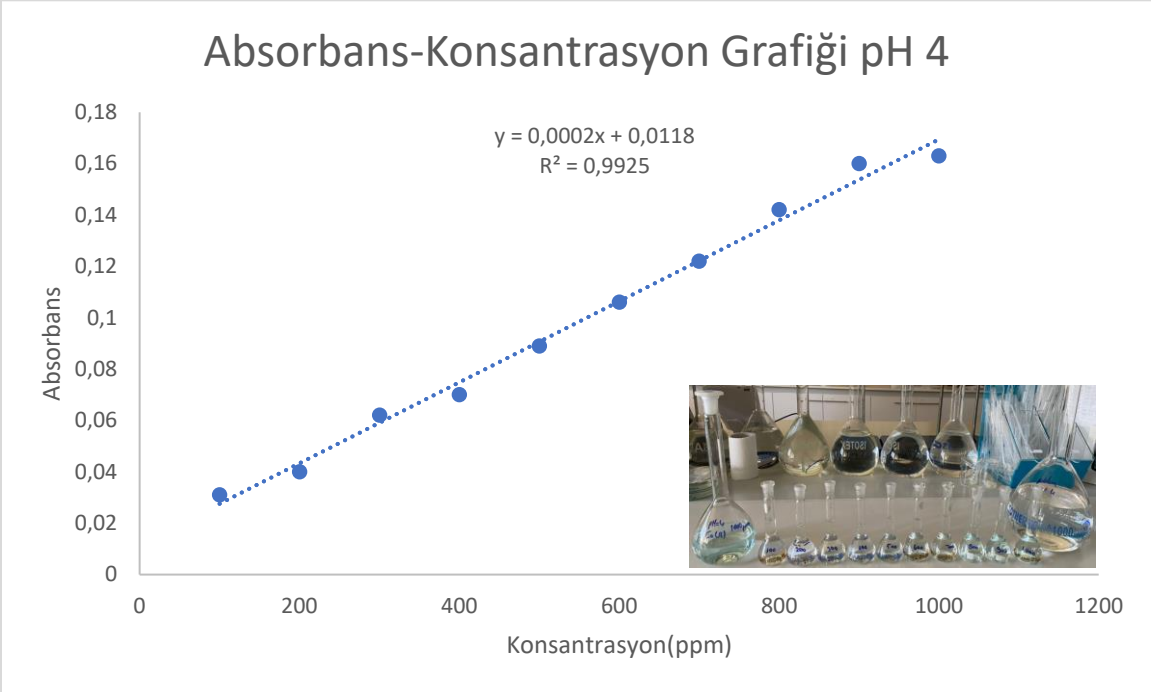
Deneysel çalışmalar sonucunda pH 2, 3 ve 4 için elde edilen değerler ile çizilen Absorbans – Konsantrasyon grafikleri aşağıda verilmiştir.



Şekil 2.2.1: pH 2 için kalibrasyon grafiği



Şekil 2.2.2: pH 3 için kalibrasyon grafiği



Şekil 2.2.3: pH 4 için kalibrasyon grafiği

3.SONUÇ

Yapılan çalışma sonucunda elde edilen değerler ile oluşturulan pH – Q_e grafiğine bakıldığında APN polimerinin Cu(II) iyonları adsorpsiyonunda optimum pH 4'te çalıştığı gözlenmiştir.

$$Q_e=((C_0-C_{son}).V)/m$$

$$Q_e=C_0-C_{son}$$

Bu denklemde;

C_o: Başlangıç konsantrasyonunu (mg/L),

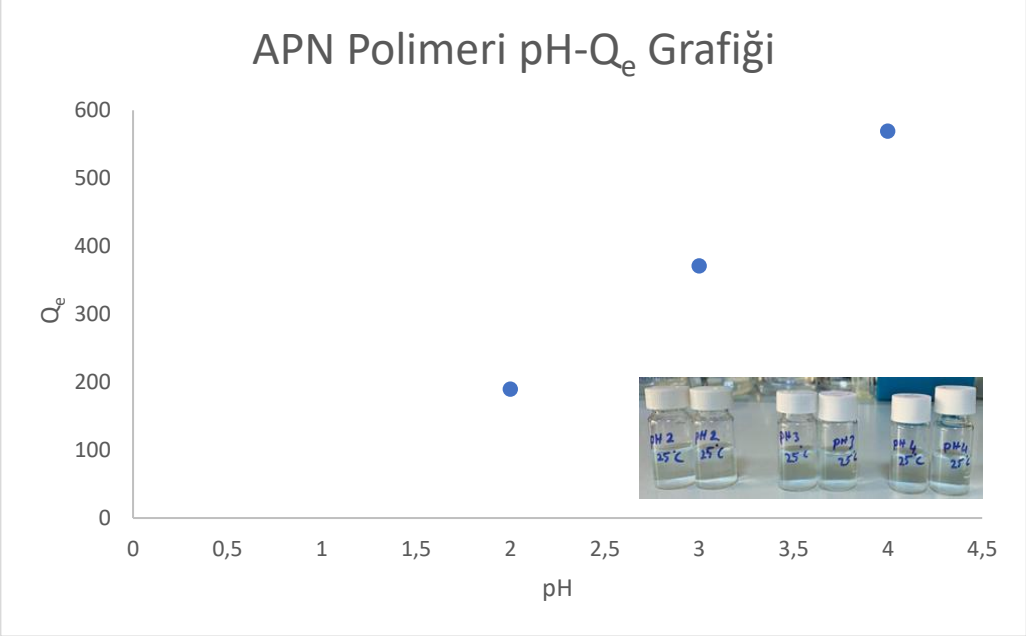
C_{son}: Çözeltinin son konsantrasyonunu (mg/L),

v : Çözeltinin hacmini (mL)

m: Kullanılan polimer miktarını (g) , temsil etmektedir.

pH değeri	C_0 (ppm)	Absorbans değeri (24 Saat)	C_{son} (ppm)	Polimer Miktarı(g)	Q_e
2	1000	0,189	810,5	0,01	189,5
3	1000	0,085	629	0,01	371
4	1000	0,098	431	0,01	569

Tablo 1: 1000 ppm için 312 nm de 24 saatlik süre sonucu



Şekil 3.1: Adsorpsiyon kapasitesinin pH etkisi

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APN POLİMERİ ÜZERİNDE SICAKLIK ETKİSİNİN ARAŞTIRILMASI

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ÖZET
Çevre kirliliği temiz ve sağlıklı bir gelecek açısından dünyada ortak endişe haline gelmiştir. Yaşamakta olduğumuz sanayi ve teknoloji çağında mevcut üretim döngüleri, nüfus artışındaki yoğunluk, çarpık kentleşme, doğal alanların tahribi gibi faaliyetler sonucunda su kaynakları da hızla kirlenmektedir. İnsanların ihtiyaçlarının artması ile sanayileşmedeki gelişmeler, atık su miktarını ve buna bağlı olarak da ağır metal yükünü artırmıştır. Madencilik, metal sanayi, petrol rafinerileri, deri sanayi, tekstil sanayi ve otomotiv sanayi ağır metal kirliliğine katkıda bulunan başlıca kaynaklardan bazılarıdır. Bunların yanı sıra evsel atık sular, çöp depolama alanları sızıntı suları ve asit yağmurları da atık sulardaki ağır metal konsantrasyonlarında artışa neden olmaktadır. Bu çalışmada bakır (II) nitrat trihidrat katısı ile hazırladığımız ana stok çözelti kullanılmıştır. Deneyde kullanılan Cu(II) için $Cu(NO_3)_2 \cdot 3(H_2O)$ (Bakır(II) nitrat trihidrat) kullanılarak stok çözeltisi hazırlanmıştır. Stok çözelti, 1000 ppm konsantrasyonunda ve 250 mL hacminde olacak şekilde hazırlanmıştır. $Cu(NO_3)_2 \cdot 3(H_2O)$ katısı beher içinde çözündükten sonra, 250 mL'lik balon jojede hazırlanan pH 4 suyu ile tamamlanmıştır. 20 mL'lik viallere 0,01 gram APN polimeri tartılarak üzerlerine hazırlanan stok çözeltisinden 10 mL eklenmiştir. APN polimerinin çalışması, sıcaklığa bağlı olarak 4°C, 25°C, 45°C ve 65°C'de zamanla incelenmiştir. Sonuçlar, APN polimerinin en iyi performansını 25°C'de sergilediğini göstermektedir.

Anahtar kelimeler: Ağır metaller, Cu(II), APN polimeri, Adsorpsiyon, UV-VIS spektroskopisi, Sıcaklık

INVESTIGATION OF THE TEMPERATURE EFFECT ON APN POLYMER

ABSTRACT
The issue of environmental pollution has become a significant global concern, particularly in relation to the need for a clean and healthy future. In the context of the industrial and technological era, a number of factors have contributed to the contamination of water sources, including existing production cycles, population density increases, unplanned urbanisation, and the destruction of natural areas. The growing needs of people and advancements in industrialisation have also led to an increase in the amount of wastewater, which in turn has placed a greater burden on the environment in terms of heavy metals. Mining, metal industry, petroleum refineries, leather industry, textile industry, and automotive industry are among the primary sources contributing to heavy metal pollution. Additionally, domestic wastewater, leachate from landfills, and acid rain also contribute to increased concentrations of heavy metals in wastewater. In this study, a main stock solution was prepared using copper (II) nitrate trihydrate solid. The copper(II) nitrate trihydrate ($Cu(NO_3)_2 \cdot 3(H_2O)$) was employed to prepare the stock solution, which was prepared at a concentration of 1000 ppm and a volume of 250 mL. Once the $Cu(NO_3)_2 \cdot 3(H_2O)$ solid had been dissolved in a beaker, the pH 4 water prepared in a 250 mL volumetric flask was added. Subsequently, 0.01 grams of APN polymer were weighed into 20 mL vials, and 10 mL of the prepared stock solution was added to them. The performance of the APN polymer was evaluated over time at temperatures of 4°C, 25°C, 45°C, and 65°C. The results demonstrated that the APN polymer exhibited optimal performance at 25°C.
Keywords: Heavy metals, Cu(II), APN polymer, Adsorption, UV-VIS spectroscopy, Temperature

GİRİŞ

Son zamanlarda, atık su arıtma sistemleri, endüstriyel atıklardaki toksik ve kanserojen ağır metallerle ilişkili sağlık ve çevre risklerini azaltmak ve ortadan kaldırmak amacıyla geliştirilmiştir. Endüstriyel işlemler sonucunda ortaya çıkan atık suları temizlemek için en yaygın tercih edilen yöntem, yüksek etkinlik, düşük maliyetler ve kolay işletilebilirlik gibi özellikleri nedeniyle adsorpsiyon yöntemidir (Hamis ve ark., 2024). Endüstriyel atık sulardaki zehirli ağır metaller hem insan sağlığı hem de su ekosistemi için önemli bir tehdit oluşturabilir. Atık sular genellikle tekstil, kimya, petrol, kozmetik, plastik, gıda ve kâğıt imalatı gibi çeşitli endüstriler tarafından üretilmektedir (Lan ve ark., 2022). Polimer malzemeler (akıllı adsorbanlar) ağır metallerin sudan gideriminde önemli yere sahiptir. Bunlar sıcaklık, pH, ışık şiddeti, çözeltinin iyonik kuvveti ve manyetik alan gibi çeşitli çalışma koşullarına farklı tepki verir. Yoğunluğu 4,5 g/ cm^{3}'ten fazla olan metaller (altın (Au), gümüş (Ag), bakır (Cu), cıva (Hg), kurşun (Pb), kadmiyum (Cd) vb.) ağır metal olarak adlandırılır. İnsan vücudunda her ne kadar Cu(II) gerekli bir iyon olsa da, vücuttaki fazla Cu(II) yavaş tepki, anemi, akciğer ödemi, halsizlik, sarılık ve ülser gibi semptomlara neden olabilir. Ağır metal iyonları insan vücudunda dolaşım sistemine girdikten sonra bazı proteinler, enzimler ve biyomoleküller ile etkileşime girerek bunların inaktivasyonuna neden olurlar (Ma ve ark., 2023). Ayrıca bazı organlarda zamanla birikebilir ve sonuçta insan vücudunda ağır metal iyonlarının kronik zehirlenmesine neden olabilir. Bu yüzden sulardaki atık maddelerin temizlenmesi düşüncesi daha da yaygınlaşmakta ve önem kazanmaktadır. Bu çalışmada APN polimeri ile Cu elementinin adsorpsiyonunu sıcaklığa bağlı olarak nasıl çalıştığı araştırılmıştır.

Yöntem	Avantajlar	Dezavantajlar
Kimyasal Çöktürme ve Filtrasyon	Kullanımı kolay ve maliyeti düşük	Yüksek derişimlerde ayrılma güçlüğü ve performans etkinliğinin yetersizliği, toksik çamur üretimi.
Elektrokimyasal Yöntemler	Metalik giderimi yüksek	Maliyeti yüksek malzeme (elektrot) kullanımı ve yalnızca yüksek derişimlerde etkili olması.
Ters Osmoz	Kullanımı kolay ve maliyeti düşük	Yüksek basınçlı sistemler gerektirir.
İyon Değişimi	Metal giderim etkinliği yüksek ve saf atık geri kazanımı	Partiküllere karşı hassasiyet ve yüksek maliyetli reçine.
Buharlaştırma	Saf atık kazanımı	Yüksek enerji ihtiyacı, yüksek maliyet gereksinimi, toksik çamur üretimi.
Membran	Saf atık kazanımı	Yüksek basınçlı sistemler, membran boyutu ve uygulanabilirlik için yüksek maliyetler.
Adsorpsiyon	Ucuz, etkin kullanılabilirlik ve bütün metallerde uygulanabilirlik	Düşük derişimlerde etkin olmama.

Tablo: Atık Su arıtım yöntemlerine ait avantajlar ve dezavantajlar tablosu (Acar, B.Ç. & Acar, M. B., 2022)

2.ARAŞTIRMA VE BULGULAR

2.1. Deneysel Çalışmalar

Bu çalışmada bakır (II) nitrat trihidrat katısı ile hazırladığımız ana stok çözelti kullanılmıştır. Deneyde kullanılacak Cu (II) için $Cu(NO_3)_2$ .3(H_2O) (Bakır (II) nitrat trihidrat) kullanılarak stok çözelti hazırlanmıştır.





Molekül Formülü: $Cu(NO_3)_2$ .3(H_2O)

Molekül Ağırlığı: 241.6 g/mol

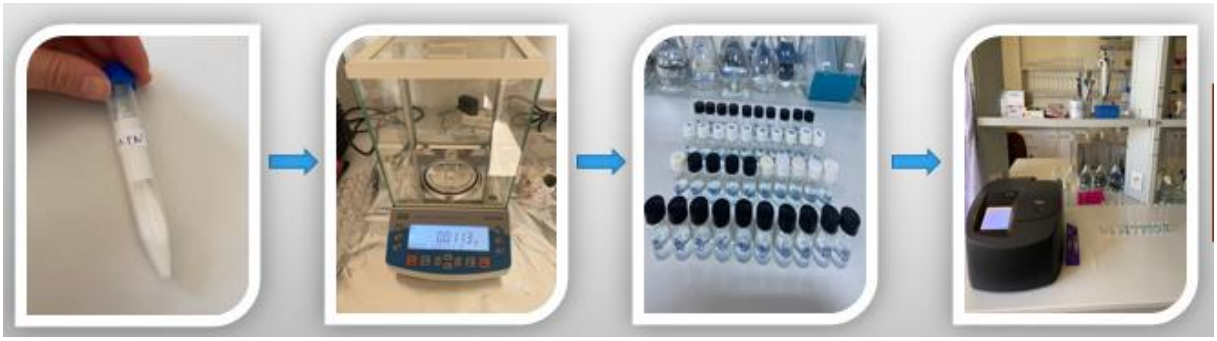
Şekil 2.1.1: Bakır (II) nitrat trihidrat katısı

Stok çözeltimiz 1000 ppm 250 ml olarak hesaplanmıştır. 0,6737 g Bakır (II) nitrat trihidrat tartılmıştır. Beherde çözüldükten sonra 250 ml'lik balon jojede hazırlanan pH 4 suyu ile tamamlanmıştır.



Şekil 2.1.2: Stok çözelti hazırlama

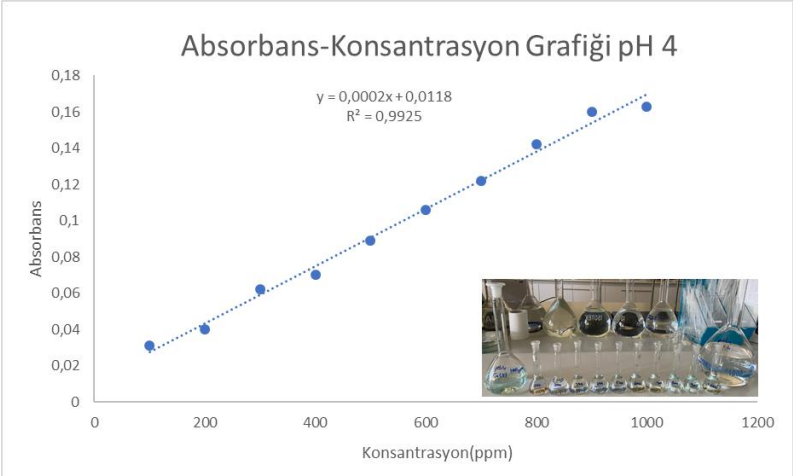
20 ml'lik viallere 0,01 gram APN polimeri tartılarak üzerlerine hazırlanan stok çözeltiden 10 ml eklenmiştir. Sıcaklığa bağlı olarak APN polimerinin çalışması 4 ^{0}C, 25 ^{0}C, 45 ^{0}C ve 65 ^{0}C'de zamana göre incelenmiştir.



Şekil 2.1.3: APN polimeri farklı sıcaklıkta UV- VIS absorpsiyonu

2.2. Deneysel Bulgular

Uygun koşullarda bekletilen numunelerden 10, 20, 30, 45, 60, 90, 120, 180, 240 dk'larda 312 nm'de ölçüm alınmıştır. Ölçüm sonucu elde edilen değerler pH 4 kalibrasyon grafiğinden yararlanılarak Zaman-Qe grafikleri çizilmiştir.



Şekil 2.2.1: pH 4 için kalibrasyon grafiği

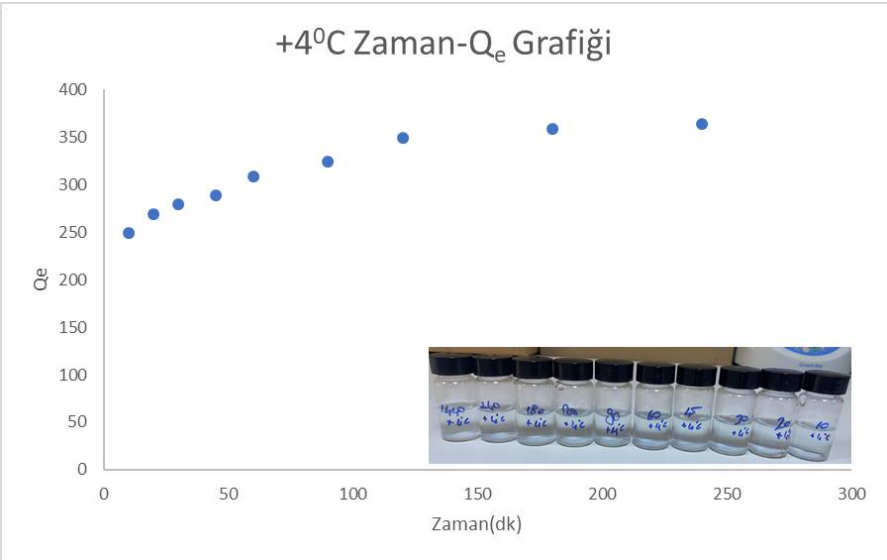
4 ^{0}C için yapılan çalışma;



Şekil 2.2.2: 4 ^{0}C için APN polimeri UV- VIS absorpsiyon

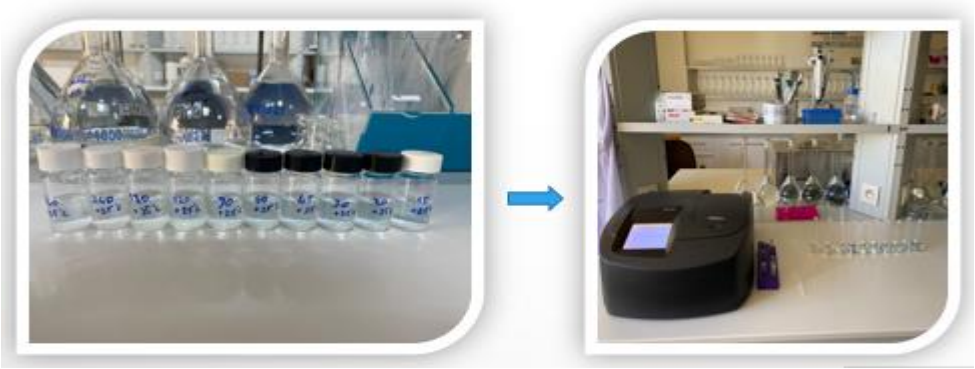
Absorbans(nm)	**Polimer miktarı(g)**	**C_0(ppm)**	**C_{son}(ppm)**	**Q_e**
0	0	0	0	0
0,162	0,01	1000	751	249
0,158	0,01	1000	731	269
0,156	0,01	1000	721	279
0,154	0,01	1000	711	289
0,15	0,01	1000	691	309
0,147	0,01	1000	676	324
0,142	0,01	1000	651	349
0,14	0,01	1000	641	359
0,139	0,01	1000	636	364
0,138	0,01	1000	631	369

Tablo 1: 4 ^{0}C'de 1000 ppm için 312 nm de 24 saatlik süre sonucu



Şekil 2.2.3: Adsorpsiyon kapasitesinin sıcaklık etkisi

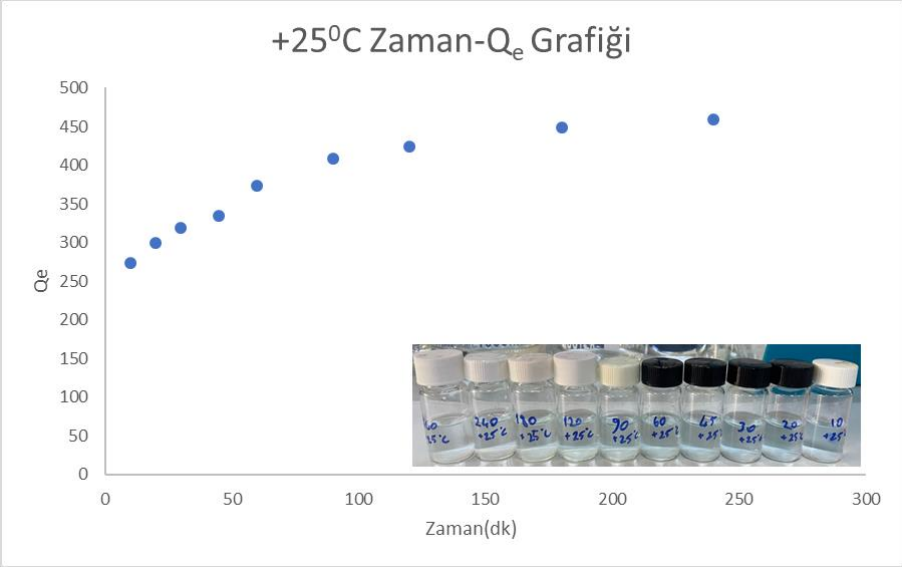
25 ^{0}C için yapılan çalışma;



Şekil 2.2.4: 25 ^{0}C için APN polimeri UV- VIS absorpsiyon

Absorbans(nm)	**Polimer miktarı(g)**	**C_0**(ppm)	**C_{son}**(ppm)	**Q_e**
0	0	0	0	0
0,157	0,01	1000	726	274
0,152	0,01	1000	701	299
0,148	0,01	1000	681	319
0,145	0,01	1000	666	334
0,137	0,01	1000	626	374
0,13	0,01	1000	591	409
0,127	0,01	1000	576	424
0,122	0,01	1000	551	449
0,12	0,01	1000	541	459
0,111	0,01	1000	496	504

Tablo 2: 25 ^{0}C'de 1000 ppm için 312 nm de 24 saatlik süre sonucu



Şekil 2.2.5: Adsorpsiyon kapasitesinin sıcaklık etkisi

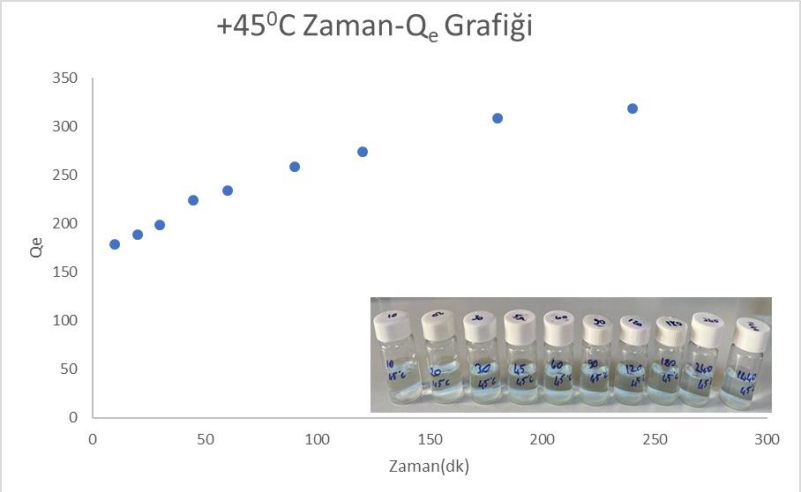
45 ^{0}C için yapılan çalışma;



Şekil 2.2.6: 45 ^{0}C için APN polimeri UV- VIS absorpsiyon

Absorbans(nm)	**Polimer miktarı(g)**	**C_0**(ppm)	**C_{son}**(ppm)	**Q_e**
0	0	0	0	0
0,176	0,01	1000	821	179
0,174	0,01	1000	811	189
0,172	0,01	1000	801	199
0,167	0,01	1000	776	224
0,165	0,01	1000	766	234
0,16	0,01	1000	741	259
0,157	0,01	1000	726	274
0,15	0,01	1000	691	309
0,148	0,01	1000	681	319
0,14	0,01	1000	641	359

Tablo 3: 45 ^{0}C'de 1000 ppm için 312 nm de 24 saatlik süre sonucu



Şekil 2.2.7: Adsorpsiyon kapasitesinin sıcaklık etkisi

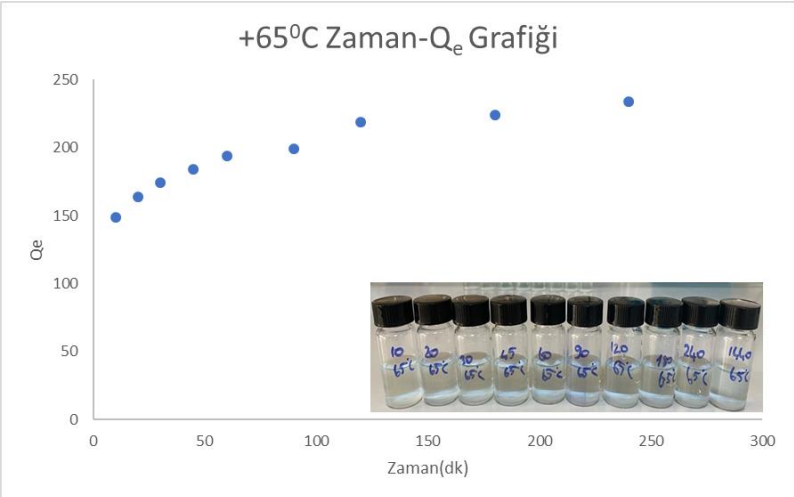
65 ^{0}C için yapılan çalışma;



Şekil 2.2.8: 65 ^{0}C için APN polimeri UV- VIS absorpsiyon

Absorbans(nm)	**Polimer miktarı(g)**	**C_0**(ppm)	**C_{son}**(ppm)	**Q_e**
0	0	0	0	0
0,182	0,01	1000	851	149
0,179	0,01	1000	836	164
0,177	0,01	1000	826	174
0,175	0,01	1000	816	184
0,173	0,01	1000	806	194
0,172	0,01	1000	801	199
0,168	0,01	1000	781	219
0,167	0,01	1000	776	224
0,165	0,01	1000	766	234
0,162	0,01	1000	751	249

Tablo 4: 65 ^{0}C'de 1000 ppm için 312 nm de 24 saatlik süre sonucu



Şekil 2.2.9: Adsorpsiyon kapasitesinin sıcaklık etkisi

3.SONUÇ

Çalışma sonucunda elde edilen sıcaklık zaman grafiklerinden APN polimerinin en iyi çalışma koşulunun 25 ^{0}C'de olduğu gözlemlenmiştir.

$$Q_e=((C_0-C_{son}).V)/m$$

$$Q_e=C_0-C_{son}$$

Bu denklemde; C_o: Başlangıç konsantrasyonunu (mg/L),

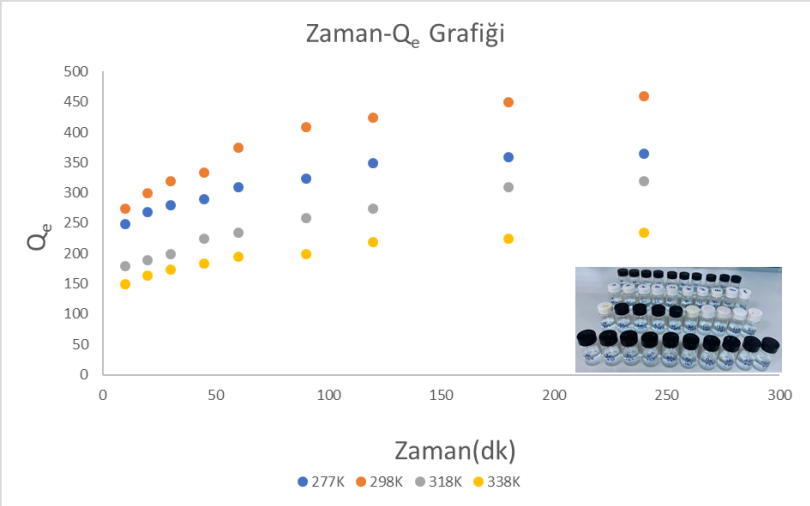
C_{son}: Çözeltinin son konsantrasyonunu (mg/L),

v: Çözeltinin hacmini (mL)

m: Kullanılan polimer miktarını (g) , temsil etmektedir.

4^{0}C=277K Q_e	**25^{0}C**=298K Q_e	**45^{0}C**=318K Q_e	**65^{0}C**=338K Q_e
0	0	0	0
249	274	179	149
269	299	189	164
279	319	199	174
289	334	224	184
309	374	234	194
324	409	259	199
349	424	274	219
359	449	309	224
364	459	319	234
369	504	359	249

Tablo 5: Farklı sıcaklıklarda 1000 ppm için 312 nm de 24 saatlik süre sonucu



Şekil 3.1: Adsorpsiyon kapasitesinin sıcaklık etkisi

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AKCİĞER, MEME VE GASTROİNTESTİNAL KANSER HASTALARINDA HTERT GENİ MNS16A VNTR VARYANTININ ARAŞTIRILMASI

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Özet

Akciğer kanseri (AK) dünya çapında kansere bağlı ölümlerin önde gelen nedenidir. Akciğer karsinomu olarak da bilinen ve epitelyal hücrelerden köken alarak akciğer dokularında kontrolsüz hücre büyümesi ile karakterize edilen kötü huylu bir akciğer tümörüdür. Meme kanseri (MK) kadınlar arasında hem en sık görülen hem de kanserden ölümlerin en yaygın nedeni olup insidansı ve mortalitesi yaşla orantılı olarak artmaktadır. Bu vakaların yaklaşık %5 ile %10' unun kalıtsal olduğu kabul edilmektedir. Gastrointestinal sistem (GİS) kanserleri küresel kanser vakalarının dörtte birinden fazlasını temsil etmekte olup kolon, rektum, mide, pankreas, yemek borusu, anüs, safra kesesi, karaciğer ve safra kanalı tümörlerini içermektedir. Telomeraz reaktivasyonu ve insan telomeraz ters transkriptaz (hTERT) gen ekspresyonu kanser hücrelerinin sınırsız çoğalma potansiyelinin ayırt edici özelliğidir. Bu gen hTERT geni 5p15.33 bölgesinde bulunur ve hücre bölünmesiyle kısalan kromozom uçlarını uzatan bir ribonükleoprotein enzimini kodlar. hTERT geninin kodlama bölgelerinde meydana gelen mutasyonların telomeraz aktivitesi ve telomer uzunluğu üzerinde önemli etkileri bildirilmiştir. Bu çalışmada hTERT geninin MNS16A değişken sayı tandem tekrarı (VNTR) varyantının Türk popülasyonundaki solid tümörlerde (AK, MK ve GİS) bir ilişkilisinin olup olmadığının belirlenmesi amaçlanmıştır. Çalışmaya 95 AK, 36 MK, 48 GİS kanseri tanısı almış hasta ile 85 sağlıklı kontrol olmak üzere toplam 264 gönüllü birey dahil edilmiştir. hTERT-MNS16A-VNTR analizi PCR yöntemiyle gerçekleştirilmiş ve agaroz jel elektroforezde analiz edilmiştir. AK, MK ve GİS tanısı almış kanser hastaları ile sağlıklı kontroller genotip ve allel frekansları açısından karşılaştırıldığında hTERT-MNS16A-VNTR varyantının genotip ve allel frekansında

istatistiksel olarak anlamlı bir farklılık saptanmamıştır. Çalışmamız üç farklı kanser türünde hTERT-MNS16A-VNTR ilişkisinin incelendiği literatürdeki ilk çalışma olup bu varyantın Türk popülasyonunda AK, MK ve GİS ile ilişkili olmayabileceğini göstermektedir. Ancak, daha büyük çalışma grupları ve farklı etnik kökenli hasta gruplarında yapılacak çalışmalar kanser ile hTERT-MNS16A-VNTR ilişkisinin daha ayrıntılı olarak aydınlatılmasını sağlayacaktır.

Anahtar Kelimeler: Akciğer, Meme, GİS, hTERT geni, VNTR, PCR.

INVESTIGATION OF THE HTERT GENE MNS16A VNTR VARIANT IN LUNG, BREAST AND GASTROINTESTINAL CANCER PATIENTS

Abstract
Lung cancer (LC) is the leading cause of cancer-related deaths worldwide. It is a malignant lung tumor, also known as lung carcinoma, characterized by uncontrolled cell growth in lung tissues originating from epithelial cells. Breast cancer (BC) is both the most common and the most common cause of cancer deaths among women, and its incidence and mortality increase with age. Approximately 5% to 10% of these cases are considered to be hereditary. Gastrointestinal system (GIS) cancers represent more than a quarter of global cancer cases and include tumors of the colon, rectum, stomach, pancreas, esophagus, anus, gall bladder, liver and bile duct. Telomerase reactivation and human telomerase reverse transcriptase (hTERT) gene expression are hallmarks of the unlimited proliferative potential of cancer cells. The hTERT gene is located in the 5p15.33 region and encodes a ribonucleoprotein enzyme that elongates chromosome ends that shorten during cell division. Mutations occurring in the coding regions of the hTERT gene have significant effects on telomerase activity and telomere length. This study aimed to determine whether the MNS16A variable number tandem repeat (VNTR) variant of the hTERT gene is associated with solid tumors (LC, BC and GIS cancers) in the Turkish population. A total of 264 volunteers, including 95 patients with LC, 36 BC, 48 patients diagnosed with GIS cancer, and 85 healthy controls, were included in the study. hTERT-MNS16A-VNTR analysis was performed by PCR method and analyzed in agarose gel electrophoresis. When cancer patients diagnosed with LC, BC and GIS and healthy controls were compared in terms of genotype and allele frequencies, no statistically significant difference was detected in the genotype and allele frequency of the hTERT -MNS16A-VNTR variant. Our study is the first study in the literature to examine the hTERT-MNS16A-VNTR relationship in three different cancer types and shows that this variant may not be associated with LC, BC and GIS in the Turkish population. However, studies to be conducted in larger study groups and patient groups of different ethnicities will provide a more detailed elucidation of the relationship between cancer and hTERT-MNS16A-VNTR.
Keywords: Lung, Breast, GIS, hTERT gene, VNTR, PCR.

Giriş

Akciğer kanseri (AK) dünya çapında kansere bağlı ölümlerin önde gelen nedenidir. AK için en önemli risk faktörü, akciğer kanserine bağlı ölümlerin %75-80'inden sorumlu olan sigaradır (Cersosimo R. J.,2002). Akciğer karsinomu olarak da bilinen ve epitelyal hücrelerden köken alarak akciğer dokularında kontrolsüz hücre büyümesi ile karakterize edilen kötü huylu bir akciğer tümörüdür. Küçük hücreli akciğer kanseri ve küçük hücreli dışı akciğer kanseri olmak üzere iki geniş kategoriye ayrılır. Küçük hücreli akciğer kanseri, nöroendokrin özellikler sergileyen hücrelerden türetilen oldukça kötü huylu bir tümördür ve akciğer kanseri vakalarının %15' ini oluşturur. Vakaların geri kalan %85' ini oluşturan küçük hücreli dışı akciğer kanseri, adenokarsinom, skuamöz hücreli karsinom ve büyük hücreli karsinom olmak üzere 3 ana patolojik alt tipe ayrılır. Adenokarsinom tek başına tüm akciğer kanseri vakalarının %38,5'ini oluşturmaktadır (Dela Cruz et al., 2011). Çevresel faktörler ve somatik olaylar, sporadik akciğer kanserinin gelişimine katkıda bulunan başlıca faktörlerdir. Ayrıca aile öyküsü ve genetik faktörlerde akciğer kanserinin gelişiminde rol oynamaktadır (Kanwal et al., 2017).

Meme kanseri (MK), kadınlarda en sık görülen kanserdir ve küresel olarak kadınlar arasında kansere bağlı ölümlerin önde gelen nedenidir (Fisusi et al., 2019). MK genetik ve çevresel faktörlerin rol oynadığı heterojen bir hastalıktır (Barzaman et al., 2020). MK vakalarının çoğunluğu adenokarsinomlardır; adenokarsinom vakalarının %85'i göğüs kanallarından ve %15'i lobüler epitelden kaynaklanmaktadır (Katsura et al., 2022). MK vakalarının yaklaşık %5-10'u kalıtsal olarak kabul edilmekte ve bilinen meme kanseri genleri bunların %3-4'ünü oluşturmaktadır. Bilinen meme kanseri genlerinin yanı sıra, genom çapında ilişkilendirme çalışmaları (GWAS'ler) ile meme kanseri riskiyle ilişkili 170'den fazla genetik varyant tanımlamıştır (Huss et al., 2018).

Gastrointestinal sistem (GİS) kanserleri tüm kanser teşhislerinin yaklaşık %20'sini oluşturur ve dünya çapında kanser ölümlerinin %22,5'inden sorumludur (Kuntz et al., 2021). GİS kanserleri kolon, rektum, mide, pankreas, yemek borusu, anüs, safra kesesi, karaciğer ve safra kanalı tümörlerini içermektedir. GİS kanserlerinin farklı türlerinin altında yatan nedenler farklılık göstermekle birlikte temel risk faktörlerinden bazıları arasında sigara içmek, aşırı alkol tüketimi, artan yaş, viral ve bakteriyel enfeksiyonlar, kronik pankreatit ve obezite yer almaktadır (Link et al., 2013). Bu kanserlerin çoğu sporadiktir. Ancak bazı hastalar ailede GİS kanser öyküsü olması nedeniyle yüksek risk altındadır (Malkani et al., 2023).

Telomeraz reaktivasyonu ve insan telomeraz ters transkriptaz (hTERT) gen ekspresyonu kanser hücrelerinin sınırsız çoğalma potansiyelinin ayırt edici özelliğidir (Hofer et al., 2011). hTERT

geni 5p15.33 bölgesinde bulunur ve hücre bölünmesiyle kısalan kromozom uçlarını uzatan bir ribonükleoprotein enzimini kodlar. hTERT geninin kodlama bölgelerinde meydana gelen mutasyonların telomeraz aktivitesi ve telomer uzunluğu üzerinde önemli etkileri vardır (Anwar et al., 2021). MNS16A gen varyantı, hTERT genindeki ekson 16'nın aşağısında bulunur ve bir transkripsiyon faktörü bağlama bölgesini barındıran CAT trinükleotidi ile ayrılan 23 bp'lik çekirdek tandem tekrarlarını oluşturur. VNTR alellerine göre MNS16A varyantları, farklı kanser türlerine sahip bireylerde incelenmiştir (Huda et al., 2021).

Bu çalışmada hTERT geninin MNS16A değişken sayı tandem tekrarı (VNTR) varyantının Türk popülasyonundaki solid tümörlerde (AK, MK ve GİS Kanseri) bir ilişkisinin olup olmadığının belirlenmesi amaçlanmıştır.

Materyal ve Metod

Çalışmaya 95 AK, 36 MK, 48 GİS Kanseri tanısı almış hasta ile 85 sağlıklı kontrol olmak üzere toplam 264 gönüllü birey dahil edilmiştir. Bireylerden alınan periferik kandan lökosit izolasyonu gerçekleştirilmiştir. Elde edilen lökositlerden ticari kit ile üreticinin yönergeleri doğrultusunda genomik DNA izolasyonu yapılmıştır. (ELK Biotech DNA izolasyon kiti).

hTERT-MNS16A-VNTR analizi PCR yöntemiyle gerçekleştirilmiştir. Analiz edilecek olan bölge için uygun primerler kullanılarak uygun PCR koşullarında DNA örnekleri çoğaltılmıştır. Ardından örnekler jel elektroforezinde yürütülerek, UV ışık altında genotiplemeleri yapılmıştır. L alleli 302 bp ve 332 bp, S alleli ise 243 bp ve 272 bp uzunluklarında bantlar göstermiştir (Anwar et al., 2021).

İstatistiksel analizler SPSS (versiyon 29.0) istatistiksel analiz yazılımı kullanılarak yapılmıştır. İncelenen varyantın genotip dağılımları, Hardy-Weinberg dengesi (HWE) açısından ve ki-kare testleri ile analiz edilmiştir.

Bulgular

AK, MK ve GİS kanseri tanısı almış hastalar ile sağlıklı kontroller genotip ve allel frekansları açısından karşılaştırıldığında hTERT-MNS16A-VNTR varyantının genotip ve allel frekansında istatistiksel olarak anlamlı bir farklılık saptanmamıştır. Bu varyant için hem hasta hem de sağlıklı kontrol grubunda HWE'den (Hardy-Weinberg Equilibrium) sapma bulunmamaktadır.

Tablo 1. Akciğer kanseri hastaları ile sağlıklı kontroller arasındaki hTERT-MNS16A-VNTR varyantının genotip ve allel frekanslarının karşılaştırılması

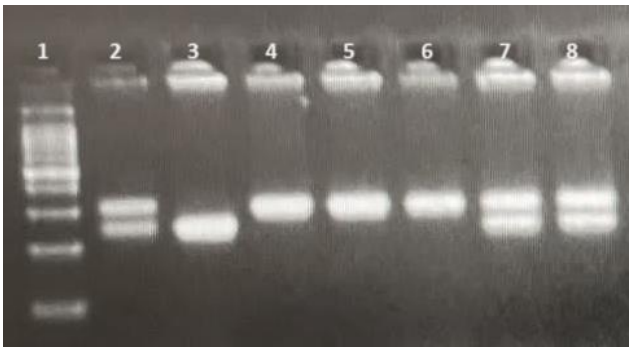
Genotip hTERT VNTR	Akciğer CA n:95 (%)	Kontrol n:85 (%)	P
LL	43 (%45,3)	36 (%42,4)	0,9177
LS	43 (%45,3)	41 (%48,2)	
SS	9 (%9,4)	8 (%9,4)	
Allel			
L	129 (%67,9)	113 (%66,5)	0,7738
S	61 (%32,1)	57 (%33,5)	
HWEp	0.709276	0.448929	

Tablo 2. Meme kanseri hastaları ile sağlıklı kontroller arasındaki hTERT-MNS16A-VNTR varyantının genotip ve allel frekanslarının karşılaştırılması

Genotip hTERT VNTR	Meme CA n:36 (%)	Kontrol n:85 (%)	P
LL	10 (%27,8)	36 (%42,4)	0,2702
LS	23 (%63,9)	41 (%48,2)	
SS	3 (%8,3)	8 (%9,4)	
Allel			
L	43 (%59,7)	113 (%66,5)	0,316
S	29 (%40,3)	57 (%33,5)	
HWEp	0.049077	0.448929	

Tablo 3. GİS kanseri hastaları ile sağlıklı kontroller arasındaki hTERT-MNS16A-VNTR varyantının genotip ve allel frekanslarının karşılaştırılması

Genotip hTERT VNTR	GİS n:48 (%)	Kontrol n:85 (%)	P
LL	19 (%39,6)	36 (%42,4)	0,2955
LS	20 (%41,7)	41 (%48,2)	
SS	9 (%18,7)	8 (%9,4)	
Allel			
L	58 (%60,4)	113 (%66,5)	0,3223
S	38 (%39,6)	57 (%33,5)	
HWEp	0.371994	0.448929	



Şekil 1. hTERT-MNS16A-VNTR varyantının örnek genotip analizi agaroz jel görüntüleri.
1: Ladder; LS genotipi:2,7,8; SS genotipi:3; LL genotipi:4,5,6

Tartışma ve Sonuç

Çalışmamızda AK, MK ve GİS tanısı almış kanser hastalarında ve sağlıklı kontrol grubunda hTERT-MNS16A-VNTR varyantı analizi gerçekleştirdi. Hastalar ve sağlıklı kontroller genotip/allel frekansları açısından karşılaştırıldığında; hTERT-MNS16A-VNTR varyantının genotip ve allel frekansında istatistiksel olarak anlamlı bir farklılık olmadığı saptandı.

Akciğer kanserinde yapılan bir çalışmada 53 akciğer kanseri hastası ve 72 sağlıklı kontrolde hTERT-MNS16A-VNTR varyantı değerlendirilmiştir. Çalışmada LL genotipi SS+LS genotipi ile karşılaştırıldığında yaş, cinsiyet, etnik köken ve sigara içme durumuna göre iki kattan fazla akciğer kanseri riskiyle ilişkilendirilmiş fakat genel olarak akciğer kanseri hastaları sağlıklı kontroller ile kıyaslandığında genotip frekansı açısından istatistiksel olarak anlamlı bulunmamıştır (Wang et al., 2003). Güneydoğu İran popülasyonunda 266 meme kanseri hastası ve 225 sağlıklı kontrolün dahil edildiği bir çalışmada ise LS genotipinin, LL ile karşılaştırıldığında meme kanseri riskini azalttığı gösterilmiştir. Ayrıca tümör evresi, tümör derecesi, östrojen ve progesteron reseptörleri, tümör boyutu ve insan büyüme faktörü reseptörü 2 dahil olmak üzere klinikopatolojik parametreler arasında anlamlı bir ilişki gözlenmemiştir (Hashemi et al., 2014). Hofer ve ark. Kafkas kökenli 1330 kolorektal kanser hastası ve 1822 sağlıklı kontrolü dahil ettikleri çalışmalarında SS alelini kolorektal kanser riski ile ilişkilendirmişlerdir. hTERT-MNS16A-VNTR SS alelinin kolorektal kanser riskinin değerlendirilmesi için potansiyel bir biyobelirteç olabileceğini belirtmişlerdir (Hofer et al., 2011). Çalışmamız üç farklı kanser türünde hTERT-MNS16A-VNTR ilişkisinin incelendiği literatürdeki ilk çalışma olup bu varyantın Türk popülasyonunda AK, MK ve GİS kanseri ile ilişkili olmayabileceğini göstermektedir. Ancak, daha büyük çalışma grupları ve farklı etnik kökenli hasta gruplarında yapılacak çalışmalar kanser ile Htert-MNS16A-VNTR ilişkisinin daha ayrıntılı olarak aydınlatılmasını sağlayacaktır.

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PİROPTOZUN MOLEKÜLER MEKANİZMALARI VE HASTALIKLARLA İLİŞKİSİ

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Özet
Piroptoz; bağışıklık ve hastalıkla yakın ilişkisi nedeniyle yeni öğrenilen bir programlanmış hücre ölümü çeşididir. İnflamasyondan kaynaklanan ateş anlamına gelen "pyro" ve programlanmış diğer hücre ölümlerinde olduğu gibi dökülme/düşme anlamına gelen "ptosis" kelimelerinden oluşmaktadır. Apoptoz ile benzer bazı karakteristik özellikler göstermesine rağmen sahip olduğu bazı morfolojik özellikler ile diğer programlanmış hücre ölümlerinden ayrılmaktadır. Piroptoz inflamatuar kaspazlara bağlıdır ve inflamatuar hastalıklardan kaynaklanan hücre ölümlerinde görülür. İnflamatuar hastalıklar dışında piroptoz kardiyovasküler hastalıklar, merkezi sinir sistemi hastalıkları ve kanserde de kullanılan bir hücre ölüm çeşididir. Piroptoz yolaklarına bakıldığında hem doğal hem de adaptif bağışıklık sistemleri ile kullanılmaktadır. Gasdermin ailesi üyelerinin farklı dokulardaki fonksiyonları üzerine yapılan çalışmalar sonucunda Gasdermin D (GSDMD) piroptozun en önemli yürütücüsü olarak tanımlanmıştır. Piroptoz mekanizmalarının aktivasyonunda en az iki yolak bulunmaktadır. Piroptoz süreçlerinin yürütülmesinde hem kanonik hem de kanonik olmayan yolaklar üzerinde inhibitör ve aktivatör etkisi bulunan bileşenler mevcuttur. Ayrıca piroptozun kendi olumsuz geri bildirim düzenleme mekanizması, inflamasyon meydana gelmesini zamanında önleyebilmektedir. Piroptozun aktivasyonunda gasdermin ailesinden GSDMD' nin parçalanmasıyla hücre membranında oluşan porlardan inflamatuar sitokinler salgılanmaktadır. Hücre döngüsü kontrol yolaklarıyla da etkileşim içinde olan bu mekanizmanın bozukluklarında hücre ölümü gerçekleşememekte ve inflamatuar hastalıklar ile kanser gibi progresif hastalıklar tetiklenebilmektedir. Son literatürlerde, piroptozun kardiyovasküler hastalıklar, kanser, nörolojik hastalıklar ve metabolik hastalıklar gibi inflamatuar durumlarda çok önemli bir rolü olduğu gösterilmekte ve bu durum da hücre ölümünü hedeflemenin tedavi için potansiyel bir müdahale olabileceği bildirilmiştir. Bu çalışmada, piroptozun moleküler mekanizmaları ve çeşitli hastalıklarla ilişkisinde son gelişmeler gözden geçirilecektir.
Anahtar Kelimeler: Piroptoz, Moleküler Mekanizması, İnsan Hastalıkları.

MOLECULAR MECHANISMS OF PYROPTOSIS AND ITS RELATIONSHIP WITH DISEASES

Abstract
Pyroptosis; It is a newly learned type of programmed cell death due to its close relationship with immunity and disease. It consists of the words "pyro", which means fever caused by inflammation, and "ptosis", which means shedding/falling, as in other programmed cell deaths. Although it shows some similar characteristics with apoptosis, it differs from other programmed cell deaths with some morphological features. Pyroptosis depends on inflammatory caspases and is seen in cell death resulting from inflammatory diseases. Apart from inflammatory diseases, pyroptosis is a type of cell death used in cardiovascular diseases, central nervous system diseases and cancer. Considering the pyroptosis pathways, it is used by both innate and adaptive immune systems. As a result of studies on the functions of Gasdermin family members in different tissues, Gasdermin-D (GSDMD) was identified as the most important executor of pyroptosis. There are at least two pathways in the activation of pyroptosis -mechanisms. There are components that have inhibitory and activating effects on both canonical and non-canonical pathways in the execution of pyroptosis processes. In addition, the own negative feedback regulation mechanism of pyroptosis can prevent inflammation from occurring in time In the activation of pyroptosis, inflammatory cytokines are secreted from the pores formed in the cell membrane by the breakdown of GSDMD from the gasdermin family. In disorders of this mechanism, which also interacts with cell cycle control pathways, cell death cannot occur and progressive diseases such as inflammatory diseases and cancer may be triggered. Recent literature has shown that pyroptosis has a very important role in inflammatory conditions such as cardiovascular diseases, cancer, neurological diseases and metabolic diseases, suggesting that targeting cell death may be a potential intervention for treatment. In this study, the molecular mechanisms of pyroptosis and the latest developments in its relationship with various diseases will be reviewed.
Keywords: Pyroptosis, Molecular Mechanism, Human Disease.

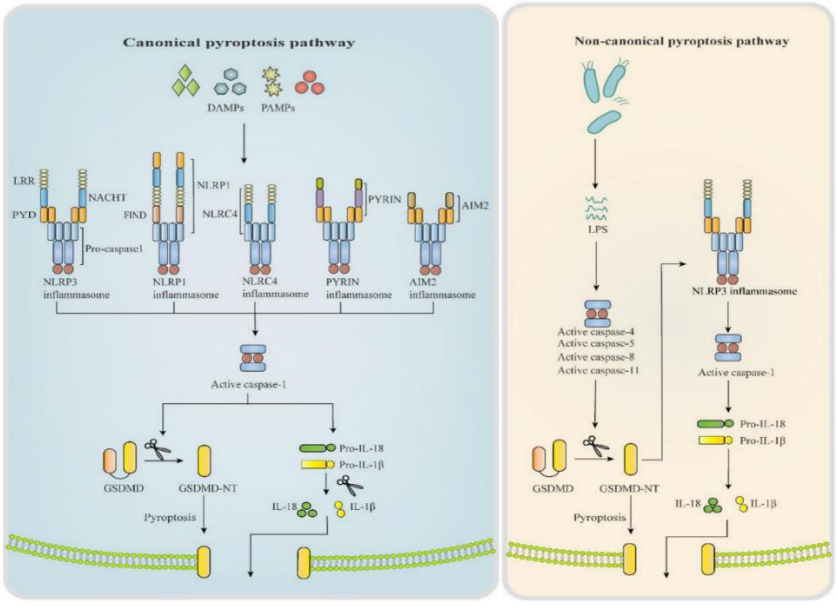
Giriş

Piroptoz

Piroptoz; inflamasyondan kaynaklanan ateş anlamına gelen "pyro" ve dökülme/düşme anlamına gelen "ptosis"'den oluşmaktadır. Piroptoz ve apoptoz arasında DNA hasarı ve kromatin yoğunlaşması gibi bazı benzerlikler vardır (Yu et al.,2021). Piroptoz, apoptoz ile benzer bazı karakteristik özellikler (DNA hasarı, nükleer yoğunlaşma ve kaspaz bağımsızlığı) göstermesine rağmen sahip olduğu bazı morfolojik özellikler ile diğer programlanmış hücre ölümlerinden ayrılmaktadır. Piroptotik hücrelerde, DNA parçalanması rastgele olurken çekirdek sağlam kalmaktadır (Fang et al.,2020). İnflamatuar programlanmış hücre ölümünün bir biçimi olarak piroptozun birincil özelliği, gasdermin protein ailesinin N-terminal alanlarına bağlı olan membran gözenek oluşumudur. Bu alanlar sıklıkla aktive edilmiş kaspaz ailesi tarafından bölünmekte, bu da hücre şişmesine, yırtılmaya ve IL-1β (interlökin-1β), IL-18 (interlökin-18) ve sitoplazmik içeriklerin dışarı akışına yol açmaktadır. Gasdermin ailesi üyelerinin farklı dokulardaki fonksiyonları üzerine yapılan çalışmalar sonucunda Gasdermin D (GSDMD) piroptozun en önemli yürütücüsü olarak tanımlanmıştır (You et al.,2022).

Piroptoz Mekanizmaları

Piroptoz yolakları hem doğal hem de adaptif bağışıklık sistemleri ile ilişkilidir. Piroptoz mekanizmalarının tetikleyicisi olarak görülen iki yolak vardır. Bunlar; Kaspaz-1'e bağımlı NLR (nükleotid oligomerizasyon alanı benzeri reseptör) aile üyelerinin katıldığı kanonik yolak ve Kaspaz-11/4/5'in aracılık ettiği kanonik olmayan yolaktır (Şekil 1) (Zheng et a.,2021).



Şekil 1. Piroptozda kanonik ve kanonik olmayan yolak (Lin et al., 2020).

Kanonik Yolak

Kaspaz-1'in aktivasyonu, klasik yolak olarak da bilinen kanonik yolağın özelliğidir. Kaspaz-1 aracılı piroptozun kanonik inflamatuar yolu, doğuştan gelen bağışıklık sisteminde kritik bir mekanizmayı temsil eder (Xu et al., 2022). Kaspaz-1, patojenik mikroorganizmaların enfeksiyonuna karşı bir savunma mekanizması olarak doğal bağışıklık sisteminin önemli bir parçasıdır. Kanonik piroptotik ölüm yolağına aktif kaspaz-1'in GSDMD'i bölmesi ve IL-1β ile IL-18 salınımının gerçekleşmesiyle oluşan inflamazom yapısı aracılık etmektedir. Kaspaz-1, çoklu kanonik inflamatuar ligandlar tarafından başlatılır ve piroptozu tetikler. İnflammasomlar, inflamatuar yanıtları düzenleyen ve konakçının antimikrobiyal savunmasını koordine eden çoklu protein sinyal platformlarıdır. Ek olarak, inflamatuarların mikrobiyal olmayan hastalıklarla da ilişkilendirildiği görülmüştür. Önemli kanıtlar, inflamatuar ve bununla ilişkili sitokinlerin, tümör oluşumunda proliferasyon, istila ve metastaz gibi kritik roller oynadığını göstermektedir. İnflamatuar düzenek, patojenle ilişkili moleküler modelleri (PAMP'ler) ve tehlikeyle ilişkili moleküler modelleri (DAMP'ler) tanıyan sitoplazmik model tanıma reseptörleri (PRR'ler) ile başlar (Pan et al., 2022).

Kanonik Olmayan Yolak

Gram-negatif bakterilerin çoğu kanonik olmayan inflamatuar yolu aktive eder. Klasik olmayan sinyal yoluna insanlarda kaspaz-4 ve kaspaz-5 ve farelerde kaspaz-11 aracılığı ile gerçekleşir. Bu kaspazlar doğrudan lipopolisakarite (LPS) bağlanarak aktive edilebilir. Aktive edilmiş kaspaz-4/5/11, piroptozu teşvik etmek için GSDMD'yi ayırır. Bununla birlikte kaspaz-4/5/11, pro-IL-18/pro-IL-1β'yı parçalayamaz ancak GSDMD'yi parçalayabilir, bu da K+ akışına ve NLRP3/kaspaz-1 yolu aktivasyonuna neden olabilir ve sonuçta olgunlaşmasına ve IL-18 ve IL-1β salınmasına yol açabilir (Liu et al., 2024). Ek olarak, kanonik olmayan inflamatuarın NLRP3 inflamatuarını da aktive edebilmesi, kanonik olmayan yolun kanonik yolla ilişkili olduğunu düşündürmektedir (Huang et al., 2023).

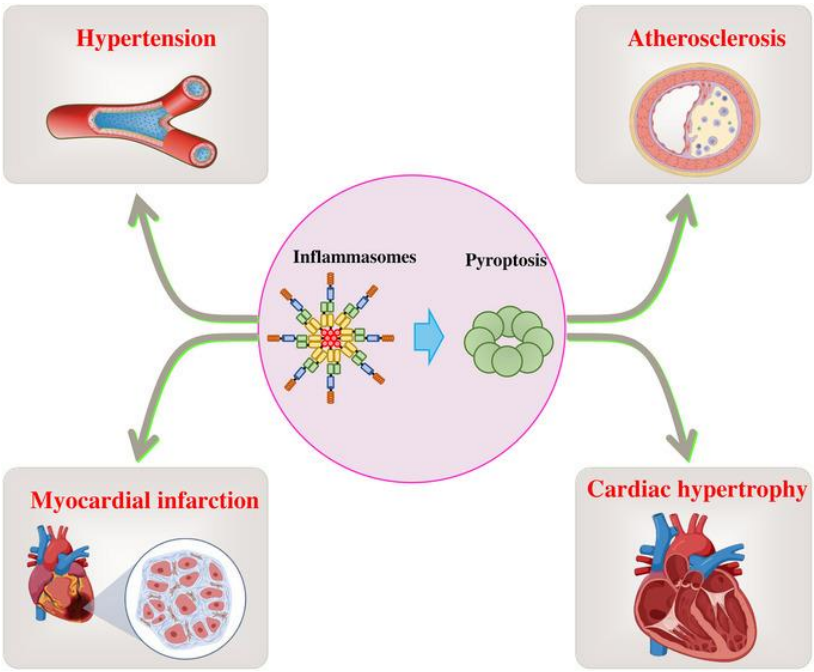
Piroptoz ve Hastalıklarla İlişkisi

İnflamatuar hastalıklar dışında piroptoz; kardiyovasküler hastalıklar, merkezi sinir sistemi hastalıkları, metabolik hastalıklar ve tümörler ile de ilişkilendirilmiştir (Yu et al.,2021).

Kardiyovasküler Hastalıklarda Piroptoz

Yapılan çalışmalar, kardiyovasküler hastalıkların ortaya çıkmasının hücre ölümüyle yakından ilişkili olduğunu göstermiştir; bu da hücre ölümünü hedeflemenin kardiyovasküler hastalıkların tedavisi için etkili bir müdahale olduğunu düşündürmektedir. Piroptoz çoklu kardiyovasküler hastalıkların ortaya çıkmasını teşvik eder. Enflamatuar aracılı piroptoz, ateroskleroz, miyokard

enfarktüsü, hipertansiyon ve kalp hipertrofisi dahil olmak üzere birçok kardiyovasküler hastalığın patogenez süreçlerinde rol oynar (Şekil 2) (Jin et al., 2023).



Şekil 2. Piroptoz ve kardiyovasküler hastalıklar (Jin et al., 2023).

1.) Piroptoz ve Ateroskleroz

Ateroskleroz, esas olarak endotel hasarını, lipid birikimini, makrofaj aktivasyonunu, fagositozu, inflamatuar yanıtı, köpük hücre oluşumunu, oksidatif modifikasyonları ve düz kas hücre göçünü içeren inflamatuar bir hastalıktır (Song et al., 2022). Aterosklerozun oluşması ve gelişmesi ve plakların yırtılması, endotel hücreleri, düz kas hücreleri ve makrofajlar dahil olmak üzere vasküler hücrelerin yaralanmasıyla ilişkilidir. Ateroskleroz gelişiminde birçok risk faktörü rol oynamaktadır, ancak mekanizmalar tam olarak anlaşılamamıştır. Son araştırmalar, endotelyal hücreler, makrofajlar ve düz kas hücreleri dahil olmak üzere aterosklerozla ilişkili hücrelerde piroptozu tetikleyen çoklu risk faktörlerinin olduğunu göstermiştir. (Lin et al., 2022). Çok sayıda çalışma piroptozun aterosklerozun gelişiminde ve ilerlemesinde rol oynadığını ve aterosklerozdaki üç temel hücrenin (vasküler endotel hücreleri, makrofajlar ve vasküler düz kas hücreleri) piroptozuyla yakından ilişkili olduğunu ortaya çıkarmıştır (Yu et al., 2021).Endotel hücreler kardiyovasküler homeostazın korunması için gereklidir ve piroptoz, endotel fonksiyon bozukluğuna ve bütünlük kaybına yol açarak ateroskleroz patogenezine katkıda bulunur. Kolesterol kristali, oksitlenmiş düşük yoğunluklu lipoprotein (ox-LDL) gibi aterosklerotikle ilişkili çok sayıda risk faktörünün endorel hücre piroptozuna neden olduğu

bulunmuştur. Kolesterol kristalleri, aterosklerotik plak hassasiyetinin iyi bilinen önemli bir patolojik belirtecidir; çalışmalar, kolesterol kristalinin, endotel hücrelerde inflamasyonun aktivasyonunu ve ardından piroptozu indükleyerek aterosklerozu desteklediğini göstermiştir. Ox-LDL, hem ateroskleroz hem de piroptozda yer alan bir risk faktörüdür ve ateroskleroz ile piroptoz arasındaki ilişkiyi gösterir (Song et al., 2022).

2.) Piroptoz ve Miyokard Enfarktüsü

Miyokard enfarktüsü, miyokard dokusunun ani iskemik ölümü olarak tanımlanır. Klinik bağlamda, miyokard enfarktüsü genellikle hassas bir plağın yırtılmasının neden olduğu koroner damarın trombotik tıkanmasından kaynaklanır (Frangogiannis, 2015). Çalışmalar piroptozun miyokard ölümüne katkıda bulunduğunu ve miyokard enfarktüsü patolojik sürecine dahil olduğunu göstermiştir (Liu et al., 2021). İnterferon düzenleyici faktör (IRF) 2, GSDMD) kaynaklı piroptoz için gerekli olan, IRF ailesine ait bir transkripsiyon faktörüdür. Miyokardiyal hücre piroptozunun azaltılması, miyokard enfarktüsünün neden olduğu kalp hasarına ve kalp fonksiyon bozukluğuna karşı koruma sağlar. GSDMD aracılı kardiyomiyositlerin ve kardiyak fibroblast piroptozunun miyokard enfarktüsü patogenezinde önemli bir rol oynamaktadır (Li et al., 2022).

Kanserde Piroptoz

Piroptoz, IL-1 ve IL-18 gibi inflamatuar sitokinlerin salınımını indükler; bu da tümör infiltrasyonunu arttırarak tümör oluşumu ve metastaz olasılığını teşvik ederek inflamatuar bir ortamı indükleyebilir (Xia et al.,2019). Ortaya çıkan kanıtlar piroptoz ve kanser arasında karmaşık bir ilişkiyi ortaya çıkarmıştır. Bir yandan inflamatuar hücre ölümü olarak piroptoz, tümörün çoğalması için rahat bir ortam sağlarken öte yandan piroptozun aşırı aktivasyonu, tümör hücrelerinin gelişimini engelleyebilir. Piroptoz hemen hemen tüm kanser türlerinde meydana gelir ve kanserlere karşı, tümör oluşumunu güçlendirebilen veya kısıtlayabilen etki gösterir (Wang et al., 2021).

1.) Piroptoz ve Kolorektal Kanser

Kolorektal kanser, dünyadaki ikinci en ölümcül kanser ve üçüncü en kötü huylu tümördür (Liu et al., 2022). Kronik inflamasyonun kolorektal kanserin kritik patojenik faktörlerinden biri olduğu, yani bunun inflamatuar ile ilişkili bir tümör olduğu bilinmektedir. Yüksek inflamatuar belirteçlere sahip inflamatuar bağırsak hastalığı olan hastalarda kolorektal kanser riski önemli ölçüde artmaktadır (Tang et al., 2020). GSDMC' nin down regülasyonu, kolorektal kanser hücrelerinin proliferasyonunda ve kolorektal kanser hücrelerinde önemli azalmalara yol açarken, GSDMC aşırı ekspresyonu hücre proliferasyonunu teşvik etmektedir. Tümör oluşumu,

GSDMC' nin kolorektal kanserde umut verici bir terapötik hedef olabileceğini düşündürmektedir (Yang et al., 2023). GSDMD ise, karsinoma hücrelerinde down regüle edilirken, normal kolorektal epitelyal hücrelerde aşırı eksprese edilmiştir (You et al., 2021).

2.) Piroptoz ve Meme Kanseri

Meme kanseri dünya çapında kadınlarda kanser morbidite ve mortalitesinin önde gelen nedenidir (Chen et al., 2023). Son çalışmalar, NLRP3 inflamatuar aracılı hücre ölümünün meme kanserinde meydana geldiğini göstermiştir. Tümör baskılayıcı DRD2' nin meme kanserinde piroptozu tetiklediği gösterilmiştir. Ayrıca Sisplatin gibi bazı yaygın kemoterapötik ajanların da meme kanserinde piroptozu indüklediği bulunmuştur (You et al., 2022). Meme kanserlerinde yüksek düzeyde GSDMB, tümörün ilerlemesi ile ilişkilidir ve GSDMB' nin aşırı ekspresyonu, HER-2 (epidermal büyüme faktörü reseptörü 2) 'nin hedefe yönelik tedavisine zayıf yanıtın göstergesidir. Bu, GSDMB' nin tümörler için yeni bir prognostik belirteç olabileceği anlamına gelmektedir (Gámez-Chiachi et al., 2022). Ayrıca yapılan başka çalışmalar ile yukarı regüle edilmiş GSDMC ekspresyonu, meme kanseri hastalarında genel sağkalımın kötü olmasıyla ilişkilendirilmiştir (Yang et al., 2023).

***3.)* Piroptoz ve Akciğer Kanseri**

Akciğer neoplazmaları dünya çapında kanser insidansı ve mortalitesinin önde gelen nedenidir (Thandra et al., 2021). Piroptoz sürecine katılan birçok molekül, akciğer kanserinin oluşumu ve gelişimi ile yakından ilişkilidir. Çalışmalar, küçük hücreli dışı akciğer kanserinde GSDMD' nin ekspresyon seviyesinin çevredeki akciğer dokularından önemli ölçüde daha yüksek olduğunu göstermiştir. Ayrıca, GSDMD ekspresyonu tümör boyutu, metastaz evresi ve yüksek agresif özelliklerle ilişkilidir. GSDMD' nin akciğer adenokarsinomunun bağımsız bir prognostik belirteci olduğu düşünülmektedir (Liu et al., 2023). Ayrıca GSDMD' nin susturulması, küçük hücreli dışı akciğer kanserinde EGFR/Akt sinyal yolunu zayıflatarak tümör proliferasyonunu inhibe etmektedir (Gao et al., 2018).

4.) Piroptoz ve Mide Kanseri

Mide kanseri, dünya çapında en sık görülen malignitelerden biridir ve kansere bağlı ölümlerin dördüncü önde gelen nedenidir. Mide kanseri hem çevresel hem de genetik faktörlerin oluşumu ve gelişimi üzerinde etkili olabildiği çok faktörlü bir hastalıktır (Machlowska et al., 2020). Piroptoz, enfeksiyonun ve endojen tehlike sinyallerinin antagonize edilmesinde önemli bir rol oynar. *H. pylori* gibi patojenler veya kemoterapi ilaçları mide kanserli hastalarda piroptoza neden olabilir (Shao et al., 2021). Yapılan bir çalışmada GSDMA’ nın mide kanserinde tümör baskılayıcı bir gen olduğu, ancak GSDMB' nin bazı mide kanseri hücrelerinde aşırı eksprese

edildiği ve bir onkogen görevi görebileceği gösterilmiştir. GSDMB, çoğu kanserli doku örneğinde yüksek düzeyde eksprese edilmektedir, ancak normal mide örneklerinin çoğunda eksprese edilmemiştir. Ayrıca GSDMC' nin mide kanserinde down regüle edilmesi, bunun tümör önleyici bir faktör olarak işlev görebileceğini göstermektedir (Saeki et al., 2009).

Nörodejeneratif Hastalıklarda Piroptoz

Nörodejeneratif hastalıklar, nöronların dejeneratif dejenerasyonu ve işlevlerinin kaybıyla karakterize edilen bozukluklardır. Nörodejeneratif hastalıkların nöroinflamasyon ve nöron ölümünün önemli faktörler olduğu karmaşık bir patofizyolojisi vardır (Liao et al., 2023). Alzheimer hastalığı, Parkinson hastalığı, felç ve amyotrofik lateral skleroz gibi nörodejeneratif hastalıklarda NLRP3 inflamatuarının neden olduğu nöroinflamasyonun kanıtlandığı gösterilmiştir (Jin et al., 2023).

***1.)* Piroptoz ve Alzheimer Hastalığı**

Alzheimer hastalığı ana patolojik özellikleri arasında β-amiloid (Aβ) birikimi, Tau proteini hiperfosforilasyonu ve nöron kaybı yer almaktadır (Zhang et al., 2021). Yapılan çalışmalar, Alzheimer hastalığının patogenezinde inflamatuarların önemli bir rol oynadığını desteklemektedir (Liu et al., 2024). Alzheimer hastalığında Aβ peptidinin birikmesi, mikroglia'nın aktive edilmesinin aracılık ettiği bir serebral nöroinflamasyon spektrumunu başlatır. Aktive edilmiş mikroglia, çevredeki beyin dokusunu etkileyen IL-1β, IL-6 ve tümör nekroz faktörü-α (TNF-α) gibi proinflamatuar sitokinlerin ekspresyonunu ortaya çıkararak potansiyel olarak zararlı bir rol oynayabilir (Wang et al., 2015). Yapılan bir çalışma ile hafif unutkanlık ve Alzheimer hastalığı olan hastaların periferik kan mononükleer hücrelerinde GSDMD aracılı inflamatuarların ve piroptozun aktive edildiği gösterilmiştir (Ju et al., 2023). IL-18 mikroglia ve astrositlerde eksprese edilmiştir, mikrogliadan türetilmiş proinflamatuar sitokinlerin Alzheimer hastalığında rol oynadığı ve IL-1β ve IL-18'in hastalığı ağırlaştırdığı düşünülmektedir (Jin et al., 2023). Aβ, tau kaynaklı mikroglia piroptozu ve nöroinflamasyona yol açan polarizasyon, Alzheimer hastalığının patogenezinde önemli bir rol oynamaktadır (Huang et al., 2022).

2.) Piroptoz ve Parkinson Hastalığı

Parkinson hastalığı, orta beyin dopamin nöronlarının ilerleyici kaybının, bazal ganglionlarda dopaminerjik nöronların dejenerasyonuyla sonuçlanan karakteristik semptomlara yol açan nörodejeneratif bir hastalıktır. Parkinson hastalığı gelişimine dopaminerjik nöronların kaybı ve görünümü eşlik eder (Alexander G. E., 2004). Enflamasyonun aktivasyonunun Parkinson hastalığında rol oynadığı gösterilmiştir (Pajares et al., 2020). Yapılan çalışmalar ile, IL-1β, IL-

2, IL-6, IL-10, TNF-a, ve NLRP3 dahil olmak üzere çeşitli piroptoz proteinlerinin Parkinson hastalarında periferik inflamatuar biyobelirteçler olarak kullanılabileceğini göstermiştir. Ayrıca piroptoz oluşumunun engellenmesi ile davranış bozukluklarının iyileştirebilir, nigrostriatal dopaminerjik dejenerasyonu ve nöroinflamasyonun azaltabilir olduğu gösterilmiştir (Liang et al., 2024).

3.) **Piroptoz ve Amyotrofik Lateral Skleroz**

Amyotrofik lateral skleroz (ALS), motor korteks, beyin sapı ve omurilikteki motor nöronların dejenerasyonu ile karakterizedir. ALS bir motor nöron hastalığı olarak görülse de nöroinflamasyon da önemli bir rol oynar. ALS hastalığı modellerindeki son kanıtlar, inflamatuar hücre ölümünün aktivasyonunu ve ardından inflamatuar bir hücre ölümü türü olan piroptozun başladığını göstermektedir (Van Schoor et al., 2022). ALS'nin geç evresinde GSDMD, NLRP3, aktif kaspaz-1 ve IL-1β esas olarak reaktif astrositler ve mikroglialarda eksprese edilir. NLRP3 inflamatuarının aktivasyonu, ALS hastalarında ventral boynuz nöronlarının piroptozuna yol açabilir ve bu durum ALS'de motor nöron dejenerasyonu ve hastalığın ilerlemesinde rol oynayabilir (Zhang et al., 2022).

Metabolik Hastalıklarda Piroptoz

Metabolik hastalıklara metabolik bozukluklar dahil olmak üzere metabolik problemler neden olmaktadır. Metabolik hastalıklar arasında başlıca diyabet, obezite ve gut yer alır (Jin et al., 2023).

1.**)Piroptoz ve Diyabet**

Diyabet, hiperglisemi ve insülin direnci ile karakterize metabolik bir hastalıktır. Piroptoz vücudun homeostazisi için iki farklı etki göstermektedir. Bir yandan çok hücreli organizmaların bakteriyel enfeksiyonlardan korunmasına yardımcı olurken öte yandan aşırı piroptoz da kronik inflamasyona yol açabilir. Aşırı piroptozun, plazma zarının hızlı yırtılmasına ve TNF-a, IL-1β ve IL-6 gibi proinflamatuar sitokinlerin ve kemokinlerin aşırı salınmasına yol açtığı gösterilmiştir (Xu et al., 2021). Hiperglisemi, diyabetik periodontal hastalığın patogenezinde önemli bir rol oynayan makrofaj GSDMD aktivasyonunu ve piroptozunu indükleyebilir ve NLRC4 fosforilasyonu anahtar rol oynayabilir (Zhao et al., 2021). Piroptoz, diyabetin patogenezinde önemli bir araştırma perspektifi haline gelmiştir, ancak diyabette piroptozun mekanizması hala belirsizdir (Jin et al., 2023)

2.)Piroptoz ve Obezite

Obezite, genetik ve yaşam tarzı etkileşimlerinden kaynaklanan heterojen bir durumdur ve önemli yansımaları olan çeşitli patolojik işlev bozukluklarıyla ilişkilidir (Zatterale et al., 2020).

Obezite sıklıkla birçok dokudaki metabolik infiltrasyonla ilişkilidir ve obez bireylerden alınan monositler sıklıkla yüksek inflamatuar kaspaz aktivitesi sergiler. Doymuş yağ asidi kaspaz-4/5 yoluyla monosit piroptozunu aktive edebilir, bu da inflamatuar mediatörlerin salınmasına ve inflamatuar aktivasyona yol açar. Bu kaspazlar, obezite ile ilişkili inflamasyonu azaltmaya yönelik potansiyel terapötik hedefler olabilir (Pillon et al., 2016). NLRP3 inflamatuarının, obezite ile ilişkili kaspaz-1 aktivasyonu indükleyicilerinin algılanmasında önemli bir rol oynadığı ve bu nedenle inflamasyonun büyüklüğünü ve bunun insülin sinyalleşmesi üzerindeki aşağı yönlü etkilerini düzenlediği gösterilmiştir (Vandanmagsar et al., 2011).

Sonuç

Piroptoz, inflamatuar kaspaz ve gasdermin proteinleri tarafından tetiklenen yeni bir inflamatuar programlı hücre ölümü türüdür. Son kanıtlar piroptozun hastalıkların ortaya çıkmasında önemli bir rol oynadığını ve hastalık gelişimiyle yakından ilişkili olduğunu doğrulamıştır. Birçok hastalığın patogenez süreçlerinde piroptozun bulunduğu gösterilmiştir. Bu durum da hücre ölümünü hedeflemenin tedavi için potansiyel bir müdahale olabileceği bildirilmiştir.

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Özet
Arıcılık bir taraftan insan beslenmesinde önemli bir yer tutan bal üretimini sağlayan, diğer taraftan tarımsal üretimin sürdürülebilirliği açısından arıların polinasyon sürecine aktif rol almasıyla biyoçeşitlilik ve verimliliğe önemli katkılar sunan bir faaliyettir. Bu çalışma arıcılığın dünya ve Türkiye'deki durumunu yıllar itibariyle ortaya koymayı amaçlamıştır. Bu amaç için 2008-2022 yıllarını kapsayan verilerle son 15 yıllık değişimler incelenmiştir. Veriler arıcılık sektörü küresel üretim değerinin 9,2 milyar doları geçtiğini göstermektedir. 2020-2022 döneminde Çin, 1.800.089 ton olan dünya bal üretiminin %25,79'unu karşılayarak ilk sırada yer alırken, Türkiye 106.239 tonluk üretimiyle ikinci sırada yer almıştır. Türkiye'yi İran, Hindistan, Arjantin ve Rusya Federasyonu takip etmiştir. Koloni varlığı bakımından Hindistan, Çin ve Türkiye ilk üç sırayı paylaşmaktadır. Türkiye 12,31 kg ile 18,02 kg olan dünya kovan bal verimi ortalamasının altında bir verimliliğe sahiptir. Üretimde olduğu gibi ihracatta da Çin lider konumdadır. Türkiye 11.051 ton ihracatıyla dünya ihracat sıralamasında 11. sırada yer almıştır. Türkiye ihracatının %43,55'ini ABD'ye yaparken, ihracat yaptığı başlıca ülkeler ABD, İspanya, Almanya ve Suudi Arabistan'dır. ABD dünyada en fazla ithalat yapan ülkedir. ABD'yi Almanya, İngiltere, Japonya, Polonya ve Belçika takip etmektedir. Türkiye'de 81 ilde bal üretimi yapılabilmekle birlikte Ordu, Adana, Muğla, Sivas ve Kocaeli illeri üretimin en fazla yapıldığı illerdir. Farklı iklim ve coğrafi özelliklere sahip olması Türkiye'yi arıcılık açısından avantajlı konuma getirse de arıcılıktaki düşük verimlilik çözülmesi gereken en önemli sorun olarak değerlendirilmektedir. Bu konuda yapılacak Ar-Ge çalışmalarına öncelik verilerek gerekli destek sağlanmalıdır.
Anahtar Kelimeler: Arıcılık sektörü, Bal, Biyoçeşitlilik, Tarım Ekonomisi

A GLOBAL VIEW OF BEEKEEPING FROM TURKEY

Abstract
Beekeeping is an activity that, on the one hand, provides honey production, which has an important place in human nutrition, and on the other hand, it is an activity that makes significant contributions to biodiversity and productivity with the active role of bees in the pollination process in terms of the sustainability of agricultural production. This study aimed to reveal the status of beekeeping in the world and Türkiye. For this purpose, the changes in the last 15 years were analyzed with data from 2008-2022. The data showed that the global production value of the beekeeping sector exceeds 9.2 billion dollars. In the 2020-2022 period, China ranked first with 25.79% of the world's honey production of 1,800,089 tons, while Türkiye ranked second with 106,239 tons. Türkiye was followed by Iran, India, Argentina, and the Russian Federation. India, China, and Türkiye share the first three places regarding colony size. Türkiye has a productivity of 12.31 kg, which is below the world hive yield average of 18.02 kg. China is the leader in exports as in production. Türkiye ranked 11th in the world export ranking with 11,051 tons of exports. Türkiye exported 43.55% of its exports to the USA, while the main export destinations were the USA, Spain, Germany, and Saudi Arabia. The USA was the country that imports the most in the world. The USA was followed by Germany, the UK, Japan, Poland and Belgium. Although honey is produced in 81 provinces Türkiye, Ordu, Adana, Muğla, Sivas and Kocaeli are the provinces with the highest production. Although having different climatic and geographical characteristics makes Türkiye advantageous in terms of beekeeping, low productivity in beekeeping is considered the most important problem to be solved. R&D studies on this issue should be prioritized and necessary support should be provided.
Keywords: Beekeeping Industry, Honey, Biodiversity, Agricultural Economics

Giriş

Arılar, dünyada ekonomiler ve ekosistemler için vazgeçilmez unsurların başında gelmekte, bitkilerin tozlaşmasından, bal ve balmumu üretimine kadar birçok konuda önemli görevleri üslenmektedir. Arıcılığın tarımsal faaliyetler içinde ayrıcalıklı bir yere sahip olmasının en önemli nedenlerinin başında bitkisel üretimin devamlılığı açısından tozlaşmada oynadığı rol, yatırımın geri dönüş süresinin kısalığı, düşük sermaye ihtiyacı ve toprağa bağımlı olmaması gelmektedir (Uzundumlu vd., 2011; Ceyhan vd., 2016). Bu özellikleri ile arıcılık uğraşı MÖ'ye ait kanıtlarla insanlık tarihinde eski bir geçmişe sahiptir (Koday & Karadağ, 2020). Arıcılık sadece bal, polen, balmumu, propolis ve arı sütü gibi ürünler aracılığıyla gelir artışına katkıda bulunmamakta, aynı zamanda tarımsal ürünlerin verimini artırmakta, biyoçeşitliliği korumakta ve ekosistem hizmetlerine ekonomik değer katmaktadır (Gratzer vd., 2021; Vrabcová & Hájek, 2020). Üretilen ürünlerin hammadde kaynağının doğanın kendisi olması ve arıların yetiştirilme şekli dikkate alındığında arıcılık doğaya en fazla bağımlı ve ekstrem hava koşullarından en fazla etkilenen hayvancılık faaliyetidir (Ceyhan vd., 2016). Arıcılık küresel olarak değerlendirildiğinde milyonlarca insan için bir geçim kaynağıdır. Dünyada yaygın olarak yapılan arıcılık, genel yapısı itibarıyla küçük aile işletmesi olarak göze çarpmakta ve ana tarımsal faaliyetlerin yanında gelir getirici ikincil bir faaliyet olarak yapılmaktadır (Erdal & Tipi, 2022). Ayrıca, gelişmekte olan ülkelerin kırsal nüfusu için iş, gelir ve beslenme kaynağı olup ekonomiye önemli katkılar sunmaktadır (Uysal, 2022). Arıcılık Türkiye, İran ve Rusya Federasyonu gibi ülkede kırsal geliri artırıcı bir faaliyet iken, Çin, Yeni Zelenda, Arjantin ve Hindistan gibi ülkeler için de önemli bir gelir kaynağıdır. Arıcılık genel olarak değerlendirildiğinde; gelir desteği, ekolojik katkılar, sürdürülebilir kalkınma, yoksulluğun azaltılması ve koruma çabalarını kapsayan çok yönlü faydalarının olduğu önemli bir faaliyettir. Türkiye sahip olduğu farklı iklim koşulları, florası, kovan sayısı ve genetik olarak çeşitli bal arısı varlığı açısından önemli bir arıcılık potansiyeline sahiptir. Özellikle bal üretiminde hayati öneme sahip ballı bitki türlerinin büyük bir çoğunluğunun Türkiye'de mevcut olması ve bu bitkilerin farklı bölgelerde farklı zamanlarda çiçeklenmesi, Türkiye arıcılığının gelişimi için büyük bir şans olarak değerlendirilmektedir (Sıralı, 2010).Bu çalışma küresel bal üretimi ve ticaretinde söz sahibi ülkelerin mevcut durumundan hareketle Türkiye'nin bu sektördeki yerini belirlemeyi amaçlamıştır. Bu amaç doğrultusunda bal üretimi, bal verimi, koloni sayısı, ihracat ve ithalat değerlerinin 2008-2022 yıllarındaki değişimi incelenmiştir.

Materyal ve Metot

Bu araştırmada bal üretim miktarı, koloni sayıları, ithalat ve ihracat değer ve miktarları materyal olarak kullanılmıştır. Analizler için kullanılan veriler Birleşmiş Milletler Tarım ve Gıda Örgütü (FAO) ve Türkiye İstatistik Kurumu (TÜİK) veri tabanından elde edilmiştir. Çalışmada bal üretiminin dünya ve Türkiye açısından potansiyeli genel olarak ele alınmış, bu çerçevede son 15 yıllık verilerin (2008-2022) üçer yıllık ortalamaları alınarak; üretim miktarları, koloni sayıları, verim, ihracat ve ithalat değerleri amaca uygun olarak düzenlenmiş, basit indeksler oluşturulmuş ve elde edilen bulgular yorumlanmıştır.

Bulgular ve Tartışma

Dünya Bal Üretimindeki Gelişmeler

Binlerce yıl boyunca insanlar arıcılığın potansiyelini fark etmiş ve kullanmış, onu ilkel bir uygulamadan gelişmiş bir endüstriye dönüştürmüştür. Balın son yıllarda talep artışı ile birlikte yüksek fiyatlardan alıcı bulması, kolay depolanabilir olması ve diğer arı ürünlerinin (balmumu, polen, arı sütü, propolis ve arı zehiri) farklı amaçlarla kullanılıyor olması arıcılık faaliyetinin gelişmesinde rol oynayan en önemli faktörlerdir. 2020-2022 yılı ortalamasına göre dünya ortalama bal üretimi 1.800.089 ton olarak gerçekleşmiştir (Çizelge 1). Bu üretimin yaklaşık %48'i Asya kıtasında yapılmaktadır. Asya kıtasının iklimsel olarak uygunluğu ve dünyada en fazla bal üreten Çin'in kıtada bulunması bu sonucu doğurmuştur. Asya kıtasını %22,6'lık payla Avrupa ve %19,9'luk üretim payıyla Amerika takip etmiştir.Dünya bal üretimi son 15 yılda %18,41 artmış, bu artışın %22,6'sı Çin'deki, %11,9'u İran'daki ve %8,8'i Türkiye'deki üretim artışından kaynaklanmıştır. Ukrayna ve ABD hariç tutulduğunda dünyada en fazla bal üreten ilk on ülkenin üretimlerinin belli oranda artırdığı Çizelge 1'den görülmektedir. Özellikle İran, Türkiye ve Hindistan'daki üretim artış oranları dikkat çekicidir.Çin, Türkiye ve İran dünya bal üretiminde ilk üç sırayı paylaşırken Çin'in toplam üretimden aldığı pay %25,79'dur. Türkiye ortalama 106.239 tonluk üretimiyle %5,9'luk bir pay alarak dünyada en fazla bal üreten ikinci ülke konumundadır. Dünyada en fazla bal üreten on ülke dünya bal üretiminin %61,17'sini gerçekleştirmiştir (Çizelge 1).Türkiye İstatistik Kurumu (TÜİK) verilerine göre Türkiye'de 2023 yılında 114.886 ton bal üretilmiştir. Bu üretim 81 ilde gerçekleştirilmekle beraber en fazla üretim yapılan iller Ordu (%16,54), Adana (%10,69), Muğla (%7,03), Sivas (%5,56), Kocaeli (%3,69), İzmir (%3,16), Mersin (%2,98) ve Aydın (%2,97)'dır (TÜİK, 2024).

Çizelge 1. Ülkelere göre bal üretim miktarları (ton) ve değişimleri (%) (FAO, 2024)

Ülkeler	2008-2010[a]	2011-2013[a]	2014-2016[a]	2017-2019[a]	2020-2022[a]	Pay (%)	Değişim (%)[b]
Çin	401.000	443.100	496.676	477.825	464.233	25,79	15,77
Türkiye	81.494	92.700	105.794	110.574	106.239	5,90	30,36
İran	44.033	65.467	72.816	73.046	77.302	4,29	75,55
Hindistan	56.667	60.333	62.138	65.228	72.662	4,04	28,23
Arjantin	64.333	71.833	65.574	78.329	71.112	3,95	10,54
Rusya Federasyonu	54.191	64.451	70.789	64.566	65.972	3,66	21,74
Meksika	57.146	57.764	59.288	59.102	60.188	3,34	5,32
Ukrayna	73.291	71.382	63.143	69.149	66.555	3,70	-9,19
Brezilya	38.313	37.030	38.672	43.255	56.379	3,13	47,15
ABD	73.583	66.550	75.100	69.544	60.429	3,36	-17,88
İlk 10 Ülke Toplamı	944.051	1.030.611	1.109.991	1.110.617	1101.072	61,17	16,63
Diğer Ülkeler	576.220	615.837	705.021	715.253	699.016	38,83	21,31
Dünya	1.520.271	1.646.448	1.815.011	1.825.871	1.800.089	100,00	18,41

[a]Üç yılın ortalaması

[b]2008-2010 dönemine göre 2020-2022 dönemindeki değişimi ifade etmektedir.

Koloni varlığı bakımından karşılaştırıldığında Hindistan en fazla arı kolonisine sahip ülkedir (Çizelge 2). Etiyopya, Tanzanya ve İspanya dünya bal üretiminde ilk on ülke arasında yer almamasına rağmen koloni varlığı bakımından ilk on ülke içinde olması dikkat çekicidir. Bu durum söz konusu ülkelerin verimliliğinin düşük olduğunun göstergesidir. Son 15 yıllık veriler ışığında koloni varlığında dünyada %27,11'lik artışın olduğunu söylemek mümkündür. Rusya Federasyonu'nda koloni sayısının azalmasına rağmen üretimin artması en önemli bulgulardan biridir. Türkiye'de ise koloni sayısının artış oranı üretim artış oranından daha yüksek gerçekleşmiştir. Son 15 yılda koloni sayısında 21 milyon adetten fazla bir artış söz konusudur. Bu artışın %15,75'i Türkiye'deki artıştan kaynaklanmıştır.

Çizelge 2. Ülkelere göre koloni varlığı (adet) ve değişimleri (%) (FAO, 2024)

Ülkeler	2008-2010[a]	2011-2013[a]	2014-2016[a]	2017-2019[a]	2020-2022[a]	Pay (%)	Değişim (%)[b]
Hindistan	10.900.000	11.550.000	11.927.760	12.223.347	12.512.918	12,52	14,80
Çin	8.750.000	8.873.333	8.998.985	9.144.236	9.223.803	9,23	5,41
Türkiye	5.276.951	6.333.563	7.577.128	8.075.952	8.632.385	8,64	63,59
İran	4.388.013	5.809.818	7.133.802	7.019.446	7.386.822	7,39	68,34
Etiyopya	4.958.513	5.108.448	5.996.897	6.852.387	6.392.157	6,40	28,91
Tanzanya	2.783.333	2.823.333	2.927.194	2.991.793	3.057.281	3,06	9,84
Arjantin	2.970.000	2.980.000	2.957.352	2.940.479	2.973.088	2,98	0,10
İspanya	2.405.750	2.437.787	2.707.171	2.968.176	2.960.000	2,96	23,04
Rusya Federasyonu	3.040.012	3.194.532	3.413.624	3.197.745	2.887.376	2,89	-5,02
ABD	2.510.667	2.556.667	2.725.000	2.774.667	2.690.000	2,69	7,14
İlk 10 Ülke Toplamı	47.983.238	51.667.481	56.364.913	58.188.227	58.715.831	58,77	22,37
Diğer Ülkeler	30.615.221	32.157.321	34.006.528	37.631.851	41.191.828	41,23	34,55
Dünya	78.598.460	83.824.802	90.371.441	95.820.078	99.907.659	100,00	27,11

[a]Üç yılın ortalaması

[b]2008-2010 dönemine göre 2020-2022 dönemindeki değişimi ifade etmektedir.

Kovan başına bal verimi, çeşitli faktörlerden etkilenen kritik bir ölçüttür. Arı türleri, kovan yeri, nektar kaynakları, kovanın genel sağlık durumu ve arıcılık teknikleri gibi faktörler kovan başına bal veriminin belirlenmesinde önemli rol oynar (Akyol vd., 2014). Bal üretiminde önde gelen ülkelerin kovan başına bal verimleri Çizelge 3'te sunulmuştur. Dünya ortalamasına göre kovan başına yaklaşık 18 kg bal üretilmektedir. Çin verimlilikte başı çeken ülkedir. Bal üretiminde ilk ona giren ülkeler arasında kovan başına bal veriminde Hindistan, İran ve Türkiye dünya ortalamasının altında kalan ülkeler olmuştur. Türkiye'de zaten düşük olan kovan başı verim son 15 yılda %20'den fazla düşmüştür. Bu verim düşüklüğünün nedenlerini tespit etmek ve gerekli önlemleri almak arıcılık sektörünün gelişmesi açısından en önemli konulardır.

Çizelge 3. Ülkelere göre bal verimi (kg/kovan) ve değişimleri (%) (FAO, 2024)

Ülkeler	2008-2010[a]	2011-2013[a]	2014-2016[a]	2017-2019[a]	2020-2022[a]	Değişim (%)[b]
Çin	45,83	49,94	55,19	52,25	50,33	9,82
Türkiye	15,44	14,64	13,96	13,69	12,31	-20,31
İran	10,03	11,27	10,21	10,41	10,46	4,28
Hindistan	5,20	5,22	5,21	5,34	5,81	11,70
Arjantin	21,66	24,11	22,17	26,64	23,92	10,42
Rusya Federasyonu	17,83	20,18	20,74	20,19	22,85	28,17
Meksika	31,66	30,51	30,36	28,67	26,97	-14,81
Ukrayna	22,39	24,48	23,18	26,84	25,23	12,72
Brezilya	38,07	37,89	38,14	42,69	55,53	45,84
ABD	29,31	26,03	27,56	25,06	22,46	-23,35
İlk 10 Ülke Toplamı	21,49	21,89	22,01	21,77	21,10	-1,85
Diğer Ülkeler	16,62	16,76	17,65	15,97	14,65	-11,84
Dünya	19,34	19,64	20,08	19,06	18,02	-6,85

[a]Üç yılın ortalaması

[b]2008-2010 dönemine göre 2020-2022 dönemindeki değişimi ifade etmektedir.

Dünya Bal Ticaretindeki Gelişmeler

Dış ticarete konu olan bal miktarının üretime oranı diğer hayvansal ürünlerle karşılaştırıldığında oldukça yüksektir. Son 15 yıllık veriler incelendiğinde yıldan yıla değişmekle beraber dünya bal üretiminin %28-42'si uluslararası ticarete konu olmuştur (FAO, 2024).

Dünya bal ihracatında önde gelen ilk on ülke ve Türkiye'ye ait ihracat istatistikleri Çizelge 4'te verilmiştir. Bal üretiminde olduğu gibi ihracatında da Çin lider ülkedir. Dünya bal ihracat miktarı 2008-2010 döneminde 444.543 ton iken 2020-2022 döneminde %70,50 artarak 757.929 tona ulaşmıştır. İhracata konu olan bal miktarı bakımından Çin %19,10'luk pay alırken Çin'i sırasıyla %9,30'luk payla Hindistan, %8,85'lik payla Arjantin takip etmiştir. İhracatta ilk on ülkenin küresel ihracatın yaklaşık %70'ini gerçekleştirmiştir. Türkiye üretimdeki potansiyelini ihracata yansıtamamıştır. Türkiye'nin dünya bal ihracatındaki payı %1,46 olurken arzu edilen seviyede olmadığını belirtmek gerekir. Son 15 yıllık ihracat verilerine göre ihracat miktarını mutlak olarak en fazla artıran ülkeler Çin, Ukrayna ve Hindistan'dır.

Türkiye 2020-2022 döneminde ortalama 11.051 ton balı yaklaşık 34 milyon dolara ihraç etmiştir. Çok sayıda ülkeye ihracatımız söz konusu olmakla birlikte en fazla ihracat yaptığımız ülkeler Almanya, ABD, İspanya ve Suudi Arabistan'dır.

Çizelge 4. Önemli bal ihracatçı ülkelerin ihracat istatistikleri (FAO, 2024)

Ülkeler	2008-2010[a]		2020-2022[a]		Pay (%)	Değişim (%)[b]
	Miktar (ton)	Değer (1000 $)	Miktar (ton)	Değer (1000 $)		
Çin	85.945	151.783	144.786	263.921	19,10	68,46
Hindistan	17.183	40.327	70.510	149.774	9,30	310,36
Arjantin	61.505	171.676	67.043	203.349	8,85	9,00
Ukrayna	5.336	13.500	63.470	140.572	8,37	1.089,40
Brezilya	20.962	54.794	43.268	133.267	5,71	106,41
Vietnam	12.000	22.667	32.859	68.319	4,34	173,82
Almanya	23.382	113.728	28.688	143.709	3,79	22,69
İspanya	18.120	69.376	28.478	120.336	3,76	57,16
Meksika	27.714	83.257	25.046	85.984	3,30	-9,63
Belçika	13.928	38.984	24.935	80.020	3,29	79,03
İlk 10 Ülke	286.075	760.091	529.083	1.389.252	69,81	84,95
Türkiye	854	4.197	11.051	34.321	1,46	1.194,06
Diğer Ülkeler	157.614	568.831	217.795	1.121.145	28,74	38,18
Dünya	444.543	1.333.120	757.929	2.544.718	100,00	70,50

[a]Üç yılın ortalaması

[b]2008-2010 dönemine göre 2020-2022 dönemindeki değişimi ifade etmektedir.

Dünya bal ithalatında önde gelen ilk on ülke ve Türkiye'ye ait ithalat istatistikleri Çizelge 5'te verilmiştir. ABD en fazla bal ithalatı ülke konumundadır. Almanya, Birleşik Krallık ve Japonya ABD'yi takip eden ülkelerdir. Son 15 yıllık veriler ithalatını mutlak olarak en fazla artıran ülkenin ABD (102.489 ton) olduğunu göstermiştir. ABD bal ithalatının yaklaşık %80'ini Hindistan, Arjantin, Brezilya, Vietnam ve Meksika'dan yapmaktadır. Almanya ise ithalatının yaklaşık yarısını Ukrayna, Arjantin, Meksika, Romanya ve Brezilya'dan karşılamaktadır. Türkiye ABD pazarından %3,22, Almanya pazarından %1,12 pay alabilmiştir.

Çizelge 5. Önemli bal ithalatçı ülkelerin ithalat istatistikleri (FAO, 2024)

Ülkeler	2008-2010[a]		2020-2022[a]		Pay (%)	Değişim (%)[b]
	Miktar (ton)	Değer (1000 $)	Miktar (ton)	Değer (1000 $)		
ABD	104.854	255.978	207.343	634.084	27,29	97,74
Almanya	88.015	264.430	80.696	295.588	10,62	-8,32
Birleşik Krallık	30.741	104.489	50.353	127.472	6,63	63,80
Japonya	39.517	90.927	47.919	170.373	6,31	21,26
Polonya	7.031	19.660	35.569	79.792	4,68	405,86
Belçika	19.006	46.373	33.260	85.914	4,38	75,00
Fransa	25.589	91.934	33.178	129.271	4,37	29,66
İspanya	16.422	38.247	33.107	80.365	4,36	101,61
İtalya	14.370	49.720	24.312	97.009	3,20	69,19
Suudi Arabistan	9.949	37.355	20.980	89.044	2,76	110,87
İlk 10 Ülke	355.495	999.114	566.716	1.788.912	74,59	59,42
Türkiye	419	1.372	57	278	0,01	-86,43
Diğer Ülkeler	105.959	345.039	192.991	786.871	25,40	82,14

[a]Üç yılın ortalaması

[b]2008-2010 dönemine göre 2020-2022 dönemindeki değişimi ifade etmektedir.

Sonuç ve Öneriler

Arıcılık, insanlar için önemli bir gıda olan balın üretimi ve bitkisel üretimin sürekliliği açısından hayati öneme sahip bir sektördür. Bu çalışmada, dünya ve Türkiye bal üretim ve ticaretindeki son 15 yıldaki gelişmeler değerlendirilmiştir. Nitekim son 15 yıllık veriler değerlendirildiğinde bal üretim ve ticaretinde önemli gelişmelerin olduğunu söylemek mümkündür. Bu artış beraberinde küresel anlamda bal ticaretinin de gelişimini sağlamıştır.Türkiye iklimi ve coğrafi konumu nedeniyle önemli bir arıcılık potansiyeline sahip olmasına ve bal üretiminde dünya sıralamasında önemli bir konumda olmasına rağmen, sektörde önemli sorunlarla karşı karşıyadır. Özellikle bal üretimindeki düşük verimlilik en önemli sorundur. Verimliliğin artırılmasına yönelik eğitim, bilinçlendirme ve Ar-Ge çalışmalarına hız verilmeli, modern tekniklerin ve teknolojik yeniliklerin benimsenmesi teşvik edilmelidir.

Türkiye potansiyelinin aksine küresel bal ticaretinde arzu edilen seviyede değildir. Bal ihraç ettiğimiz ülkelerin pazarından aldığımız pay çok düşük oranlarda kalmaktadır. Bunun en büyük nedenlerinden biri dış pazarın istediği kalitede bal üretimimizin olmamasıdır. Bu nedenle

kaliteli bal üretiminin artırılmasına yönelik inisiyatiflerin harekete geçirilmesi, beraberinde coğrafi işaret ve kalite standartlarının devreye alınması, bal ihracatının değerini artırmada en önemli konular olarak değerlendirilmektedir.

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GEÇMİŞTEN GÜNÜMÜZE TIBBİ VE AROMATİK BİTKİLER

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ÖZET
Tıbbi ve aromatik bitkiler kavramı hem bitkileri, hem bitkilerde ki etken maddeleri ve hem de bunların kullanım alanları bakımından çok büyük bir alanı kapsamaktadır. Tıbbi aromatik bitkiler, beslenme, kozmetik, vücut bakımı, tütsü veya dini törenler, gıdalara güzel koku ve tat vermek için kullanılmaktadır. Gıdaların depolama ve raf ömürlerini uzatma, gıdaların ve doğal liflerin boyanması gibi daha pek çok alanda da kullanım sahası vardır. Bitkilerin tedavide kullanımları insanlık tarihiyle birlikte başlamıştır. Binlerce yıl önce insan, bitkilerin tedavi edici gücünü tanımış ve sağlıklı yasayabilmek için ondan yararlanmıştır. İnsanlık tarihi boyunca birçok hastalığı tedavi amacıyla bitkiler kullanılarak tedavi edilmeye çalışılmış ve çalışılmaktadır. WHO (Dünya sağlık örgütü) raporuna göre dünyada 70000 bitkinin 21000 kadarı ilaç sanayinde kullanılmakta, ülkemizde yetişen ve çoğunluğu doğal olarak bulunan türlerin sadece 1000 kadarı tıbbi amaçla kullanılmaktadır.
Anahtar kelimeler: tıbbi bitkiler, aromatik bitkiler, baharat, geçmişten günümüze

MEDICINAL AND AROMATIC PLANTS FROM PAST TO PRESENT

ABSTRACT
When medicinal and aromatic plants are mentioned, they cover a very large area in terms of plants, active ingredients and consumption areas. While medicinal plants are used in areas such as nutrition, cosmetics, body care, incense or religious ceremonies, aromatic plants are used to give pleasant smell and taste. Aromatic plants also have wide usage areas in the food, cosmetics and perfumery industries. The use of plants in treatment began with the history of humanity. Thousands of years ago, people recognized the therapeutic power of plants and used them to live a healthy life. Throughout human history, many diseases have been tried and are being treated using plants. According to the WHO (World Health Organization) report, approximately 21,000 of the 70,000 plants in the world are used in the pharmaceutical industry, and only about 1,000 of the species that grow in our country, most of which occur naturally, are used for medicinal purposes.
Keywords: mededicinal plants, aromatic plants, spice, from past to present

INTRODUCTION

All living and non-living entities on Earth maintain their existence as a product of an extraordinary balance. Perhaps the most significant among these entities are undoubtedly plants. So much so that plants have an indispensable place, especially for human and animal life. This indispensability has continued without losing its importance since the first day humans appeared on Earth. Throughout history, humans have benefited from plants in various ways, such as for shelter, clothing, nutrition, and treatment.The beginning of the relationship between plants and humans is considered to be the findings in a Neanderthal grave at Shanidar Cave in Northern Iraq, during excavations between 1957 and 1961. Dating back 60,000 years and believed to belong to a shaman, this grave contained types of plants like yarrow, canary grass, purple hyacinth, rose mallow, passionflower, and ephedra. In a society that had begun burying its dead, it is thought that these plants were placed in the grave with the idea that the deceased might use them upon returning to life. This might indicate the beginning of differentiating between edible and medicinal plants since these plant types are still important today, especially as medicinal plants (Lewin, 2000; Heinrich et al., 2004).The bond between humans and plants over the centuries has given rise to the field of ethnobotany, which is recognized and researched worldwide today (Koçyiğit, 2005). The knowledge of ethnobotany, gained through trial and error over a long period and transmitted from generation to generation, contributes significantly to the scientific evaluation of plants.In France, Chauvet Cave contains Paleolithic period archaeological findings and remnants from around 30,000 BCE, including fossil remnants of some medicinal plants used today. The well-preserved "Ice Man Ötzi," discovered accidentally in the Austrian Alps in the 1990s and dating back to 3,300 BCE, had plants with him that are thought to have been used for protective and medicinal purposes (Megep, 2010).Among the earliest written texts about the uses of plants are agricultural and medicinal recipes inscribed in cuneiform on clay tablets by the Sumerians around 3,500-3,000 BCE. It is claimed that the roots of traditional Chinese medicine originate from the legendary Chinese Emperor Shennong, who lived around 3,000-2,700 BCE. His writings on medicinal plants and agriculture have been handed down through the centuries. Around 1,700 BCE, Hammurabi, the king of Babylon, immortalized health-related laws and information about medicinal and aromatic plants on a monumental stone inscription. The Ebers Papyrus, believed to be written around 1,500 BCE and containing information from at least 1,000-1,500 years earlier, is one of the oldest and most important written sources on medicinal and aromatic plants (Bayramoğlu and Toksoy, 2008).

The term "Phytotherapy," meaning treatment with medicinal plants, was first used by French physician Henri Leclerc (1870-1955) (Faydaoğlu and Sürücüoğlu, 2011).

Throughout human history, many diseases such as diabetes, jaundice, and respiratory issues have been treated using plants. According to the World Health Organization (WHO), approximately 4 billion people (80% of the world's population) initially address health problems using herbal drugs. Additionally, about 25% of prescription medications in developed countries are made up of active ingredients derived from plants (Farnsworth et al., 1985).

CONCLUSION

Medicinal and aromatic plants have been an essential component of health since the existence of humanity. They continue to be a vital source of compounds capable of treating many diseases, even amidst modern medical advancements. Despite the development of medical drugs and treatment methods, the treatment with medicinal plants still retains its importance. Traditional treatment methods are preferred before medical treatment, especially during the fall and winter seasons when flu, colds, and respiratory diseases caused by viruses are more common. Additionally, people who want to strengthen their immune system or mitigate the symptoms of diseases often prioritize herbal treatments over medical drugs. Extensive studies have been conducted and continue to be necessary worldwide on the antimicrobial activities of extracts obtained from various plant species belonging to many families against various pathogens.

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SÜREKLİ GÜVENCE DENETİMİ VE BİLGİSAYAR DESTEKLİ MUHASEBE DENETİM SÜREÇLERİ

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Özet
İşletmeler, küresel ekonomi ve bilgi teknolojilerindeki ilerlemeler sebebi ile muhasebe denetim süreçlerini geliştirmişlerdir. Hatta, iç kontrol de bu durumdan etkilenmiştir. Günümüzde, muhasebe ile teknolojinin entegrasyonu daha önce hiç olmadığı kadar yüksektir ve ivme devam etmektedir. Covid-19 salgını ise bu süreci daha da hızlandırmıştır. Bu çalışmada, öncelikli olarak sürekli güvence denetimi (Continuous Assurance Auditing - CAA) kavramı açıklanmış ve bilgisayar destekli muhasebe denetim süreçleri üzerinde durulmuştur. Aynı zamanda, sürekli güvence denetimi (Continuous Assurance Auditing - CAA) kavramının uygulanmasını sağlayan ve süreci kolaylaştıran Bilgisayar Destekli Denetim Araç ve Teknikleri (Computer-Assisted Audit Tools - CAATs) incelenmiştir. Bahse konu olan teknikler, muhasebe hata ve hilelerinin önlenmesinde önemli araçlardır. Ek olarak, riski azaltıcı ve işletme performansını artırıcı etkiye sahiptirler. Araştırma, sürekli güvence denetimi (Continuous Assurance Auditing - CAA) ve bilgisayar destekli muhasebe denetim süreçlerinin ayrıntılı ile derin bir yapı arz ettiğini göstermektedir. Aynı zamanda denetimde sorgulama ve analiz araçları kapsamında programlar (yazılımlar), programlama dilleri ve denetime yönelik araç setleri de çeşitliliğe sahiptir. İşletmeler muhasebe denetiminde kullanılmak üzere büyük veri analiz tekniklerine ve yapay zeka uygulamalarına yatırım yapmak zorundadırlar. Bunun yanında muhasebe, denetim ve iç kontrolün geleneksel yapılarından sıyrılarak yeniden şekillenmeleri, işletmelerin genel olarak entelektüel sermayeye, spesifik olarak ise insan sermayesine de yatırım yapmalarını zorunlu hale getirmiştir. Gelecek çalışmalarda iç ve dış (bağımsız) denetimde robotik, makine öğrenmesi veya derin öğrenme tekniklerinin denetime etkileri incelenebilir. Güncel programlar (yazılımlar), programlama dilleri ve denetime yönelik araç setleri mercek altına alınabilir. Aynı zamanda, işletmeler üzerinde uygulama ve örneklere odaklanılabilir.
Anahtar Kelimeler: Muhasebe, Denetim, Teknoloji, Sürekli Güvence Denetimi, Bilgisayar Destekli Muhasebe Denetim Süreçleri

CONTINOUS ASSURANCE AUDITING AND COMPUTER-ASSISTED ACCOUNTING AUDUTING PROCESSES

Abstract
Businesses have improved their accounting audit processes due to advances in the global economy and information technologies (IT). In fact, internal controls were also affected by this situation. Today, the integration of accounting and technology is higher than ever before and the momentum continues. The Covid-19 epidemic has accelerated this process even further. In this study, primarily the concept of Continuous Assurance Auditing (CAA) is explained and computer-aided accounting auditing processes are emphasized. At the same time, Computer-Assisted Audit Tools and Techniques (CAATs), which enable the implementation of the CAA and facilitate the process, were examined. The techniques in question are important tools in preventing accounting errors and frauds. In addition, they have the effect of reducing risk and increasing business performance. The research shows that CAA and computer-aided accounting auditing processes have a detailed and deep structure. At the same time, programs (software), programming languages and audit tool sets within the scope of auditing investigation and analysis tools also have diversity. Businesses must invest in big data analysis techniques and artificial intelligence (AI) applications to be used in accounting auditing. In addition, the reshaping of accounting, auditing and internal controls by breaking away from their traditional structures has made it necessary for businesses to invest in intellectual capital in general and human capital specifically. In future studies, the effects of robotics, machine learning or deep learning techniques on internal and external (independent) auditing can be examined. Current programs (software), programming languages and control tool sets can be taken into consideration. At the same time, the focus can be on applications and examples on businesses.
Keywords: Accounting, Auditing, Technology, Continuous Assurance Auditing, Computer-Assisted Accounting Auditing Processes

Giriş

Küreselleşme ve bilgi teknolojilerinde (informaton technologies - IT) yaşanan gelişmeler, klasik işletme kavramından dijital işletme kavramına geçişe yol açmıştır (Aksel ve diğ, 2013). Hiç şüphesiz, muhasebe ve denetim de tecrübe edilen bu değişimden etkilenmiştir. Muhasebe zaman içerisinde çok daha kapsayıcı bir karaktere sahip olmuş, paydaşlar nezdinde daha da önemli bir konuma yükselmiştir.Muhasebe, denetim ve iç kontrolde teknoloji ile entegrasyon hızlanmıştır. Covid-19 döneminin ise bu bağlamda katalizör görevi gördüğünü ifade etmek yanlış olmayacaktır. Covid-19 salgını, aslında muhasebe, denetim ve iç kontrolde gerçekleşmekte olan değişim ile yeniden şekillenmeleri daha erken bir tarihe çekmiştir.Bu çalışmada Giriş bölümünden sonra Sürekli Güvence Denetimi (Continuous Assurance Auditing - CAA) bölümü yer almıştır. Bu kısmı Bilgisayar Destekli Denetim Araç ve Teknikleri (Computer-Assisted Audit Tools - CAATs) bölümü takip etmiştir. Araştırma, Sonuç ve Öneriler bölümü ile noktalanmıştır.

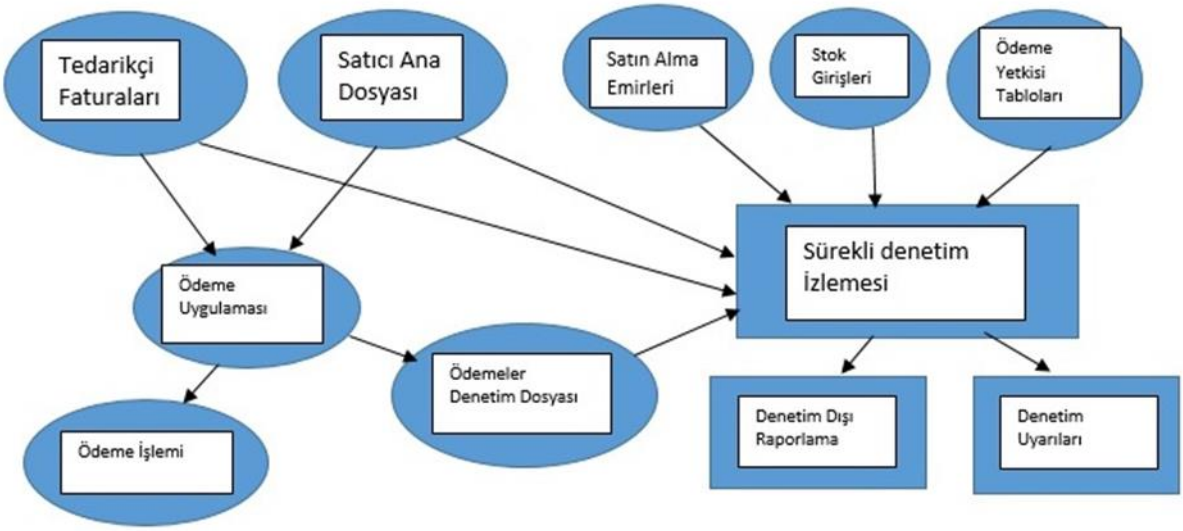
Sürekli Güvence Denetimi (Continuous Assurance Auditing - CAA)

Sürekli güvence denetimi, kontrolle ilgili sistemlerin bilgi teknolojileri (information technologies - IT) içerisinde kurulmasıdır. Bu sistemler genellikle iç denetçi olmak üzere, denetçiye herhangi bir denetim limiti veya parametresinden sapma meydana gelirse denetimle ilgili mesaj veya uyarı gönderirler. Günümüzde, iç denetimin riskleri minimize etme ve fırsatlardan yararlanma hususlarındaki etkisi göz ardı edilemez (Deloitte, 2024). Teknoloji ise, sürekli denetimin uygulanmasını çok daha kolay bir hale getirmiştir (Moeller, 2016).Çağımızda işletmelerin, bilgi sistemleri veri tabanlarında depolanan her türlü operasyonel ve geçmişe yönelik bilgiyi saklamaya ihtiyacı vardır. Eğer bu depolanmış veri büyük, karmaşık ve birbirleri ile ilişkili veri tabanlarında saklanıyorsa bu kavram veri ambarı (data warehouse) olarak tanımlanmaktadır. Veri ambarı, veri madenciliği ve çevrimiçi analitik işlem araçları gibi, sürekli güvence denetimini uygulamak için gerekli bir unsurdur (Moeller, 2016).Bilgisayar destekli muhasebe denetim süreçlerinin etkin olarak işleyebilmesi için yeterli bilgiye sahip denetçiler istihdam edilmeli ve teknik altyapı oluşturulmalıdır (Gönen ve Rasgen, 2015). İşletmelerin, bilgisayar teknolojileri altyapılarının kurulmasına ve denetçilerin bu teknolojileri kullanmalarına yönelik eğitimlerine bütçelerinde pay ayırmaları önemli bir gerekliliktir. (Orhan ve Serçemeli, 2015). Denetimde kullanılan bilgi teknolojilerinin denetçilerin iş tatmini ve motivasyonlarını arttırdığı ve deneyimli denetçilerin riskli ile teknik konulara daha iyi odaklanabildikleri belirlenmiştir (Ertaş ve Güven, 2008). Bu noktada, günümüzde hem bir alt küme olarak insan sermayesine, hem de bu bağlamda insan sermayesini de kapsayan bir üst

küme olarak entelektüel sermayeye değinilmelidir. Hiç şüphesiz, insan sermayesi ve genel anlamda entelektüel sermaye, işletmelerin gerçek değerlerinin farkına varıp bunları yansıtabilmeleri için kritik bir faktördür (Arslan ve Kızıl, 2019).

Sürekli Güvence Denetiminin (Continuous Assurance Auditing - CAA) Özellikleri

- Tekrarlanan yazılım denetim monitörleri (izleyici programlar) bilgi teknolojileri uygulamalarına yerleştirilmiştir. Örneğin, eğer işletmenin iç denetim departmanı, özellikle bir büyük defter (defteri kebir) hesabındaki belirli bir limitin üzerindeki finansal işlemlerle ilgileniyorsa, bu durumu karşılayan her aktiviteyi izleyecek bir yazılım değişikliğini sisteme yükleyebilir.
- İşletmenin bir alanını gözden geçirmek için periyodik iç denetimler planlamak yerine, sürekli güvence denetimi (Continuous Assurance Auditing - CAA) iç denetimin dikkatini çekebilecek potansiyel ilgi alanlarını kaydeder. Daha sonra ise bunları takip etmek, iç denetimin sorumluluğundadır (Moeller, 2016).



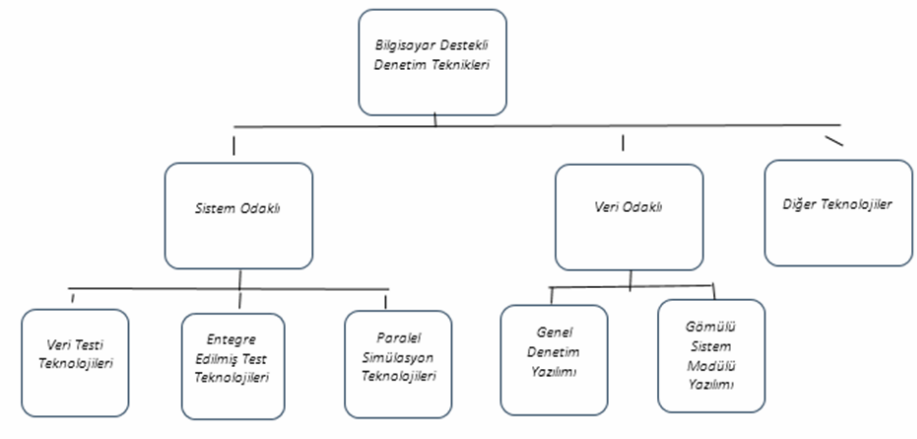
Şekil 1. Ödeme Sistemi Sürekli Denetim İzleme Örneği (Moeller, 2010)

Şekil 1'de ödeme sistemi sürekli denetim izleme örneği yer almaktadır. Sürekli izleme uygulaması, tüm ödemeler işlem dosyasındaki faaliyetleri periyodik olarak izleyen, ayrı ve paralel yazılım setlerinden oluşmaktadır. Faaliyet özetleri periyodik olarak raporlanır ve herhangi bir olağandışı öge, bir sapma raporuyla e-posta şeklinde iletilir. Bu sistem birçok işletmede bulunan şifre güvenlik izleme sistemlerine çok benzerdir. Sapma faaliyeti düzenli aralıklarda rapor edilir, aynı zamanda herhangi bir kırmızı bayrak ihlali hemen dikkate alınacak şekilde denetçiye bildirilmektedir (Moeller, 2010).Sürekli İzleme (Continous Monitor - CM) ve Sürekli Güvence Denetimi (Continuous Assurance Auditing - CAA) kavramları benzerdir,

ancak amaçlarında farklılar mevcuttur. Bir bilişim teknolojileri denetçisi, sürekli izleme hakkında temel bir anlayışa ve sürekli güvence denetimi temel özellikleri hakkında bilgiye sahip olmalıdır. Sürekli izleme bir risk ve kontrol izleme sistemi iken, en temel tasarımında sürekli güvence denetimi diğer kritik uygulamaları izleyen bağımsız bir uygulamadır. CM uygulaması bir ödeme işlem dosyasındaki etkinliği, ayrı ve periyodik incelemeler yoluyla tüm ödeme faaliyetleri bazında izleyen paralel yazılım setidir. Faaliyet özetleri periyodik olarak raporlanmaktadır ve fark edilen olağandışı öğeler, bir e-posta aracılığıyla bir istisna raporunda vurgulanmaktadır (Moeller, 2010).

Bilgisayar Destekli Denetim Araç ve Teknikleri (Computer-Assisted Audit Tools - CAATs)

Bilgisayar Destekli Denetim Araç ve Teknikleri, iç veya dış (bağımsız) denetçiler tarafından kullanılmaktadır ve bir işletmeninin bilgi sistemi içerisinde bulunan, denetim için önemli olan verinin işlenmesine yönelik denetim prosedürlerinin bir parçası olarak bilinmektedir. Denetçiler tarafından en çok kullanılan teknik ve araçlar literatürde, elektronik çalışma belgeleri, hile tespiti, bilgi toplama ve analiz için destekleyici görevi bulunan genel denetim yazılımı, ağ güvenlik testi, sürekli izleme, denetim raporlaması, denetim geçmişi veri tabanları, bilgisayar tabanlı eğitim, elektronik ticaret ve internet güvenliği olarak yer almaktadır (Mahzan ve Lymer, 2014). Denetimin konusunu ise artık sadece finansal veriler oluşturmamaktadır. Bahse konu olan değişim, denetim teknoloji ve metotlarında da değişime sebep olmuştur. Şekil 2'de bilgisayar destekli denetim teknikleri (teknolojileri), uygulama durumlarına göre sınıflandırılmıştır (Jiang, 2019).



Şekil 2. Bilgisayar Destekli Denetim Tekniklerinin (Teknolojilerinin) Sınıflandırılması (Jiang, 2019)Bilgisayar destekli denetim teknikleri (teknolojileri) ile gerçekleştirilen bazı faaliyetler ise aşağıda sıralanmıştır: (Handoko, Lindawati ve Mustapha, 2020)

- Denetim örneklemesinden bilgisayar parametrelerinin seçilmesinde, hesaplanmasında ve örnek sonuçlarının değerlendirilmesinde yararlanılması
- Simülasyon ve yazılımların değerlendirilmesinde bilgisayar kullanımı
- Test edilecek verinin toplanması
- Denetim çalışma kağıtlarının hazırlanması
- Verinin hesaplanması ve karşılaştırılması
- Hesaplamaların analizi
- Bütçe ve zaman takibi
- Standart denetim yazışmaları
- Verilerin eksiksizliğinin, tutarlılığının, tahsisinin ve doğruluğunun kontrolü
- Formüllerin kontrolü
- Veri bütünlüğünün karşılaştırılması
- Veri analizi için genel gözden geçirme, sıralama, birleştirme, bölme ve oranlama
- Gerçekleştirilen çeşitli denetim prosedürleri arasındaki verilerin karşılaştırılması

Genelleştirilmiş denetim yazılımları (Generalized audit software - GAS) olarak bilinen ve kolayca erişilebilen, denetçinin bilgi teknolojileri konusunda uzmanlığımı gerektirmeyen bilgisayar denetim programları da sıkça kullanılmaktadır. Genelleştirilmiş denetim yazılımları, bilgisayar depolama ortamında tutulan verilere erişim elde etmek ve bunları değiştirmek için bir araç sunan tamamlanmış programlardır. Bu yazılımlar, matematiksel hesaplamalar, tabakalandırma, istatistiksel analiz, sıra denetimi, çift kontrol, yeniden hesaplamalar vb. tüm özelliklere sahiptir. Denetçiler, başvuru sistemleri tarafından üretilen ve tutulan kayıtların kalitesi hakkında doğrudan onay alabilirler. Buna karşılık, kayıtların kalitesine ilişkin vardıkları sonuçlar, bu kayıtları işleyen başvuru sisteminin kalitesi hakkında yargıda bulunmalarını da sağlayacaktır. Genelleştirilmiş denetim yazılımları (GAS), denetimi gerçekleştiremez. Fakat, müşterilerin gereksinimlerine göre bilgilerin seçilmesini ve işlenmesini kolaylaştırabilir. En sık kullanılan iki GAS ise, ACL (Audit Command Language) ve IDEA'dır (Interactive Data Extraction Analysis). ACL aslında bir programlama dili ve denetime yönelik araçlar setidir. IDEA ise aslında denetime yönelik bir veri analiz yazılımı ve teknolojisidir. Denetimde sorgulama ve analiz araçları örnekleri Tablo 1'de belirtilmiştir (Serpeninova, Makarenko, Litvinova, 2020). Hile denetiminde kullanılan yazılımlar ve programlama dillerine de örnek olarak ACL, IDEA ve Excel gösterilebilir. Yapılacak hile denetim testlerini ana başlıklara ayıracak olursak ticari alacaklar, ticari borçlar, büyük defter, maaş ve ödemeler ile satın alma

emirleri yönetimi şeklinde sınıflandırmak mümkündür. Hiç şüphesiz, hile denetimi testlerinin aslında daha kapsamlı olduğunu da bu noktada vurgulamak gereklidir (Coderre, 2009).Genelleştirilmiş denetim yazılımlarının yanı sıra denetçiler, verilere erişmek ve bu verileri işlemek için bir programlama dili kullanabilirler. Özellikle birçok denetçi, sistem güvenilirliğine ilişkin kanıt toplamak için C, C++, JAVA, SQL, Pyton, PHP gibi programlama dillerini ve ACL ile IDEA'yı kullanmaktadır. Genel destek araçlarından bazıları ise şunlardır: MS Office, Oracle, Webmetrics 3.0, MS Access ve MS Excel (Serpeninova, Makarenko, Litvinova, 2020).

Tablo 1. Denetimde Sorgulama ve Analiz Araçları Örnekleri (Serpeninova,Y., Makarenko, S., Litvinova, M., 2020)

Program / Programlama Dili / Denetime Yönelik Araç Seti	**Özellikler**
MS Access	Veri seçimi, analizi ve raporlaması sağlayan Microsoft'a ait bir veri tabanı programı.
ACL	Çoğu formattan (Örnek: EBCDIC, TXT) dosyaları okuyan ve veri seçimi, analizi ve raporlaması sağlayan programlama dili ile denetime yönelik araçlar seti.
MS Excel	Analiz, hesaplama, grafik ve raporlama sağlayan Microsoft'a ait elektronik tablo yazılımı.
CA-Examine	Veri seçimi, analizi ve değerlendirmesi sağlayan interaktif bir yazılım.
CA-Easytrieve	Veri seçimi, analizi ve değerlendirmesi sağlayan rapor oluşturma yazılımı.
C, C++, JAVA, SQL, Pyton, PHP	Veri seçimi, analizi ve değerlendirmesi sağlayan programlama dilleri.
SAS, SPSS	Veri seçimi, analizi ve değerlendirmesi sağlayan istatistik programları.

Bilgisayar destekli denetim teknolojisi, ortaya çıkan bilgi sistemleri ve denetim risklerini azaltmak için önemli bir araçtır. Audit Command Language (ACL) gibi programlama dilleri ve denetime yönelik araç setlerinin kullanımı, işletmelerin performanslarını arttırmaktadır. İç Denetçiler Enstitüsü'ne (Institute of Internal Auditors - IIA) göre, bilgisayar destekli denetim yazılımları, birçok denetçinin denetim prosedürünü yürütmesi için bir araç haline gelmiştir (Chou, 2018). İç denetimde bilgisayar destekli denetim araçlarının kullanmanın ise, satın almadan ödemeye kadar olan işletme süreçlerinde yaşanabilecek hileli işlemlerin tespitinde çok önemli bir rolü bulunmaktadır (Samagaio ve Diogo, 2020). Bilgisayar destekli muhasebe denetim süreçlerinin, özellikle Covid-19 döneminde de ön plana çıktığını vurgulamak gerekir. Hatta, Covid-19 döneminde iç kontrol süreçleri dahi yeniden şekillenmiştir (Kızıl, Kızıl ve Dolaz, 2021).

Sonuç ve Öneriler

Günümüzde muhasebe ve denetimin teknoloji ile entegrasyonu geçmiş yıllara göre çok daha hızlı bir şekilde devam etmektedir. Sürekli güvence denetimi ve bilgisayar destekli muhasebe denetim süreçleri ise, iç ve dış (bağımsız) denetim faaliyetleri sırasında işletmelerde olabilecek hata ile hilelerin belirlenip önlenmesinde büyük bir öneme sahiptir. Sürekli güvence denetimi ve bilgisayar destekli muhasebe denetim süreçleri, hataları ile hileleri sıfırlayamaz ve riskleri tamamen bertaraf edemez. Fakat, bu hususlarda büyük avantajlar sunmaktadır.Bilgisayar destekli muhasebe denetim süreçlerinin son yıllarda daha da işlerlik kazanarak uygulama sahasının genişlemesi, teknolojinin hızla gelişimi ile küreselleşmenin bir sonucudur. Covid-19 dönemi ise bu süreci hızlandırmıştır. Muhasebe ve denetimin yanında, iç kontrol de her geçen gün klasik kimliğinden uzaklaşarak yeniden şekillenmektedir. Muhasebe, denetim ve iç kontrol alanlarında yeni trendler gözlemlenmektedir.Son olarak, günümüzde işletmeler denetimde büyük veri analizine yönelik çalışmalara yatırım yapmak ve veri analistlerine istihdam sağlamak zorundadırlar. Gelecek çalışmalarda, yapay zeka uygulamalarının gelişmesi sebebi ile iç ve dış (bağımsız) denetimde robotik, makine öğrenmesi veya derin öğrenme tekniklerinin denetim kalitesi ile güvencesine etkileri incelenebilir. Güncel programlar (yazılımlar), programlama dilleri ve denetime yönelik araç setleri mercek altına alınabilir. Aynı zamanda, işletmeler üzerinde uygulama ve örneklere odaklanılabilir.

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KADINLARIN JİNEKOLOJİK KANSERLERE YÖNELİK FARKINDALIKLARI: DENİZLİ İLİ ÖRNEĞİ

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Özet
Amaç: Araştırma kadınların jinekolojik kanserlere yönelik farkındalıklarını belirlemek amacıyla yapılmıştır. Gereç ve Yöntem: Araştırma analitik-kesitsel olarak, Aralık 2020-Aralık 2021 tarihleri arasında, Denizli il merkezine bağlı 65 adet Aile Sağlığı Merkezine kayıtlı olan 20-65 yaşları arasındaki 650 kadınla yürütülmüştür. Araştırmanın verileri Tanıtıcı Bilgi Formu ve Jinekolojik Kanserler Farkındalık Ölçeği kullanılarak toplanmıştır. Araştırma verileri Statistical Package For Social Science (SPSS) 25.0 paket programı ile analiz edilmiştir. Verilerin değerlendirilmesinde tanımlayıcı istatistikler, değişkenlerin karşılaştırılmasında Pearson ki-kare, Mann Whitney U, One Way ANOVA ve Kruskal Wallis testleri ile post-hoc analizinde Bonferroni testi kullanılmıştır. Bulgular: Kadınların yaş ortalaması 41,06±12,15, %37,80'i ilkokul mezunu, %57,70'i bir işte çalışmaktadır. Jinekolojik Kanserler Farkındalık Ölçeği toplam puan ortalaması 158,34±16,84, "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" alt ölçek puan ortalaması 17,30±2,09, "Jinekolojik Kanser Riskleri Farkındalığı" alt ölçek puan ortalaması 29,97±4,93, "Jinekolojik Kanserlerden Korunma Farkındalığı" alt ölçek puan ortalaması 23,80±3,32, "Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı" alt ölçek puan ortalaması 87,28±12,10 olarak bulunmuştur. Kadınların jinekolojik kanserlere yönelik farkındalıklarını yaş, eğitim, çalışma durumu, sosyal güvence, gebelik sayısı, menopoz durumu, kanserlere ilişkin bilgi sahibi olması, tarama testi yaptırma durumunun etkilediği tespit edilmiştir ($p<0,05$). Sonuç: Bu çalışmadaki kadınların jinekolojik kanserlere yönelik farkındalıklarının sosyo-demografik ve jinekolojik-obstetrik özelliklerinden etkilendiği tespit edilmiştir. Kadınların jinekolojik kanserlere yönelik farkındalığını artırmak için toplumdaki kadınların statüsünün artırılması ve sağlıklı yaşama yönelik davranışların kazandırılması gerekmektedir.
Anahtar kelimeler: Ebe, Farkındalık, Jinekolojik kanser, Kadın, Kanser tarama.

WOMEN'S AWARENESS TOWARDS GYNECOLOGICAL CANCERS: THE EXAMPLE OF DENIZLI PROVINCE

Abstract
Objective: The research was conducted to determine women's awareness of gynecological cancers. Materials and Methods: The research was conducted analytically-cross-sectionally with 650 women aged 20-65 who were registered in 65 Family Health Centers in Denizli city center between December 2020 and December 2021. The data of the study were collected using the Introductory Information Form and the Gynecological Cancers Awareness Scale. Research data were analyzed with the Statistical Package for Social Science (SPSS) 25.0 package program. Descriptive statistics were used to evaluate the data, Pearson chi-square, Mann Whitney U, One Way ANOVA and Kruskal Wallis tests were used to compare variables, and Bonferroni test was used for post-hoc analysis. Results: The mean age of women is 41,06±12,15, %37,80 of them are primary school graduates, %57,70 of them are working in any job. Gynecological Cancers Awareness Scale total score average is 158,34±16,84, "Early Diagnosis and Information Awareness in Gynecological Cancers" subscale score average is 17,30±2,09, "Gynecological Cancer Risk Awareness" subscale score average is 29,97±4,93 The mean score of "Awareness of Prevention from Gynecological Cancers" was 23,80±3,32, and the mean score of "Awareness of Routine Control in Gynecological Cancers and Perception of Severe Disease Perception" was 87,28±12,10. It has been determined that women's awareness of gynecological cancers is affected by age, education, employment status, social security, number of pregnancies, menopause status, having knowledge about cancers, and having a screening test ($p<0.05$). Conclusion: The women in this study's awareness of gynecological cancers ıt has been determined that socio-demographic and gynecological-obstetric characteristics affect. In order to increase women's awareness of gynecological cancers, it is necessary to increase the status of women in the society and to gain healthy lifestyle behaviors.
Keywords: Awareness, Cancer screening, Gynecological cancer, Midwife, Woman.

Giriş

Kadınları etkileyen sağlık ile ilgili problemler sadece kadınları değil aile bireylerini ve içinde yaşadığı toplumu da yakından etkilemektedir. Jinekolojik kanserler tıpta bilimsel ilerlemeler olmasına rağmen dünyanın ve ülkemizin en önemli sağlık sorunlarından biri olup, insidans hızının artış göstermesi ile gündemdeki yerini korumaktadır (Sağlık İstatistikleri Yıllığı, 2020; THSK Kanser Daire Başkanlığı, 2021). Jinekolojik kanserler kadınların mortalite ve morbidite hızını etkilemektedir. Jinekolojik kanserler bireylerde sakatlıklara, ekstremite kayıplarına, ruhsal çöküntülere neden olmakta ve iş veriminin düşmesini etkilemektedir. Jinekolojik kanser tedavilerinin pahalı olması ve sürecin uzun sürmesi ise ülke ekonomisi açısından önemli bir sorun teşkil etmektedir (Erdem ve diğerleri, 2017; Ismail ve diğerleri, 2017). Jinekolojik kanserlerin prevalansının belirlenmesi, neden olan risk faktörlerinin bilinerek saptanması, korunma yolları ve uygun tedavi protokollerinin geliştirilmesinin önemi gün geçtikçe artmaktadır (Sağlık İstatistikleri Yıllığı, 2020; THSK Kanser Daire Başkanlığı, 2021; The Global Cancer Observatory, 2021).Dünyada jinekolojik kanser yükü giderek artmakta olup, orta ve düşük gelirli ülkeleri daha fazla etkilemektedir. Bu durumda orta ve düşük gelirli ülkelerde jinekolojik kanserlerin önüne geçmek daha da önemli hale gelmektedir (THSK Kanser Daire Başkanlığı, 2021). Uluslararası Kanser Araştırma Ajansı (IARC) tarafından yayınlanan Global Cancer Statistics (GLOBOCAN) 2020 verilerine göre dünyada kadınlarda jinekolojik kanserlerin görülme sıklığı en fazla serviks, uterus ve over kanseri şeklinde bulunmuştur (The Global Cancer Observatory, 2021). Ülkemizde beş yılda bir yayınlanan 2017 yılında yapılan "Türkiye Kanser İstatistikleri" verilerine göre kadınlarda jinekolojik kanserlerden uterus korpusu % 5,6 ile 5. sırada, over kanseri % 3,3 ile 7. sırada, serviks kanseri %2,3 ile 9. sırada yer almaktadır (Sağlık İstatistikleri Yıllığı, 2020). Jinekolojik kanserlerdeki risk faktörleri kanserin türüne ve kişiye göre farklılık gösterebilmektedir. Yaş, zararlı madde kullanımı (alkol, sigara vb.), hormonal, çevresel ve bireysel faktörler, kilolu olmak, aile öyküsü, sedanter (hareketsiz) yaşam, Human Papilloma Virüs (HPV) enfeksiyonu, onkolojik virüsler, sosyo-ekonomik düzey kişilerde jinekolojik kanserlere zemin hazırlamaktadır (Alp Dal ve Ertem, 2017; Aydoğdu ve Özsoy, 2018; Rieck ve Fiander, 2006). Yaş kontrol edilemeyecek bir risk faktörü iken diğer risklerden korunabilmek ise mümkündür (Alp Dal ve Ertem, 2017). Jinekolojik kanserlerin önlenmesinde birincil, ikincil ve üçüncül koruma yöntemleri dikkate alınmalıdır. Birincil korunmada jinekolojik kanserlere yönelik bireylere farkındalık kazandırmak önemlidir. Kanser kontrol programında ebeler jinekolojik kanserlerden korunmada, taramalarda, erken tanıda aktif rol oynamaktadır. Ebelerin birincil korumadaki

görevi jinekolojik kanserlere yönelik farkındalık oluşturarak kadınlara davranış değişikliği kazandırmaktır (Dal ve diğerleri, 2020). Ebeler kadınlara farkındalık oluşturmak için eğitici, danışman, rahatlatıcı, bakım verici, araştırmacı rollerini aktif kullanmalıdır (Gedük, 2018). Bu rollerin ışığında ebeler gerekli eğitimleri planlayarak jinekolojik kanserlerden korunmak için neler yapılacağı, risk faktörleri, sağlıklı yaşam şekli, erken tanı ve tedavinin önemini vurgulamalıdır (Dal ve diğerleri, 2020; Eroğlu ve Koç, 2014).Jinekolojik kanserden korunmada, risk altındaki kadınların saptanması ve erken tanı önemlidir. Erken tanı, hastalığın klinik belirtileri görülmediği dönemde teşhis edilmesidir. Erken tanının amacı, hastalığın erken teşhisi ile vücutta yayılmanın önüne geçilerek, tedavinin başarılı olması için zaman kazanmayı sağlamaktadır. Ebeler risk altındaki kadınları daha dikkatli gözlemleyerek kendi sağlığı ile ilgili sorumluluk almasını, vücudundaki değişimleri erken fark etmesini sağlamalıdır (Açıkgöz ve diğerleri, 2011; Özçam ve diğerleri, 2014). Jinekolojik kanserlere yönelik risk faktörlerinin değiştirilebilenler (sağlıklı beslenmek, aile planlaması yöntemi kullanmak, HPV enfeksiyonu, sigara ve alkol kullanmamak) ve değiştirilemeyenler (yaş, genetik, aile geçmişi) üzerine odaklanmak farkındalık için önemlidir. Jinekolojik kanserden korumak için değiştirilebilen risk faktörlerine yönelik sağlık algısının arttırılması gereklidir. Değiştirilemeyecek risk faktörlerini bilmek jinekolojik kanserlerin erken tespitinde ve jinekolojik kanser taramalarında önemli yer tutmaktadır (Kaya ve diğerleri, 2021). Kadınların jinekolojik kanserlerden korunmalarının en etkin yolu erken tanı ve taramalarını zamanında yaptırmalarıdır. Literatürde, kadınların jinekolojik kanserlere yönelik farkındalıklarını etkileyen faktörler konusu ile ilgili sınırlı sayıda çalışma olduğu görülmüş ve yapılan çalışmaların çoğunlukla serviks kanseriyle ilgili çalışmalar olduğu dikkat çekmektedir. Kadınların jinekolojik kanserlere yönelik farkındalıklarının belirlenmesi ve farkındalıklarını artırmaya yönelik öneriler sunulmasını amaçlayan çalışmalara ihtiyaç olduğu saptanmış ve bu çalışmanın yapılmasına karar verilmiştir. Çalışmamızın sonucundaki verilerin bilime katkı sağlayarak ebelerin eğitici ve danışman rollerini tekrar gözden geçirmelerini ve sağlık kurumlarındaki yöneticilerin kararlarına yardımcı olabileceği düşünülmektedir.

Gereç ve Yöntem

Araştırmanın Tipi

Araştırma analitik-kesitsel olarak yapılmıştır.

Araştırmanın Evreni ve Örneklemi

Araştırma evrenini, Denizli ili merkezinde yaşayan 20-65 yaşları arasındaki 199 877 kadın oluşturmuştur. Araştırmanın örneklemini ise evreni belirli örneklem yöntemine göre %99

güven aralığında, kabul edilebilir hata 0,05 ve N=199877 evren sayısı ile hesaplandığında 540 bulunmuştur. Araştırma olası vaka kayıpları (yaklaşık %15) dikkate alınarak 650 kadın ile tamamlanmıştır.Araştırma Aralık 2020- Aralık 2021 tarihleri arasında, Denizli İl Sağlık Müdürlüğü'ne bağlı 65 adet Aile Sağlığı Merkezine (ASM) kayıtlı, 20-65 yaşları arasında, ilkokul ve daha fazla eğitimi olan 650 kadınla yürütülmüştür. Araştırmanın tüm Denizli il merkezini kapsaması bakımından her ASM'den 10'ar kadına ulaşılmıştır.

Araştırma Verilerinin Toplanması

Veri Toplama Araçları

Araştırmada kadınların özelliklerini belirlemek için Tanıtıcı Bilgi Formu ve Jinekolojik Kanserlere Yönelik Farkındalık Ölçeği (JİKFÖ) kullanılmıştır.

1. Tanıtıcı Bilgi Formu

Araştırmada konu ile ilgili literatürden faydalanılarak "Tanıtıcı Bilgi Formu" oluşturulmuştur. Bu form araştırmacı tarafından hazırlanmıştır. Formda kadınların sosyo-demografik özelliklerini içeren 8 soru, (yaş, eğitim durumu, çalışma durumu, mesleği, eşinin eğitim durumu, eşinin mesleği, gelir gider durumu, sosyal güvencesi) obstetrik öykülerini içeren 12 soru, (gebelik sayısı, doğum sayısı, kaçıncı evliliği, evlilik süresi, ilk evlenme yaşı, ilk cinsel ilişki yaşı, ilk adet yaşı, ilk gebelik yaşı, menopoz durumu, kullandığı aile planlaması yöntemi) kanserlere yönelik 11 soru olmak üzere toplam 39 sorudan oluşmaktadır (Dal ve Ertem, 2017; Şirin ve Kavlak, 2015; Taşkın, 2016). Bu form araştırmaya katılan kadınlarla yüz yüze görüşülerek araştırmacı tarafından doldurulmuştur.

2. Jinekolojik Kanserler Farkındalık Ölçeği

Jinekolojik Kanserler Farkındalık Ölçeği (JİKFÖ) Dal ve Ertem (2017) tarafından 20-65 yaş arası evli kadınların jinekolojik kanserlere ilişkin farkındalıklarını değerlendirmek amacıyla geliştirilmiştir (Dal ve Ertem, 2017). Geçerli, güvenilir olduğu saptanan JİKFÖ 41 maddeden ve dört alt boyuttan oluşan 5'li likert tipte bir ölçektir. Ölçekte her soru maddesi için kadınların "Kesinlikle Katılmıyorum", "Katılmıyorum", "Kararsızım", "Katılıyorum", "Kesinlikle Katılıyorum" seçeneklerinden kendisine uygun olan seçeneği işaretlenmesi beklenmektedir. Ölçeğin alt boyutları ve ilgili maddeleri aşağıda verilmiştir:

Jinekolojik Kanser Riskleri Farkındalığı: 3, 4, 5, 6, 7, 8, 9, 10, 11. Maddeleri

Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı: 1, 2, 12, 13. Maddeleri

Jinekolojik Kanserlerden Korunma Farkındalığı: 14, 15, 16, 17, 18, 19. maddeleri

Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı: 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41. maddeleri kapsamaktadır.

Ölçek değerlendirilirken en düşük puan 41, en yüksek puan 205'tir. Araştırmaya katılanların ölçek puanlarının yüksek olması farkındalık düzeylerinin de yüksek olduğunu göstermektedir. Bu ölçeğin bir kesme değeri bulunmamakta olup, kadınların JİKFÖ 'inden aldıkları puan arttıkça farkındalıkları artmaktadır. Bu formu araştırmaya katılanların kadınların kendileri tarafından doldurmuştur. Dal (2017)'ın çalışmasında JİKFÖ'nin cronbach alpha değeri 0,944 olup, çalışmamızda 0,927, "Jinekolojik Kanser Riskleri Farkındalığı" alt boyutunun cronbach alpha değeri 0,843 iken, çalışmamızda 0,753, "Jinekolojik Kanserlerden Korunma Farkındalığı" alt boyutunun cronbach alpha değeri 0,778 çalışmamızda 0,551, " Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" alt boyutunun cronbach alpha değeri 0,708, çalışmamızda 0,676, "Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı" alt boyutunun cronbach alpha değeri 0,979 çalışmamızda 0,939 olarak bulunmuştur (Dal ve Ertem, 2017).

Verilerin Değerlendirilmesi

Araştırmadan elde edilen veriler, SPSS paket programı (Statistical Package for Social Sciences; IBM SPSS Statistics for Macintosh, Armonk, NY) versiyon 25,0 kullanılarak analiz edilmiştir. Çalışmada tanımlayıcı analizler; kategorik verilerde sayı (n) ve yüzde (%) olarak, sürekli verilerde ise ortalama±standart sapma (ort±standart sapma) olarak gösterilmiştir. Sürekli değişkenlerin normal dağılıma uygunluğu Kolmogorov-Smirnov testi ile değerlendirilmiştir. Normal dağılmayan değişkenlerin iki grupta karşılaştırılmasında Mann Whitney U-testi kullanılmıştır. İkiden fazla grup karşılaştırılmasında parametrik değişkenlerde One Way ANOVA testi, nonparametrik değişkenlerde Kruskal Wallis testi kullanılmıştır. Birden fazla olan grup karşılaştırmalarında anlamlı farkın hangi gruptan kaynaklandığını belirlemek için Bonferroni testi kullanılmıştır. Analizlerde istatistiksel anlamlılık düzeyi $p<0,05$ olarak kabul edilmiştir.

Araştırmanın Etik Yönü

Araştırma Helsinki Deklarasyonu maddeleri dikkate alınarak yapılmıştır. Araştırma için Aydın Adnan Menderes Üniversitesi Sağlık Bilimleri Fakültesi Girişimsel Olmayan Klinik Araştırmalar Etik Kurulundan ön onay (Sayı: 03/03/2020-E.15229, Protokol No: 2020/012) alınmıştır. Araştırmanın Denizli İl Sağlık Müdürlüğüne bağlı Denizli merkezinde bulunan ASM'lerde yürütülebilmesi için yazılı izin alınmıştır. Araştırmada kullanılan JİKFÖ için Doç. Dr. Nursel Alp Dal'dan e-posta yoluyla iletişime geçilerek izin alınmıştır. Araştırmaya dahil edilen kadınlara çalışma ile ilgili bilgi verilmiş, sözlü ve yazılı onamları alınmıştır.

Araştırmanının Sınırlılıkları

Araştırma araştırmaya katılan kadınları temsil etmektedir.

Araştırmanın Güçlükleri

Araştırmanın veri toplama süreci Covid-19 pandemisinden etkilenmiş ve poliklinik hizmetlerinde esnek mesaiye geçilmesi, formları doldururken ASM'lerin kalabalık olması, gürültü olması, sosyal mesafeyi koruyarak iletişim kurmaya çalışmak, poliklinik sırası gelenlerin formu doldurmak istememeleri sorulara cevap vermeyi zorlaştırmıştır.

Bulgular

Tablo 1: Kadınların tanıtıcı özelliklerine göre dağılımı (n= 650)

Sosyo-demoğrafik özellikler	Sayı (n)	Yüzde (%)
Yaş ortalaması: 41,06±12,15 (min=20 max=65)		
Yaş grupları		
20-29	145	22,30
30-39	162	25,00
40-49	166	25,50
50-65	177	27,20
Beden kitle indeksi		
Zayıf (<18,5)	21	3,20
Normal (18,5-24,9)	247	38,00
Fazla kilolu (25,0-29,9)	256	39,40
Obez (>30)	126	19,40
Eğitim durumu		
İlkokul	246	37,80
Ortaokul	93	14,30
Lise	119	18,30
Üniversite	158	24,30
Lisansüstü Eğiti	34	5,30
Çalışma durumu		
Evet	375	57,70
Hayır	275	42,30
Meslek		
Ev hanımı	270	41,50
İşçi	125	19,20
Memur	101	15,60
Serbest Meslek	89	13,70
Diğer (temizlikçi, kasiyer, güvenlikçi vb)	65	10,00
Sosyal Güvence Durumu		
Var	589	90,60
Yok	61	9,40
Toplam gebelik sayısı ortalaması: 2,18±1,68 (min=0 max=10)		
Toplam gebelik sayısı (n=524)		
1	96	18,32
2	179	34,16
3 ve üzeri	249	47,52
Menopoz yaş ortalaması (n=177): 48,33 ±3,88 (min=33 max=56)		
Menopoza girme durumu		
Evet	177	27,20
Hayır	473	72,80
Aile planlaması yöntemi kullanma durumu		
Evet	390	60,00
Hayır	260	40,00
Kansere ilişkin bilgi alma durumu		
Evet	442	68,00
Hayır	208	32,00
Kansere ilişkin tarama testleri yapıldığını bilme durumu		
Biliyorum	510	78,50
Bilmiyorum	140	21,50
Tarama testi yaptırma durumu		
Evet	188	28,90
Hayır	462	71,10

Kadınların tanıtıcı özelliklerine göre dağılımı incelendiğinde yaş ortalamaları 41,06±12,15 yıl ve %27,20'si 50 yaş ve üzeri olduğu belirlenmiştir. Beden kitle indeksine göre yapılan

sınıflandırmada kadınların en çok %39,40 ile fazla kilolu grupta yer aldığı tespit edilmiştir. Kadınların eğitim durumlarına bakıldığında %37,80'i ilkokul mezunu ve %24,30 üniversite mezunudur. Çalışmamızdaki kadınların %57,70'i aktif olarak çalışırken, %42,30'u çalışmamaktadır. Kadınların %90,60'nın sosyal güvencesi olup, %19,20'sinin işçi, %15,60'nın memur olarak çalıştığı belirlenmiştir. Kadınların toplam gebelik sayısı ortalaması 2,18±1,68 yıl olarak bulunmuştur. Kadınların %34,61'inin üç ve üzeri gebeliği bulunmaktadır. Menopoza giren kadınların (n=177) menopoza girme yaş ortalaması 48,33±3,88 yıldır. Kadınların %60,00'ı aile planlaması yöntemi kullanmaktadır. Kadınların, %68,00'nın kansere ilişkin bilgilerinin olduğu saptanmıştır. Kadınların %78,50'si hangi kanser türlerine ilişkin tarama testleri yapıldığını bildiklerini ifade etmişlerdir. Kadınların %71,10'u herhangi bir tarama yaptırmamışken, %28,90'ı ise tarama yaptırdığını belirtmiştir.

Tablo 2: Kadınların JİKFÖ toplam ve alt ölçeklerinden almış olduğu puanlar (n= 650)

JİKFÖ ve Alt Ölçekler	Ortalama	SS*	Çalışma Min-Max	Ölçek Min-Max	Cronbach's Alpha
Jinekolojik kanserlerde erken tanı ve bilgi farkındalığı alt ölçeği	17,30	2,09	10-20	4-20	0,676
Jinekolojik kanser riskleri farkındalığı alt ölçeği	29,97	4,93	14-45	9-45	0,753
Jinekolojik kanserlerden korunma farkındalığı alt ölçeği	23,80	3,32	9-30	6-30	0,551
Jinekolojik kanserlerde rutin kontrol ve ciddi hastalık algısı farkındalığı alt ölçeği	87,28	12,10	52-110	22-110	0,939
JİKFÖ toplam puanı	158,34	16,84	108-204	41-205	0,927

* Standart Sapma

Tablo 2'de kadınların toplam JİKFÖ ve alt ölçeklerinden almış oldukları puanlar verilmiştir. Buna göre kadınların JİKFÖ toplam puanlarının ortalaması 158,34±16,84 olup, en düşük puan 108 en yüksek puan 204 olarak hesaplanmıştır. JİKFÖ'nin "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" alt ölçeğine bakıldığında ortalama puanları 17,30±2,09 ve en küçük puan 10 iken en yüksek puan 20 olduğu görülmüştür. "Jinekolojik Kanser Riskleri Farkındalığı" alt ölçeğinde kadınların ortalama puanlarının 29,97±4,93, en küçük puan 14, en yüksek puan 45'tir. "Jinekolojik Kanserlerden Korunma Farkındalığı" alt ölçeği ortalama puanları

23,80±3,32, en küçük puan 9, en büyük puan 30 olarak bulunmuştur. "Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı" alt ölçeği ortalama puanları 87,28±12,10 en küçük 52 iken en yüksek puanın 110 olduğu hesaplanmıştır.

Tablo 3: Kadınların Tanıtıcı Özelliklerine göre JİKFÖ Puan Ortalamalarının Karşılaştırılması

Tanıtıcı Özellikler	Jinekolojik kanserlerde erken tanı ve bilgi farkındalığı alt ölçek puanı	Jinekolojik kanser riskleri farkındalığı alt ölçek puanı	Jinekolojik kanserlerden korunma farkındalığı alt ölçek puanı	Jinekolojik kanserlerde rutin kontrol ve ciddi hastalık algısı farkındalığı alt ölçek puanı	JİKFÖ toplam puanı
	Ort±SS	Ort±SS	Ort±SS	Ort±SS	Ort±SS
Yaş grupları					
20-29 yaş	17,11±2,11	30,14±5,35	23,70±3,30	89,92±11,08	160,88±16,30
30-39 yaş	17,06±2,19	29,92±4,81	24,03±3,26	87,60±11,92	158,61±16,68
40-49 yaş	17,37±1,95	30,48±5,02	24,51±3,22	89,22±11,62	161,58±16,16
50-65 yaş	17,62±1,98	29,38±4,54	23,00±3,32**	82,99±12,45**	152,98±16,87**
H değeri	4,278	4,735	16,852	31,908	34,205
P değeri* **	0,129	0,115	**0,011***	**0,001***	**0,001***
Eğitim durumu					
İlkokul	17,48±2,02	29,43±4,57	23,06±3,27**	82,90±12,78**	152,87±17,09**
Ortaokul	17,38±2,26	30,23±4,81	23,99±2,98	87,60±9,36	159,19±14,82
Lise	17,27±1,91	29,71±4,95	23,93±3,04	88,45±9,60	159,35±14,01
Üniversite	16,93±2,21	30,46±5,31	24,30±3,52	92,01±11,73	163,70±16,83
Lisansüstü	17,65±1,91	31,79±5,38	25,82±3,22	91,97±12,67	167,24±17,28
H değeri	3,872	9,494	**28,761**	**59,140**	**61,943**
p değeri* **	0,168	0,05	**0,001***	**0,001***	**0,001***
Çalışma durumu					
Çalışıyor	17,10±2,12	30,44±5,12	24,30±3,26	90,11±11,41	161,94±16,20
Çalışmıyor	17,58±2,01	29,32±4,58	23,12±3,28	83,42±11,96	153,44±16,47
Z değeri	**-9,763**	-2,871	**-4,467**	**-7,130**	**-7,465**
P değeri* **	**0,009***	**0,004***	**0,001***	**0,001***	**0,001***
Sosyal güvence durumu					
Var	17,40±2,05	30,01±4,96	23,93±3,19	88,00±11,82	159,34±1,61
Yok	16,39±2,25	29,57±4,63	22,51±4,15	80,26±12,59	148,74±19,66
Z değeri	**-3,592**	-6,290	**-0,630**	**-2,775**	**-4,136**
P değeri* **	**<0,001***	**<0,001***	0,534	**0,006***	**<0,001***
Toplam gebelik sayısı					
Gebelik yok	17,82±2,12	29,63±5,55	23,90±3,50	89,27±12,89	160,61±19,30
1 gebelik	17,67±1,84	30,25±5,03	23,89±2,98	88,71±11,79	160,51±17,20
2 gebelik	17,60±1,87	30,22±4,96	24,13±3,35	88,84±11,16	160,79±17,33
3 ve üzeri gebelik	16,69±2,16**	29,85±4,52**	23,47±3,32	84,59±12,04	154,60±17,73**
H değeri	**36,403**	**32,442**	**2,246**	**3,490**	**15,105**
P değeri* **	**0,002***	**0,001***	0,523	0,322	**0,001***
Menopoz durumu					
Evet	17,57±1,98	29,36±4,40	23,16±3,40	83,47±13,17	153,56±17,63
Hayır	17,20±2,12	30,19±5,10	24,04±3,26	88,7±11,37	160,13±16,19
Z değeri	**-2,074**	-1,510	**-2,944**	**-4,660**	**-4,985**
P değeri* **	0,102	0,217	**0,013***	**0,001***	**0,001***

Kansere ilişkin bilgi alma durumu					
Evet	17,24±2,15	30,26±5,08	24,13±3,21	88,71±11,73	160,34±16,42
Hayır	17,44±1,93	29,33±4,53	23,10±3,44	84,23±12,34	154,10±16,97
Z değeri	**-1,742**	-2,083	**-3,402**	**-4,160**	**-4,402**
P değeri* **	0,284	**0,037***	**0,001***	**0,001***	**0,001***
Kanser tarama testlerini bilme durumu					
Evet	17,31±2,12	30,18±5,03	24,13±3,20	88,48±11,87	160,09±16,63
Hayır	17,27±1,97	29,19±4,46	22,61±3,46	82,90±11,98	151,97±16,10
Z değeri	0,611	**-2,384**	**-4,551**	**-4,635**	**-5,012**
P değeri* **	0,903	**0,017***	**0,001***	**0,001***	**0,001***
Kansere yönelik tarama yaptırma durumu					
Evet	17,34±2,05	30,32±4,77	24,46±3,04	89,93±11,42	162,05±15,93
Hayır	17,29±2,10	29,82±4,99	23,53±3,39	86,2±12,21	156,84±16,98
Z değeri	**-0,374**	-1,406	**-2,942**	**-3,291**	**-3,488**
P değeri* **	0,921	0,16	**0,003***	**0,001***	**0,001***

Kadınların yaş gruplarına göre yapılan karşılaştırmada JİKFÖ toplam ölçek puanı, "Jinekolojik Kanserlerden Korunma Farkındalığı ve "Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı" alt ölçek puanları arasında anlamlı farklılık mevcuttur (p değerleri sırasıyla p= 0,001, p= 0,011 ve p= 0,001). Yaş grupları açısından anlamlı farklılık saptanan gruplarda, farklılığın hangi gruplardan kaynaklandığını tespit etmek üzere post-hoc analiz yapılmıştır. Buna göre JİKFÖ toplam puanı için gruplar arası farklılık, 50-65 yaşları arasındaki kadınların aldıkları düşük puanlardan kaynaklanmıştır. Kadınların eğitim durumuna göre yapılan karşılaştırmada kadınların eğitim durumu ilkokuldan lisansüstü eğitime doğru arttıkça JİKFÖ toplam puanında anlamlı düzeyde artış görülmektedir (p= 0,001). Post-hoc analizi sonucunda farklılık nedeni eğitim durumu ilkokul olan gruptaki kadınların aldıkları düşük puanlardan kaynaklandığı görülmüştür. Çalışan gruptaki kadınların JİKFÖ toplam ve alt ölçek puanları anlamlı oranda daha yüksek olarak bulunmuştur. Sosyal güvencesi olan kadınların "Jinekolojik Kanserlerden Korunma Farkındalığı" alt ölçeği haricindeki bütün alt ölçekler ve JİKFÖ toplam puanlarının sosyal güvencesi olmayan kadınlara kıyasla anlamlı oranda daha yüksek bulunmuştur (sırasıyla p<0,001, p<0,001, p= 0,006 ve p<0,001). Gebelik sayısı arttıkça JİKFÖ toplam puanı, ilk iki alt ölçekte "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" ve "Jinekolojik Kanser Riskleri Farkındalığı" puanları anlamlı oranda azalmaktadır (p değerleri sırasıyla p= 0,001, p= 0,002, p= 0001). Post-hoc analizleri sonucunda farklılığın üç ve üzeri gebeliği olan kadınların puanlarının düşük olmasından kaynaklandığı saptanmıştır. Menopoza giren kadınların JİKFÖ toplam ölçek puanı, "Jinekolojik Kanserlerden Korunma Farkındalığı" ve "Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı" alt ölçek puanları, menopoza girmemiş kadınlardan anlamlı oranda daha yüksektir (p değerleri sırasıyla p= 0,001, p= 0,013 ve p= 0,001). Kansere ilişkin bilgisi olan

kadınların "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" alt ölçeği hariç tüm alt ölçek puanları ile JİKFÖ toplam ölçek puanı anlamlı olarak daha yüksek saptanmıştır. Kanserlere yönelik tarama testi yapıldığını bilen kadınların**,** "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" hariç tüm alt ölçekler ile JİKFÖ toplam puanı anlamlı olarak daha yüksek bulunmuştur. Kanser taraması yaptıran kadınların JİKFÖ puanları daha yüksektir.

4. Tartışma

Kadınların jinekolojik kanserlere yönelik farkındalıkları arttırmak için kansere neden olan risk faktörlerini bilmeleri ve taramalara katılmaları önemlidir ((THSK Kanser Daire Başkanlığı, 2021). Yapılan çalışmada 40-49 yaşları arasındaki kadınların jinekolojik kanserlere yönelik farkındalık puanları yüksek bulunmuştur. Yapılan araştırmaların sonucunda kadınların jinekolojik kanserlere yönelik farkındalıklarının farklı yaş aralıklarında yüksek olduğu saptanmıştır (Atlas, 2020; Dal, 2022; Gözüyeşil ve diğerleri, 2020; Kaya Şenol ve diğerleri, 2021). Gözüyeşil ve diğerlerinin (2020) çalışmasında 30-39 yaş aralığındaki kadınların, Kaya Şenol ve diğerlerinin (2021) çalışmasında 36-50 yaşları arasındaki kadınların, Atlas ve Güneri (2022)'nin çalışmasında 18-29 yaşları arasındaki kadınların, Atlas (2020)'ın çalışmasında 29 yaşından küçük kadınların jinekolojik kanserlere yönelik farkındalık puanları yüksek olarak saptanmıştır. Teşkereci ve diğerlerinin (2021) çalışmasında jinekolojik kanserlere yönelik farkındalık puanlarının yaş ile birlikte arttığı sonucuna ulaşmışlardır. Fonnes ve diğerlerinin (2021) yaptığı çalışmada kadınların serviks kanserine yönelik farkındalık düzeylerinin 18-29 yaşları arasında en yüksek olduğu bulunmuştur. Yaşlar arasındaki jinekolojik kanserlere yönelik farkındalık puanlarındaki değişikliğin nedeni bölgesel kaynaklı olabilir. Karşılaştırılan çalışmalarda kadınların sosyo-demografik özelliklerinin farklı olması farklı yaş aralığındaki kadınların farkındalıklarının yüksek olduğunu göstermektedir.

Yaptığımız çalışmada kadınların eğitim durumunun artması ile JİKFÖ puanlarının arttığı görülmektedir. Çelebi (2021)'nin ve Dal (2022)'ın çalışması çalışmamızla benzerlik göstermektedir. Öz (2021)'ün çalışmasında üniversite mezunu olan kadınların JİKFÖ ve alt ölçek puanları daha yüksek bulunmuştur. Yurtdışı çalışmalarında eğitim durumu ile serviks kanseri farkındalığı arasında anlamlı bir ilişki saptanmıştır (Gyamfua ve diğerleri, 2019; Mbachu, ve diğerleri, 2017; Moshi ve diğerleri, 2018). Nijerya'da yapılan çalışmada yüksek eğitim düzeyine sahip kadınların, yumurtalık kanseri risk faktörleri ve semptomları hakkında daha bilgili olduğu bulunmuştur (Okunowo ve Adaramoye, 2018). Eğitim düzeyi yüksek kadınların sağlıkla ilgili konuları daha fazla araştırarak doğru bilgilere ulaştığı ve ulaştığı bilgileri daha iyi anladığı söylenilebilir.

Çalışmamızdaki çalışan kadınların JİKFÖ toplam ve alt ölçek puanları anlamlı oranda yüksek bulunmuştur. Yapılan çalışmaların sonucu benzer olup, çalışma hayatı olan kadınların JİKFÖ toplam ve alt ölçek puanlarının yüksek olduğu saptanmıştır (Atlas ve Güneri, 2022; Kaya Şenol ve diğerleri, 2021; Öz, 2021). Nijerya'da yapılan çalışmada çalışan kadınların yumurtalık kanseri semptomları ve risk faktörleri konusunda daha fazla bilgi sahibi olduğu görülmüştür (Okunowo ve Adaramoye, 2018). İş ortamındaki kadınların iletişim içinde olmaları sağlık arayışlarını arttırarak jinekolojik kanserlere yönelik farkındalık konusunda birbirlerini olumlu yönde etkilediği düşünülebilir. Sosyo-demografik durumu iyi olan kadınların hastanelere veya özel kliniklere kolay gidebilecek olması farkındalığı arttırabilir.

Çalışmamızda sosyal güvencesi olan kadınların JİKFÖ puanları yüksektir. Şahin (2009)'in çalışmasında sosyal güvencesi emekli sandığı olan bireylerin jinekolojik kanserlerle ilgili bilgi puanları yüksek bulunmuştur. Akkoyun (2020)'un çalışmasında sosyal güvencesi olan kadınların kadın üreme organları kanserlerinden korunmaya ilişkin bilgi düzeyleri sosyal güvencesi olmayanlardan yüksek bulunmuştur. Sosyal güvencesi olmayan kadınların ücret karşılığı muayene olması, herhangi bir semptom varlığında direkt doktora gitmeyi ertelemesine neden olarak farkındalığı etkileyebilir.

Sosyo-ekonomik durum jinekolojik kanserlerde insidans ve sağ kalım hızını etkilemektedir. Sosyo-ekonomik durum, kadınların sağlık hizmetlerine ulaşımını, sağlık ve kanser hakkında farkındalığını, belirtileri zamanında çözümleyebilmesini, yaşam şeklini, ek hastalıklarını etkileyerek kanserler için risk faktörü oluşturmaktadır (Booth ve diğerleri, 2010). Avustralya'da 2001-2015 yılları arasında kansere yakalanan kadınların incelendiği bir çalışmada; kırsal kesimde yaşayan gelir durumu düşük olan kadınlarda yumurtalık, serviks, uterus kanserlerinden ölümlerin yüksek olduğu sonucuna ulaşılmıştır (Afshar ve diğerleri, 2020). Amerika Birleşik Devletleri, Yeni Zelanda ve Danimarka'da yapılan çalışmalardan elde edilen bulgular Afshar ve diğerlerinin çalışması ile tutarlıdır (Dalton ve diğerleri, 2019; Singh ve Jemal, 2017; Soeberg ve diğerleri, 2015). Çalışmamızda çalışan ve sosyal güvencesi olan kadınların farkındalıkları daha yüksek bulunmuştur. Gelir durumu iyi olan kadınların finansal durum sağlık hizmetlerine erişimi attırması sebebiyle JKFÖ'nün yüksek olması ön görülen bir durumdur.

Çalışmamızdaki toplam gebelik sayısı arttıkça JİKFÖ toplam puanı, "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" ve "Jinekolojik Kanser Riskleri Farkındalığı" alt ölçek puanları azalmaktadır. Atlas ve Güneri (2022)'nin çalışmasında gebelik sayısı 1-2 olan kadınların JİKFÖ puanları yüksek bulunmuştur (20). Dal (2022) ve Atlas (2020)'ın çalışmaları

benzer olup; 2 ve altı gebeliği olan kadınların, 3 ve üstünde gebeliği bulunan kadınlara göre JİKFÖ puanları anlamlı olarak daha yüksek bulunmuştur. Gebelik sayısının fazla olması farkındalığı ters yönde etkilemektedir.

Çalışmamızda JİKFÖ puanı menopoza girmemiş kadınlardan anlamlı oranda daha yüksektir. Yapılan bazı çalışmalar çalışmamızla benzerlikler göstermektedir (Atlas, 2020; Dal, 2022; Kaya Şenol ve diğerleri, 2021). Gözüyeşil (2020)'in çalışmasında menopozdaki kadınların puanları arasında fark bulunmamıştır. Öz (2021)'ün çalışmasında menopozda olan kadınların "Jinekolojik Kanser Riskleri Farkındalığı" alt ölçek puanu yüksek, Gökgöz ve Aktaş (2015)'ın çalışmasında menopozda olan kadınların serviks kanserine yönelik taramalar konusunda farkındalıklarının yüksek olduğu saptanmıştır. Öztürk ve diğerlerinin (2021) çalışmasında menopozal dönemdeki kadınların jinekolojik kanser farkındalığı yüksek olmasına rağmen yeterli bilgi sahibi olmadıkları, tarama ve korunma yöntemlerine uymadıkları ve sağlıklı yaşama yönelik alışkanlıkları orta düzeyde bulunmuştur. Çalışmalardaki farklılığın sebebi bölgesel kaynaklı ve sosyo-demoğrafik özelliklerinin farklılığından kaynaklı olabilir.

Çalışmamızda kansere ilişkin bilgisi olan kadınların, Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı alt ölçeği hariç tüm alt ölçek puanları ile JİKFÖ puanı anlamlı olarak daha yüksek saptanmıştır. Çalışmamız Öz (2021)'ün çalışması ile benzerdir. Jinekolojik kanserlerden korunma yolları hakkında fikri olan kadınların farkındalıkları yüksek olarak bulunmuştur (Kaya Şenol ve diğerleri, 2021). Kadınların kansere ilişkin bilgisinin olması farkındalığı pozitif yönde etkileyebilir.

Çalışmamızda hangi kanser türlerine yönelik tarama yapıldığını bilen kadınların "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" hariç tüm alt ölçekler ile JİKFÖ puanı anlamlı olarak daha yüksektir. Literatürde de kanserlere yönelik taramalar hakkında bilgisi bulunan kadınların jinekolojik kanserlere yönelik farkındalık puanları anlamlı şekilde yüksek saptanmıştır (Atlas, 2020; Çelebi, 2021; Dal, 2022). Kamboçya'da yapılan çalışmada pap smear testini bilen kadınların serviks kanserinden korunma konusunda bilgilerinin yüksek olduğu bulunmuştur ((Touch ve Kyoung Oh, 2018). Yapılan çalışmalardaki sonuçlar benzerdir.

Çalışmamızdaki kanser taraması yaptıran kadınların puanları daha yüksek saptanmış olup, düzenli pap-smear taraması yaptıran kadınların, JİKFÖ toplam ve alt ölçek puanları istatistiksel olarak daha yüksek bulunmuştur (Atlas, 2020; Çelebi, 2021; Dal, 2022; Öz, 2021). Kamboçya'da yapılan bir çalışmada pap smear tarama testini bilen kadınların serviks kanseri konusunda farkındalık ve bilgi düzeylerinin yüksek olduğu görülmüştür (38). Kanser taraması

yaptıran kadınların sağlıklarına dikkat ederek (pap-smear taraması yaptırmak) farkındalıklarını davranışlara dönüştürdükleri düşünülebilir.

Çalışmamızdaki kadınların "Jinekolojik Kanserler Farkındalık Ölçeği Ortalaması" 158,34±16,84 iken; Alp Dal ve Ertem (2017) çalışmasında 155,8±17,5, Atlas (2020)'ın çalışmasında 160,31±22,42'dir. Çelebi (2021)'nin çalışmasında 149,26±14,69, Öz (2021)'ün çalışmasında 156,3±13,81, Dal (2022)'ın çalışmasında 148±25,71'dir. Çalışmamızdaki JİKFÖ'nün, "Jinekolojik Kanser Riskleri Farkındalığı" alt ölçek puanı 29,97±4,93 diğer çalışmalarda 28,01±6,69, 29,25±5,16, 30,1±5,1, 30,76±6,59, 29,25±5,16 bulunmuştur. "Jinekolojik Kanserlerden Korunma Farkındalığı" alt ölçek puanı çalışmada 23,80±3,32 iken diğer çalışmalarda 19,40±4,79, 23,02±2,97, 22,0±3,9, 23,04±4,29, 23,02±2,97 bulunmuştur. "Jinekolojik Kanserlerde Erken Tanı ve Bilgi Farkındalığı" alt ölçek puanı 17,30± 2,09 iken, diğer çalışmalarda 15,87±2,97, 16,35±1,88, 16,4±1,9, 16,76±3,29, 16,35±1,88 arasındadır. "Jinekolojik Kanserlerde Rutin Kontrol ve Ciddi Hastalık Algısı Farkındalığı" alt ölçek puanı 87,28 ±12,10 iken diğer çalışmaların puanları 80,92±16,84, 87,67±7,98, 89,74±14,11, 91,1±12,6, 87,67±7,98 arasında değişmektedir. Çalışma bulgularımızla diğer çalışma bulguları benzerlik göstermektedir.

5. Sonuç ve Öneriler

Kadınların jinekolojik kanserlere yönelik farkındalıklarını; yaş, eğitim durumu, çalışma durumu, gelir durumu, sosyal güvencesi, gebelik sayısı, ,menopoz durumu, kanserlere ilişkin bilgi sahibi olması, tarama testi yaptırma durumunun etkilediği sonucuna ulaşılmıştır.

Kadınların sosyo ekonomik, eğitim ve sağlıklı yaşama yönelik davranışları jinekolojik kanserlere yönelik farkındalıklarını etkilediği sonucundan yola çıkarak; toplumdaki kadınların statüsünün artırılması ve sağlıklı yaşam biçimi davranışlarının kazandırılması önemlidir. Jinekolojik kanser risk faktörleri, semptomları, erken tanı yöntemleri, HPV aşısı, KKVM uygulaması, jinekolojik kanserlerden korunma konusunda eksiklikleri belirlenerek bunlara uygun eğitimlerin planlanması, bu eğitimlerin farklı görsel, işitsel ve yazınsal araçlarla desteklenmesi gereklidir. Kadınlara jinekolojik kanserlere yönelik farkındalık kazandırmak için sahada çalışan ebe ve hemşirelerin uzmanlaşarak eğitici ve danışman rolünü ön planda tutularak özellikle 50 yaş ve üzerindeki kadınlara eğitim ve danışmanlık hizmetinin sunulmalıdır. Kadınların jinekolojik kanserlere yönelik farkındalıklarının belirlenmesi üzerine yapılan çalışmalar yeterli düzeyde olmayıp, yeni çalışmaların yapılması önerilebilir.

Çıkar çatışması

Yazarlar herhangi bir çıkar çatışması olmadığını beyan etmişlerdir.

Maddi destek

Yazarlar bu çalışma için finansal destek ve bağış almadıklarını beyan etmişlerdir.

Teşekkür

Çalışmamıza katılan tüm kadınlara teşekkür ederiz.

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İŞ SAĞLIĞI VE GÜVENLİĞİNDE GÖREV VE SORUMLULUKLARIN ÖNEMİ

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ÖZET
İşyerleri ile ilgili stres kaynakları içerisinde yer alan görev ve sorumlulukların belirsiz olması rol karmaşıklığa sebep olmaktadır. Çalışmanın amacı görev ve sorumluluk kavramlarına vurgu yapmak, mevzuat kapsamında yer alan hususların yetkililerce yerine getirilmesi ve uygulanmasını sağlamaktır. Nitel araştırma metodu kapsamında literatür taraması yapılarak iş sağlığı ve güvenliği kapsamında görev ve sorumluluk kavramlarının önemine dikkat çekilmiştir. Elde edilen bulgular yorumlanarak görev ve sorumluluğun iş güvenliğindeki rolü üzerinde değerlendirmeler yapılmıştır. Kişinin rol beklentilerine ilişkin bilgi sahibi olmayışı, diğer bir ifadeyle rol sonucunun ne yapılması gerektiği konusunda eksik bilgiye sahip olarak tanımlanan Rol Belirsizliği ile iki veya daha fazla rol temsiline aynı anda uymak ve başka bir rol temsiline bağlı kalmanın zor olması durumunda ortaya çıkan Rol Çatışması gibi iş güvenliği kapsamında yer alan ve stres kaynaklarının temelini oluşturan görev ve sorumluluk terimlerinin önemi vurgulanmıştır. Bu çalışmada rol karmaşasına neden olabilen görev ve sorumluluk kavramlarının yetkililerce mevzuata uygun olarak yapılması ve sınırların belirlenmesi için önerilerde bulunulmuş ve örnek bir form rehberlik etmesi için hazırlanmıştır. İş güvenliği çerçevesinde görev ve sorumluluklarının tehlike sınıfına uygun olarak yapılması ve belgelendirilmesi önem arz etmektedir. Sonuç olarak görev ve sorumlulukların tebliğ tebellüğ belgeleriyle özlük dosyalarında arşivlenmesi önerilmektedir.
Anahtar Kelimeler: Rol Yetersizliği, Psikososyal Risk Etmenleri, Görev ve Sorumluluk, Rol Çatışması, Rol Belirsizliği

THE IMPORTANCE OF DUTIES AND RESPONSIBILITIES IN THE AREA OF HEALTH AND SAFETY AT WORK

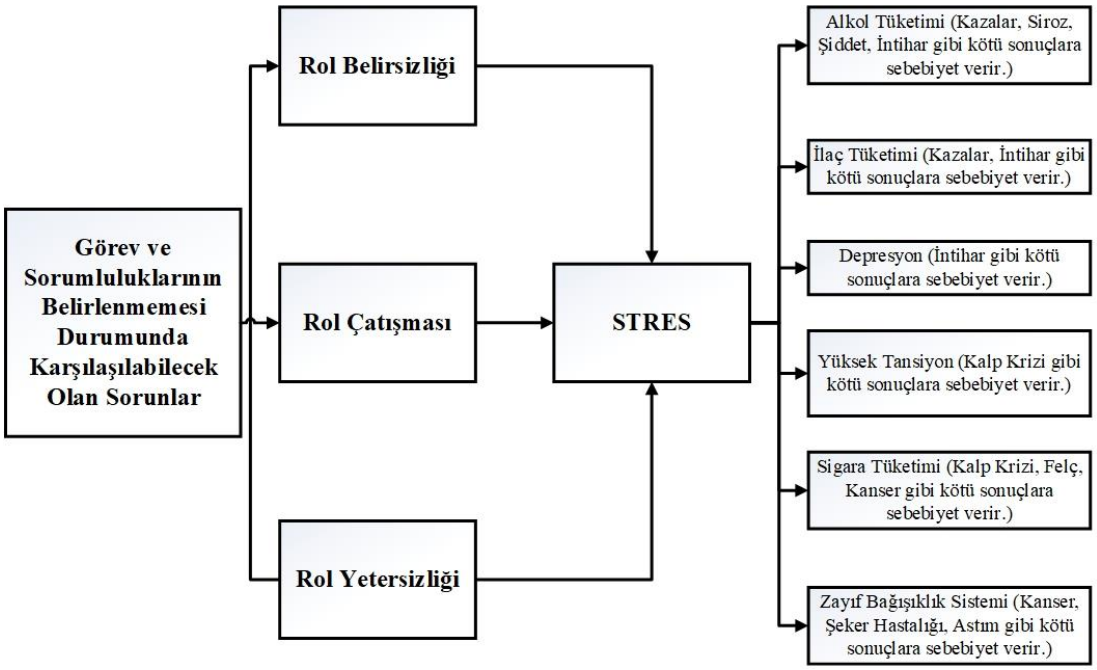
ABSTRACT
Uncertainty about duties and responsibilities, among the sources of stress in the workplace, leads to role complexity. The study aims to highlight the concepts of duty and responsibility and to ensure that the issues are met and implemented by authorities within the framework of legislation. Through a literature review using the qualitative research method, attention was drawn to the importance of the concepts of duty and responsibility in occupational health and safety. The findings were interpreted and assessments were made on the role of duty and responsibility in occupational health and safety. Role ambiguity, which is defined as a person's lack of knowledge about the role expectations, i.e. incomplete information about what to do based on the role, and role conflict, which occurs when it is difficult to fulfill two or more role representations simultaneously and to adhere to another role representation. The importance of the concepts of duty and responsibility, which fall within the scope of safety and form the basis of sources of stress, is emphasized. Suggestions have been made in this study to ensure that the concepts of duty and responsibility, which may cause role confusion, are defined by the authorities in accordance with legislation, and a model form has been produced to provide guidance. In the context of occupational health and safety, duties and responsibilities must be carried out and documented according to the hazard class. It is therefore recommended that the duties and responsibilities are archived in personnel files with notification documents.
Keywords: Role Inadequacy, Psychosocial Risk Factors, Duty and Responsibility, Role Conflict, Role Ambiguity

GİRİŞ

Günümüzde çalışma hayatı; çalışma koşullarındaki olumsuz değişiklikler (rekabet koşulları, artan iş yükü ve çalışma temposu, uzun çalışma saatleri, azalan iş güvencesi ve olumsuz yönetim politikaları gibi) çalışanların sağlığını olumsuz etkilemektedir. Çalışanların sağlığını ve iş ortamındaki disiplin ortamını bozan temel nedenlerden biri olarak görev ve sorumluluk formlarının imzalatılmaması veya çalışanların bu hususta bilgilendirilmemesi ön görülebilir. Çalışma formları her bir çalışanın ne yapması gerektiğini ve işyerinde nasıl hareket etmesi gerektiğine dair rehberlik görevi görmektedir (URL 1).Görev, kişinin yerine getirmesi gereken bir yükümlülük iken sorumluluk, size verilen bir görevi kabul etme ve yerine getirme eylemidir. Görev; Yasal veya ahlaki bir zorunluluk olarak görülür. Gerçekleştirilmesi gereken bir görev olup genellikle çalışanın işinin bir parçasıdır. Yani çalışanın yapmak zorunda olduğu ve yapmaması durumunda tepki alabileceği hususların bir bütünüdür. Sorumluluk ise; birisi veya bir görev üzerinde kontrol sahibi olmayı, bir şeyle uğraşmayı içermektedir. Bir şeyden sorumlu olmak ve yetki altındaki süreçlere göre doğru kararların alınması anlamını taşımaktadır. Görev'in en yaygın kullanılan anlamı hukuki veya ahlaki yükümlülüktür. Sorumluluk aynı zamanda bir şey üzerinde kontrol sahibi olmayı veya bir şeyle uğraşma ihtiyacını da ifade eder (URL 2, URL 3).6331 sayılı İş Sağlığı ve Güvenliği Kanunu, işyerinde alınan koruyucu tedbirler konusunda işverenlere çeşitli sorumluluk ve yükümlülükler yüklemektedir. İş sağlığı ve güvenliği mevzuatı kapsamında işyerleri çalışan sayısına ve tehlike kategorilerine göre sınıflandırılmaktadır. Meri mevzuat, 50'den az çalışanı olan ve az tehlikeli olarak sınıflandırılan işyerleri için daha basit yükümlülükler tanımlarken, tehlike kategorisi veya çalışan sayısı arttıkça işyerlerinin benimsediği iş sağlığı ve güvenliği tedbirlerinin kapsamı ve detayı genişlemektedir. Yükümlülük ve sorumluluk biçimlerinin kapsamı da bu çerçevede belirlenmektedir (URL 1; URL 2, URL 3; Ceylan ve Ulutürk, 2006). Bu nedenle her bir çalışanın yapması gerekenler veya sahip olması gereken kriterlerin yer aldığı bu formların yetkililerce doldurulması ve imzalanması gerekmektedir. İmzalanan bu formlar çalışanın istihdam edildiği konumda çalıştığı müddetçe özlük dosyasında bulundurulması ve bir nüshasının da çalışanda bulundurulması sağlanmalıdır. Deneyim sonucu kariyer ilerlemesinden dolayı konumunun değiştirilmesi durumlarında yeni konuma uygun görev ve sorumluluk formlarının mevzuata uygun şekilde yeniden doldurtulup imzalatılması sağlanmalıdır. Bu çalışmada ileride yapılacak olan benzer çalışmalara öncülük etmek ve her bir işyerinde bulundurulması gerekliliğine dikkat çekmek amacıyla Ek-1'de yer alan form hazırlanmış ve ayrıca farklı iş türlerine göre geliştirilmesi önerilmiştir. Hazırlanan bu formun hem alan yazına

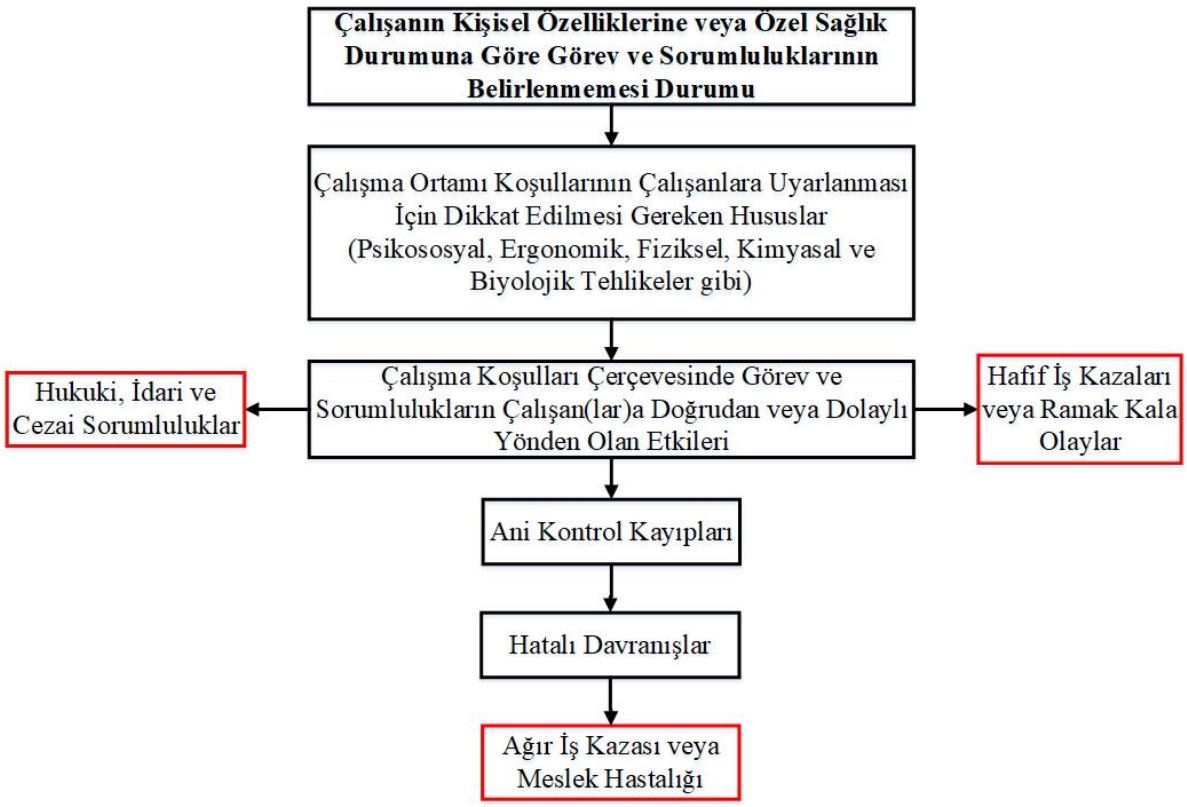
kazandırılması hem de iş sağlığı ve güvenliği (İSG) uygulamaları kapsamında İSG profesyonellerine rehberlik etmesi hedeflenmiştir. Çünkü formda yer alan bilgiler işverenlere ve çalışanlara ilişkin tüm kural, düzenleme ve sorumlulukları içerebilir. İçerikler tehlike sınıfı veya işyerinin özelliklerine göre şekillenebilir veya sahaya özgü hazırlanabilir. İş kanunu ve ilgili diğer mevzuat hükümleri, çalışanların bilgi sahibi olması veya yetkililere başvurabilmesi için her işverenin bir kopyasını çalışana vermesi ve bir nüshasının da insan kaynakları biriminde özlük dosyasında bulundurmasını zorunlu kılmaktadır. Çalışanların İş Kanunu ve diğer istihdam mevzuatına uygun olarak faaliyet gösterebilmeleri için yürütülen uyum süreçlerinde iş sağlığı ve güvenliği gereklilikleri çoğu zaman ihmal edilmektedir (Ünsar ve Oğuzhan, 2009; Adıgüzel, 2012; Ertem Eray, T., 2017; Tepe, 2018; Sayğan Tunçay ve Çıraklar, 2020; Demirci, 2021; Çivilidağ ve Durmaz, 2022; Eren Bana ve Bekaroğlu, 2022; Altan ve ark. 2022).Görev ve sorumluluk formlarının hazırlanmaması durumunda çalışanların rollerinde psikososyal risklere sebebiyet verebileceği düşünülmektedir. Vardiya sisteminde sorunların yaşanabileceği, çalışanların rollerinde çatışmaların, yetersizliklerin veya belirsizliklerin yaşanabileceği ihtimalleri bulunmaktadır. Ulusal veya uluslararası literatürde bu terimlere sık sık değinilmiş ve açıklık kazandırılmaya çalışılmıştır. Bu yönde kullanılan ve literatür taramalarında kayda değer sayıda çalışmanın yürütüldüğü terimleri aşağıdaki gibi tarif etmek mümkündür.*Rol belirsizliği,* Çalışanların işteki rollerini tam olarak anlamadıkları ve hedefler, beklentiler, amaç ve sorumluluklar konusunda belirsizlik olduğu zaman ortaya çıkacağı ifade edilmiştir. İş doyumunun azalmasına, stresin artmasına ve işten ayrılma niyetlerinde artış olabileceği ele alınmıştır. *Rol belirsizliği*, kişinin rol beklentilerine ilişkin açık ve performans bilgi sahibi olmayışı, diğer bir ifadeyle rol sonucunun ne yapılması gerektiği konusunda eksik bilgi olarak tanımlanabilir (Pearce, 1981; King ve King, 1990; Bauer, ve Simmons, 2000; Eys ve Carron, 2001).*Rol çatışması,* Çalışanlardan kendi değerleriyle çatışan veya birbirleriyle uyumsuz roller üstlenmeleri istendiğinde ortaya çıkan bir durum olarak değerlendirilmiştir. Rol çatışmalarının artması sonucu iş tatmininin de azalacağı vurgulanmıştır. Rol çatışması, iki veya daha fazla rol temsilinden birinin aynı anda uyulması ve başka bir rol temsiline bağlı kalmanın zor olması durumlarında ortaya çıkacağı ifade edilmiştir. (Stouffer ve Toby, 1951; Getzels ve Guba, 1954; King ve King, 1990; Creary ve Gordon, 2016; Ürü Şimşek, 2022).*Rol Yetersizliği,* Bir kuruluşun çalışanlarının becerilerinden ve eğitiminden yararlanamaması durumunda ortaya çıkacağı ve iş tatminini azaltıp stresi artırdığı vurgulanmıştır (Pestonjee ve Azeem, 2001; Kurt, 2010; Rohit, Singh, Sangeetha, ve Kumbhare, 2017; Yadav, 2017; Öztürk, ve Gezer, 2021).Yapılan işlerin sürekli olarak iş görülen ve bu nedenle birbirini takip eden postalar

halinde çalışan çalıştıran, ya da nöbetleşe çalışan postaları ile tutulan işlemler olarak tanımlanan *vardiyalı çalışmaların* da görev ve sorumlulukların belirlenmemesi durumunda işlerinde hasassiyet gösterenlerde ağır iş yüküne sebebiyet verebileceği gibi hususlar değerlendirimiştir (Scott, 2000; Shields, 2002; Wright ve ark. 2013).Psikososyal risk etmenlerinin kapsamının geniş olmasından dolayı bu çalışmada sadece görev ve sorumlulukların neden olabileceği durumlar ele alınmaya çalışılmıştır. İşyerleri ile ilgili stres kaynakları içerisinde yer alan görev ve sorumlulukların belirsiz olması rol karmaşıklığa sebep olmaktadır. Çalışmanın amacı görev ve sorumluluk kavramlarına vurgu yaparak mevzuat kapsamında yer alan hususların sorumlularca yerine getirilmesi ve uygulanmasının sağlaması yönündedir. Nitel araştırma metodu kapsamında literatür taraması yapılarak iş sağlığı ve güvenliği kapsamında görev ve sorumluluk kavramlarının önemine dikkat çekilmiştir. Elde edilen bulgular yorumlanarak görev ve sorumluluğun iş güvenliğindeki rolü üzerinde değerlendirmeler yapılmıştır. Görev ve sorumluluk kavramlarının belirlenmemesi durumunda rol belirsizliği, rol çatışması veya rol yetersizliği gibi stres kaynaklarına sebep olabileceği aşikârdır. Bu yüzden iş güvenliği çerçevesinde görev ve sorumluluklarının tehlike sınıfına uygun olarak yapılması ve belgelendirilmesi büyük önem arz etmektedir (Sabuncuoğlu, 2016; Adıgüzel ve Küçükoğlu, 2019; Gedik ve Çet, 2020; Öztürk ve Şeremet, 2021).Şekil 1'de görev ve sorumluluklarının belirlenmemesi durumunda neden olabileceği stres kaynaklarına görsellik kazandırılmıştır. Amaç bu çalışmaya bir bütün olarak bakmak ve stres kaynaklarının temelinde görev tanımlarının yapılmamış olmasıdır. Görev ve sorumlulukların belirlenmesi çok çalışkan personel(ler)in iş yükünü hafifletirken çalışmayan veya işini önemsemeyen personel(ler)e de sorumluluklar yüklemektir. Psikososyal risk etmenleri çerçevesinde stres kaynakları geniş bir yelpazeye sahip olmaktadır. Ayrıca stres kaynaklarında domino etkisini de görebiliriz. Yani bir stresin veya hastalığın kaynağı bir diğer stres kaynağına bağlanabilir. Örneğin fazla çalışmanın veya yoğun tempoda çalışılan bir ortamda personel sırt veya bel incinmeleri yaşayabileceği gibi sosyal aktivtite gibi olanaklardan da uzak kalacağı için kendisi sigara içme, alkol tüketme, uyuşturucu madde veya hap kullanma gibi zararlı maddeleri de tüketebilir.



Şekil 1. Görev ve Sorumlulukların Neden Olabileceği Psikososyal Nedenler

Şekil 1'de görselleştirilen stres kaynaklarının iş örgütlenmesi ve yönetimi kapsamında kişisel özelliklerin esas tutulması sonucu tedbirlerin zamanında alınması ve işyerlerinin çalışma türüne özgü olarak kapsamının genişletilmesi gerekmektedir. İşyerinde görev ve sorumluluklarının etkili yönetimi için; problemlerin tespit edilmesi, alınması gereken tedbir ve eylemlere karar verilmesi, eylemlerin yerine getirilmesi ve yapılan faaliyetlerin kontrol edilmesi neticesinde olumlu sonuçların alınabileceği düşünülebilir. Liyakat esaslı görevlerin ve sorumlulukların belirlenmemesi durumunda Şekil 2' de yer alan sorun ve olaylar netice verebilir. Sistematik olarak yapılan mobbing, iş vermemek ve aşırı iş vermek, diğer çalışanlara verilen haklardan eşit yararlanmamak gibi psikososyal baskılar çalışanları yalnızlaştırır ve meslek hastalığı, iş kazası, hukuki, idari ve cezai sorumluluklar gibi sonuçlara sebebiyet verebilir (URL 4). Bu yüzden hem çalışanların hem de işverenlerin bu hususta eğitim almalarının sağlanması gerekmektedir (Akşit ve Gür, 2022). İş sağlığı ve güvenliği çerçevesinde verilmesi gereken eğitimlerde görev ve sorumluluklar hakkında tarafların veya tüm paydaşların bilgilendirimesi gerekmektedir. İşlerin havalecilikten kurtulması ve görev karmaşıklığına son verilmesi için bu tarz bilgilendirmeler büyük önem arz etmektedir. Çalışanların kişisel ve sağlık özellikleri esas alınarak görev ve sorumluluklarının belirlenmemesi durumunda yetkililerin veya gerekli mevzuat hükümlerinin yerine getirilmesi durumunda görev ve sorumlulukları çerçevesinde hareket etmeyen çalışanlar hukuki, idari ve cezai yaptırımlarla karşılaşabilir. Bu yüzden tarafların bilgilendirilmesi ve belgelendirilmesi önemlidir.



Şekil 2. Kişisel özelliklere uygun görev ve sorumlulukların belirlenmemesi durumunda netice verebileceği sorunlar

ARAŞTIRMA VE BULGULAR

Nitel araştırma, algıları ve olayları doğal ortamda gerçekçi ve bütüncül bir şekilde ortaya çıkarmak için gözlem, görüşme, doküman analizi gibi nitel veri toplama yöntemlerini kullanan bir süreçtir. Sosyal bilimler bağımsızlaştıkça ve kendine özgü araştırma yöntemleri geliştikçe ve nicel araştırma yöntemleri toplumsal gerçekliği açıklamakta yetersiz kaldıkça, nicel araştırma yöntemlerinin sosyal bilimlerdeki etkinliği azalmaya başlıyor ve nitel araştırmanın önemi artıyor. Sosyal olgular, sosyal davranışı belirleyen genel kanunlar üretmek yerine, durumların spesifik boyutlarının araştırılmasıyla anlaşılabilir. Nitel veri analizi, insanların kendilerini ve çevrelerini nasıl algıladıklarını veya tanımladıklarını anlamayı amaçlayan kişi merkezli bir yaklaşımdır. Çalışan merkezli bu çalışmada da bu yüzden nitel araştırma metodu kullanılmıştır (Aydın, 2018; Yıldırım ve Şimşek, 2021).Nitel araştırma, çeşitli disiplinlere dayanan sağlam bir teorik temele sahiptir. Sosyoloji, antropoloji, psikoloji, felsefe, dilbilim, iş sağlığı ve güvenliği gibi disiplinlerin tümü nitel araştırmaya bakış açıları ve yöntemleri ile katkıda bulunur. Tüm bu disiplinlerin ortak amacı insan davranışını ve onun içinde bulunduğu çevresel durumu çok yönlü olarak anlamaya çalışmaktır. Nitel araştırma tasarımı, bir araştırma

yöntemini tanımlayan ve çeşitli aşamaların bu yöntem etrafında hizalanmasına rehberlik eden bir strateji olarak tanımlanabilir. Nitel araştırma tasarımı, araştırmacılara araştırma faaliyetlerini tutarlı ve amaçlı bir şekilde yürütme konusunda rehberlik eder (Yıldırım ve Şimşek, 2021).Bu çalışmada da ulusal ve uluslararası çalışmalarda yer alan görev ve sorumluluk ile ilgili çalışmalar araştırılmıştır. Ancak yapılan literatür taramasında görev ve sorumluluğun iş sağlığı ve güvenliği yönünden önemi hakkında yapılan her hangi bir çalışmaya rastlanmamıştır. Araştırma neticesinde çalışanların görev ve sorumlulukları ile ilgili çalışma bulunmazken psikososyal risk etmenlerinin temel unsurlarından sayılabilecek olan rol belirsizliği, rol çatışması, rol yetersizliği, vardiya çalışmaları, stres gibi hususlarda çalışmaların sıklıkla yapıldığı bulgularına rastlanmıştır. Kayda değer düzeyde yapılan bu tür çalışmalarda görev ve sorumluluklar hakkında araştırmalara ağırlık verilmemesinden dolayı literatürde bu yönde bir boşluk olduğu ortaya çıkmaktadır. Bu yüzden çalışanların çalışmalarını belli bir plan ve program çerçevesinde yapabilmesi için her mesleğe uygun olarak görev ve sorumluluk ile ilgili çalışmaların yapılması literatüre katkı sunacağı düşünülmektedir.Araştırma neticesinde mobbing veya stres'e neden olan hususlar hakkında elde edilen bulguları; çalışan(lar)ın işyerlerinde yalnızlaştırılması, iş yapma olanaklarının zorlaştırılması, çalışanın yok sayılması veya dikkate alınmaması, çalışan ile alay edilmesi, yaptığı işin küçümsenmesi veya aşağılanması, statüsünün küçümsenmesi, çalışma isteğinin kırılmaya çalışılması, sürekli suçlanması veya eleştirilmesi, arkasından konuşulması veya dedikodusunun normalleştirilmesi, işle ilgili olmayan olağandışı taleplerde bulunulması, kariyeri hakkında tehdit edilmesi ve çalışmamızın konusu olan görev tanımının dışında sorumluluklar veya işlerin verilmesi şeklinde sıralayabiliriz.

SONUÇ VE ÖNERİLER

Bu çalışmada rol karmaşasına neden olabilen görev ve sorumluluk kavramlarının yetkililerce mevzuata uygun olarak yapılması ve sınırların belirlenmesi için önerilerde bulunulmuştur Yapılan literatür taraması ve iş güvenliği uzmanı olarak saha çalışmalarından elde edilen deneyim sonucu, görev ve sorumluluk sorunlarıyla mücadele konusunda alınması gereken tedbirler için aşağıda listenen tavsiyelerde bulunulabilir.

- Periyodik eğitimlerin verilmesi (mesleki eğitimler, kişisel gelişim eğitimleri gibi),
- İşin yürütüm koşullarında değişikliklere gidilmesi,
- Çalışma ortamının vazifenin gerektiği hale getirmek veya yeniden tasarlamak,
- Çalışan(lar)a özel danışmanlık hizmetleri sunmak,
- Çalışma koşullarında veya sürelerinde değişiklikler yapmak,

- Görev ve sorumlulukların çözümleme yönerge veya prosedürlerin iş ortamına / şartlarına göre oluşturmak,
- Mesleki kariyer çerçevesinde alımlar yapmak,
- Görev ve sorumluluklarla ilgili sorunlarda kime veya hangi yetkililere başvuracakları konusunda çalışanları bilgilendirmek,
- Geleceği emanet edebilecek meslek erbaplarının yetişmesini sağlamak,
- Bu çalışma kapsamında hazırlanan Ek -1 formunun sektörel bazda uygulanmasını sağlamak ve kapsamının genişletilmesi için çalışmalar yürütmek gibi birçok öneride bulunulabilir.

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TEKSTİL SEKTÖRÜNDE İŞ SAĞLIĞI VE GÜVENLİĞİ KAPSAMINDA ALINMASI GEREKEN TEDBİRLER

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ÖZET
Tekstil veya dokuma sektörü, genellikle hayvansal, bitkisel veya kimyasal liflerin kullanılmasıyla elde edilen çeşitli ürünleri içermektedir. Bu sektör, liflerin işlenmesi ve bir araya getirilmesi suretiyle kumaşların ve tekstil ürünlerinin üretildiği karmaşık bir süreci kapsar. Türkiye'deki tekstil imalat sektöründe 2008-2021 döneminde kaydedilen 172.445 iş kazası gerçekleşmiş ve söz konusu yıllar arasındaki tüm sektörlerdeki iş kazalarının %5'i tekstil ürünleri imalatı sektöründe gerçekleşmiştir. Bu bağlamda çalışmanın amacı, tekstil sektöründe iş sağlığı ve güvenliği uygulamalarına odaklanarak, bu alanda literatüre katkıda bulunmak ve işverenler ile çalışanların iş kazaları ve meslek hastalıklarına karşı korunmasını sağlamaktır. Bu doğrultuda, sektörde uygulanmakta olan iş sağlığı ve güvenliği önlemlerine dikkat çekilerek, alınması gereken tedbirlerin önemi vurgulanmaktadır. Ulusal ve uluslararası kaynaklardan elde edilen bilgilerle tekstil işlerinin gerçekleştirildiği ortamlardaki iş güvenliği önlemleri incelenmektedir. Çalışmada nitel araştırma metodu kullanılarak tekstil atölyelerindeki risklerin kapsamlı bir değerlendirmesi yapılmaktadır. İş sağlığı ve güvenliği riskleri, tekstil sektöründe de diğer sektörlerde olduğu gibi önemli bir konudur, ancak sektöre özgü materyallerin ve işlemlerin kullanımıyla bazı riskler öne çıkmaktadır. Ergonomik, fiziksel, kimyasal, biyolojik ve psikososyal riskler, tekstil sektöründe gözlemlenen risk kategorileridir ve bu risklere karşı uygun önlemler alınmalıdır. Bu çalışma, iş sahasındaki risklerin kapsamlı bir şekilde ele alınmasını sağlayarak tekstil sektöründe iş sağlığı ve güvenliği konusunda daha bilinçli bir yaklaşımın teşvik edilmesine katkıda bulunmayı hedeflemektedir.
Anahtar Kelimeler: Risk, Tekstil, Dokumacılık, Atölye, İş Sağlığı ve Güvenliği

MEASURES TO BE TAKEN WITHIN THE SCOPE OF OCCUPATIONAL HEALTH AND SAFETY IN THE TEXTILE INDUSTRY

ABSTRACT
The textile or weaving sector includes various products generally obtained using animal, vegetable, or chemical fibers. This sector covers the complex process of producing fabrics and textile products by processing and assembling fibers. There were 172,445 occupational accidents recorded in the textile manufacturing sector in Turkey in the 2008-2021 period, and 5% of the occupational accidents in all sectors between these years occurred in the textile products manufacturing sector. In this context, the study aims to contribute to the literature in this field by focusing on occupational health and safety practices in the textile industry and to ensure that employers and employees are protected against work accidents and occupational diseases. In this regard, attention is drawn to the occupational health and safety measures implemented in the sector, and the importance of the measures that need to be taken is emphasized. Occupational safety measures in the environments where textile work is carried out are examined with information obtained from national and international sources. In the study, a comprehensive evaluation of the risks in textile workshops is made using the qualitative research method. Occupational health and safety risks are an important issue in the textile industry as in other sectors, but some risks come to the fore with the use of sector-specific materials and processes. Ergonomic, physical, chemical, biological, and psychosocial risks are the risk categories observed in the textile industry and appropriate measures should be taken against these risks. This study aims to contribute to promoting a more conscious approach to occupational health and safety in the textile industry by ensuring that risks in the workplace are comprehensively addressed.
KeyWords: Risk, Textile, Weaving, Workshop, Occupational Health and Safety

Giriş

Tekstil sektöründe çalışanlar, iş kazalarıyla fiziksel, kimyasal, biyolojik, psikososyal ve ergonomik risklere maruz kalabilirler. Daha sağlıklı ve güvenli bir iş ortamı sağlamak için, risklerin belirlenmesi ve ortadan kaldırılması için tedbirler alınması gerekmektedir.Çalışma hayatındaki öncelikler arasında iş sağlığı ve güvenliği, kritik bir öneme sahiptir. Bu tedbirlerin ihmal edilmesi, çalışanların hayatını tehlikeye atabilir veya ciddi yaralanmalara yol açabilir; bunun yanı sıra işverenler için önemli maddi kayıplara sebep olabilir. İş sağlığı ve güvenliği alanında, tedbirlerin alınması ve bunlara riayet edilmesi, öncelikle işverenin, ardından çalışanın sorumluluğundadır. Türkiye'de en fazla istihdamın gerçekleştiği sektörlerden biri olan tekstil endüstrisi, iş sağlığı ve güvenliği açısından bir dizi risk ve tehlikeyi içinde barındırmaktadır. Bu risklerle başa çıkabilmek için, tekstil sektöründe iş sağlığı ve güvenliği ile ilgili önlemlerin alınması gerekmekte olup, bu sayede sektördeki iş kazalarının ve meslek hastalıklarının büyük ölçüde önlenebileceği vurgulanmaktadır (Değirmenci ve Bozkurt, 2018).Ülkemizde, iş sağlığı ve güvenliği sorunlarının yaşandığı sektörlerden biri yoğun emek ve zaman gerektiren Tekstil sektörüdür. Bu sektörde, üretim verimliliğini artırmakla çalışanların refahını sağlamak arasında hassas bir denge bulunmaktadır ve her iki hedefi de başarıyla elde etmek zordur. Özellikle küçük işletmelerde, iş sağlığı ve güvenliği ile ilgili alınan önlemler maalesef yeterli seviyede değildir (Özbakır, 2023). 2008 ile 2021 yılları arasında ülkemizde tekstil imalat sektöründe toplamda 172.445 iş kazası kaydedilmiştir. Kaza geçirenler arasında kadın çalışanların sayısının diğer sektörlere kıyasla fazla olması, iş kazalarından etkilenen çalışanların %25'inin kadın olmasına neden olmuştur. Bu durum, diğer sektörlerde görülmeyen bir orandır. Söz konusu dönemde, tüm sektörlerde gerçekleşen iş kazalarının %5'i tekstil ürünleri imalat sektöründe meydana gelmiştir.İnsanoğlu giyim, süslenme, ev tekstili gibi pek çok alanda tekstil ürünlerine ihtiyaç duyduğundan dolayı bu alanlarda üretim yapmak zorundadır. Tekstil ürünlerine yönelik olarak özellikle son dönemlerde talebin artmış olmasından dolayı, tekstil ürünlerinin daha hızlı bir şekilde üretilmesi için çok sayıda makinenin yapılmasına neden olmuştur. Bu da, fabrikasyon üretim çağını başlatmış ve bu makineler de çalışanlar için, yangın, gürültü, tozlar, tehlikeli kimyasallar, hareketli aksamlar başta olmak üzere pek çok iş sağlığı ve güvenliği sorununu ortaya çıkarmıştır (Özbek, 2022). Yakın gelecekte, iş güvenliği alanında geniş bir bilgiye sahip olan ve her sektörde çalışabilecek uzmanların yanı sıra, her sektörde işe özgü uzmanların eğitimi daha da

önemli hale gelecektir. Bu, sadece çok tehlikeli ve tehlikeli kategorilerde değil, her sektörde iş güvenliği standartlarının ve gereksinimlerinin karşılanmasını sağlamak için gereklidir (Kökten ve Avinç, 2014).Kişisel koruyucu ekipmanların yeterli düzeyde kullanıldığı, ramak kala, iş kazası ve meslek hastalıkları sayısının az olduğu, risk değerlendirmelerinin yapıldığı, çalışan temsilcilerinin belirlendiği ve gerekli kayıtların tutulduğu ve raporlamaların yapıldığı iş yerleri, iş sağlığı ve güvenliği tedbirlerinin üst düzeyde uygulandığı yerlerdir. Bireysel bilgi, beceri ve yargıya göre belirlenmenin yanında, iş sağlığı ve güvenliği kurallarına uygun hareket eden bir çalışanlar grubu oluşturulmalıdır. Kazalar önlenebilir olduğu için işverenlerin sorumluluk alması önem arz etmektedir (Ağırgan, 2020).Tekstil fabrikalarında makine fazlalığı ve ürün çeşitliliği farklı iş yönelimlerine yol açmaktadır. Ürünlerin ve üretim faktörlerinin çeşitliliği, işçiler üzerinde termal baskı oluşturur. Ortaya çıkan sıcaklık stresi uzun yıllar çalışan kişilerde meslek hastalıklarına da yol açmaktadır. İş sağlığı ve güvenliği önlemleri, mühendislik çalışmaları ve işgücü yönetimi sayesinde çalışanları iş kazalarından ve meslek hastalıklarından korumak mümkündür. Tekstil fabrikalarında yaz ve kış mevsiminde çalışma ortamındaki farklılıkları etkileyen memnuniyetsizlik düzeyinin belirlenmesi, meslek hastalıklarının ve sağlık sorunlarının azaltılmasına yönelik, önleyici tedbirlerin ve teknik testlerin uygulanması gerekli olacaktır. Termal konfor, mesleki hijyen önlemlerine, metabolik iş ayarlarına ve teknik standartlara göre kıyafet seçimi yapılarak düzenlenebilir (Öz ve ark., 2018).Tekstil sektöründe ergonomi, yoğun emek ve insana dayalı, sık sık tekrarlanan hareketlerin yer aldığı bir sektör olmasından ötürü büyük önem taşımaktadır. Oturarak çalışmada sandalye ve masa tasarımının özellikleri önemlidir. Sandalyelerin yüksekliğinin ve derinliğinin ayarlanabilir olması, yeterli sırt dayanağına sahip olması çalışanlar açısından faydalı olacaktır. Sandalyeler, tercihen nefes alabilen, kaymayan ve beş noktalı teması sağlayan yeterince yumuşak kumaşlardan yapılmış olmalıdır. Tekstil sektöründe, işlem yapılan veya incelenen/kontrol edilen nesne ile göz arasındaki mesafe yeterli olmalıdır. İşlem yapılan malzemenin bükülmesini ve esnemesini önlemek için kenarlıklar masalara yerleştirilebilir. Tekrarlayan hareketlerden kaçınmak için çeşitli aktiviteler kullanılabilir. Özellikle gürültü, aydınlatma, toz ve termal konfor açısından uygun olmayan bir çalışma ortamında, ölçümler yapılarak çalışanlar üzerinde olumsuz etki oluşturmaması için önlemler alınmalıdır (Aksüt ve ark., 2021). Çalışma ortamı koşulları; iş tatmini, işin verimliliği ve kalitesiyle bağlantılı bir kavramdır. Özellikle yoğun emek harcayan çalışanlar için ergonomik uyumun sağlanması,

yapılan işe doğrudan etki etmektedir. Çalışma ve dinlenme sürelerine bakıldığında, çalışanların uzun saatler çalıştıkları, molalarda ise herhangi bir fiziksel aktivite yapmadıkları görülmektedir. Dolayısıyla çalışma koşulları, çalışanlar için tüm faktörler dikkate alınarak oluşturulmalıdır (Efe ve Efe, 2015). Hem çalışma alanında hem de dinlenme alanında ergonomik uyum önemlidir.Çalışanların iş güvenliği algıları, kişiden kişiye değişen ve birçok çevresel ve bireysel faktörden etkilenen değer yargılarını temsil etmektedir. Küreselleşme ve artan rekabet, değişen sosyo-ekonomik koşullara ayak uydurmak için yapısal değişikliklere uğrayan örgütlerde, asli personel dışında çalışanlara sunulan iş güvencesinin kaybolmasına yol açmıştır. Ayrıca ekonomik durgunluk ve kriz gibi durumlar işyerlerinin kapanmasına, işsizliğin artmasına, mevcut çalışanlar için statü ve maaş kaybına, performans baskısının ve işsizlik riskinin artmasına neden olmaktadır. Bütün bu değişiklikler; durum belirsizliğini artırmış ve iş güvencesizliği çalışanlar için önemli bir sorun haline gelmiştir (Derin ve Şimşek Ilkım, 2017). İş kazalarını önlemek veya azaltmak için, iş kazasına neden olan faktörlerin analiz ve değerlendirmelerle belirlenmesi, gerekli tüm önlemlerin hassasiyetle alınması ve önlemlerin etkin bir şekilde uygulanıp uygulanmadığının belirlenmesi için sıkı kontrollerin yapılması gerekmektedir (Kodaloğlu, 2024).Tekstil, kapsamı geniş olduğu kadar iş güvenliği kapsamından da riskleri de o kadar geniş bir yelpazeye sahiptir. İmalatından tasarımına mevcut olan riskler ile üretimden lojistik hizmetlerine veya tüketiciye erişim sürecine kadar yer alan riskler farklılık arz edebilmektedir. Bu çalışmada risklerin atölye kısmında bir bütün olarak görülebilmesi için şekil-2'deki görsel hazırlanmış ve mevcut süreçlerin yer alması için çalışmalar yürütülmüştür. Tüm kategoriler sığdırılamasa da risklerin bir bütün olarak görülmesi amaç edinilmiştir. Görselde tüm risklerin ana unsurlarını tespit edebilecek başlıkların görülmesine olanak tanıdığını söylemek mümkündür. Çalışamalarda kapsamın genişletilmesi, tehlike ve risklerin tanımlanması için rehberlik etmektedir. Bu yüzden benzer çalışmalarda da temsili görsellerin hazırlanması somutlaştırma adına büyük önem arz ettiği söylenebilir.

2. Çalışma Alanı:

Tekstil sektöründe çalışanların karşılaştığı farklı tehlikeler bulunmaktadır. Çalışma ortamındaki tehlikelerin oluşmasından sorumlu olan farklı faktörler vardır. Tekstilde bunlar Fiziksel, Biyolojik, Kimyasal ve Ergonomik (kişisel) faktörlerdir. Vardiyalı çalışma, işyerinde sigara içme, iş yoğunluğu nedeniyle kişisel koruyucu ekipmanların uygun şekilde kullanılması gibi işyeri ortamında tehlikeler oluşturmaktan sorumlu olan birden fazla hususlar vardır.

Endüstride tehlikeli teknolojik cihazların kullanılmaya başlanması, meslek hastalıkları etkenleri ve sağlıksız çalışma ortamları gibi durumlar yüksek kaza oranlarıyla sonuçlanmıştır. Çoğu çalışan okuma yazma bilmediği için işlerinde ne gibi koruyucu önlemlerin gerekli olduğunu öğrenemiyor. İşgücünün büyük bir kısmı imalat ve endüstriyel süreçlerin oluşturduğu tehlikelerle başa çıkmaya hazır değil. Bu çalışma, tekstil endüstrisinde İş Sağlığı ve Güvenliği (İSG) konusunda tehlike kontrol önlemlerinin rolünü bilmek amacıyla tasarlanmıştır.Bu yüzden çalışma alanı olarak tekstil sektörü seçilmiştir. Tekstil sektörü üretim sürecinden tüketim sürecine kadar birçok işlem aşamasını içermektedir. Tasarım, kalıp hazırlama, elle kesim, elle serim, otomatik kesim ve makine ile serim, kesimhane, dikimhane, ütüleme, paketleme, sevkiyat, aksesuarlar gibi birden fazla süreci içermektedir. Her bir süreç kendisine özgü riskleri içermektedir. Tekstil sektöründe en sık rastlanan sırt ve bel ağrıları, kesme veya delinme, karpal tünel sendromu gibi şikayetlerdir. Tekstil sektöründe kullanılan iş ekipmanlarının çeşitliliği, risklerin de çeşidini artırmaktadır. Kullanılan bazı ekipmanları şu şekilde sıralamak mümkündür: harman hallaç makinesi, şerit birleştirme, vatka birleştirme, tarak, cer, penyöz, fitil, ring, bobinleme, yıkama kurutma makinesi, melanjör makinesi, eğirme makinesi, ikileme makinesi, finisör makinesi, elyaf yağlama makinesi, germe-çekme makinesi, fikse makinesi, tekstüre makinesi, kutlama büküm aktarma, basınçla boya kazanı, boya mikseri, örme makinesi, çözgü haşıllama, kasarlama makinesi, çözgü makinesi, haşıl sökme makinesi, merserizasyon makinesi, termofikse makinesi, yakma (gaze) makinesi, boya makinesi, rotasyon baskı, film baskı makinesi, rulu baskı makinesi, yaş apre halat açma makinesi, ramöz makinesi, hasırlı kurutma makinesi, sanfor makinesi, zımpara makinesi, makas-tıraş makinesi, şardon makinesi, kalandır makinesi vb. şeklinde sıralamak mümkündür (Yağımlı ve Erdoğan, 2021). Bu açıdan, tekstil sektöründe riskler kapsamı geniş olmanın yanında tedbir almanın da zorluklarından bahsetmek gerekmektedir. Bu zorluklar üretim-tüketim ve geri dönüşüm süreci çerçevesinde ele alınabilir. Çalışma alanının tekstil seçilme sebeplerini risklerinin yoğun olmasına bağlayabiliriz.

3. Materyal ve Yöntem

Nitel araştırma metodu kapsamında ulusal ve uluslararası literatürden faydalanılmıştır. Materyal olarak görsel araçlar kullanılarak bir tekstil atölyesinin görseli hazırlanmıştır. Merdiven altı tekstil atölyeleri istisnadır. Yapılan çalışmada risklerin bir bütün olarak görsel üzerinde sağlanması ve elde edilen görselin çalışma sahalarında tüm çalışanlar tarafından

görülmesi sağlanmalıdır. Çalışma alanına hitap edecek şekilde risklerin mevcut olduğu görseller, birimlere hitap edecek şekilde bir yöntem kullanılarak çalışanlar bilgilendirilebilir. Bu çalışmada tekstil sektöründe ilgili tehlikelerin türünü ve yaygınlığını, sektörürün iş gücü kayıplarını tanımlamak için literatür araştırmasına başvurulmuştur.

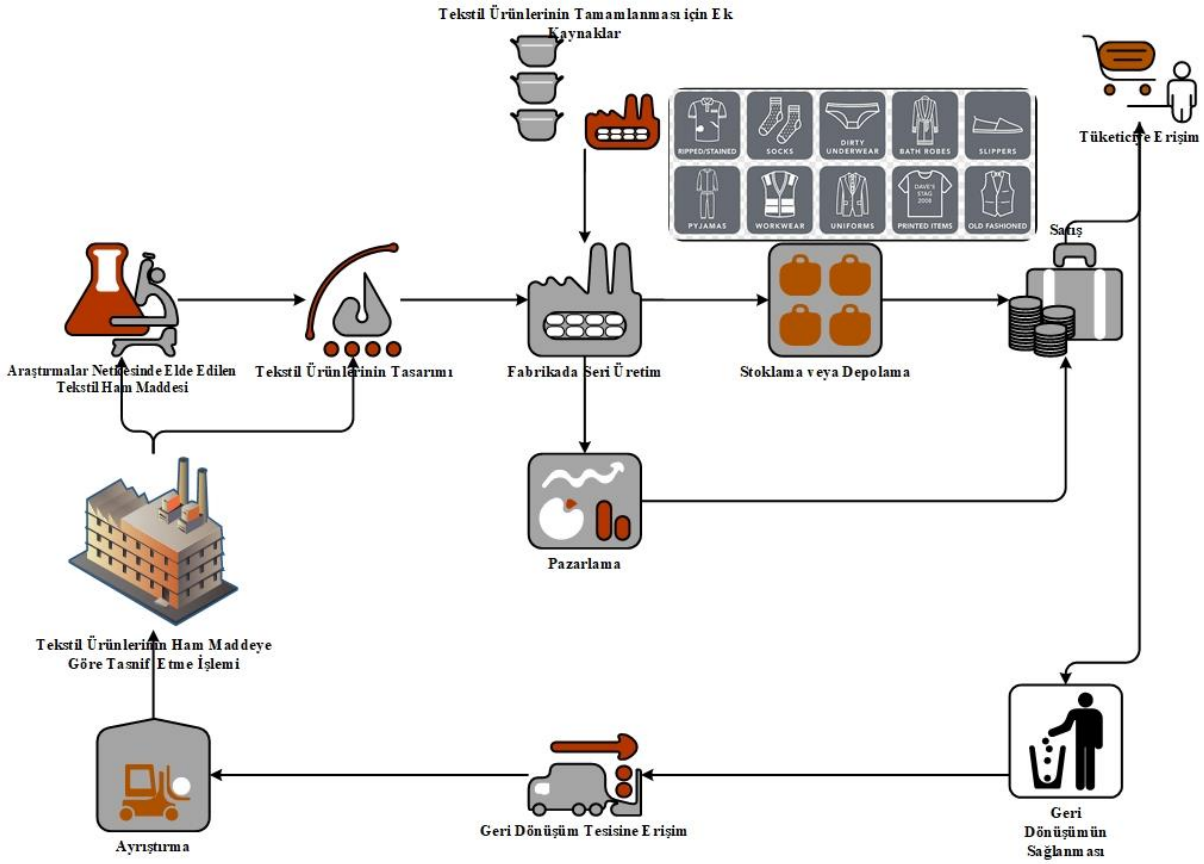
4. Bulgular ve Tartışma

Yapılan çalışma kapsamında risklerin ortak olmasının yanında ergonomik risklerin ağırlık kazandığından bahsedilebilir. Karpal tünel sendromu ve monoton çalışma temposu sağlık açısından riskler oluşturmaktadır. Kesme-delme işlemlerinde de el kol yaralanmalarına sebebiyet verdiği söylenebilir. Bel-sırt ağrıları ve çalışma alanındaki ekipmanların uygun olmamasından dolayı ergonomik riskler ağırlık kazanmaktadır. Ancak iş temposu ve fazla mesai gibi hususların bulunmasından dolayı psikososyal risklerden de bahsedilebilir. İş yeri koşulları (özellikle ergonomik şartlar), kas-iskelet rahatsızlıklarına ve duruş bozukluklarına neden olmaktadır. Tekstil ürünlerinde meslek hastalıklarına karşı kimyasal risklere de (boya, toz, solvent vb.) tedbir alınmalıdır. Tekstil sektörü kimyasal ürünlerin yoğun kullanılması, aydınlatma ve termal konfor gibi fiziksel risklerin de yoğun olduğu bir sektördür. Hijyen ve kalabalık bir çalışma alanında çalışılmasından ötürü biyolojik risklerden de bahsedilebilir. Tekstil endrüstrisinde işitme kaybı gibi sağlık problemleri de dahil olmak üzere, sağlık açısından birçok tehlike barındırmaktadır. Tekstil sektöründe iş kazaları ve meslek hastalıklarının önlenmesi kapsamında alınacak tedbirler, çok büyük maddi harcamalara gerek kalmadan basit önlemlerle veya yöntemlerle (örneğin; maske kullanımı, korucu kıyafet-teçhizat kullanımı, uyarı ve ikaz işaretlerinin belirgin olması, denetim ve kontrol işlemleri, makine ve teçhizatların kullanım kılavuzlarının okunması, eğitim eksikliklerinin giderilmesi gibi) birçok iş kazasının-meslek hastalığının meydana gelmesi önlenebileceği bulgularına değinebiliriz.Hiremath ve ark. (2014) de, çalışanların çoğunun solunum problemleri, kas tonusunda artış, göz problemleri ve kas-iskelet sistemi sorunlarından etkilendiğini bulgularını elde etmişlerdir. Ayrıca iş güvencesinin veya düzenli çalışmanın, çalışanın uzun vadede vücut sağlığını da olumlu yönde etkilediğini gözlemlemişlerdir. Ancak, endüstriyel tesisler, çalışma ortamı ve iş sağlığı ve güvenliği yönergelerine ilişkin talimat ve prosedürleri içeren Hindistan Fabrikalar Yasası (OHSAS 18001/ ILO-OSH 2001) uyarınca önlemlerin benimsenmesi ve uygulanmasına yeterince sağlanmadığını ifade etmişlerdir.

Akşit ve Gür (2022)' de iş sağlığı ve güvenliği çerçevesinde verilmesi gereken eğitimler üzerine yapmış oldukları çalışmada mesleklere özgü olan nitelikli eğitimlerin verilmesi gerektiği hususu öne çıkmaktadır. Yapılan çalışmada hazırlanan form işyerlerinin tehlike sınıfı ve üretim sürecini de dikkate almak gerektiği sonucuna erişilmektedir. Böylece sektör bazlı eğitimlerin verilmesi daha etkili olacağı bulgusu ortaya çıkmaktadır.Kumie ve ark. (2016) da, Mevcut hızlı ekonomik gelişmenin Etiyopya dahil gelişmekte olan ülkelerdeki işyerlerinde değişikliklere yol açtığına değinmişlerdir. Etiyopya'daki işyerlerinde iş sağlığı hizmetlerinin boşlukları ve ihtiyaçları hakkında sınırlı bilgi bulunduğunu, İş sağlığı ve güvenliği hizmetlerinin organizasyonu, sanayileşme bağlamında çalışan sağlığına yönelik artan talepleri karşılayacak kadar dayanıklı olmadığını ifade etmişlerdir.Khan ve ark. (2015), Solunum yolu hastalığı semptomlarının (ateş, nefes darlığı, göğüste sıkışma ve öksürük) yaygınlığı genellikle pamuk endüstrisinin dokuma bölümünde en yüksek olduğu ifade etmişlerdir. Pakistan'da pamuk endüstrisinde işçilerin farklı mesleki tehlikelere maruz kaldığı kötü çalışma koşulları hala mevcut olduğu ve küçük dokuma fabrikalarından (elektrikli tezgahlar) daha fazla sağlık belirtisinin olduğu bildirilmiştir. Bu endüstriyel sektörde iş sağlığı ve güvenliği konusunda, özellikle elektrikli tezgahlara odaklanılması konusunda ciddi iyileştirmelere ihtiyaç olduğuna değinilmiştir.Abraha ve ark. (2018) de, İşe bağlı kas-iskelet sistemi bozukluklarının görülme sıklığının %53,1 olduğu, bunun ise cinsiyet, yaş, hizmet yılı, fiziksel aktivite eksikliği, ayarlanabilir sandalyenin bulunmaması, iş yükü ve yetersiz ışık gibi sorunların sırt ağrısı riskinin artmasına neden olduğuyla ilişkilendirimiştir.Das ve Kathiresan, (2022) de, Hindistan'daki iplik eğirme endüstrileri, kırsal alanlardan vasıfsız işgücünü çekmede çok önemli olan, emek yoğun geleneksel endüstrilerdir. İplik sektörüyle ilgili tehlikeler ve riskler, daha az dikkat edilmesine rağmen diğer sektörlerle karşılaştırıldığında daha ciddidir. Kazaların büyük çoğunluğu hukuki sonuçlara yol açmıyor. İşçiler okuma yazma bilmedikleri için sağlık ve güvenlik prosedürlerinin gerekliliğinden habersizler. Ayrıca İSG'nin (iş sağlığı ve güvenliği) benimsenmesindeki zorluklar nedeniyle, yönetim bunu teşvik etmeye yüksek öncelik vermemektedir. İplik endüstrileri bir takım güvenlik ve sağlık sorunlarıyla ilgilenmektedir. Das ve Kathiresan, (2022) bu çalışmalarında Hindistan'daki iplik endüstrileriyle bağlantılı olarak bu zorlukların her birini ve bu zorluklara yönelik potansiyel çözümleri incelemeyi amaçlamaktadır.

5. Sonuçlar

Tekstil alanı sürecinden geçen her bir ürünün yıkanması ve içerisinde kullanılan kimyasalların türüne göre kullanım kılavuzlarında bu hususların bulundurulması önerilir. İçerisinde yer alan kimyevi maddelerin sebebiyet verebileceği hususlar hakkında tüketiciler bilgilendirilmelidir. Yetkili bir devlet kurumu tarafından denetimlerinin yapılması ve CE-TSE gibi belgelendirme işlemlerinin tamamlanmadan piyasa arzının engellenmesi tavsiye edilir. Kâr amacı ile satılan bu ürünlerin denetimi, eğitim almış yetkili, liyakatlı ve bağımsız personeller tarafından yapılmalıdır. Fabrika, atölye, hastane, otel ve ev gibi ortamlar başta olmak üzere tekstil atığının meydana geldiği ve tüm tekstil ürünlerinin kullanılamaz duruma gelmesi durumunda hem çevre sağlığı hem de gereksiz harcama ve tüketimin önüne geçmek için şekil 1'de görsel hale getirilen süreçte geri dönüşüm kaynaklarının tam olarak kullanılması önerilir.

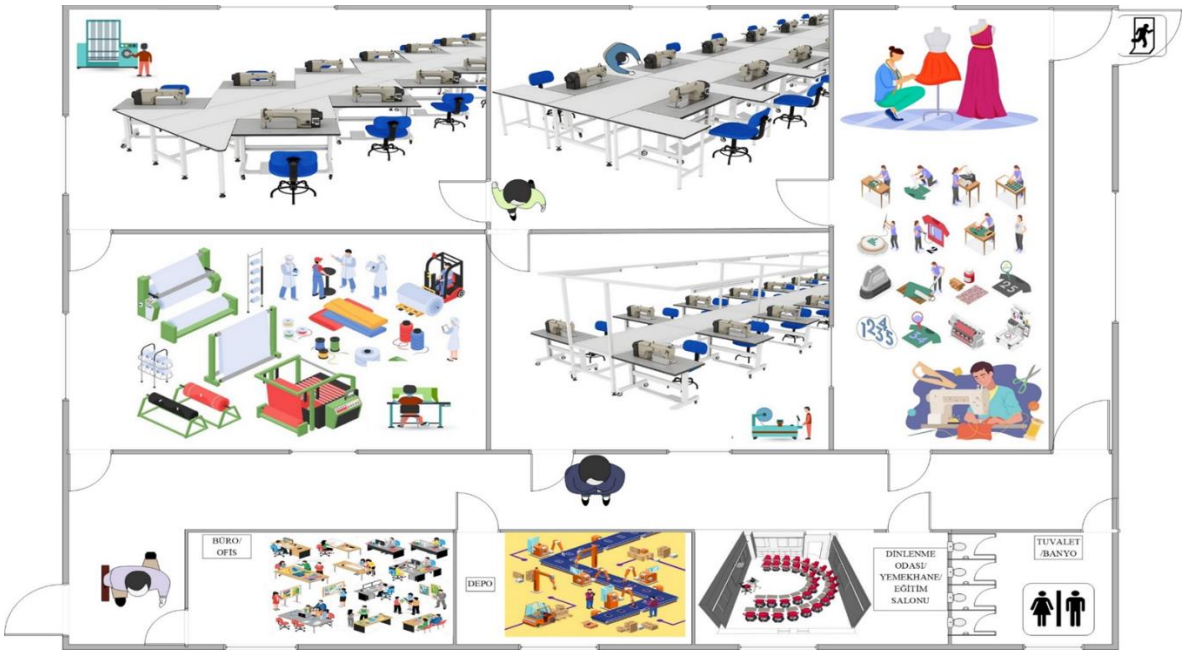


Şekil 1. Tekstil Ürünlerinin Geri Dönüşüm Süreci

Yeterli vasıflara sahip sınırlı insan gücünün mevcut olduğu sektörlerden olan tekstil sektöründe iş güvenliği, sağlık hizmetleri ve ilgili hastalıkların durumunu araştırmak için İleride yapılması

öngörülen çalışmalar için yapılandırılmış bir kontrol listesinin hazırlanarak kullanılması önerilebilir.

Şekil-2: Tekstil atölyesinin çalışma sürecini ve riskleri bir bütün olarak görmek için hazırlanan temsili görsel (URL: 1,2,3)



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GELENEKSEL YIĞMA TAŞ KİREÇ YAPILARIN ONARIMI

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Özet
Dayanıklılığı ve ekonomikliği nedeniyle duvarcılık, antik çağlardan günümüze kadar sadece yapılarda değil, taş kuleler ve kaleler gibi birçok yapıda da kullanılmıştır. Tarihi ve geleneksel harçların çoğu kireçle yapılmıştır. Kireç harçları doğası ve işlevi gereği hava koşullarına maruz kalır ve değiştirilmesi gerekir. Portland çimentosunun geleneksel yapı malzemelerine karşı kimyasal ve fiziksel bağlayıcılığı düşüktür. Bu durum tarihi yapıların restorasyonunu ve doğal taşın kullanıldığı modern rustik mimariyi engellemektedir. Kireç bağlayıcı teknolojileri birçok bina koruma projesinde önemli bir rol oynamaktadır. Bu tür bağlayıcılar, tarihi binalardaki çok çeşitli inşaat teknolojilerinde yaygın olarak kullanılmaktadır ve bunlar arasında beton, harç, sıva, kireç ve harçlar yer almaktadır. Doğru bakım uygulamaları, yeniden oluşturulan bileşenlerin performansını garanti etmek ve iyi çalışan parçalara zarar gelmemesini sağlamak için güçlendirme malzemelerinin uygun şekilde kullanılmasını gerektirir. Tarihi binaların hassas onarımı, müdahale sonrasında daha yüksek düzeyde uyumluluk ve özgünlük sağlamak için her zaman, yapılarını oluşturan yerel malzemelerin anlaşılmasını gerektirir.
Anahtar kelimeler: Geleneksel yapılar, restorasyon, yığma taş, kireç

REPAIR OF TRADITIONAL MASONRY STONE LIME BUILDINGS

Abstract
Due to its durability and economy, masonry has been used not only in buildings from ancient times to the present day, but also in many structures such as stone towers and castles. Most historical and traditional mortars are made with lime. Lime mortars, by their nature and function, are subject to weathering and need to be replaced. Portland cement has low chemical and physical binding to traditional building materials. This situation prevents the restoration of historical buildings and modern rustic architecture using natural stone. Lime binding technologies play an important role in many building conservation projects. Such binders are widely used in a wide range of construction technologies in historic buildings and include concrete, mortar, plaster, lime and mortars. Proper maintenance practices require the proper use of retrofit materials to guarantee the performance of rebuilt components and to ensure no damage to well-functioning parts. Precision restoration of historic buildings always requires an understanding of the local materials that make up their structures, in order to ensure a higher level of compatibility and authenticity after intervention.
Keywords: Traditional buildings, restoration, masonry stone, lime

Sürdürülebilir binalar bağlamında duvarcılık

Herhangi bir yapının en etkili ve önemli bileşeni duvardır. Kolezyum, antik Yunan ve Roma'dan kalma binalar, Orta Amerika binaları ve Miken yapılarının tümü bu malzemeyi ana yapı unsurlarından biri olarak kullanmıştır. En eski biçim düzensiz şekilli taşlardan oluşan kuru duvarcılıktır. Masif duvarın çevresel kontrol kapasitesinin yanı sıra, çevre üzerinde düşük etkiye sahip bir onarıcı malzeme olarak duvar işçiliğinin ekolojik nitelikleri, sürdürülebilirlik konusundaki güncel kaygılar bağlamında, duvar işçiliğini sürdürülebilir bina mimarlığı için uygun bir malzeme olarak tekrar dikkatleri üzerine çekmektedir (Almssad ve ark., 2022).Duvar, birimlerden ve bağlantı noktalarından oluşan heterojen bir malzemedir. Birimleri tuğla, blok, kesme taş, kerpiç, düzensiz taşlar ve diğerleridir. Harç, kil, bitüm, tebeşir, kireç/çimento bazlı harç, yapıştırıcı veya başka bir madde olabilir. Birimlerin geometrisi, doğası ve düzeninin yanı sıra harçların özelliklerinden kaynaklanan çok sayıda olası kombinasyon, “kagir” teriminin doğruluğu konusunda şüpheler uyandırmaktadır. Bununla birlikte, farklı duvar türlerinin mekanik davranışı genel olarak ortak özelliklere sahiptir: yüksek özgül kütle, düşük çekme ve kesme mukavemetleri ve düşük süneklik (kırılgan davranış). Genel olarak antik yığma yapılar, depremlerin neden olduğu yüksek eylemsizlik yükleri dikkate alınmadan düşey statik yükler (basınç davranışı) için tasarlanmıştır (Lourenço ve ark., 2011).Teknik olarak "Duvarcılık", belirli bir düzende döşenen ve harçla birleştirilen duvar birimlerinin bir araya getirilmesidir. Donatılı duvar olarak kabul edilecek kadar yeterli takviye içermeyen bir duvar "donatısız duvar"dır. Çubukların veya ağın harç veya betona gömüldüğü ve böylece tüm malzemelerin etkilere karşı birlikte direnç gösterdiği duvarcılık "güçlendirilmiş duvarcılık"tır. "Öngerilmeli duvar", gerilmiş takviye ile kasıtlı olarak iç basınç gerilimlerinin oluşturulduğu bir duvardır. "Sınırlı yığma", dikey ve yatay yönde betonarme veya güçlendirilmiş yığma sınırlayıcı elemanlarla donatılmış bir duvardır. "Duvar bağı", ortak eylemi gerçekleştirmek için duvardaki birimlerin düzenli bir düzende yerleştirilmesidir. Bir "yığma birim", yığma inşaatta kullanılması amaçlanan, önceden oluşturulmuş bir bileşendir. "Duvar harcı", duvar işçiliğinin yataklanması, birleştirilmesi ve sivriltilmesi için bir veya daha fazla inorganik bağlayıcı, agrega ve su karışımı ve bazen ilaveler ve/veya katkılardır (AB Direktifi (2004). Harç, bina teknolojisi açısından temel öneme sahiptir. Duvar birimlerini birbirine bağlamak ve inşaat sürecini kolaylaştırmak için kullanılır. Harçların yapışkanlığı artırma ve sağlam yapılar oluşturma kapasitesinden yararlanmak için çeşitli inşaat teknikleri geliştirilmiştir. Alçı harçları, yapışma özellikleri ve çabuk sertleşmeleri nedeniyle çeşitli avantajlar sunar. Alçıtaşı açısından zengin bölgelerde yapısal bağlayıcı madde olarak kullanımları gelişmiş ve özellikle tonoz yapımında

önemli olmuştur. Kireç harçları, özellikle mekanik direnç ve nemli koşullara dayanıklılık açısından alçı harçlara göre farklı avantajlar sunuyordu. Kireç harçlarının yoğun kullanımı antik Romalılar dönemine denk gelir ve en önemli bağlayıcı malzeme olarak yüzyıllar boyunca kullanılmıştır. Kullanımları, on dokuzuncu yüzyılda Portland çimento harçlarının piyasaya sürülmesine kadar devam etmiştir (Vitti, 2021).

2. Kireç harcı

Kalsiyum karbonatın çökelmesi topraklarda (özellikle kurak bölgelerde) ve regolitlerde yaygındır. Kalkerli gözenekli kil aynı zamanda dünyanın kurak bölgelerinde de bulunur. Tuğla duvarlar genellikle yapıların dış duvarlarını, korkulukları, iç bölmeleri, bağımsız duvarları, istinat duvarlarını ve diğer dikey yapı elemanlarını oluşturmak için kullanılır. Duvar işçiliğini kısaca tuğlayla inşa etme sanatı olarak tanımlayabiliriz. Bu, biri tuğla olmak üzere iki tür duvar işçiliği olduğunu ima eder. Derzleri doldurmak ve duvar inşa etmek için kil ve çimentonun kullanıldığı kil işi ve çimento işi olarak daha alt kategorilere ayrılabilir. Duvarın gücü, üzerindeki yapısal elemanların uyguladığı yükü destekleme yeteneğidir. Buna karşılık yatay yükleme altında konumunu koruyabilmesine stabilite denir. Yüklerin duvarlara uygulanması iç gerilimlere ve deformasyonlara neden olur. Harç ve tuğlanın tipi, duvar malzemelerinin şekli ve boyutu, harç katmanlarının kalınlığı ve yoğunluğu birlikte duvar işçiliğinin gücünü belirler (Almssad ve ark., 2022).Kireç, çok sayıda kategori ve alt kategori olmasına rağmen, kalsiyum hidroksite verilen genel addır. Binalarda farklı uygulamalar için farklı türdeki kireçler kullanılabilir ve spesifik fiziksel özellikleri ve performans özelliklerine göre seçilirler. Kireç harcının özellikleri, onu üretmek için kullanılan kireç bağlayıcının doğasına ve ayrıca karışıma katılan katkı maddelerinin etkilerine bağlıdır (Snow ve Torney, 2014). Kireç harcı, bağlayıcı olarak kullanılan kireç ve agreganın (normalde nehir kumu ve su) bir karışımıdır. Kireç harçları çok eski çağlardan beri yapı malzemelerinde kullanılmaktadır. Bunların kullanımının ilk örnekleri Filistin ve Türkiye'de bulunmuş ve M.Ö. 12.000 yıllarına kadar uzanmaktadır. Daha sonra Antik Yunan ve Roma İmparatorluğu'nda rastlanılmaktadır (Degryse ve ark., 2002; Genestar & Pons, 2003; Maravelaki-Kalaitzaki ve ark., 2003).'Yağlı kireç' veya 'hidrolik olmayan kireç' olarak da adlandırılan havada sönmüş kireçler iki kategoriye ayrılabilir: kalsiyum kireci ve dolomitik kireç ve bunların spesifik kimyasal bileşimlerine ilişkin başka alt bölümler. Bu kireçler, 'saf' olduğu kabul edilen, yani herhangi bir silikat veya alüminat 'kirliliği' içermeyen kireçtaşının yakılmasıyla oluşan doğal kireçlerdir. Kalsiyum kireçtaşından oluşan kalsiyum kirecinin aksine, dolomitik kireç, kalsiyumun bir kısmının magnezyum ile değiştirildiği bir kireç taşı olan dolomitin (magnezyum kireçtaşı) yakılmasıyla oluşur. Bu tip

kireçtaşı, kalsiyum kireçtaşından daha düşük bir yanma sıcaklığı gerektirir. Bunun dikkate alınmaması, aşırı yanmış sönmemiş kirecin oluşması riskini arttırır, bu da sönme ve olgunlaşma sürelerini uzatabilir. Sönmemiş kirecin gecikmiş hidrasyonu, harcın döşendikten sonra genleşmesine ve dolayısıyla başarısızlığa yol açabilir. Havada sönmüş kireç bir harç içinde kullanıldığında yalnızca karbonatlama ve kurutma yoluyla sertleşir. Bu reaksiyonun ilerlemesi için havadaki karbondioksit gereklidir. Az miktarda nem de gereklidir ki harçtaki ve havadaki nem genellikle yeterlidir. Havada sönmüş kireçler ıslak koşullarda sertleşemez ve duvarın kalıcı olarak doymuş kalması, uzun süre doygunluğa maruz kalması veya su altında kalması muhtemel durumlarında kullanılmamalıdır. Havada sönmüş kireç üç fiziksel formda mevcuttur: taş kireç, kuru sönmüş kireç tozu ve sulu kireç macunu. Sönmemiş kireç (topak kireç olarak da bilinir), kireçtaşının bir fırında yakılmasının ürünüdür. Sönmemiş kireç, diğer kireç türlerini (hidratlı kireç, kireç macunu) üretmek için gerçekleştirilebilecek sonraki değişiklikler/işlemlerden önce fırından çıkarılan malzemedir. Sönmemiş kireç, dikkatle kullanılması gereken oldukça reaktif bir malzemedir. Erken sönmeyi önlemek için kuru ve hava geçirmez kaplarda saklanmalıdır (Snow & Torney, 2014).Sönmüş kireç (aynı zamanda torbalı kireç, inşaat kireci veya kuru hidrat olarak da adlandırılır), kuru bir toz üretmek için sönmemiş kirecin yeterli suyla söndürülmesiyle üretilen bir kireçtir. Doğru şekilde saklanmadığı takdirde, havadaki karbondioksit ve nem nedeniyle sönmüş kireç hala torbanın içindeyken karbonatlaşmaya başlayabilir. Bu haldeki kireç kullanılmamalıdır. Sönmüş kireç, yine kuru toz formunda da temin edilen 'hidrolik kireç' ile karıştırılmamalıdır. Sönmüş kireç, malzemenin işlenebilirliğini arttırdığı için çimento harçlarında sıklıkla 'plastikleştirici' olarak kullanılır. Bir çimento karışımına sönmüş kirecin eklenmesi, ortaya çıkan ürünü bir 'kireç harcı' haline getirmez, bunun yerine kireçle işlenmiş bir çimento karışımı haline getirir (Snow ve Torney, 2014). Kireç macunu (yağlı kireç olarak da bilinir), sönmemiş kirecin aşırı su içinde söndürülmesiyle üretilir. Kireç macunu tamamen söndürülür ve genellikle kireç harcında kullanılmadan önce en az 48 saat "şişmesine" izin verilir. Macunun olgunlaşması veya "şişmesi" zamanla giderek daha ince kireç parçacıklarının oluşmasıyla sonuçlanır (Hansen ve ark., 2000).Macunu tüm kireç türleri arasında en yumuşak, geçirgen, esnek ve işlenebilir hale getiren de bu işlemdir. Macun genellikle kuru hidratlı kireçlere göre daha üstün bir ürün olarak kabul edilir. Kuru hidratın fazla su ile söndürülmesi yoluyla kireç macunu elde edilmesi uygulaması tavsiye edilmez. Bu, sönmemiş kireçten oluşan kireç macununa göre daha düşük özelliklere sahip bir malzemenin oluşmasıyla sonuçlanır. Tarihsel olarak inşaat işlerinde kullanılan harçlar ya sıcak kireç karışımları ya da kireç macun karışımları olarak hazırlanırdı.

Torbalanmış sönmüş kireç (toz halinde), öncelikle ölçülü çimento harçlarında plastikleştirici olarak kullanılan daha yeni bir üründür (Snow & Torney, 2014).

Yığma duvarları değerlendirme testleri

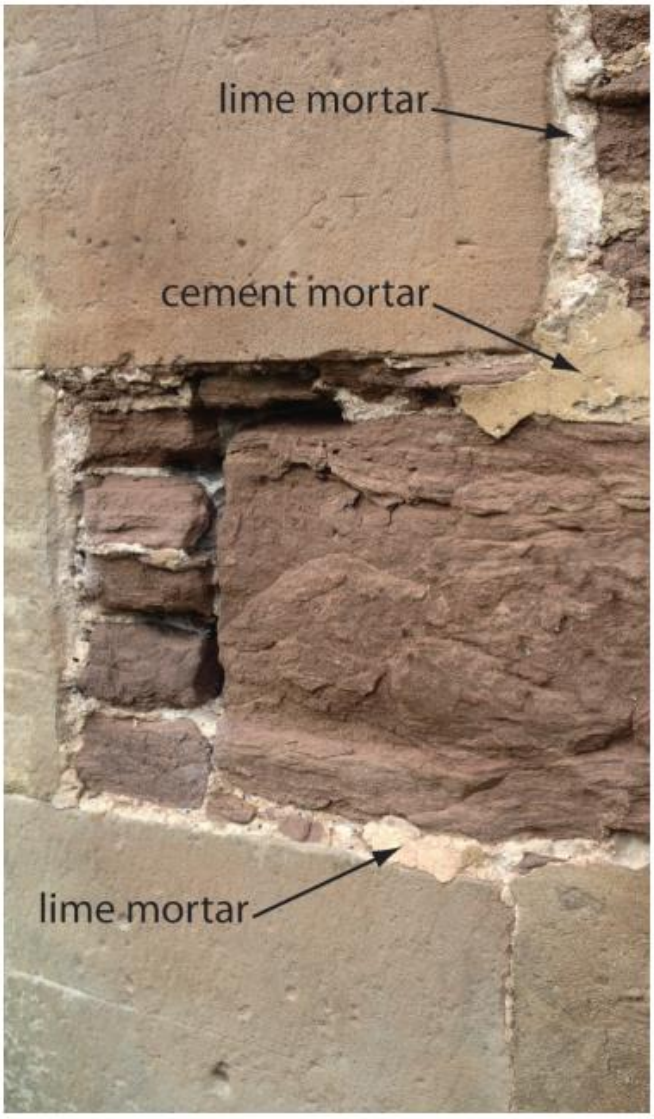
Duvarcılık, genellikle harç veya bloklar arasındaki sürtünme kuvvetleri aracılığıyla birbirine sağlam bir şekilde yerleştirilen ve birbirine bağlanan bireysel birimlerden oluşan yapıların inşasıdır. Betonun gelişmesinden önce, 19. yüzyıla kadar en dayanıklı mimari form duvarcılıktı. Ancak kullanılan malzemeler, işçiliğin kalitesi ve birimlerin yerleştirildiği desen, genel yığma yapının dayanıklılığını güçlü bir şekilde etkileyebilir. Duvar işçiliğinin direnciyle ilgili çok sayıda parametre vardır: bileşen malzemeleri, birimlerin az çok düzenli geometrisi, bunların yerleştirilme şekli, harç derzlerinin kalınlığı, duvar elemanının farklı yaprakları arasındaki bağlantı vb. (Garcia ve ark., 2012). Her bir tipolojinin tanımı, coğrafi konumuna, dönemine, orijinal amacına ve ekonomik gücüne dayanmaktadır. Bu nedenle, farklı yığma inşaat teknikleri, yapıyı güçlendiren veya zayıflatan çeşitli faktörler sunar. Düzensiz taş duvarcılık durumunda kesinlikle çok zor olan duvar işçiliğinin nihai mukavemetini ve deforme olabilirliğini tahmin etmeye yönelik tüm bu çabalara rağmen, daha kesin değerler yalnızca belirli bir duvar işçiliğinin önemli ve temsili hacimleri üzerinde yapılan, aynı düzen ve geometrik oranlarda yapılan testlerden elde edilebilir (Oliveira, 2003). Bu verileri elde etmek için tam boyutlu testler yapılabilir, ancak tam boyutlu test programları genellikle çok pahalıdır ve bazı durumlarda diğer sınırlamalar nedeniyle pratik değildir. Daha büyük boyutlu numunelerin çıkarılması genellikle çok zordur, hatta kültürel miras anıtları söz konusu olduğunda imkansızdır. Geçmişte prizma testinin uygun maliyetli olduğu ve tam boyutlu testlerle bir dereceye kadar korelasyon sağladığı kanıtlanmıştır (Garcia ve ark., 2012). Avrupa Standartları (Eurocode 6 - Yığma yapıların tasarımı - Bölüm 1-1: Güçlendirilmiş ve takviyesiz yığma yapılar için genel kurallar) ayrıca bu test yönteminin, duvar elemanının basınç dayanımını ve elastiklik modülünü yansıttığını da belirtir.Bütün yığma duvarların davranışının laboratuarda tahribatlı testler yoluyla değerlendirilmesinin çeşitli yolları vardır. Orijinal yapıdan kesilmiş büyük numuneler veya çekirdekler, yeniden oluşturulmuş duvarların numuneleri, yığın bağ prizmaları ve/veya laboratuvarda inşa edilen ölçekli duvarlar numune olarak kullanılmaktadır. Monotonik veya döngüsel yükler kullanılarak, eksenel yer değiştirme veya yük izlenerek ve farklı sınır koşulları uygulanarak bu tür numuneler üzerinde hem malzeme hem de yapısal testler yapılabilir. Tüm bu olasılıklar, duvar özellikleriyle birlikte bir hasar modunu tanımlayacaktır. Duvar prizmalarında basınç dayanımı deneyleri kolaylıkla yapılabilir. RILEM test numunesi (RILEM, 2004) gibi yığın bağ prizmaları, duvarın tek eksenli

basınç dayanımını değerlendirmek için sıklıkla kullanılır. Tek eksenli sıkıştırma ile yüklenen istiflenmiş bir prizmada, harç, ilgili elastik özelliklerinden dolayı, taşa göre yanal olarak daha fazla genleşme eğilimindedir. Taş ve harç arasındaki uyum ve sürtünme ile sağlanan süreklilik, harcın yanal hapsolmasına yol açar. Sonuç olarak, harç-taş ara yüzeyinde kayma gerilmeleri gelişir ve harçta üç eksenli bir basınç gerilimi durumu ve taşta tek eksenli sıkışma ile birlikte iki taraflı gerilim meydana gelir. Sonuç olarak başarısızlık durumu genellikle taşlarda yükleme yönüne paralel çatlakların oluşması nedeniyle meydana gelir (Oliveira ve ark., 2006).Genestar & Pons, (2003) tarafından İspanya'da Palma de Mallorca'daki saray, manastır ve konaklardan alınan İslami, Gotik ve daha sonraki dönemleri içeren tarihi harçların analizi yapılmıştır. Enerji dağılımlı X-ışını spektrometresine (EDX) bağlı taramalı elektron mikroskobu (SEM), Fourier dönüşümü kızılötesi spektroskopisi (FTIR) ve X-ışını kırınımı (XRD) teknikleri, analiz edilen numunelerin morfolojisini ve analitik bileşimini karakterize etmek için kullanılmıştır. Genel olarak kaplama sıva harçlarının düşük oranda küçük boyutlu agrega içerdiği görülmüştür. İncelenen kaplama sıva harçlarının büyük çoğunluğu kireç harcı grubuna aittir. Karışık alçı-kireç harçları arasında bulunan kalsit-alçıtaşı oranları, eski eserlerde belirtilen oranlarla iyi bir uyum içindedir. 11. yüzyıl analitik kompozisyonu ile 15. yüzyıl kireç harçlarının karşılaştırılmasında herhangi bir farklılık görülmemiştir. Alçı bakımından zengin harçların kalsit harçlarından çok daha sert ve kompakt olduğu bulunmuştur. Sonuçlar, karışık ve kireçli harçların kullanıldığını, dolayısıyla kullanılan harcın türü ile yaşı arasında bir ilişki kurmanın mümkün olmadığını göstermiştir. Boyalı harçlarda çok renklilik de incelenmiştir. Bulunabilen en yaygın pigmentler doğal topraklar olmuştur.

Tarihi yığma yapı restorasyonu

Dünyanın her yerindeki hem mimari anıtlarda hem de şehir merkezlerinde birçok tarihi yapıda duvar işçiliği kullanımı çok yaygındır. Bu duvarcılık genellikle farklı tipolojilerle karakterize edilen çeşitli ve çok zayıf malzemelerden yapılmıştır. Bu heterojen malzemenin kırılganlığı, günümüzde insan yaşamının korunmasına yönelik yapısal tasarımın güvenlik ilkelerini oluşturan enerji dağıtımına dayalı süneklik kriterleriyle çatışmaktadır (Angiollilli ve Gregori, 2020). Sismik hareketlerin yol açtığı felaketler, antik çağlardan modern çağa kadar takviyesiz duvarların kullanımını engellemiştir. Güçlendirme sistemlerinin benimsenmesinin, geleneksel depreme dayanıklı ahşap çerçeveler gibi ilkel uygarlıkla başladığını söylemek yeterli olacaktır (Aloisio ve ark., 2019).Yığma yapılar için kireç harçlarının seçimi, bir onarım veya yeni inşaat projesinin önemli bir bileşeni olabilir. Karar verme sürecinde dikkate alınması gereken değişkenlerin sayısı ve materyallerin algılanan doğal karmaşıklığı nedeniyle bu seçimin zor

olduğu düşünülmektedir. Dayanıklılığa ilişkin nispeten yeni üretilmiş çeşitli veri setlerinin kullanılması, kireç harçlarının uygun seçimine yardımcı olabilir. Ancak bu belirleyicilerin, maruz kalma seviyelerinin, bina detaylarının ve nem tutma performansının geleneksel değerlendirmesiyle ilişkilendirilmesi gerekir. Bu harçların seçim sürecinin iyileştirilmesini sağlamak için mevcut yapının yapı durumu araştırması esastır (Forster ve Carter, 2011). 21. yüzyıla kadar inşaatlarda sürekli olarak kireç harçları kullanılmıştır. 19. yüzyılın ikinci yarısında Portland çimentosunun ortaya çıkışı, kireç harçlarının kullanımında önemli bir düşüşe yol açmıştır; çünkü çimento, hızlı prizlenme süresi ve yüksek mekanik direnç gibi bazı önemli avantajlar sunuyordu. Son yıllarda Portland çimentosunun bazı yetersiz özelliklere sahip olduğu ve pek çok doğal taşla uyumsuz olduğu keşfedilince, tarihi binaların restorasyonunda kireç harçlarının kullanımı yeniden canlanmıştır (Moropoulou ve ark., 2005). Kalsiyum sülfatlar ve sodyum tuzları gibi çözünür tuzlar bazen Portland çimentosunda bulunur ve zamanla sızabilir. Bu meydana gelirse, yakın çevresindeki malzemelere hızla zarar verebilir. Kireç harçlarıyla ilgili gelenek ve teknikler, sanayi devriminden sonra birçok batı ülkesinde neredeyse tamamen kaybolmuştur. Ayrıca, restorasyonlarda ve doğal taşın kullanıldığı modern mimaride çimento esaslı harçların kullanımının dezavantajlarına rağmen kireç harçlarının yeni kullanımları, Portland karışımlarıyla aynı şekilde işlendiğinden her zaman başarılı olmamıştır. Antik çağlarda ve aslında 19. yüzyıla kadar kirecin özelliklerini iyileştirmek ve değiştirmek için birçok farklı katkı maddesi karıştırılmıştır. İyileştirilmek istenen bu özellikler arasında sertleşme süresi, yapışma, geçirimsizlik ve sertlik sayılabilir. Bu karışımlar, kireç harçlarının modern "yeniden keşfi" sırasında tamamen kaybolmuş, reçineler ve sentetik organik malzemeler içeren ticari karışımlar ise eski tekniklerin geleneksel uygulamaları etrafında çokça "gürültülü" şekilde piyasaya çıkmıştır (Ventola ve ark., 2011).Hem kireç hem de çimento harçları uygun şekilde kullanıldığında iyi performans gösterebilir. Çoğu durumda, geleneksel olarak inşa edilmiş yığma yapıların onarımı için kireç harcı gerekli olacaktır. Uyumsuz harçların kullanılması duvar çürümesinin hızlanmasına ve nem sorunlarına yol açabilir. Uygun becerilere sahip bir bina danışmanı veya taş ustası, önlenebilir duvar çürümesinin ve ilgili sorunların önlenmesi amacıyla doğru malzemelerin kullanıldığından emin olmak için herhangi bir koruma çalışmasında erken bir aşamadan itibaren onarım malzemelerinin belirlenmesi sürecine dahil edilmelidir (Mitchell & Torney, 2015).



Şekil 1. Başarısız çimento kaplamasında kopmanın alttaki orijinal kireç harcını ortaya çıkarması durumu (Mitchell & Torney, 2015).

Fiber bazlı güçlendirme sisteminin geliştirilmesi, beton malzemenin sünekliğini arttırmak için çelik fiberlerin eklenmesi potansiyelinin fark edildiği 1960'lı yıllarda başlamıştır. Ancak bu teknoloji, harç enjeksiyonu, güçlendirilmiş delme ve betonarme sıva gibi geleneksel sistemlere alternatif olarak ancak son on yılda yığma yapıların güçlendirilmesi için yaygın olarak benimsenmiştir. Gerçekten de, tarihi yapıların korunmasına ilişkin katı kurallar nedeniyle, koruma komiteleri genellikle tarihi yapıları korumak için yapısal olarak verimli ancak daha az müdahaleci teknikler talep etmektedir. Mevcut yapılara modern ve yenilikçi müdahale çözümleri arasında, Fiber Takviyeli Polimerler (FRP) veya Fiber Takviyeli Çimentolu Matris (FRCM) gibi kompozit malzemeler, Hem modern hem de tarihi yığma yapıların (binalar, köprüler, kuleler) ve yapısal bileşenlerin (duvarlar, kemerler ve tonozlar, sütunlar ve sütunlar)

güçlendirilmesi ve onarımı için giderek daha fazla dikkate alınmaktadır. Bu teknolojiler, tek veya çift yönlü uzun liflerle karakterize edilen kompozit malzemenin kullanımından oluşur. Bu malzemelerin, yığma elemanların yük taşıma kapasitesinin arttırılmasında ve kritik gevrek kırılma modlarının azaltılması yoluyla yapısal davranışlarının iyileştirilmesinde etkili olduğu kanıtlanmıştır. En önemlisi, geleneksel olanlara (örneğin betonarme sıva) kıyasla, yapısal ağırlık artışının daha düşük olmasıyla mukavemet artışı elde edilir (Angiolilli ve ark., 2020).

FRP teknolojisi laminat ve çubukların uygulanmasından oluşur. Laminatların kullanımı, önceden kumlama ve macunlama prosedürüyle hazırlanmış olan yığma panellerin yüzeyine fiber levhaların manuel olarak döşenmesi yoluyla uygulanmasını içerir. Elyaflar, sertleştikten sonra yeni oluşturulan laminatın güçlendirilmiş elemanın ayrılmaz bir parçası haline gelmesini sağlayan bir epoksi reçine ile emprenye edilir. Öte yandan, pultruzyon çubukların kullanımı, bunların güçlendirilecek elemanın yüzeyinde kesilen oluklara yerleştirilmesinden oluşur. Oluk, epoksi bazlı bir macunla doldurulur ve daha sonra çubuk oluğun içine yerleştirilir ve macunun çubuğun etrafında akmasını sağlamak için hafifçe bastırılır. Daha sonra oluk daha fazla macunla doldurularak yüzey düzeltilir (Tumialan ve ark., 2001).Tarihi yapıların restorasyonunda genellikle duvar harcının değiştirilmesi veya onarılması gerekir, ancak uygun harcın seçimi genellikle sorunludur. Uygunsuz bir seçim, restorasyon çalışmasının başarısız olmasına ve belki de daha fazla hasara yol açabilir. Bu nedenle, orijinal harç teknolojisinin tam olarak anlaşılması ve uygun yedek malzemelerin üretilmesi önemli araştırma hedefleridir. Duvar harçlarında yıllar içinde pek çok çeşit malzeme kullanılmış ve teknoloji, eski zamanların tek bileşenli harcından, çeşitli bileşenler içeren hibrit versiyonlara doğru yavaş yavaş gelişmiştir. Avrupa'da M.Ö. 2450'den itibaren kireç duvar harcı olarak kullanılmaya başlandı. Roma döneminde kireç harcına öğütülmüş volkanik kül, tuğla tozu ve seramik parçacıkları eklenerek performansı büyük ölçüde artırıldı. Üstün özellikleri nedeniyle bu hidrolik (yani su altında priz alabilen) harcın kullanımı tüm Avrupa'da ve Batı Asya'da yaygınlaşmış ve benimsenmiştir. Belki de antik Çin'de volkanik kül gibi doğal malzemelerin bulunmamasından dolayı hidrolik harç teknolojisi gelişmemişti. Ancak özel bir inorganik-organik kompozit yapı malzemesi olan yapışkan pirinç-kireç harcı geliştirilmiştir. Bu teknoloji, mezarlar gibi binalarda, kentsel inşaatlarda ve hatta su koruma tesislerinde yaygın olarak kullanılmıştır. Yapışkan pirinç-kireç harcı, dünyada yaygınlaşan ilk inorganik-organik kompozit harç teknolojisi haline gelebilir (Yang ve ark., 2010).Yeterli miktarda boşluk içeren çok parçalı taş yığma duvarlara harç enjeksiyonu, bu tür duvarların sismik güçlendirilmesi için etkili bir teknik olabilir. Çimento-kireç enjeksiyonu kombinasyonu kullanılarak yeterli düzeyde sismik direnç

elde edilebilir, ancak çimento enjeksiyonu daha yüksek sismik direnç sağlayabilir (Uranjek ve ark., 2012).

1990 yılından bu yana, Roma kenti Sagalassos'ta (Türkiye'nin güneybatısı) Leuven Katolik Üniversitesi (Belçika) tarafından düzenli arkeolojik kazılar yapılmaktadır. Sagalassos topraklarında bulunan mineral hammaddelerin kaynağının araştırılması kapsamında, Sagalassos'taki kireç harçlarının mineralojisi ve petrografisi ayrıntılı olarak incelenmiştir. Uygun bir tamir harcı tasarlamak için numuneler ince kesitler üzerinde optik mikroskopla analiz edilmiş ve ardından XRD analizleri yapılmıştır. Bağlayıcı olarak kullanılan kireç yerel Triyas kireçtaşlarından yakılarak kuru söndürülerek hazırlanmıştır. Üç ana agrega türü tanımlanmıştır: yerel Mesozoyik kireçtaşlarından elde edilen kireçtaşı, yerel olarak üretilen kaba kırılmış seramikler ve yakındaki bir volkanik bölgeden gelen volkanik tüf. Kazıdan çıkan kalıntıları çok sert iklim koşullarında korumak için, restorasyon harcının deneysel karışımları, eski zamanlarda olduğu gibi benzer hammaddeler kullanılarak dayanıklılık ve dona dayanıklılık açısından test edilmiştir. Yerinde daha fazla koruma ve restorasyon için önerilen harç, Isparta bölgesinden gelen kırılmış volkanik kaya ile kireç karışımından oluşmaktadır. Bu bileşim orijinal Roma malzemesine çok benzerdir ve donma-çözülme testlerinde yüksek donma direnci göstermiştir (Degryse ve ark., 2002).Minos'tan günümüze kadar Girit'teki çeşitli dönemlere ait anıtlardan alınan harçlar, deniz ve nemli ortamda dayanıklılıklarını değerlendirmek amacıyla (mineralojik ve kimyasal bileşim, tane büyüklüğü dağılımı, hammaddeler, çekme mukavemeti açısından) Maravelaki-Kalaitzaki ve ark., (2003) tarafından incelenmiştir. Kireç teknolojisi ve hammaddeleri çeşitlidir: (a) kireç, (b) hidrolik kireç, (c) kırma tuğlalı kireç ve (d) puzolanikli kireç malzeme. Bunlar, %22 (puzolanik harçlar) ila %29 (kireç harçları) arasında değişen miktarlarda bağlayıcılar içerir. Kalsiyum silikat/alüminat hidratlar gibi hidrolik bileşikler ve çekme mukavemeti puzolanik harçlarda daha yüksek olup bunu kırılmış tuğla kireci, hidrolik kireç ve kireç harçları takip etmiştir. Kireç harçlarında tespit edilen suda çözünebilen tuzların yüksek miktarları bunların parçalanma riskini göstermiştir. Büyük olasılıkla, hava koşullarına bağlı olarak kalsitin sızması, düşük miktarlarda bağlayıcı malzemeyi açıklamaktadır. Harçların ölçülen çekme mukavemeti değerleri hidroliklik düzeyleriyle doğru orantılıdır. Kireç harçları yerel kalkerli tortul taşların kırılması veya deniz kumu kullanılmasıyla hazırlanmıştır. Bağlayıcılar tamamen karbonatlı, ince kristalize kalsittir. Bu harçlar, ince kumların kullanılmasıyla birlikte ortalama %30 oranında bağlayıcı malzeme sağlar. Ayrıca, bu harçların suda çözünen kısmında tespit edilen yüksek miktarlardaki Ca2+, Cl ve SO42, bunların bozulmaya karşı duyarlılığının yüksek olduğunu göstermektedir. Çalışma, tam kimyasal analiz

sonuçlarının, harçların asitte çözünen/çözünmeyen fraksiyonunun kimyasal analizlerinin ve toplam harçla ilişkili olarak bağlayıcının ağırlık faktörüne ilişkin mineralojik veri bilgilerinin birleştirilerek elde edilebileceğine işaret etmektedir.

5. Sonuç

Kireç, binlerce yıldır duvar harçlarında kullanılmaktadır ve çimentoyla karşılaştırıldığında düşük basınç dayanımına rağmen birçok eski bina, tamamen kireç teknolojisiyle bugün ayakta kalmaktadır. Modern yaklaşımlar, onarım döngülerini ve işçilik maliyetlerini en aza indirmek için daha güçlü ve daha dayanıklı malzemelere yöneliyor ancak bu, geleneksel binaların zararına oluyor. Tarihi duvarların onarımında kullanılan çimento bazlı harçlar, onlarca yıldır makul durumda olan eski binaların çürümesini hızlandırdı. Bu, koruma endüstrisinin kireç teknolojilerini masif yığma binalar için daha uyumlu bir çözüm olarak değerlendirmeye geri dönmesine neden oldu.Fiber bazlı güçlendirme sistemi teknolojisi, mirasın korunması için koruma komitelerinin gerektirdiği giderek daha katı kurallar nedeniyle duvarcılıkta yaygın olarak ancak son on yılda benimsenmiştir. Güçlendirme sisteminin verimliliği güçlendirme çözümünün düşük invazivliği ve orijinal yapılarla yüksek uyumluluk ile birlikte gereklidir.

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ELEKTROOKÜLOGRAFİ İŞARETİNİN ÇOKLU-FRAKTAL DAVRANIŞI

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Özet
Bu çalışmanın amacı, gözlerden kaynaklı elektriksel aktiviteye dayanan bir göz hareketi kayıt tekniği olan elektrookülografi (EOG) işaretinin, çoklu-fraktal davranışını incelemektir. Bu amaçla, elektrookülografi zaman serisinden güç yasası üslerinin çoklu-fraktal spektrumunu belirleyebilen, çoklu-fraktal eğilimsiz dalgalanma analizi isimli yöntem kullanılmaktadır. Elektrookülografi, insan bilgisayar arayüzlerini geliştirmek için kullanılabilecek bir biyomedikal işarettir. Biyomedikal işaretlerin yapısal özellikleri genellikle görsel olarak belirgindir ancak bu yapısal özellikler sinyalin ortalama genliği gibi geleneksel ölçümlerle yakalanamaz. Biyomedikal bir işaret, işaretin alt aralıklarındaki yapılar kendini tekrarladığında ölçekten bağımsız değişmez bir yapıya sahiptir. Fraktal analiz, biyomedikal sinyalin belirli türde ölçekten bağımsız değişmez yapısını tanımlayan güç yasası üssünü tahmin eder. Fraktal analizler, biyomedikal işaret işlemede (EKG, EEG, MR ve X-ışını görüntülerinde) işaretin ölçekten bağımsız değişmez yapısını tanımlamak için sıklıkla kullanılır. Fraktal analiz, sinir hücrelerinin aksiyon potansiyelleri arasındaki aralığı, insan yürüyüşünün adımlar arası aralığı, insan solunumunun nefesler arası aralığı ve insan kalbinin atışlar arası aralıklarının ölçek değişmez yapılarını, sağlıklı ve patolojik durumlar arasında ayrım yapılabilmesine imkan sağlamaktadır. Bununla birlikte, biyomedikal işaretlerin ölçekle değişmeyen yapısında uzamsal ve zamansal farklılıklar sıklıkla ortaya çıkar. Bu uzamsal ve zamansal değişimler, biyomedikal işaretin, güç yasası üslerinin çoklu-fraktal spektrumu tarafından tanımlanan çoklu-fraktal bir yapısını gösterir. Biyomedikal işaretin tek-fraktal ve çoklu-fraktal yapıları, belirli bir ölçekte değişmez yapılardır. En yaygın olarak, biyomedikal sinyallerin tek-fraktal yapısı, tek bir kuvvet kanunu üssü ile tanımlanır ve ölçek değişmezliğinin zaman ve mekandan bağımsız olduğunu varsayar. Bununla birlikte, biyomedikal sinyalin ölçekle değişmeyen yapısında uzaysal ve zamansal farklılıklar sıklıkla ortaya çıkar. Bu uzaysal ve zamansal varyasyonlar, biyomedikal sinyalin, güç yasası üslerinin çoklu-fraktal spektrumu tarafından tanımlanan bir yapısını gösterir. Bu çalışmada, insan deneklerden alınan EOG işareti, çeşitli ölçeklerde çoklu-fraktal eğilimsiz dalgalanma analizi yöntemiyle incelenerek, EOG işaretinin çoklu-fraktal yapısı gösterilmektedir.
Anahtar Kelimeler: Fraktal Analiz, Elektrookülografi, Biyomedikal İşaret İşleme, İnsan-Bilgisayar Arayüzü

MULTI-FRACTAL BEHAVIOR OF ELECTROOCULOGRAPHY SIGN

Abstract
The aim of this study is to examine the multi-fractal behavior of the electrooculography (EOG) signal, which is an eye movement recording technique based on electrical activity originating from the eyes. For this purpose, the method called multifractal detrended fluctuation analysis is used, which can determine the multi-fractal spectrum of power law exponents from the electrooculography time series. Electrooculography is a biomedical signal that can be used to improve human-computer interfaces. Structural features of biomedical signals are often visually evident, but these structural features cannot be captured by traditional measurements such as the average amplitude of the signal. A biomedical signal has a scale-invariant structure when structures in subranges of the signal repeat themselves. Fractal analysis estimates the power law exponent that describes certain types of scale-invariant structure of the biomedical signal. Fractal analyzes are frequently used in biomedical signal processing (ECG, EEG, MR and X-ray images) to define the scale-independent invariant structure of the signal. Fractal analysis enables the discrimination between healthy and pathological conditions by using the scale-invariant structures of the interval between action potentials of nerve cells, the interval between steps of human walking, the interval between breaths of human respiration and the intervals between beats of the human heart. However, spatial and temporal differences in the scale-invariant structure of biomedical signals often occur. These spatial and temporal variations indicate a multi-fractal structure of the biomedical signal defined by a multifractal spectrum of power law exponents. The monofractal and multifractal structures of the biomedical signal are invariant structures at a certain scale. Most commonly, the monofractal structure of biomedical signals is described by a single power-law exponent and assumes scale invariance to be independent of time and space. However, spatial and temporal differences in the scale-invariant structure of the biomedical signal often occur. These spatial and temporal variations indicate a structure of the biomedical signal defined by a multifractal spectrum of power law exponents. In this study, the EOG signal taken from human subjects is examined by the multifractal detrended fluctuation analysis method at various scales and the multifractal structure of the EOG signal is shown.
Keywords: Fractal Analysis, Electrooculography, Biomedical Signal Processing, Human-Computer Interface

Giriş

Çoklu-fraktal analiz, ölçekleme davranışlarında değişkenlik sergileyen daha karmaşık sistemleri tanımlamak için geleneksel fraktal analizin ötesine geçen bir matematiksel çerçevedir. Kökeni fizik ve matematik alanlarından gelen bu yaklaşım, meteoroloji, jeofizik, ekonomi gibi farklı disiplinlerde ve hatta insan fizyolojisinin analizinde geniş kapsamlı uygulamalar bulmuştur. Multifraktal analiz, özünde, bir sistem içinde mevcut olan heterojenliğin veya düzensizliğin derecesini ölçmeye, sistemin dinamik ve çoğunlukla kaotik doğasının özünü yakalamaya çalışır.Tek bir ölçeklendirme kuralı veya fraktal boyutla karakterize edilen basit fraktalların aksine, çoklu-fraktal sistemler, sistemin farklı bölümleriyle ilişkili ölçeklendirme davranışları spektrumuna sahiptir. Bu çok yönlü ölçeklendirme, sistem içinde mevcut olan ve tek bir üs veya boyutla yeterince tanımlanamayan karmaşık hiyerarşik yapıların ve değişen derecelerdeki kendi kendine benzerliğin göstergesidir. Bu nedenle, çoklu-fraktal analiz, karmaşık sistemlerin daha incelikli ve ayrıntılı bir karakterizasyonunu sağlayarak araştırmacıların, bir sistemi yöneten temel kalıpların veya dinamiklerin ortaya çıkarılmasına ve anlamasına olanak tanır.Fraktal analizler biyomedikal işaret işlemede EKG, EEG, MR ve X-ışını resimlerinde ölçek değişmez yapısını tanımlamak için sıklıkla kullanılır (Lopes ve Betrouni, 2009). Fraktal analiz, sinir hücrelerinin aksiyon potansiyelleri arasındaki aralığı, insan yürüyüşünün adımlar arası aralığı, insan solunumunun nefesler arası aralığı ve insan kalbinin atışlar arası aralıklarının ölçek değişmez yapılarını, sağlıklı ve patolojik durumlar arasında ayrım yapılabilmesine imkan sağlamaktadır (Ivanov vd., 1999; Peng vd., 2002; Zheng vd., 2005; Hausdorff, 2007; Wang vd, 2007).Çoklu-fraktallar, fraktalların bir uzantısı olarak görülebilir. Biyomedikal işaretin tek-fraktal ve çoklu-fraktal yapıları, belirli bir ölçekte değişmez yapılardır. En yaygın olarak, biyomedikal işaretlerin tek-fraktal yapısı, tek bir kuvvet kanunu üssü ile tanımlanır ve ölçek değişmezliğinin zaman ve mekandan bağımsız olduğunu varsayar. Bununla birlikte, biyomedikal işaretin ölçekle değişmeyen yapısında uzaysal ve zamansal farklılıklar sıklıkla ortaya çıkar. Bu uzamsal ve zamansal varyasyonlar, biyomedikal işaretin, güç yasası üslerinin çoklu-fraktal spektrumu tarafından tanımlanan bir yapısını gösterir.Çoklu-fraktal analizler bu nedenle biyomedikal işaret işleme bilgisayar destekli bir araç olarak önemlidir. Son yıllarda eğilimsiz dalgalanma analizi (EDA) yöntemi (Peng vd, 1994; Ossadnik vd, 1994), bir zaman serisinin tek-fraktal ölçeklendirme özelliklerinin belirlenmesi ve gürültülü, durağan olmayan zaman serilerinde uzun dönemli korelasyonların tespiti için yaygın olarak kullanılan bir teknik haline gelmiştir (Kantelhardt vd, 2001; Hu vd, 2001). DNA dizileri (Peng vd, 1994; Ossadnik vd, 1994), kalp atış hızı dinamikleri (Ashkenazy vd, 2001),

nöron ateşlemesi (Bahar vd, 2001) ve insan yürüyüşü (Hausdorff vd, 1997), gibi çeşitli alanlara başarıyla uygulanmıştır. EDA yöntemini kullanmanın bir nedeni, zaman serisindeki durağan olmayan durumların eseri olan korelasyonların sahte tespitini önlemektir.Çoğu zaman serisi, tek bir ölçeklendirme üssüyle açıklanabilecek basit bir tek-fraktal ölçeklendirme davranışı sergilemez. Bazı durumlarda, farklı ölçeklendirme üslerine sahip τ_x zaman ölçekleri rejimleri mevcuttur (Kantelhardt vd, 2001; Hu vd, 2001). Örneğin, $\tau<<\tau_x$ için küçük ölçeklerde uzun dönemli korelasyonlar ve $\tau>>\tau_x$ için daha büyük ölçeklerde başka türde korelasyonlar veya ilişkisiz davranışlar gözlemlenebilir. Diğer durumlarda ölçeklendirme davranışı daha karmaşıktır ve serinin farklı bölümleri için farklı ölçeklendirme üsleri gerekir (Chen vd, 2002). Bu, örneğin, serinin ilk yarısındaki ölçekleme davranışının ikinci yarıdaki ölçekleme davranışından farklı olması durumunda meydana gelir. Daha da karmaşık durumlarda, zaman serisinin birçok iç içe geçmiş fraktal alt kümesi için bu tür farklı ölçeklendirme davranışı gözlemlenebilir. Bu durumda, ölçeklendirme davranışının tam bir açıklaması için çok sayıda ölçeklendirme üssü gereklidir ve çoklu-fraktal bir analiz uygulanmalıdır. EDA yönteminin genelleştirilmiş bir hali olan çoklu-fraktal eğilimsiz dalgalanma analizi (ÇF-EDA) çok sayıda ölçeklendirme üssü kullanarak, zaman serisinin çoklu-fraktal davranışını ortaya çıkararak daha doğru bir analizine imkan tanır (Kantelhardt vd, 2002).Göz tabanlı insan-bilgisayar arayüzünün gelişimi temel olarak, kullanıcının hareketlerini kaydetmek ve kullanıcının oküler durumunu tahmin etmek için bir kamera ve görüntü işleme algoritmalarının kullanımını içeren bir göz hareketi kayıt tekniği olan video okülografiye (VOG) dayanmaktadır. Bu teknik genellikle hesaplama açısından karmaşıktır ve diğer sınırlamaların yanı sıra değişen ortam aydınlatma koşullarına ve kullanıcı hareketlerine karşı hassastır. Hesaplama açısından daha kolay bir alternatif ise elektrookülografinin (EOG) kullanılmasıdır. Bu yöntem, insan gözünün ürettiği elektriksel aktiviteyi kaydeden bir göz hareketi kayıt tekniğidir (Miyashita vd, 2013). Bu çalışmada, gözlerden kaynaklı elektriksel aktiviteye dayanan bir göz hareketi kayıt tekniği olan elektrookülografi (EOG) işaretinin ÇF-EDA yöntemi ile çoklu-fraktal davranışı incelenmektedir.

1. Yöntem

1.1. Çoklu-fraktal Eğilimsiz Dalgalanma Analizi (ÇF-EDA)

ÇF-EDA prosedürü beş adımdan oluşmaktadır (Kantelhardt vd, 2002). İlk üç adım aslında geleneksel EDA prosedürüyle aynıdır (Peng vd, 1994; Ossadnik vd, 1994). x_k'nin N uzunluğunda bir zaman serisi ve bu serinin kompakt destekte olduğunu varsayılsın. Destek,

sıfırdan farklı x_k değerlerine sahip k endekslerinin kümesi olarak tanımlanır ve serinin yalnızca önemsiz bir kısmı için $x_k = 0$ ise kompakttır. $x_k = 0$ değeri bu k'da hiçbir değerin olmadığı şeklinde yorumlanır. Kantelhardt vd. (2002) tarafından geliştirilen ÇF-EDA prosedürünün adımları ve yönteme ilişkin detaylar aşağıda verilmektedir:

- Birinci adım, zaman serisinin profilinin tanımlanmasını içerir ve bu aşağıdaki şekilde gösterilir.

$$Y(i) = \sum_{k=1}^{i}[x_k - \langle x \rangle], \quad i = 1, \dots, N \tag{1}$$

Burada $\langle x \rangle$ ortalamayı göstermektedir.

- İkinci adımda, $Y(i)$ profili, $N_s \equiv \text{int}(N/s)$ olan s eşit uzunluğunda örtüşmeyen parçalara bölünür. Serinin N uzunluğu, çoğu zaman dikkate alınan zaman ölçeğinin (veri boyunun) s katı olmadığından, profilin sonunda kısa bir veri kalabilir. Serinin bu kısmını atlamamak için aynı işlem karşı uçtan başlayarak tekrarlanır. Böylece toplam $2N_s$ parça elde edilmiş olur.
- Üçüncü adımda, $2N_s$ 'lik bölümlerin her biri için yerel eğilim, söz konusu parçalara en küçük kareler yöntemiyle uydurulan m dereceli polinom yardımıyla hesaplanır ve daha sonra varyans belirlenir.

$$F^2(v, s) \equiv \frac{1}{s}\sum_{i=1}^{s}\{Y[(v-1)s + i] - y_v(i)\}^2 \tag{2}$$

(2) eşitliğinde her v parçası için v=1,...,N_s dir. v=N_s+1,...,2N_s için aşağıdaki şekildedir.

$$F^2(v, s) \equiv \frac{1}{s}\sum_{i=1}^{s}\{Y[N - (v - N_s)s + i] - y_v(i)\}^2 \tag{3}$$

Burada $y_v(i)$, v parçasındaki verilere uydurulan polinomdur. Eğri uydurma prosedüründe doğrusal, ikinci dereceden, kübik veya daha yüksek dereceli polinomlar kullanılabilir. Zaman serisini eğiliminden arındırma, uydurulan polinomların profilden çıkarılmasıyla yapıldığından, farklı dereceli (m) polinomlarla uygulanan EDA 'nın serideki trendleri ortadan kaldırma yetenekleri farklılık gösterir. Örneğin, ÇF-EDAm [m'inci dereceli ÇF-EDA] ile profildeki m dereceli eğilimler ortadan kaldırılmış olur. Bu nedenle, EDA'nın farklı dereceleri için sonuçların karşılaştırılması, zaman serisindeki polinom eğiliminin tipinin tahmin edilmesine olanak sağlar (Hu vd, 2001).

- Dördüncü adımda, q'uncu dereceden dalgalanma fonksiyonunu elde etmek için tüm parçaların ortalaması aşağıdaki şekilde hesaplanır.

$$F_q(s) \equiv \left\{\frac{1}{2N_s}\sum_{v=1}^{2N_s}[F^2(v, s)]^{q/2}\right\}^{1/q} \tag{4}$$

Burada, genel olarak, q değişkeni herhangi bir gerçek sayı olabilir. $q = 2$ durumu için standart EDA prosedürü elde edilmiş olunur. ÇF-EDA yönteminde ise genelleştirilmiş q 'ya bağlı $F_q(s)$ dalgalanma fonksiyonlarının, q'nun farklı değerleri için zaman ölçeği s'ye nasıl bağlı olduğuyla ilgilenilmektedir. Bu nedenle, birkaç zaman ölçeği için 2'den 4'e kadar olan adımları tekrarlamak gerekmektedir. Artan s ile $F_q(s)$'nin artacağı açıktır. Elbette $F_q(s)$, aynı zamanda m dereceli EDA 'ya da bağlıdır. Yapı itibariyle $F_q(s)$ yalnızca $s \geq m + 2$ için tanımlanır.

- Beşinci adımda, Her q değeri için s 'ye karşı çizilen $F_q(s)$ log-log grafiği analiz edilerek dalgalanma fonksiyonlarının ölçeklendirme davranışı belirlenir. Eğer x_i serisi uzun dönemli kuvvet kanunu ile korelasyonlu ise, $F_q(s)$, büyük s değerleri için aşağıdaki kuvvet kanununa uyumlu olarak artar,

$$F_q(s) \sim s^{h(q)} \tag{5}$$

Çok büyük ölçekler için ($s > N/4$); $F_q(s)$ istatistiksel olarak güvenilmez hale gelir çünkü 4. adımdaki ortalama prosedürü için N_s segmentlerinin sayısı çok küçük olur. Bu nedenle, $h(q)$'yu belirlemek için genellikle $s > N/4$ ölçekleri eğri uydurma prosedürünün dışında tutulur. Bunun yanı sıra, (5) denklemindeki ölçeklendirme davranışından sistematik sapmalar, çok küçük ölçekler için ($s \approx 10$) ortaya çıkar ve düzeltilebilirdir. Genel olarak (5) denklemindeki $h(q)$ üssü q 'ya bağlıdır. Durağan zaman serileri için $h(q=2)$, iyi bilinen Hurst üssü H ile aynıdır (Feder, 1988). Böylece $h(q)$ fonksiyonuna genelleştirilmiş Hurst üssü adı verilir.

$q \rightarrow 0$ için $h(q)$ limitine karşılık gelen $h(0)$ değeri, ıraksak üs nedeniyle (4) denklemindeki ortalama alma prosedürü kullanılarak doğrudan belirlenemez. Bunun yerine (6) denklemiyle verilen logaritmik ortalama alma prosedürü kullanılır.

$$F_0(s) \equiv exp\left\{\frac{1}{4N_s}\sum_{v=1}^{2N_s} \ln[F^2(v,s)]\right\} \sim s^{h(0)} \tag{6}$$

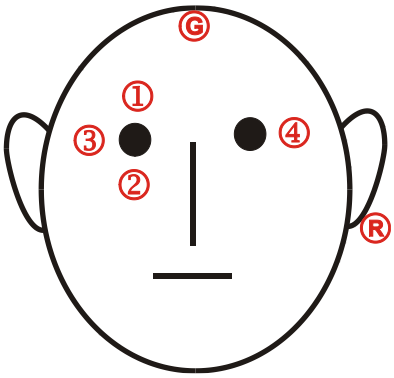
$h(0)$'ın fraktal destekli zaman serileri için tanımlanamayacağına dikkat edilmelidir. Burada $h(q)$ $q \rightarrow 0$ için ıraksar.

Kompakt destekli tek-fraktal zaman serileri için $h(q)$, q'dan bağımsızdır, çünkü $F^2(v,s)$ varyanslarının ölçeklendirme davranışı tüm v bölümleri için aynıdır ve (4) denklemindeki ortalama alma prosedürü q'nun tüm değerleri için tam olarak aynı ölçeklendirme davranışını verecektir. Ancak küçük ve büyük dalgalanmalar farklı ölçeklenirse, $h(q)$'nun q'ya önemli bir bağımlılığı olacaktır: Eğer q'nun pozitif değerleri dikkate alınırsa, büyük $F^2(v,s)$ varyansına sahip v parçaları (yani, karşılık gelen eğri uydurmadan kaynaklı büyük değişimler) ortalama $F_q(s)$'i büyük oranda etkiler. Dolayısıyla q'nun pozitif değerleri için; $h(q)$, büyük dalgalanmalara sahip bölümlerin ölçeklenme davranışını açıklar. Tersine, q'nun negatif

değerleri için, küçük $F^2(v,s)$ varyansına sahip v bölümleri ortalama $F_q(s)$ üzerinde büyük etkiye sahip olacaktır. Dolayısıyla, q'nun negatif değerleri için $h(q)$, küçük dalgalanmalara sahip bölümlerin ölçeklenme davranışını tanımlar.Genellikle büyük dalgalanmalar, çoklu-fraktal seriler için küçük dalgalanmalardan daha küçük $h(q)$ ölçeklendirme üssü ile karakterize edilir. Maksimum ölçek $s=N$ için dalgalanma fonksiyonu $F_q(s)$ q'dan bağımsızdır, çünkü (4) denklemindeki toplam yalnızca iki özdeş bölüm üzerinden çalışır ($N_s \equiv [N/s] = 1$). Daha küçük ölçekler için ($s<<N$) ortalama alma prosedürü birkaç bölüm üzerinde uygulanır ve eğer $q<0$ ise, $F_q(s)$ ortalama değeri, küçük dalgalanmalara sahip bölümlerden kaynaklı $F^2(v,s)$ tarafından etkilenecektir. Benzer şekilde, q>0 için, $F_q(s)$ ortalama değeri, büyük dalgalanmalara sahip bölümlerden kaynaklı $F^2(v,s)$ tarafından etkilenir. Bu nedenle, $s<<N$ için; $q<0$ olan $F_q(s)$ değeri, q>0 olan $F_q(s)$'den daha küçük olacaktır. $s=N$ için her ikisi de eşittir. Dolayısıyla, $F_q(s)$'nin (5) denklemini takiben homojen bir ölçeklendirme davranışı olduğunu varsayılırsa, $q>0$'a karşılık gelen s 'ye karşı çizilen $F_q(s)$ log-log grafiğindeki $h(q)$ eğimi, q>0 olan $F_q(s)$'nin karşılık gelen eğiminden daha büyük olmalıdır. Böylece, $q<0$ için $h(q)$, genellikle $q>0$ için $h(q)$'dan daha büyük olacaktır.

1.2. Elektrookülografi (EOG) işareti

İnsan gözünün, kornea ve retinanın sırasıyla pozitif ve negatif kutupları oluşturduğu bir elektriksel dipol gibi davrandığı düşünülebilir. Bu dipolün eksenleri gözün optik eksenlerine göre yönlendirilir ve dolayısıyla gözle birlikte döner. Aslında gözün ön ve arka bölgesi arasında korneo-retinal potansiyel adı verilen ve büyüklüğü 0,4-1,0 mV arasında değişen bir potansiyel farkı vardır. Bu, bir elektrik alanı yaratır ve bu alan tarafından üretilen elektriksel aktivite, gözlerin yakınına yerleştirilen elektrotlar kullanılarak invaziv olmayan bir şekilde yakalanır (Heide vd, 1999; Bulling vd, 2011).EOG işaretleri, taban çizgisi tipik olarak sabit olmadığından ve kaymaya maruz kaldığından, taban çizgisi gezinme etkisinden dolayı bozulmaktadır (Heide vd, 1999; Bulling vd, 2011).Özellikle, bu kayma, edinilen EOG işaretlerine müdahale eden ve esas olarak arka plan işaret girişiminin bir sonucu olan düşük frekanslı bir işaret olarak elektrot polarizasyonu, değişen elektrot temas basıncı ve terlemeye bağlı olarak cilt direncindeki değişiklikler şeklinde kendini gösterir (Heide vd, 1999; Bulling vd, 2011; Huda vd, 2015; Marandi vd, 2015).Bu çalışmada kullanılan EOG işareti Barbara ve arkadaşlarının kaydettikleri EOG verilerini temel almaktadır (Barbara vd, 2020). EOG işaretinin kaydedilmesi sırasında kullanılan elektrot yerleşimi Şekil 1 'de verilmektedir.



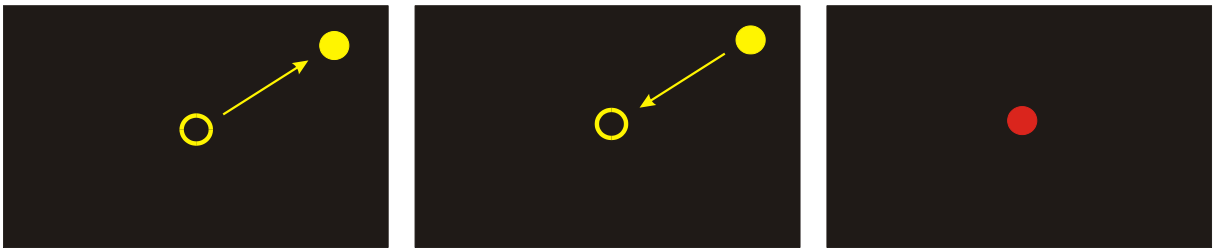
Şekil 1. EOG elektrot yerleşimi (Barbara vd, 2020).

Şekil 1 ile verilen elektrot yerleşimi temel alınarak kaydedilen yatay ve dikey OEG işaretleri aşağıdaki şekilde tanımlanmaktadır. Şekil 1'de "G" ile gösterilen alın noktası işaret toprağı ve "R" ile gösterilen referans elektrodu sol kulağın arkasına takılıdır (Barbara vd, 2020).

$$EOG_h(t) = V_3(t) - V_4(t) \quad (7)$$

$$EOG_v(t) = V_1(t) - V_2(t) \quad (8)$$

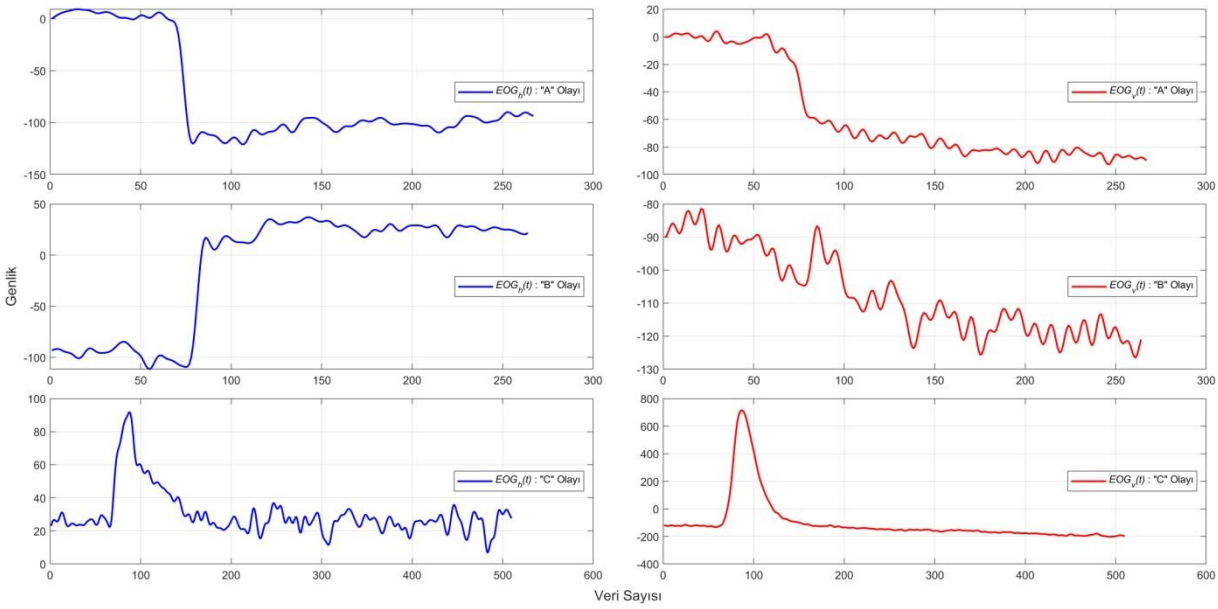
(7) ve (8) nolu ifadelerde, $V_1(t)$, $V_2(t)$, $V_3(t)$ ve $V_4(t)$ EOG gerilimleri, Şekil 1 'deki sırasıyla 1, 2, 3 ve 4 numaralı noktalardan ölçülen gerilimlerdir. Yatay olarak yerleştirilen elektrotların farkı olan $EOG_h(t)$ gerilimi, yatay EOG işareti ve dikey olarak yerleştirilen elektrotların farkı olan $EOG_v(t)$ gerilimi dikey EOG işareti olarak adlandırılmaktadır. Söz konusu veri seti, 256 Hz örnekleme frekansına sahiptir. EOG verilerinin kaydı sırasında Barbara vd. (2020) deneklerden, bakış noktalarını ekranda vurgulanan bir işarete sabitlemelerini istemiştir. Buna göre, Şekil 2'de gösterildiği gibi bir dizi 4 saniyelik denemeler kaydedilmiştir; burada önce denekten ilk 1 saniyede ekranın ortasından rastgele bir hedef konuma doğru gözüyle bir seğirme yapması istenmiştir ("A" olayı). Bunu, sonraki 1 saniye içinde ekranın ortasına doğru karşılık gelen bir geri dönüş hareketi ("B" olayı) ve her denemenin son 2 saniyesinde bir göz kırpma ("C" olayı) izlemektedir. Her denek için üç ayrı oturumda bu tür toplam 300 deneme kaydedildiği raporlanmıştır (Barbara vd, 2020).



Şekil 2. Deneklerden alınan EOG kayıtlarının açıklaması. "A" olayı : Ekranın ortasından bir hedef konuma doğru seğirme, "B" olayı : Ekranın ortasına doğru karşılık gelen bir geri dönüş hareketi, "C" olayı : Göz kırpma.

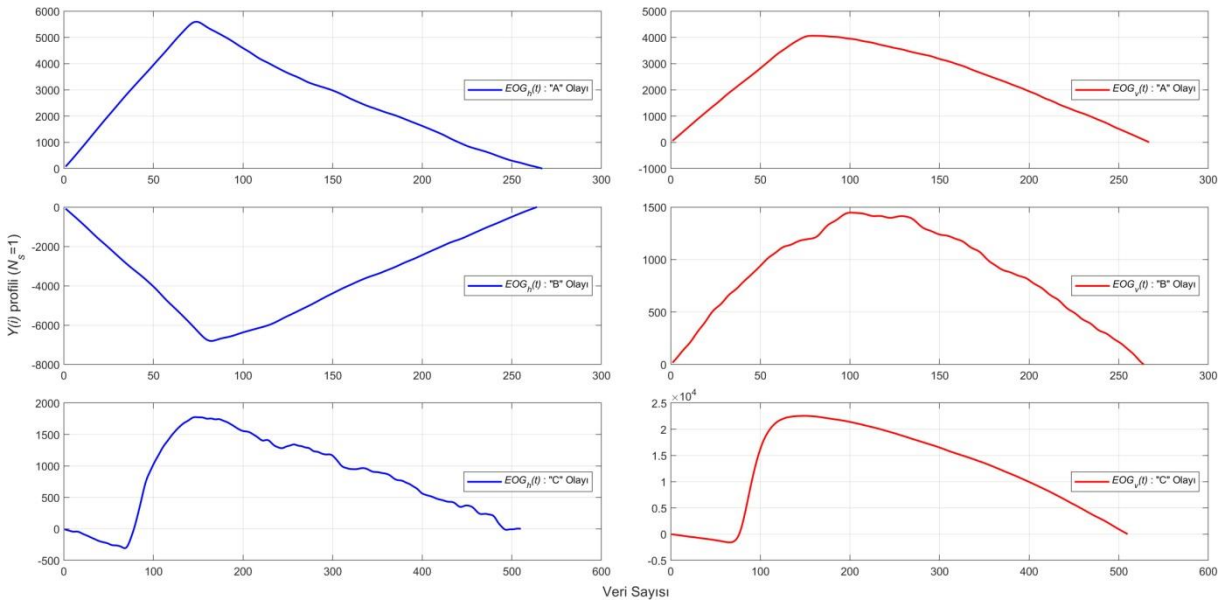
2. Sonuçlar ve Değerlendirme

"A", "B" ve "C" olaylarına karşılık gelen EOG işaretlerinden rastgele seçilen bir örnek Şekil 3 'de verilmektedir.

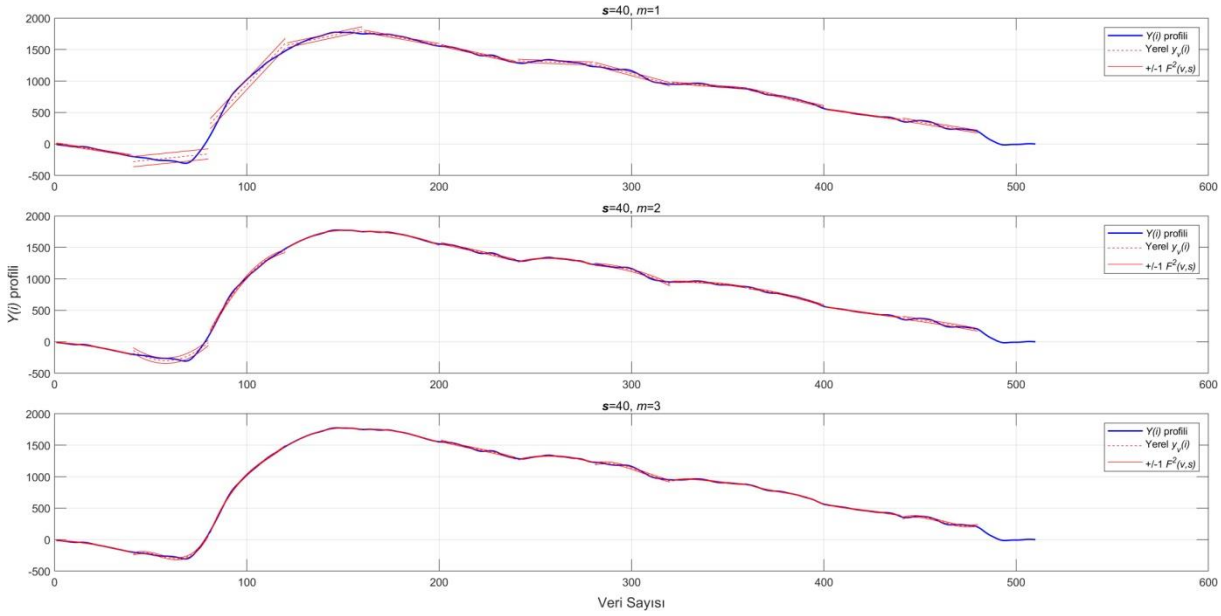


Şekil 3. "A", "B" ve "C" olaylarına karşılık gelen $EOG_h(t)$ ve $EOG_v(t)$ işaretlerinden bir örnek.

EOG veri setinden rastgele seçilen ve Şekil 3'de görülen $EOG_h(t)$ ve $EOG_v(t)$ işaretlerinin N_s=1 için, (1) denklemi ile hesaplanan $Y(i)$ profili Şekil 4 'de görülmektedir. Kaydedilen EOG işaretlerinin sayısının çokluğu nedeniyle, basitlik adına, bu noktadan itibaren "C" olayını içeren $EOG_h(t)$ işaretinin analizi yapılacaktır. Şekil 5 'den görüleceği üzere, (2) denklemi gereğince "C" olayını içeren $EOG_h(t)$ işaretine, s=40 için m=1, 2 ve 3. dereceden polinomlar uydurulmuştur. Farklı m dereceleri için varyansın değiştiği görülmektedir. Bu durum, ÇF-EDA yönteminin doğal bir sonucudur.

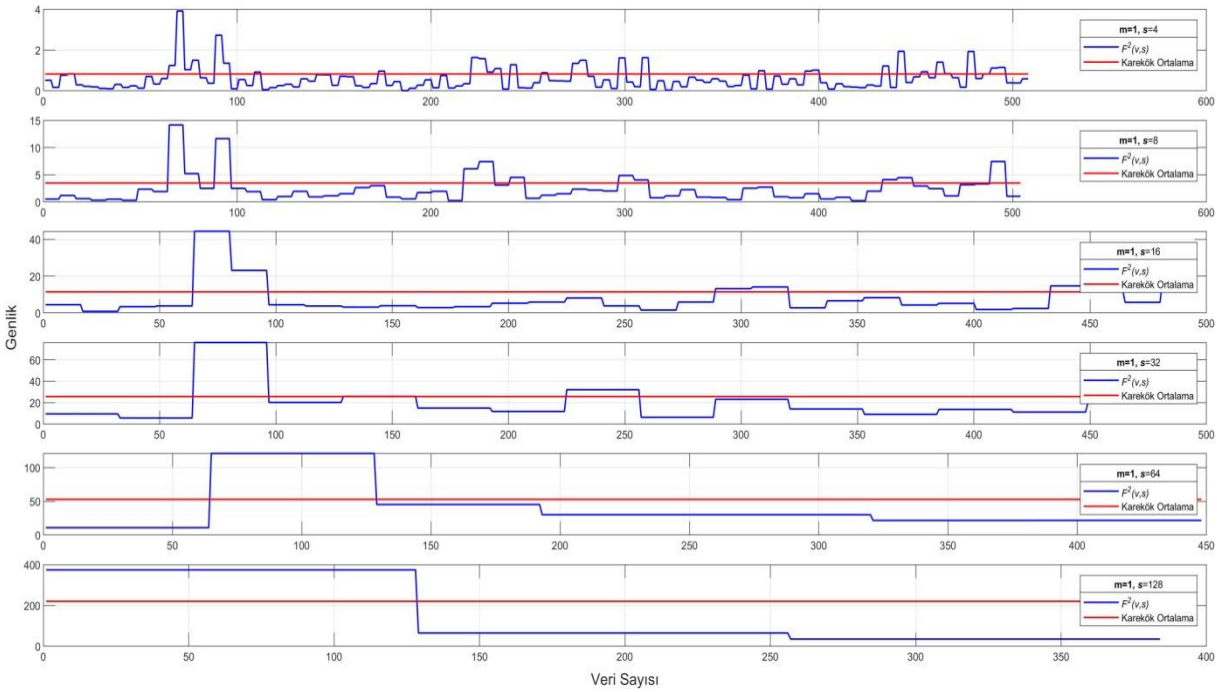


Şekil 4. N_s=1 için, (1) denklemi ile hesaplanan *Y(i)* profili.

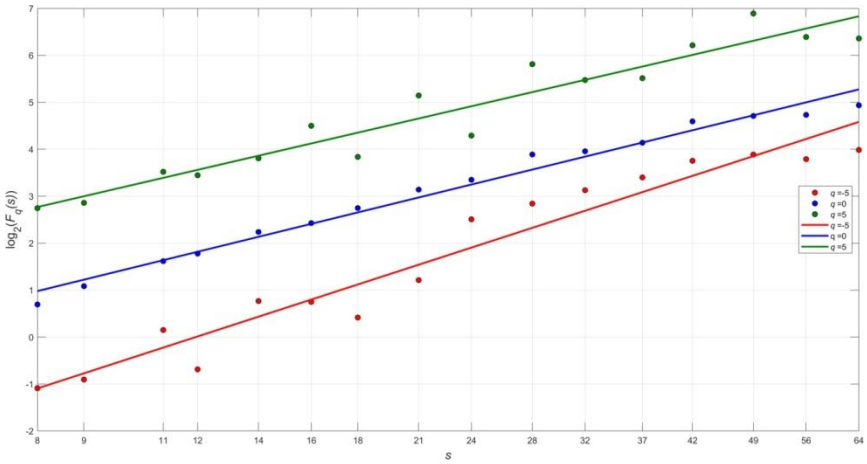


Şekil 5. *s*=40 için, her bir örtüşmeyen *v* parçasına 1, 2 ve 3. dereceden polinomlarla uydurulan $y_v(i)$ verisi (kırmızı noktalı çizgi) ile *Y(i)* profilindeki her bir parça için ±1 $F^2(v,s)$ (kırmızı düz çizgi).

"C" olayını içeren $EOG_h(t)$ işareti ile ilgili olarak, *m*=1dereceli polinom ve *s*=4, 8, 16, 32, 64 ve 128 parça boyutları için hesaplanan $F^2(v,s)$ değerlerinin değişimi Şekil 6 'da görülmektedir. Şekil 6 'da görüleceği üzere, $F^2(v,s)$ genliği küçülen *s* için azalmaktadır.

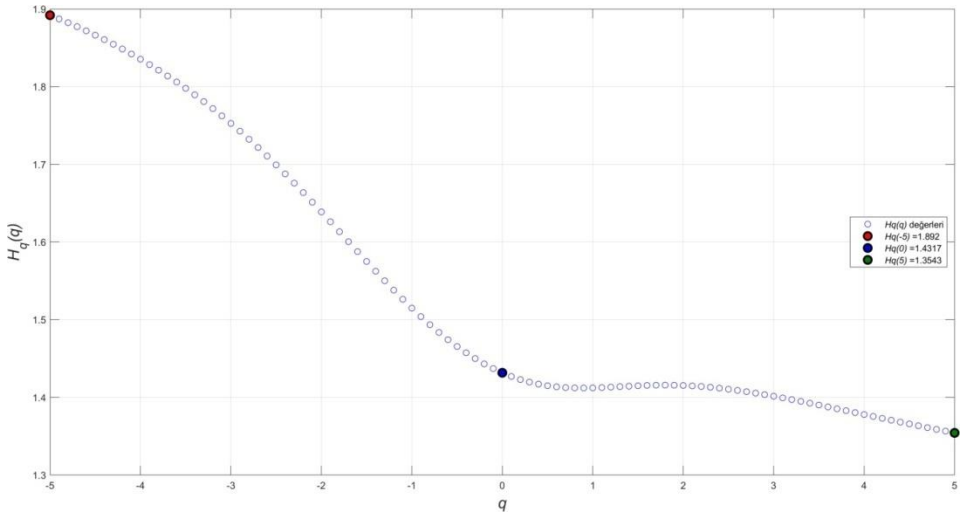


Şekil 6. "C" olayını içeren $EOG_h(t)$ işaretinin, m=1dereceli polinom ve s=4, 8, 16, 32, 64 ve 128 bölüm boyutları için hesaplanan $F^2(v,s)$ değerleri.



Şekil 7. "C" olayını içeren $EOG_h(t)$ işareti ile ilgili olarak; q dereceli $F_q(s)$ ve s=8-64 değerleri için log-log çizimi (noktalar) ve bunlara karşılık gelen doğrusal polinom regresyonu (düz çizgiler).

Şekil 7'den görüleceği üzere, farklı s değerleri için hesaplanan q dereceli $F_q(s)$ değerleri, log-log çiziminde, eğimleri birbirinden farklı olan doğrular üretmektedir. Bu sonuç, EOG işaretinin durağan olmayan doğası ve çoklu-fraktal yapısının bir göstergesi durumundadır. Bu sonuçları kullanarak elde edilen $H_q(q)$ Hurst üstellerinin q 'ya bağlı grafiği Şekil 8 'de görülmektedir.



Şekil 8. "C" olayını içeren $EOG_h(t)$ işareti ile ilgili olarak; q=-5 ve 5 aralığı için $H_q(q)$ Hurst üsteli.

Şekil 8 ile verilen $H_q(q)$ Hurst üsteli grafiği, q 'ya bağlı olarak Hurst üstellerinin sabit olmadığını ve azaldığını açık bir şekilde göstermektedir. Bu durum çoklu-fraktal yapıya sahip zaman serilerinin bir özelliğidir. Dolayısıyla, "C" olayını içeren $EOG_h(t)$ işareti üzerinden yapılan analiz, EOG işaretinin çoklu-fraktal davranışının bir delilidir. Tüm EOG işaretlerinin analizinde benzer sonuçlara ulaşılmıştır.Bu çalışmada, ÇF-EDA yöntemi kullanılarak, farklı veri ölçekleri için (s=4, 8, 16, 32, 64) EOG işareti eğiliminden arındırıldıktan sonra, q 'ya bağlı olarak $H_q(q)$ Hurst üstelleri elde edilmiştir. Hurst üstelleri q'ya bağlı olarak değiştiğinden, EEG, EKG gibi EOG işaretinin de çoklu-fraktal bir davranışa sahip olduğu gösterilmiştir.

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DC MAGNETRON SAÇTIRMA YÖNTEMİ İLE REAKTİF NiO İNCE FİLM KAPLAMA UYGULAMASI

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Özet
Bu çalışma, DC Magnetron Saçtırma yöntemi ile cam alttaş üzerine reaktif NiO ince film kaplama uygulamasını konu etmektedir. NiO, ferromanyetik malzemeler, p-tipi şeffaf iletken film, elektrokromik görüntüleme cihazlarında ve kimyasal sensörlerde fonksiyonel bir sensör katmanı olarak uygulama alanı bulmaktadır. Saçtırma, ince film biriktirmek amacıyla kullanılan bir fiziksel buhar biriktirme (FBB) yöntemidir. Bu yöntem, malzemenin, biri kaynak olan bir "hedeften" cam gibi bir "alt katmana" saçtırılmasını içerir. Saçtırma, yarı iletken endüstrisinde, entegre devre işlemede çeşitli malzemelerin ince filmlerini biriktirmek için yaygın olarak kullanılmaktadır. Optik uygulamalar için cam üzerine ince yansıma önleyici kaplamalar da saçtırma yoluyla biriktirilir. Saçtırma yönteminin en eski ticari uygulamalarından biri bilgisayar sabit disklerinin üretimidir. Kullanılan düşük alttaş sıcaklıkları nedeniyle saçtırma, ince film transistör üretiminde temas metallerini biriktirmek için ideal bir yöntemdir. Reaktif saçtırmada, hedef malzemeden saçtırılan parçacıklar (Ni), belirli bir alttaş üzerinde (cam) farklı bileşime sahip bir filmin biriktirilmesini amaçlayan kimyasal bir reaksiyona girer. Parçacıkların maruz kaldığı kimyasal reaksiyon, saçtırma odasına verilen oksijen gibi reaktif bir gazla gerçekleşerek oksit filmlerin üretilmesini sağlar. Yöntemde ilave bir unsurun, yani reaktif gazın eklenmesi, arzu edilen ince film birikmesi üzerinde önemli bir etkiye sahiptir ve ideal çalışma noktalarının bulunmasını zorlaştırır. Bu şekilde, reaktif bazlı saçtırma işlemlerinin büyük çoğunluğu, histerezis benzeri bir davranışla karakterize edilir, dolayısıyla ilgili ilave soygaz, basınç ve sıcaklık parametrelerinin uygun şekilde kontrol edilmesini gerektirir. Reaktif saçtırma yoluyla ince film birikimini kontrol eden birçok parametrenin varlığı, bunu karmaşık bir süreç haline getirir, ancak aynı zamanda oluşan ince filmin büyümesi ve mikro yapısı üzerinde büyük ölçüde kontrol sağlar. Bu çalışmada, hedef olarak yüksek saflıkta Ni hedef varlığında, Argon gazı ile farklı oranlarda karıştırılmış Oksijen (reaktif gaz), NiO ince film üretimi için kullanılmıştır. Basınç, sıcaklık ve plazmanın akım sınırı sabit tutularak üretilen NiO ince filmlerin karakterizasyonu, optik geçirgenlik, yansıma, kaplama kalınlığı ve iletkenlik ölçümleri yapılarak optimize edilmiştir.
Anahtar Kelimeler: DC Magnetron Saçtırma, NiO, Reaktif Saçtırma, İnce Film, Sensörler

REACTIVE NiO THIN FILM COATING APPLICATION BY DC MAGNETRON SPOTTING METHOD

Abstract
This study is about the application of reactive NiO thin film coating on glass substrate by DC Magnetron Sputtering method. NiO finds application in ferromagnetic materials, p-type transparent conductive film, electrochromic imaging devices and chemical sensors as a functional sensor layer. Sputtering is a physical vapor deposition method used to deposit thin films. This method involves sputtering material from a "target" one of which is the source, onto a "substrate" such as glass. Sputtering is widely used in the semiconductor industry to deposit thin films of various materials in integrated circuit processing. For optical applications, thin anti-reflective coatings are also deposited on glass by sputtering. One of the oldest commercial applications of the sputtering method is in the production of computer hard disks. Due to the low substrate temperatures used, sputtering is an ideal method to deposit contact metals in thin-film transistor fabrication. In reactive sputtering, particles sputtered from the target material (Ni) undergo a chemical reaction aimed at the deposition of a film of different composition on a specific substrate (glass). The chemical reaction that the particles are exposed to occurs with a reactive gas such as oxygen supplied to the sputtering chamber, resulting in the production of oxide films. The introduction of an additional element in the method, namely reactive gas, has a significant impact on the desired thin film deposition and makes it difficult to find ideal operating points. In this way, the vast majority of reactive sputtering processes are characterized by a hysteresis-like behavior, thus requiring appropriate control of the additional inert gas, pressure and temperature parameters involved. The existence of many parameters controlling thin film deposition by reactive sputtering makes this a complex process, but also provides a large degree of control over the growth and microstructure of the resulting thin film. In this study, Oxygen (reactive gas) mixed with Argon gas in different proportions was used to produce NiO thin film in the presence of high purity Ni target as the target. The characterization of NiO thin films produced by keeping the pressure, temperature and plasma current limit constant was optimized by measuring optical transmittance, reflectance, coating thickness and conductivity.
Keywords: DC Magnetron Sputtering, NiO, Reactive Sputtering, Thin Film, Sensors

Giriş

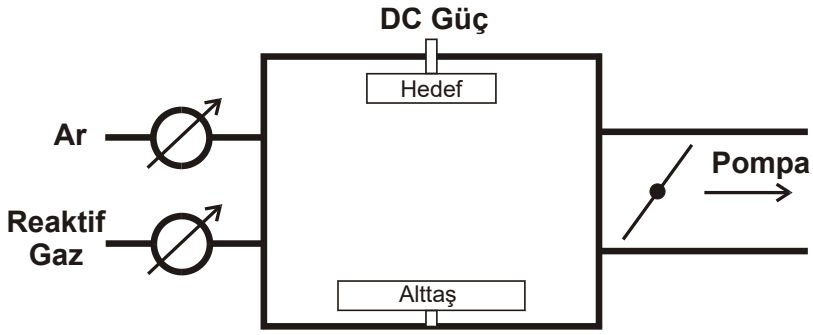
Saçtırma, ince film biriktirmek amacıyla kullanılan bir fiziksel buhar biriktirme (FBB) yöntemidir. Bu yöntem, malzemenin, biri kaynak olan bir "hedeften" cam gibi bir "alt katmana" saçtırılmasını içerir. Saçtırma, yarı iletken endüstrisinde, entegre devre işlemede çeşitli malzemelerin ince filmlerini biriktirmek için yaygın olarak kullanılmaktadır. Optik uygulamalar için cam üzerine ince yansıma önleyici kaplamalar da saçtırma yoluyla biriktirilir. Saçtırma yönteminin en eski ticari uygulamalarından biri bilgisayar sabit disklerinin üretimidir. Kullanılan düşük alttaş sıcaklıkları nedeniyle saçtırma, ince film transistör üretiminde temas metallerini biriktirmek için de ideal bir yöntemdir (Frey H. ve Khan H. R. (Eds.), (2015).Reaktif saçtırma, hem saçtırılan hedef malzemeyle hem de hedef yüzeyle kütlesel reaksiyona giren kimyasal olarak reaktif gazların varlığında hedeflerin saçtırılması olarak tanımlanabilir. Reaktif saçtırma, oksitler, nitrürler, karbürler, florürler veya arsenitler (Graham vd., 1994) dahil olmak üzere çok çeşitli bileşik ve alaşım ince filmlerinin biriktirilmesi için günümüzün yeni malzeme özellikleri arayışında çok popüler bir teknik haline gelmiştir. Reaktif olmayan saçtırma yöntemi ile üretilen filmlerin gelişmiş özelliklerinin yanında, temel hedeflerden (yani tek bir öğeden oluşan bir hedeften) DC reaktif saçtırmanın popülaritesinin artması, birkaç faktöre atfedilebilir: (a) Endüstriyel ölçekte (Rizk vd., 1988; Vossen vd., 1991) yüksek biriktirme hızlarında ve kontrol edilebilir bileşime (Larsson vd., 1988) sahip ince bileşik filmler üretme kapasitesine sahiptir. (b) elementsel hedefler genellikle daha kolay saflaştırılır ve dolayısıyla yüksek saflıkta filmler üretilebilir (Okamoto ve Serikawa, 1986); (c) metalik hedefler elektriksel olarak iletken olduğundan RF sistemlerinin karmaşıklığı ve pahalılığına gerek kalmayabilir ve dolayısıyla DC güç uygulanabilir; (d) temel hedeflerin işlenmesi genellikle kolaydır; (e) metalik hedefler termal olarak iletkendir, bu da bu hedeflerin soğutulmasını daha verimli hale getirir. Böylece uygulanan gücün aralığı genişletilebilir; hedefte çatlama korkusu olmadan 50 W/cm^2 ve üstüne kadar çıkılabilir; ve (f) ince filmler 300 °C'nin altındaki sıcaklıklarda biriktirilebilir (Kadlec vd, 1986).Reaktif sıçratma kavramsal olarak basit olmasına rağmen aslında birbirine bağlı birçok parametreyi içeren karmaşık ve doğrusal olmayan bir süreçtir (Tsiogas ve Avaritsiotis, 1992). Hem katot yüzeyinde hem de alttaşta reaktif gazın varlığı, reaktif gazın yalnızca yoğunlaşan malzemeyle değil aynı zamanda katot yüzeyiyle de güçlü etkileşimlerine neden olur; buna "hedef zehirlenmesi" denir. Bu katot reaksiyonlarının, belirli bir reaktif gaz akışı hızında aniden arttığı görülmektedir. Reaktif gazın akışı kontrol altında tutulursa, bu tür reaksiyonlarda, plazmanın empedansında bir değişiklik, sistem basıncında veya daha kesin olarak reaktif gaz basıncında ani bir artış, biriktirme oranında ciddi bir düşüş ve filmde metal açısından zenginden

gaz açısından zengine geçiş, yani stokiyometride bir değişiklik gözlenebilir. Bu nedenle, reaktif gazın sağlanmasıyla kontrol edilen reaktif saçtırma işlemleri oldukça karmaşık bir davranış sergiler (Glocker ve Shah, 2018).Bu çalışma, DC Magnetron Saçtırma yöntemi ile cam alttaş üzerine reaktif NiO ince film kaplama uygulamasını konu etmektedir. NiO, ferromanyetik malzemeler (Fujii vd., 1996), p-tipi şeffaf iletken film (Sato vd, 1993), elektrokromik görüntüleme cihazlarında (Yoshimura vd, 1995) ve kimyasal sensörlerde fonksiyonel bir sensör katmanı (Bögner vd., 1998) olarak uygulama alanı bulmaktadır. Reaktif saçtırma yoluyla ince film birikimini kontrol eden birçok parametrenin varlığı, bu yöntemi karmaşık bir süreç haline getirir, ancak aynı zamanda oluşan ince filmin büyümesi ve mikro yapısı üzerinde büyük ölçüde kontrol sağlar (Glocker ve Shah, 2018). Bu çalışmada, hedef olarak yüksek saflıkta Ni hedef varlığında, Argon gazı ile karıştırılmış Oksijen (reaktif gaz), reaktif NiO ince film üretimi için kullanılmıştır.

1. Yöntem

1.1. Reaktif Saçtırma Yöntemi

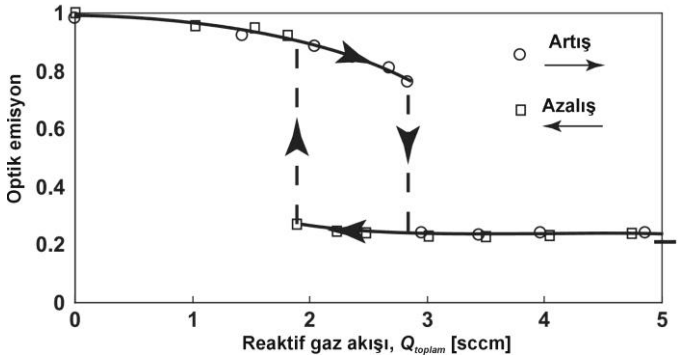
Benzerliklere rağmen reaktif saçtırma işlemi, temel soygaz saçtırma işleminden önemli ölçüde farklı davranır. Davranıştaki bu büyük farklılığın temel nedeni, reaktif saçtırmaya dayalı biriktirme prosesinin, reaktif gazın kısmi basıncına son derece duyarlı olmasıdır. Bu kısmi basınç, hem katoda sağlanan elektrik gücünden hem de reaktif gazın beslenmesindeki değişikliklerden etkilenir. İlk bakışta bu çok büyük bir sorun gibi görünmeyebilir. Bununla birlikte, bu parametrelerin etkileşim şekli, reaktif saçtırma işleminin doğrusal olmayan bir şekilde davranmasına ve çoğu durumda histerezis etkileri sergilemesine neden olur (Glocker ve Shah, 2018).Reaktif saçtırmada, hedef malzemeden saçtırılan parçacıklar, belirli bir alttaş üzerinde farklı bileşime sahip bir filmin biriktirilmesini amaçlayan kimyasal bir reaksiyona girer. Parçacıkların maruz kaldığı kimyasal reaksiyon, saçtırma odasına verilen oksijen veya nitrojen gibi reaktif bir gazla gerçekleşir ve sırasıyla oksit ve nitrür filmlerin üretilmesini sağlar, Şekil 1. Proseste ilave bir unsurun, yani reaktif gazın eklenmesi, arzu edilen çökeltmeler üzerinde önemli bir etkiye sahiptir ve ideal çalışma noktalarının bulunmasını zorlaştırır. Bu şekilde, reaktif bazlı saçtırma işlemlerinin büyük çoğunluğu, histerezis benzeri bir davranışla karakterize edilir ve dolayısıyla ilgili parametrelerin uygun şekilde kontrol edilmesini gerektirir (Glocker ve Shah, 2018).



Şekil 1. Reaktif saçtırma yönteminin şematik çizimi.

1.2 Reaktif Saçtırma Yöntemindeki Kararsızlıklar

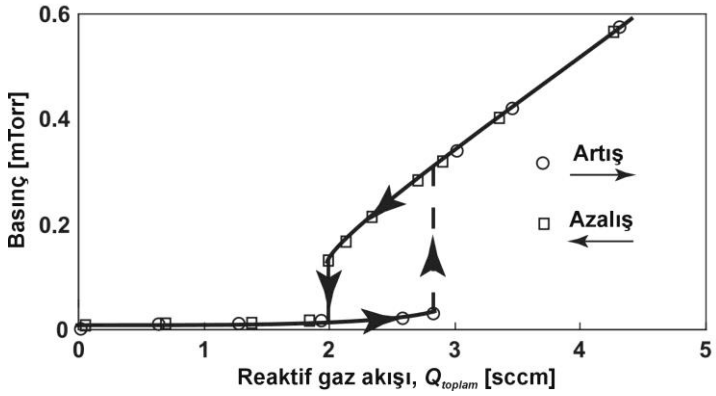
Şekil 2, reaktif saçtırma prosesi (işlem sırasında sabit akımla gerçekleştirilir) için saçtırma erozyon hızına karşı reaktif gaz beslemesine ilişkin tipik bir deneysel proses eğrisini göstermektedir. Bu eğrinin karakteristik özelliği histerezis etkisi sergilemesidir. Reaktif gazın beslenmesi ile birikme oranı aynı değerde azalmaz ve artmaz. Azalma ve artış arasındaki ayrım genişliği histerezis bölgesinin genişliğini belirtir (Glocker ve Shah, 2018).



Şekil 2. Reaktif saçtırma işlemi için tipik bir deneysel eğri. Saçtırılmış metal atomlarından kaynaklanan optik emisyon (OE), saçtırma erozyon hızını temsil eder. Q_{toplam}, dakika başına standart santimetreküp (sccm) cinsinden ifade edilir.

Kısmi basınç ile reaktif gazın besleme hızı arasındaki ilişki için de karşılık gelen bir histerezis etkisi gözlemlenir, Şekil 3. Bu şekil, reaktif gaz beslemesinin arttırılması ve azaltılması arasındaki farkı açıkça göstermektedir. Reaktif gaz beslemesinin artış dizisi sırasında reaktif gazın kısmi basıncı, histerezis genişliğinin üst sınır değerine ulaşana kadar çok düşük bir seviyede kalır. Reaktif gaz beslemesinin azalması sırasında kısmi basınç, histerezis bölgesinde gazın artması durumuna göre önemli ölçüde daha yüksek kalır. Bu, artış dizisi sırasında bileşik oluşumu için daha fazla gaz tüketildiğine işaret etmektedir. Bu, karşılık gelen diziler için saçtırma erozyon hızı eğrisinin karşılaştırılması yoluyla anlaşılabilir. Daha yüksek saçtırma erozyon oranı, bileşik kaplamalar oluşturmak için daha fazla reaktif gaza ihtiyaç duyar.

Histerezis etkisi reaktif saçtırma sistemlerinde en önemli sorunlardan biridir. (Glocker ve Shah, 2018).

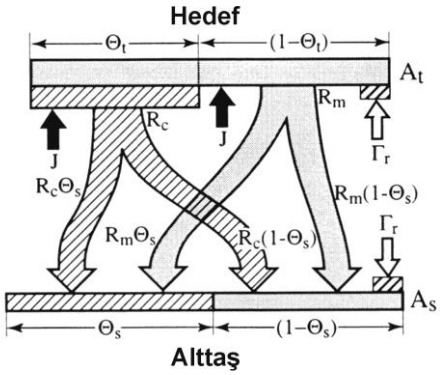


Şekil 3. Şekil 1'deki eğriye karşılık gelen reaktif gazın kısmi basıncı.

Bu nedenlerle, reaktif saçtırma işleminin sonucunun tahmin edilebilmesi için güvenilir bir modele ihtiyaç vardır.

1.3 Reaktif Saçtırma Yönteminin Modellenmesi

İlk kez 1987'de Uppsala Üniversitesi'nde Berg ve çalışma arkadaşları tarafından önerilen, 'Berg modeli' olarak adlandırılan temel reaktif saçtırma prosesi tanımlanmıştır ve aşağıda açıklanmaktadır (Berg vd., 1987). Bu model yoluyla; biriktirme oranındaki, biriktirilen filmin bileşimindeki, reaktif gazın kısmi basıncındaki, hedef yüzeyin reaktif gaz tarafından 'zehirlenmesini', histerezis bölgesinin genişliğini ve konumunun yanı sıra hedef yüzeydeki ciddi değişiklikleri tahmin etmek mümkündür.



Şekil 4. Reaktif saçtırma işleminde saçtırılan malzemenin hedeften alttaşa taşınmasının gösterimi (Berg vd., 1987).

Berg modeli Şekil 4 ile gösterilen ve aşağıda tanımlanan varsayımları içermektedir :

- Hedef, elemental bir metal malzemedir (Ni, Al, Cu, Ti vb.).
- Yalnızca soy gazdan gelen iyonlar hedefin saçtırma erozyonuna katkıda bulunur. Reaktif gazdan gelen iyonların saçtırma katkısı ihmal edilmiştir.

- Hedef yüzeyden saçtırılan bileşik molekülleri, moleküller halinde biriktirilir.
- Hedef akımı tamamen soy gazdaki iyonlar tarafından taşınır. Hedeften yayılan ikincil elektronların katkısı ihmal edilir.
- Hedefteki iyon akımı hedef yüzeyine (A_t) eşit olarak dağılmıştır.
- Hedef yüzeyden saçtırılarak aşındırılan malzemenin tümü, 'toplayan' A_s alttaş yüzeyinde eşit şekilde biriktirilmektedir. Bu 'toplayan' yüzey hem alttaş yüzeyini hem de vakum odasındaki tüm diğer alıcı yüzeyleri temsil eder.
- İşlem sırasında, hedef metal yüzeyinin bir kısmı reaktif gazla reaksiyona girecek ve karşılık gelen metal bileşiğini oluşturacaktır. Bu bileşiğin kapsadığı hedefin kısmı Θ_t ile gösterilir. Şekil 4'de bu durum, A_t hedef alanının iki parçaya bölünmesiyle gösterilmektedir: metal bileşiğini içeren yüzey kısmı Θ_t ve reaksiyona girmemiş metalden oluşan yüzey bölümü $(1 - \Theta_t)$.
- Aynı reaksiyon A_s biriktirme alanında da gerçekleşir. Bununla birlikte, bu yüzeydeki bileşik malzeme (reaksiyona giren hedef metal) tarafından kaplanan Θ_s bölümü, hedef yüzeydeki Θ_t bölümünden farklı olabilir.
- Vakum odasına sağlanan reaktif gaz, oda içinde eşit olarak dağıtılan kısmi P_r basıncında yükselmeye sebep olur. Bu basınç, reaktif gaz moleküllerinin odadaki tüm yüzeylere Γ_r akışına neden olur. P_r ile Γ_r arasındaki ilişki aşağıdaki gibidir.

$$\Gamma_r = \frac{P_r}{\sqrt{2\pi mkT}} \quad (1)$$

(1) denkleminde; m, reaktif gaz molekülünün kütlesi, k Boltzmann sabiti ve T mutlak sıcaklıktır.

- Yapışma katsayısı, reaktif bir gaz molekülünün bir yüzeye çarptığında yüzeyde kalma olasılığı olarak tanımlanır. Bu olasılık, odanın bileşik kaplı kısımları ve hedef yüzeyleri için sıfır olarak alınmıştır.

Yukarıdaki varsayımlara dayanarak, reaktif sıçratma biriktirme sürecini tanımlayan üç temel denge denklemini tanımlamak mümkündür.

1.3.1 A_t Hedef Alanındaki Şartlar

Hedef yüzeyinde bileşik oluşumu yalnızca, reaktif gaz ve reaksiyona girmemiş hedef metali içeren ve $(1-\Theta_t)$ ile gösterilen hedef kısım arasındaki reaksiyonlar nedeniyle gerçekleşecektir. Hedefte bileşik oluşum hızı (birim zamandaki molekül sayısı) aşağıdaki şekilde yazılabilir:

$$\Gamma_r \alpha_t (1 - \Theta_t) A_t b$$

Burada α_t, reaktif gaz moleküllerinin metal yüzeyine yapışma katsayısıdır ve b, bir adet reaktif gaz molekülünün oluşturduğu bileşik moleküllerin sayısını tanımlayan bir faktördür. Bileşik moleküllerin hedef yüzeyden saçılma hızı şu şekilde yazılabilir:

$$\left(\frac{J}{q}\right)\Theta_t A_t \gamma_c$$

Burada J hedef yüzeydeki iyon akım yoğunluğudur (normalde argon iyonları), q temel yüktür, $\Theta_t A_t$ metal bileşik tarafından kaplanan hedef yüzey alanıdır ve γ_c gelen enerjik iyon için bileşiğin saçtırma verimidir ve γ_c iyonun enerjisine bağlıdır.

Kararlı durumda bileşik oluşum hızı (metal hedef ile reaktif gaz arasındaki reaksiyonlardan dolayı), bileşik malzemenin hedeften saçtırma erozyon hızıyla aynı olmalıdır. Bu, Θ_t 'nin kararlı durum değerine ulaştığı anlamına gelir. Bu bize ilk temel denge denklemini verir:

$$\Gamma_r \alpha_t (1-\Theta_t) A_t b = \left(\frac{J}{q}\right)\Theta_t A_t \gamma_c \quad (2)$$

Denklemdeki diğer tüm parametreler kullanıcı tarafından tanımlanabildiğinden, (1) ve (2) denklemi yardımıyla herhangi bir P_r değeri için Θ_t 'yi hesaplamak mümkündür. Hedeften saçtırma toplam erozyon oranı R şu şekilde ifade edilebilir:

$$R = \left(\frac{J}{q}\right)[\gamma_c \Theta_t + \gamma_m (1-\Theta_t)] A_t \quad (3)$$

(3) denkleminde γ_m, enerjik iyonlar aracılığı ile saçtırılma nedeniyle metal atomlarının saçtırma verimidir. Buradaki erozyon hızı saniye başına birim parçacık (metal atomları ve bileşik moleküller) cinsinden ifade edilir.

1.3.2 A_s Biriktirme Alanındaki Şartlar

Hedefteki koşullar için olana benzer bir argüman, A_s biriktirme alanındaki koşulları tanımlamak için kullanılabilir. Kararlı durumda bileşik oluşum hızı, bu yüzeyden 'bileşik eliminasyon' hızıyla aynı olmalıdır. Ancak bu yüzeyde bileşik malzemenin saçtırma erozyonu meydana gelmez. Bunun yerine 'bileşik eliminasyonu', biriktirme yüzeyi A_s 'nin bileşik biriken kısmı (Θ_s) üzerinde toplanan ve hedeften saçtırılan metal atomları tarafından gerçekleştirilir. Bu nedenle, biriktirme yüzeyinin bileşik kaplı kısmının (Θ_s) üzerine bir miktar 'reaksiyona girmemiş metal' eklenir ve böylece bu, bir 'metal' yüzeye dönüştürülür. Bu etki, biriktirme yüzeyi kapsama değerinin (Θ_s) azalmasına neden olur. Θ_s 'deki bu azalmaya ilişkin ifade aşağıdaki şekilde elde edilebilir. 'Taze hedef metal atomlarının' toplam saçtırma erozyon hızı, R_m, şu şekilde yazılabilir:

$$R_m = \left(\frac{J}{q}\right)\gamma_m (1-\Theta_t) A_t$$

Bu saçtırmayla aşındırılmış metal, biriktirme yüzeyi üzerinde düzgün bir R_m/A_s biriktirme oranına yol açar. Biriktirme yüzeyinin Θ_s bileşik kaplanmış bölümü üzerinde biriken R_m miktarı $R_m\Theta_s$ dir. Bu terim, reaksiyona girmemiş metal atomlarının birikmesi nedeniyle Θ_s 'deki azalma oranını tanımlar. R_m, $R_m\Theta_s$ ve $R_m(1\text{-}\Theta_s)$ terimleri Şekil 4'de oklarla gösterilmiştir.

Biriktirme alanının metal kısmına $(1\text{-}\Theta_s)$ biriken saçtırılmış metalin tamamlayıcı kısmı $R_m(1\text{-}\Theta_s)$, A_s biriktirme yüzeyindeki metal kısmını değiştirmeyecektir. Çünkü, metalin metal üzerine biriktirilmesi bu konumdaki bileşimi değiştirmez. Aynı durum, biriktirme yüzeyindeki Θ_s kısmı üzerinde saçtırılan bileşik malzemenin biriktirilmesi için de geçerlidir. Benzer bir şekilde, bileşik malzeme üzerine bileşik malzeme biriktirmek, $A_s\Theta_s$ alanının bileşimini değiştirmez.

Bileşik malzeme, biriktirme yüzeyinde iki farklı işlemle oluşturulabilir. Birincisi, biriktirme yüzeyinin taze metal kısmı $(1\text{-}\Theta_s)$ reaktif gazla reaksiyona girerek bu yüzey üzerinde bileşik malzeme oluşturabilir. Bu işlem için toplam bileşik oluşumu oranı aşağıdaki gibidir.

$$\Gamma_r \alpha_s (1 - \Theta_s) A_s b$$

Burada, α_s, reaktif gazın biriktirme yüzeyindeki metal yüzeye yapışma katsayısıdır ve $(1\text{-}\Theta_s)A_s$, biriktirme yüzeyinin metal kısmıdır. Bileşik oluşumuna yol açabilecek ikinci işlem, biriktirme alanının $(1\text{-}\Theta_s)$ metal kısmı üzerinde saçtırılmış bileşik malzemenin birikmesidir. Hedeften bileşik malzemenin toplam saçtırma erozyon oranı R_c aşağıdaki gibi verilmektedir:

$$R_c = \left(\frac{J}{q}\right) \gamma_c \Theta_t A_t$$

Bu saçtırılmış bileşik malzeme, biriktirme alanı A_s üzerinde eşit olarak dağılmıştır. Biriktirme yüzeyinin $(1\text{-}\Theta_s)$ metal kısmı üzerinde biriken parça şu şekildedir:

$$R_c(1 - \Theta_s)$$

Bu terim, saçtırılan bileşik malzemenin biriktirme yüzeyinin taze metal kısmı üzerine birikmesi nedeniyle Θ_s 'deki artış oranını tanımlar. Şekil 4 'de, R_c, $R_c\Theta_s$ ve $R_c(1\text{-}\Theta_s)$ terimleri oklarla gösterilmiştir.

Kararlı durumda, biriktirme yüzeyindeki bileşik oluşumuna katkıda bulunan iki terim, bu yüzeydeki bileşik eliminasyonunu tanımlayan terimi dengelemelidir. Bu, ikinci temel denge denklemini tanımlar.

$$R_c(1 - \Theta_s) + \Gamma_r \alpha_s (1 - \Theta_s) A_s b = \left(\frac{R_m \Theta_s}{d}\right) \quad (4)$$

Burada d, bir adet bileşik molekülündeki metal atomlarının sayısını tanımlayan bir faktördür. (4) denklemin sağ tarafı, her iki tarafın da aynı birimde, yani zaman birimi başına bileşik

molekül olarak ifade edilmesini sağlamak için *d*'ye bölünmüştür. Θ_t (2) denklemi kullanılarak hesaplandığında, (4) denkleminden Θ_s 'yi hesaplamak mümkündür.

Genelde deney ekipmanları, işlem sırasında reaktif gazın kısmi basıncını izleyecek şekilde donatılmamıştır. Reaktif gaz normalde bir kütle akış kontrolörü aracılığıyla vakum odasına beslenir. Bir reaktif saçtırma işleminden bahsederken, normalde reaktif gaz beslemesinin bir girdi parametresi olarak kullanılmasının nedeni budur. Bu nedenle modelde reaktif gazın beslemesi için bir ifade bulmaya ihtiyaç olur.

Yukarıda açıklandığı gibi reaktif gaz, hem hedefte hem de biriktirme yüzeylerinde 'taze metal yüzeyler' ile reaksiyona girecektir. Bu etki nedeniyle reaktif gaz molekülleri bu yüzeylerde giderilecektir (katı bileşik molekülleri oluşturularak gaz fazından çıkacaktır). Reaktif gazın belirli bir kısmi basıncında hedef yüzeydeki giderilme oranı Q_t (birim zamandaki molekül sayısı) şu şekilde yazılabilir:

$$Q_t = \Gamma_r \alpha_t (1 - \Theta_t) A_t \tag{5}$$

Biriktirme yüzeyinde karşılık gelen reaktif gaz giderme terimi Q_s ise şu şekildedir:

$$Q_s = \Gamma_r \alpha_s (1 - \Theta_s) A_s \tag{6}$$

Deney sisteminin vakum pompası, reaktif gazın P_r kısmi basıncında Q_p'yi, yani birim zamandaki molekül sayısını, dışarı pompalayacaktır.

$$Q_p = k_1 P_r S \tag{7}$$

Burada *S*, vakum pompasının pompalama hızıdır ve k_1, ifadeyi istenen birime dönüştüren bir faktördür. (5)-(7) denklemleri, vakum odasındaki reaktif gazın toplam tüketim oranını (Q) belirler. Kararlı durumda (5)-(7) denklemlerinden elde edilen katkı, reaktif gazın toplam giriş akışı Q'yu dengelemelidir. Bu üçüncü temel denge denklemini tanımlar.

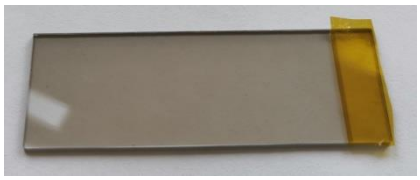
$$Q = Q_t + Q_s + Q_p \tag{8}$$

Γ_r, Θ_t ve Θ_s , (1)-(4) denklemlerinden hesaplanabildiğinden, tüm P_r değerleri için, Q 'yu (8) denkleminden hesaplamak da mümkündür. (8) denklemi, reaktif gazın sabit kısmi basıncını korumak için (kararlı durum), (5)-(7) denklemleriyle tanımlanan üç gaz giderme mekanizması nedeniyle bu gazın toplam Q kaybını telafi etmek amacıyla reaktif gaz vakum odasına Q oranında sağlanması gerektiğini ifade etmektedir.

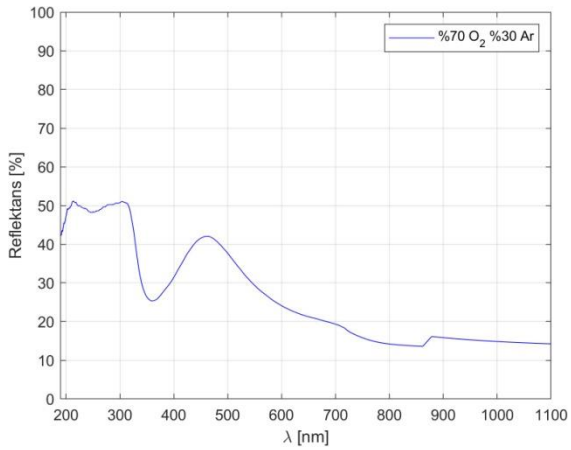
2. Sonuçlar ve Değerlendirme

Cam alttaş üzerine reaktif NiO saçtırma işlemini yapabilmek için, yukarıda açıklanan ve (1)-(8) denklemleri ile ifade edilen tüm optimizasyona işlemleri yapılarak optimal çalışma şartları elde edilmiştir.Buna göre, reaktif gaz olarak %70 O_2 ve %30 Ar gaz karışımı şartları altında,

vakum odasının optimal basıncı 25 mTorr olarak bulunmuş ve plazmanın akım sınırı 500 mA 'e ayarlanmıştır. NiO kaplamanın cam alttaş yüzeyi üzerinde eşit bir şekilde biriktirilmesi amacıyla, alttaş 15 rpm hızında döndürülmüştür. Sıcaklık, oda sıcaklığıdır ve bu şartlar altında, (3) denklemi gereğince hedeften saçtırma erozyon oranı ortalama olarak R=0.02 nm/s hızındadır. 25 mTorr olan vakum odası basıncında reaktif gaz O_2 'in kısmi akışı 7.2 sccm dir. Elde edilen NiO reaktif saçtırma ince film örneği Şekil 5 'te görülmektedir. Şekil 6 'da Şekil 5 'de görülen örnek için yapılan reflektans ölçümünün grafiği verilmektedir.



Şekil 5. 25.4×76.2 mm boyutlarında cam alttaş üzerine 50 nm kalınlığında reaktif NiO biriktirme.



Şekil 6. 190-1100 nm dalgaboyu aralığı için 50 nm kalınlığında reaktif NiO reflektans grafiği.

Bu çalışmada, reaktif saçtırma parametreleri optimize edilmiş ve kararlı çalışma koşulları elde edilerek cam alttaş üzerine reaktif saçtırma yöntemiyle NiO başarıyla biriktirilmiştir.

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UÇUŞ EKİPLERİNİN İŞ SAĞLIĞI VE GÜVENLİĞİ RİSKLERİ VE BU RİSKLERİN YÖNETİMİNDE ÇALIŞAN KATILIMINI SAĞLAMAK İÇİN İYİ UYGULAMA ÖRNEĞİ: İSG GÖNÜLLÜSÜ UÇUŞ EKİBİ

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Özet:
Sivil havacılık sektörü bir asrı geçen mazisi ve her geçen gün büyüyen ekonomisi ile günümüzün parlayan sektörlerindendir. Bu sektörde yer alan farklı disiplinlerdeki milyonlarca çalışan, sektörü ayakta tutmakta ve her yıl milyarlarca yolcunun emniyetli, güvenli ve zamanında bir yerden bir yere ulaşmasını sağlamak için tüm gayreti ve güler yüzü ile çalışmaktadır. Tüm bu çalışmalar süresince hiç kuşkusuz bir takım İş Sağlığı ve Güvenliği (İSG) riskleri doğmakta ve bu risklerin yönetilmesi gerekmektedir. Gerek yasal mevzuat gereklilikleri gerek ulusal ve uluslararası otoritelerin talimatları gerekse sivil havacılık firmaların inisiyatifleri ile pek çok çalışma yapılmaktadır. Yapılan bu çalışmaların temel odağı çalışma ortamlarının iyileştirilmesi ve geliştirilmesi olduğu için bunu çalışanın görüşünü almadan yapmak çok mümkün değildir. Özellikle yasal mevzuat gereği çalışanın görüşünün İSG bağlamında paylaşımı konusunda çalışan temsilcisi, destek elemanı gibi birtakım tanımlamalar yapılsa da sivil havacılık gibi çok büyük, dağınık ve özel bir sektörde bunlar yeterli olmamaktadır. Bu çalışmanın motivasyonu tespit edilen bu eksikliğin giderilmesi ve çalışan katkısının sağlanması adına ülkemizin bayrak taşıyıcı hava yolu firması olan Türk Hava Yolları Anonim Ortaklığında (THY) İSG Gönüllüsü Uçuş Ekibi (İSGGUE) olarak adlandırılan bir uygulamanın hayata geçirilmesidir. Uçuş ekibinin İSG risklerini, bu risklerin yönetimi ve İSG bağlamındaki tüm süreçlerin içerisinde olmasını, yapılan iyileştirmelerde ve saha uygulamalarında görüşlerini paylaşmasını ve alınacak kararlara bir fiil iştirak etmesini amaçlayan bu çalışma ile alana pozitif katkı sağlamak amaçlanmıştır.
Anahtar kelimeler: İş sağlığı, iş güvenliği, uçuş ekibi, risk, gönüllü

ENGAGING FLIGHT CREW IN OCCUPATIONAL HEALTH AND SAFETY RISK MANAGEMENT: AN IMPLEMENTATION OCCUPATIONAL HEALTH AND SAFETY VOLUNTEER FLIGHT CREW

Abstract
The civil aviation sector, with its history spanning over a century and its ever-growing economy, stands as one of the shining industries of our time. The millions of professionals within this sector work tirelessly, with dedication and a smile, to keep the industry thriving and to ensure the safe, secure, and timely transportation of billions of passengers each year. Throughout all these efforts, undoubtedly, Occupational Health and Safety (OHS) risks arise and must be managed. Various efforts are made, driven by legal requirements, national and international regulations, as well as initiatives from civil aviation companies. However, given the fundamental focus of these efforts on improving and enhancing work environments, it is hardly feasible to do so without considering the perspectives of the employees. While designations such as employee representatives or support personnel are defined, especially as per legal requirements, within a vast, scattered, and specialized sector like civil aviation, these may not be sufficient. Motivated by the recognition of this inadequacy and aiming to harness employee contributions, a practice named the Occupational Health and Safety Volunteer Flight Team (OHSTVFT) is proposed to be implemented within our country's flagship carrier, Turkish Airlines Inc. (THY). This initiative seeks to involve the flight team in all aspects of OHS, including the identification and management of OHS risks, sharing their perspectives in improvements and field applications, and actively participating in decision-making processes. Through this initiative, the goal is to make a positive contribution to the field.
Keywords: Occupational health, occupational safety, flight crew, risk, volunteer

GİRİŞ

15. yy. da uçak kanatları ile ilgili çizimler yapan Leonardo Da Vinci ile ilk temelleri atılan havacılık sektörü, 17. yy. da Lagari Hasan Çelebi ve Hezarfen Ahmed Çelebi, 18. yy. da ise Montgolfier kardeşleri çalışmaları ile biraz daha şekillenmiştir. 20. yy. başlarında ise Henri Giffard'un kontrol edilebilir ilk hava gemisi olan zeplin ve Wright kardeşlerin ilk motorlu uçağı ile modern havacılığın temelleri atılmıştır (1). Günümüzde ise sadece Türkiye'de 2021 yılında +253.000 kişinin çalıştığı havacılık sektörü 2022 yılında yaklaşık 600 uçaklık toplam filo, 12.000 kişilik pilot, +180.000.000 toplam yolcuya hizmet verilen bir sektöre dönüşmüştür (2). ICAO'nun 2019 yılı verilerine göre Dünya'da tarifeli seferlerde taşınan toplam yolcu sayısı yaklaşık 4,5 milyar, sefer sayısı ise 38,3 milyona ulaşmıştır (3). Devasa büyüklüklere ulaşan havacılık sektörünün önemli dişlilerinden bir tanesi hava ulaştırma işletmeleridir. Hava araçlarıyla ticari amaçla, belirli hatlar üzerinde, ücret karşılığında yolcu veya yük veya yolcu ve yük taşıması yapan işletmeler ile ticari hava taşımacılığı kapsamında olmayan yolcu ve yük taşımacılığı ile ücret karşılığı olup olmadığına bakılmaksızın yapılacak hava işi ve eğitim faaliyetlerini yapan işletmeler hava taşıma işletmeleri olarak nitelendirilmektedir (4). Hava ulaştırma işletmelerinin Türkiye'deki en bilindik örnekleri ise Türk Hava Yolları (5), Pegasus (6) gibi şirketlerdir. Bu şirketlerin personel yapısına bakıldığında ise personelin yaklaşık %65'inin genel olarak Uçuş Ekibi olarak adlandırılan Kabin Memuru ve Pilotlardan oluştuğu görülmektedir (7). Yolcu taşımacılığı yapan hava araçlarında gerekli emniyet ve güvenlik önlemlerinin uygulanmasından ve yolcu konforundan sorumlu görevliler "kabin memuru" ya da "kabin görevlisi" olarak tanımlanmaktadır. Uçuşun emniyetli, güvenli ve konforlu bir şekilde gerçekleşmesi için hava aracının kabin bölümünde görev alan Kabin Memurları; Sivil Havacılık Genel Müdürlüğü tarafından yayımlanan ilgili mevzuatlarda belirtilen gereklilikleri sağlayarak eğitimlerini başarı ile tamamlayan ve bunun sonucunda "Kabin Memuru Sertifikası" almaya hak kazanmış kişilerdir (8). Pilot ise; hobi, hususi veya profesyonel olarak bir hava taşıtını kullanan, sevk ve idaresini üstlenen meslek grubunun genel adıdır. Hobi olarak uçmak için sadece bir hususi pilot lisansına sahip olmak yeterliyken meslek olarak pilotluğu seçmek istenmesi halinde hususi pilot lisanslarına yönelik uçuş eğitiminden veya sınavından ayrı olarak ticari seviyede bir lisansa sahip olmak gerekmektedir (9). 20/06/2012 tarihli ve 6331 sayılı İş Sağlığı ve Güvenliği (İSG) Kanununun 9 uncu maddesi uyarınca işyerlerinin iş sağlığı ve güvenliği açısından yer aldığı tehlike sınıfları Ek-1'de yer alan İşyeri Tehlike Sınıfları Listesine göre Tehlikeli Sınıfta almaktadır. Bu bağlamda 6331 sayılı Kanununun ilgili tüm hükümlerine

ek olarak tüm uçuş ekipleri için aşağıda belirtilen bazı İSG süreç ve hizmetleri sağlanması gerekmektedir.

- Her 500 uçuş ekibi için tam gün çalışacak en az bir iş güvenliği uzmanı ve kalan her bir çalışan için en az 20 dk. ek iş güvenliği uzmanlığı hizmeti verilmelidir. (10)
- Her 1.000 uçuş ekibi için tam gün çalışacak en az bir işyeri hekimi ve kalan her bir çalışan için en az 10 dk. ek işyeri hekimliği hizmeti verilmelidir. (11)
- Her uçuş personeli işe girişlerinde ve takiben her 3 yılda bir periyodik sağlık muayenesine tabi tutulmak zorundadır (11).
- Her uçuş personeli işe girişlerinde ve tekraren her iki yılda bir 12 saatlik İSG Eğitimi almak zorundadır (12).
- İSG risk analizleri en geç 4 yılda bir yenilenmelidir (13).
- Her 2 ay da bir İSG kurulu toplanmalıdır (14).

Uçuş Ekipleri özelinde İSG bağlamında 2016 ve 2023 yılları arasında tam zamanlı olarak iş güvenliği hizmeti verilmiştir. Bu hizmet süresince yapılan saha gözetimleri, risk analizleri, iş kazası araştırmaları gibi saha uygulamaları ile birlikte İSG eğitimleri, etkinlikler ve kurullar gibi platformlarda elde edilen bilgiler ışığında Uçuş Ekipleri ile alakalı en önemli İSG riskleri aşağıdaki gibi belirlenmiştir.

- **Hat Bazlı Riskler:** Uçuş ekibinin gerçekleştirdiği uçuş hattı (rotası) farklılaştıkça riskleri de değişecektir. Yapılan aylık planlamalara göre bir hava yolu firması kaç farklı destinasyona uçuş gerçekleştiriyorsa bir uçuş ekibi de bu uçuşların tamamında görev alabilmektedir. Örneğin ülkemizde Türk Hava Yolları, dünyanın en çok ülkesine uçan havayolu şirketidir (15). Türk Hava Yollarının İstanbul- Ankara seferi ile İstanbul- Rio de Janeiro seferinin süresi, ikram konsepti, ekip sayısı vb. parametreler farklı olduğundan bu hatların İSG riskleri de birbirinden farklıdır. Temel olarak görev uçuş faaliyeti olsa da ilgili parametreler riskleri ve maruziyetleri farklı boyutlara taşıyacaktır.
- **Uçak Bazlı Riskler:** Hava yolu firmalarının ihtiyaçları doğrultusunda farklı marka ve modellerdeki uçaklara sahip olduğu bilinmektedir (16). Her uçağın boyutu, uçak içi ekipmanları, taşıyacağı yolcu sayısı, içinde çalışacak ekip sayısı (17), (18) vb. her uçak tipi bazında farklı olacağı için uçuş ekibinin de maruz kalacağı İSG riskleri farklılaşmaktadır. Örneğin geniş gövde uçaklarda bulunan crew rest alanları dar gövde uçaklarda

bulunmamaktadır. Bu alanlar uçuş ekibine oteldeki gibi dinlenme imkânı sağlar (19). Ancak bu alan diğer uçaklarda olmadığı için uçak bazlı İSG risklerini farklılaştırmaktadır.

- **Ekipman Bazlı Riskler:** Uçak içinde uçuş ekiplerinin çeşitli sebeplerle kullandığı trolley (uçakta yiyecek ve içecek servisi için kullanılan tekerlekli araçlar), hot jug (çay ve kahve termosları), drower, (içeceklerin trolleylere yerleştirilmesinde kullanılan çekmeceler), fırın, kahve makinesi, su ısıtıcı, çeşitli tepsi, yemek takımları ve bardaklar gibi çok sayıda ekipman bulunmaktadır. Bu ekipmanların her birinin kendince İSG riskleri bulunmaktadır (20).
- **Servis Süreçleri Kaynaklı Riskler:** Havayolu ikram sektörü, faaliyet alanı itibariyle havacılık ve gıda sektörünün kesiştiği bir noktada konumlanmaktadır. Uçaklarda, uçuş sırasında ikram edilen tüm gıda ürünlerinin belirlenen standartlara uygun olarak hazırlanması ve uçaklara sevk edilmesi en temel faaliyet alanıdır (21). Yapılan servis süreci hava yolu firmalar bağlamında da değişiklik göstermektedir. Bazı hava yolu firmaları low cost olarak daha çok ikramı ücret ile satarken diğer hava yolları ise sınırsız ikram sunmaktadır. Bu bağlamda servis yapan uçuş ekibi servis öncesi, sırası ve sonrasındaki süreçlerde başta yanık ve kesik olmak üzere herhangi bir restoranda çalışan servis elemanı ile hemen hemen aynı İSG risklerine sahiptir.
- **Uçuş Kaynaklı Riskler:** Uçuş operasyonun ve uçak içerisinde çalışmanın İSG bağlamında özel bazı riskleri bulunmaktadır. Bu risklerin başında uçağın sürekli hareket halinde olması gerekmektedir. Özellikle kabin ekibi çalışırken üzerlerinde bulunan zemin sürekli çeşitli yönlere hareket etmektedir. Bu durum, bir nevi standart bir personelin çalıştığı ofisin sürekli küçük çaplı depremlere maruz kalmasına ve personelin bu depremlere rağmen çalışmasına bir şey yokmuş gibi devam etmesine benzetilebilir. Sarsıntıların şiddetlenmesi sonucu daha büyük risklere sebep olacak türbülans riski ile karşılaşılabilir.

Uçuş ekibi zaman zaman jet yakıtı gazlarına maruz kalabilir. Bununla birlikte hava alma sistemi nedeniyle kabin havasına tehlikeli maddeler girebilir (22). Ayrıca kabin içerisindeki hava, kabin ekibini enfeksiyon riskine sokacak mikrop ve virüs içerebilir. Parazitlerin yanlışlıkla havayoluna yayılmasını azaltmak için bazı ülkelerin uçak kabinlerinin dezenfekte edilmesi gerekmektedir (23). Uçuş Ekibi çalışma süresi boyunca sürekli ayakta durmakta, malzeme taşımakta, indirip kaldırmakta ve çeşitli alanlara uzanmaktadır. Bu hususlarda yine İSG bağlamında özel riskler doğurmaktadır (24). Uçuş ekibi aynı zamanda hareketli uçaktan kaynaklanan gürültü ve titreşimlere de maruz kalır. Tüm vücut titreşimleri uçuş sırasında, özellikle iniş ve kalkışta veya türbülans sırasında meydana gelir. Uygun olmayan şok emilimi

olan zayıf oturma, kas-iskelet sistemi rahatsızlıkları riskini arttırır. Basınçlı bir kabinde uzun saatler çalışmak, uçuş sırasında barotravmaya neden olabilir. Barotravma, en sık orta kulağı etkileyen, havacılıkta iniş ve çıkış sırasındaki basınç değişimleri ile indüklenir. Östaki borusu tıkalı ve bu nedenle orta kulaktaki hava basıncını dış kabin basıncı ile eşitleyemediğinde oluşur. Barotravma acı verebilir, uçuş ekibinin konsantrasyonunu ve çalışma kapasitesini ciddi şekilde etkileyebilir (25). Uçak motorlarından, yardımcı güç birimlerinden, kara taşıtlarından ve rampadaki ekipmandan kaynaklanan gürültü 85 desibeli geçebilir. 8 saat boyunca 85 desibel ve üzeri bir sese maruz kalmak kalıcı işitme hasarlarına sebep olabilmektedir (26). Uçuş ekibi hafta sonları ve resmî tatilleri de içeren, aile sorumluluklarını ve eğlence etkinliklerini olumsuz yönde etkileyen düzensiz çalışma saatlerine sahiptirler. Bu durum strese ve yorgunluğa neden olabilmektedir. Uzun mesafeli uçuşlarda uçan uçuş ekipleri saat değişikliklerine ve ardından sirkadiyen ritimdeki değişikliklere maruz kalır, bu da jet lag olarak bilinen belirtiye yol açar. Bu durum aşırı yorgunluğa ve performans düşüklüğüne sebep olabilir (27).

- **Yolcu Kaynaklı Riskler:** Uçuş ekibi temel olarak yolcuların mutluluğu ve güvenliği için uçakta bulunmaktadır. Bu bağlamda yolcular ile temas halindeyken yolcunun istemeden teması sebebiyle çeşitli İSG riskleri ortaya çıkmakta ve ekip iş kazaları yaşayabilmektedir. İstemsiz temaslara ek olarak sivil havacılık sektöründe uçuş emniyeti ve güvenliğini tehdit eden kural dışı yolcu olayları, son yıllarda giderek artmakta ve sektör açısından birçok olumsuz sonucu beraberinde getirmektedir (28). Ayrıca kabin görevlileri saldırgan ya da sıkıntılı yolcularla da karşı karşıya kalabilmektedir. Bu yolcular emniyet ve güvenlik tehlikesi oluşturabilirler. ICAO'ya kural dışı yolcular kaba veya küfürlü konuşmak, uçuş ekibinin talimatları ve otoritesine karşı gelmek/uymamak, farklı ses tonu ya da yüz ifadeleri gibi nezaketsiz davranışlar yoluyla memnuniyetsizlik belirtmek, bir tartışmayı kışkırtarak sürdürmek, mantıksız taleplerde bulunmak veya reddedilen talebi devam ettirmek, şüpheli davranışlar (uyuşuk, tepkisiz, heyecanlı, mesafeli vb.), herhangi bir emniyet kuralının ihlalinde bulunabilir. Yolcular ayrıca uçuş ekibine açıktan veya saldırgan bir şekilde fiziksel temas veya saldırı, uçuş ekibine karşı müstehcen, cinsel içerikli ve ahlaka aykırı davranmak, uçuş ekibi veya yolcuları fiziksel şiddet uygulamakla tehdit etmek, uçaktaki herhangi bir acil durum ekipmanını kurcalamak ve gereksiz yere oynamak, uçaktaki herhangi bir ekipmana/parçaya ve mala kasıtlı olarak zarar vermek gibi davranışlarda da bulunabilir. Yolcular bu davranışlarını biraz daha arttırarak silah göstererek tehdit etmek veya silah kullanımı, yaralama niyeti ile yapılan fiziksel veya cinsel saldırı gibi ciddi hayati tehlike oluşturan davranışlarda

bulunabilirken ayrıca kokpite girmeye teşebbüs etmek gibi çok ciddi sonuçları olan davranışlarda da bulunabilir (29).

- **Konaklama ve Lokasyon Bazlı Riskler:** Uçuş operasyonun bir parçası olan konaklama süreci hava yolu firmalarının işletme ve hizmet tiplerine bağlı olsa da uçuş ekipleri için zaruri bir süreçtir. Uçuş planlamalarına uygun olarak iki uçuş arasında da uzun süreli görevlendirmelerde uçuş ekibi çok fazla otel kullanımı yapmaktadır. Gerek yurt içi gerekse de yurt dışındaki otellerde birçok riskin olduğu bilinmektedir (30). Genel oda içinden, kaygan zeminlere, banyo / wc kullanımından genel otel içi ıslak / kaygan zeminlere, otel restoranından ve otelin bahçe ve çevresine kadar pek çok faktör İSG bağlamında riskler barındırmaktadır. Uçuş ekipleri özellikle yurt dışı konaklamalarında otel risklerine bağlı olarak ilgili ülke, kıta, lokasyon vb. bazlı risklere de maruz kalmaktadır. Örneğin özellikle güney yarım kürede görülen sıtma hastalığı uçuş ekibi için ciddi anlamda İSG riski doğurmaktadır (31). Bunun yanı sıra uçuş ekiplerinin ana vatanı ile konakladıkları ülkelerdeki olası deprem, terör, yangın, sel gibi acil durumlar, meteorolojik, kültürel, siyasi, dini, sosyolojik ve trafiğin ters yönden aklaması bölgeye özgü farklılıklar aynı zamanda çeşitli İSG risklerini beraberinde getirmektedir.
- **Ulaşım Süreçleri Bazlı Riskler:** Uçuş ekibi gerek evlerinden havalimanlarına ulaşmak gerek havalimanı içinde uçağa geçmek gerekse de konaklama yapakları lokasyonlarda havalimanları ile oteller arasında çeşitli araçlar ile ulaşımlarını sağlamaktadır. Bu ulaşımlar için kullanılan kara yolu araçların için pek çok İSG boyutu olduğu bilinmektedir (32). Bu araçlar içinde yaşanabilecek olası trafik kazaları, yol veya şoför kaynaklı sorunlar, ilgili lokasyona özgü trafik sorunları, ulaşım sağlandığı araca ait problemler gibi hususlar ilgili ulaşım sürecinin İSG boyutlarını etkilemektedir.
- **Havalimanları ve Ekip Odaları Bazlı Riskler:** Uçuş ekipleri uçuğa geçmeden önce öncelikle kendilerine özgü ekip binaları /odaları ve havalimanlarını kullanmakta ve öncelikle bu alanları kullanıp bu alanlar üzerinden uçağa geçmeleri gerekmektedir. Bu alanlarda bulunan otopark, yürüme alanları ve kaygan yüzeyler, kullanılan merdiven, asansör, yürüme alanlarının kendilerine özgü İSG riskleri mevcuttur. Özellikle havalimanı kullanımlarındaki yolcu ile temas alanları ve kalabalık ortaklar ek riskler doğurmaktadır. Yine havacılık sektöründeki emniyete verilen önem gereği sürekli kullanılması gereken x-ray cihazları ve güvenlik aramaları da yine İSG bağlamında özel risklere sahiptir.

- **Kişi Kaynaklı Riskler:** İşletmelerde yaşanan iş kazaları incelendiğinde kazalanmaların büyük bir kısmı kişisel hatalar olarak değerlendirilebilir (33). Uçuş ekibinin uymaları gereken kurallara uymamaları, yapmamaları gereken faaliyetleri icra etmeleri, kişisel koruyucu donanımlarını kullanmamaları ve anlık dikkatsizlerden kaynaklı çeşitli iş kazaları yaşayabilmekte ve bu kişisel faktörler gerek kendileri gerek ekip arkadaşları gerekse yolcular için İSG bağlamında çeşitli İSG risklerine sebep olmaktadır.
- **Zaman Kaynaklı Riskler:** Sivil havacılık tamamıyla bir zaman çizelgesine oturtulmuş ve gecikmeye tahammülü olmayan bir sektördür. Uçağın zamanında hazırlanması, kapı kapatması, taxi'ye başlaması, kalkması ve inmesi gibi tüm parametreleri zamanında gerçekleşmesi temek performans göstergeleridir. Bu bağlamda bu operasyonun en büyük paydaşlarından biri olan uçuş ekibi içinde aynı hassasiyet geçerli olup uçuş ekibi kaynaklı herhangi bir gecikme olmamalı, tüm süreçler zamanında eksiksiz tamamlanmalı ve hem yolcu memnuniyeti hem de uçuş güvenliğinden taviz verilmemelidir. Bu bağlamda tüm hususların yerine getirilmesi için uçuş ekipleri büyük bir özveri ile çalışmakta ve ellerinden geldiğince hızlı hareket etmeye çalışmaktadır. Bu bağlamda işlerin hızlı yapılması ve dolayısıyla üzerlerindeki zaman baskısı zaman zaman İSG riski olarak karşımıza çıkabilmektedir.

1. METODOLOJİ

2.1. İSG RİSKLERİNİN YÖNETİMİNDE ÇALIŞANLARIN ROLÜ

6331 Sayılı İş Sağlığı ve Güvenliği Kanunu gereği İşveren, iş sağlığı ve güvenliği yönünden risk değerlendirmesi yapmak veya yaptırmakla yükümlüdür (34). Risk analizi öncesi risk analizi ekibi kurulmalı ve bu ekibin içinde işyeri çalışan temsilcileri ve destek elemanlarının bulunması gerekmektedir. Çalışan temsilcisi ve destek elemanına ek olarak risk değerlendirme işyerindeki bütün birimleri temsil edecek şekilde belirlenen ve işyerinde yürütülen çalışmalar, mevcut veya muhtemel tehlike kaynakları ile riskler konusunda bilgi sahibi çalışanlar da bulunmalıdır. İlgili yasal mevzuatımız gereği çalışan temsilcisi; iş sağlığı ve güvenliği ile ilgili çalışmalara katılma, çalışmaları izleme, tedbir alınmasını isteme, tekliflerde bulunma ve benzeri konularda çalışanları temsil etmeye yetkili çalışan olarak tanımlanırken destek elemanı ise asli görevinin yanında iş sağlığı ve güvenliği ile ilgili önleme, koruma, tahliye, yangınla mücadele, ilk yardım ve benzeri konularda özel olarak görevlendirilmiş uygun donanım ve yeterli eğitime sahip kişi olarak tanımlanmaktadır (34). Yerel mevzuata ek olarak Dünya'daki uygulamalara da bakıldığında çalışan temsilcisi ya da destek elemanı gibi kavramların İSG süreçlerine çok fazla dahil edildiğini görebiliriz. Avrupa Konseyi, Uluslararası Çalışma Örgütü,

Avrupa Birliği gibi birlikteliklere ek olarak başta Almanya, Fransa, İsveç başta olmak üzere çok sayıda ülkede benzer uygulamaların olduğu görülmektedir (35).

2.2. İSG GÖNÜLLÜSÜ ve ÇALIŞMA PRENSİPLERİ

THY, ülkemizin bayrak taşıyıcı firması olarak önümüzdeki 10 yıl boyunca büyük bir atılım planlamaktadır. Bu bağlamda 2023 yılında 85 milyondan fazla taşıyan bayrak taşıyıcı firmamız bu rakamı 171 milyona, 435 olan uçak sayısını 813'e, yaklaşık 82 bin olan grup personel sayısını 150.000'e çıkarmayı planlarken uçuş ekibi sayısını yaklaşık 2,5 kat arttırmayı planlamaktadır (36). Personel sayısı ve operasyonel sayısındaki artışlar İSG süreçlerini de direk etkilemektedir. Bu bağlamda hali hazırda kendi bünyesindeki İş Güvenliği Uzmanları, İşyeri Hekimleri, İşyeri Hemşireleri, Çalışan Temsilcileri, Destek Elemanları bulunan şirket, uçuş ekiplerinin İSG süreçlerinin daha efektif yönetimi için İSG Gönüllüsü Uçuş Ekibi Projesini (İSGGUEP) başlatmıştır.

İSGGUEP pilot çalışma olarak 2016 yılında başlatılmıştır. İlgili tarihte yapılacak olan İSG risk analizi çalışması için kurulacak olan İSG Risk Değerlendirme Ekibinde görev almak isteyen uçuş ekipleri için şirket içi bir duyuru yayınlanmış ve aktif C, B veya A sınıfı İSG Uzmanlığı belgesine sahip ya da eğitimini almış olup bu çalışmada gönüllü olarak görev yapmak isteyen uçuş ekibinin gönüllülük usulü ile projeye dahil olabileceği belirtilmiştir. İlgili duyuruya yapılan başvurular arasında beş kişi seçilmiş olup ilgili kişiler öncelikli olarak şirketin İSG Uzmanları tarafından detaylı bir eğitime tabi tutulmuşlardır. İlgili eğitim sonrası ayın yarısında İSG risk değerlendirme ekibi tarafından icra edilen risk analizi çalışmalarına katılmışlardır. İlgili personel, risk değerlendirme çalışmalarına pek çok katkı sağladığı görülmüş olup temelde operasyonel süreçlere çok hâkim olmaları, ilgili süreçlerin İSG bağlamındaki etkilerini çok iyi gözlemleyebilmeleri ve riski yaşıysan kişiler olarak riskin etkisinin azaltılabilmesi adına çok kaliteli ve etkin risk azaltıcı tedbir önerileri sunabilmeleri ile ön plana çıkmıştır. Risk analizi sürecinin bitmesi sonrası bu ekibin sağladığı katma değerin kaybedilmemesi adına süreç İSGGUEP'e evrilmiş ve bu bağlamda öncelikli olarak şirket içi prosedür oluşturulup süreç kayıt altına alınmıştır. İlgili prosedür bağlamında İSGGUE; Tercihen Çalışma ve Sosyal Güvenlik Bakanlığı'ndan onaylı A, B ya da C sınıfı İş Güvenliği Uzmanlığı Sertifikasına sahip ve İSG gönüllüsü olmak isteyen uçuş personeli olarak tanımlanmıştır. Akabinde İSG birimi tarafından şirket içi ilan yayınlanmış ve gönüllü olarak İSG süreçlerine destek vermeye hazır olan uçuş ekibinden bu ilana başvuru yapmaları talep edilmiştir. Başvuru süreci sonrası ilgili başvurular; kişinin CV'si ve geçmiş İSG performansı göz önüne alınarak ön değerlendirmeye tabi tutulmuş olup ön değerlendirmeden başarı ile geçenler ile bire bir mülakat yapılmış ve nihai olarak uygun

görülen uçuş ekibi idari olarak da değerlendirildikten sonra İSGGUEP'e dahil edilmektedir. Bu projeye dahil olan İSGGUE, aktif olarak uçuş görevine sıradan bir uçuş ekibi gibi devam ederken aynı zamanda İSG birimi ile koordineli olarak İSG süreçlerine destek sağlamaktadır. İSGGUEP'e dahil olan uçuş ekibi detaylı bir eğitime tabi tutulmakta ve eğitim sürecini başarı ile tamamladıktan sonra aktif olarak göreve başlamaktadır. İlgili görev tamamıyla gönüllülük usulüne bağlı kalarak, şirketin İSG biriminin koordinasyonunda yürütülmektedir. Öncelikle İSGGUE'lere her ilk ayında detaylı bir İSG birimi tarafından İSG brifingi verilip ekibin İSG bağlamındaki eksikleri tamamlanmaktadır. Ayrıca ekibin yıllık ve aylık yapacağı temel faaliyetler yıl başlarında genel olarak ekip ile paylaşılırken yine her ayın başında ise aylık olarak yapılacak çalışmalar paylaşılmaktadır. Her ay sonu yaptığı faaliyetleri bireysel olarak İSG birimine raporlayan İSGGUEP üyelerinin aylık ve yıllık performans karneleri yine İSG birimi tarafından hazırlanmaktadır. İSGGUE, dilediği zaman projeden kendi isteği ile de ayrılıp faaliyetlerini sonlandırabilmektedir. İSGGUE, İSG performansını yüksek tutması gerekmekte olup aksi taktirde projedeki görevine son verilebilir. İSGGUE olarak minimum üç yıl görev almış ve İSG farkındalığı kazandırılmış ekibin yerine yeni İSGGUE kazandırmak üzere ekibin İSG Gönüllülük süreci sonlandırılabilir. Herhangi bir sebeple görev sonlanmaları sebebiyle projede aksaklık olmaması adına en geç iki yılda bir şirket içi İSGDUEP duyurusu güncellenmektedir. Hali hazırda 25 Kabin Ekibi ve 10 Kokpit Personelinin aktif olarak görev aldığı projede personel sayısının %0,2 – 0,5'i arasındaki personelin aktif olarak bulunması adına İSG birimi tarafından süreç takip edilmektedir.

2.3. İSG GÖNÜLLÜSÜ FAALİYETLERİ

İSGGUE'nin, göreve başladıktan sonra dört temel sorumluluğu bulunmaktadır. Bunlar temel olarak;

- Tespit ettiği tüm ramak kala ve İSG hususlarını İSG birimine raporlamak
- Birlikte görev yaptığı uçuş ekibinin İSG farkındalığı ve kültürüne katkı sağlamak
- Güncel İSG hususlarının sahada takip edilmesini sağlamak
- İSG birimi tarafından yapılan İSG proje ve çalışmalarına iştirak etmek

İSGGUE, çok sayıda çalışmaya imza atmıştır. Ekibin yürüttüğü faaliyetler Standart Çalışmalar ve Proje Bazlı Çalışmalar olarak iki başlık altında toplanabilir.

2.3.1. Standart Çalışmalar:

Bu çalışmalar tüm İSGGUE tarafından tüm uçuş ve faaliyetlerinde gerçekleştirilmesi gereken çalışmalar olup detayları aşağıdaki gibidir.

- **Ramak kala Paylaşımları:** İSGGUE, evden çıkıp tekrar eve gelene kadarki tüm süreçlerde tespit ettiği tüm ramak kalaları İSG birimi ile paylaşır. THY, Dünyada 274 noktasına uçak bir hava yolu firmasıdır (37). Buda binlerce THY uçuş ekibinin günün herhangi bir anında havada, Dünya'nın herhangi bir havalimanında, ekip araçlarında veya otellerde olduğunu göstermektedir. Özellikle İSG profesyonellerinin bulunmadığı bu alanlardaki İSGGUE'nin paylaşımları şirketin İSG kültürünün gelişmesine çok ciddi katma değer sağlamaktadır.
    - Ev – Havalimanı arası toplu ulaşım ve ekip araçları / servisler, ulaşım yolları, şoförler vb.
    - Havalimanları ve çevreleri,
    - Uçak içi süreçler ve yolcu davranışları,
    - Otel konaklamaları, otel transfer araçları, genel oda şartları, yemekler vb.

  Bu şekilde 2023 yılında 1.000'den fazla ramak kala paylaşımı yapılmıştır.
- **İSG Brifingleri:** Uçuş ekibi her uçuş öncesi uçağın Kabin Amiri ve Kaptan Pilotu önderliğinde brifing yapmaktadır. İSG birimi tarafından İSGGUE içinde periyodik olarak İSG bağlamında içerik oluşturulmaktadır. İSGGUE, kendisine İSG birimi tarafından sağlanan bu içeriği ilgili brifinglerde tüm ekibi ile paylaşmakta ve bu paylaşım ekibin İSG farkındalığı ve kültürüne nihai olarak ise şirketin İSG kültürüne pozitif olarak yansımaktadır. Pandemi öncesi 2019 yılında yapılan brifing çalışmaları ile 12.000'den fazla uçuş ekibine ulaşılmıştır.
- **İSG İyileştirme Takibi:** Şirket bünyesinde süreç içerisinde İSG ile alakalı pek çok iyileştirmeler yapılmaktadır. Bu iyileştirmeler periyodik olarak İSG birimi tarafından İSGGUE ile paylaşılmaktadır. Ekibimiz ise saha da ilgili hususları sürekli gözleyerek süreçlerdeki bir hata olup olmadığı, sürecin reel katkısı, sürekliliği ve yeni geliştirme önerileri ile İSG birimine geri dönüş sağlamaktadır.

2.3.2. Proje Bazlı Çalışmalar:

Bu çalışmalar rutin çalışma olmayıp İSG ekibi tarafından yapılan proje bazlı çalışmalardır. "Riski en iyi işi yapan bilir" prensibi ile proje bağlamında İSG birimi tarafından İSGGUE'nin tamamı ya da bir kısmı proje ekibine dahil edip İSGGUE'nin ilgili konu ile alakalı görüşleri

alınır ve proje bazlı saha uygulamasında desteği istenir. Bu prensip ile yürütülen çalışmaların bazılarının detayları aşağıdaki gibidir.

- **Risk Analizleri:** Gerek İSG yasal mevzuatımız gereği (13) gerekse yaşanan iş kazaları, yeni süreçlerin gelişmesi vb. sebeplerle yapılan risk analizi revizyon süreçlerine destek verilmektedir.
- **Teknik Bilgi Paylaşımı:** Uçuş ekibi işleri itibarı ile çok teknik bir iş icra etmektedirler. Yapılan bu işin teknik boyutunun İSG süreçleri ile eşleştirilmesinde İSGGUE'nin İSG birimine verdiği teknik destek çok ciddi önem arz etmektedir. Bu bağlamda İSG birimi tarafından aylık periyodik toplantılar ve özel çalışmalar icra edilip İSGGUE bu toplantılara davet edilmekte ve ilgili konunun İSG boyutu ile alakalı İSGGUE'nin görüşlerine başvurulmaktadır.
- **Hatların Analizi:** İSG bağlamında riskli görülen hatlar vardır. Ayrıca yeni açılan hatlarında İSG bağlamında risklerinin tespit edilmesi gerekmektedir. Bu hatların değerlendirilmesi adına bir ekip oluşturulur. Ekip; hatta görevli uçuş ekibi (bu ekip tamamıyla İSGGUE üyelerinden seçilir), İSG Profesyoneli (İSG uzmanı ve işyeri hekimi) ve operasyonel birimlerden oluşan bir ekip ile o hatta aktif bir uçuş gerçekleştirilir. Bu uçuş şirket içerisinde İSG Uçuşu olarak adlandırılır ve uçuş sırası ve sonrasında hattın riskli bir hat olmasının sebepleri proje ekibi tarafından tespit edilmeye çalışılır. Bu aşamada o hatta sürekli uçuş gerçekleştiren çalışanlar olarak İSGGUE, proje ekibine geri dönüş ve teknik destek sağlayarak ilgili risklerin tespiti hususunda katma değer sağlamaktadır.
- **Uçakların Analizi:** Uçaklar, uçuş ekiplerinin işyeri olup bu alanlarda çok fazla zaman geçirmektedirler. Bu bağlamda gerek mevcut gerekse de filoya yeni katılan uçakların İSG risk ve tehlikelerini uçuş ekibinden daha iyi kimse bilememekte ve yorumlayamamaktadır. İSG Uçuşlarında olduğu gibi uçakların İSG değerlendirme süreçlerinde de İSGGUE'nin destek, teknik bilgi ve yönlendirmelerine başvurulmaktadır.
- **Konaklama ve Otel İSG Çalışmaları:** Dünya'nın en çok noktasına uçak hava yolu şirketlerinden biri olan THY'nin uçuş ekipleri yıllık milyon geceleri bulan konaklamalar yapmaktadır. Bu bağlamda Dünya'nın dört bir tarafında olan oteller ve otel – havalimanı arası transfer süreçleri de İSG bağlamında çok ciddi riskler içermektedir. Bu risklerin yönetimi konusunda İSGGUE çok ciddi rol almaktadır.

Kendilerine İSG birimi tarafından sağlanan form ve yardımcı ekipmanlar ile otel ve ulaşım süreçlerinin İSG boyutunu adeta bir İSG profesyoneli gibi analiz eden İSGGUE konaklama sonrası İSG ekibine raporlama yaparak otelin İSG boyutunda İSG birimini ve şirketini haberdar etmektedir.

- **Farkındalık Çalışmaları:** Uçuş ekiplerinin İSG farkındalığını arttırmak üzere THY bünyesinde çok çalışmalar icra edilmektedir. Bu çalışmalardan bazıları da İSG etkinlikleridir. İSG Etkinliklerinde İSGGUE'ne bu etkinliklerde rol verilmekte olup uçuş ekibinin İSG farkındalığının arttırılmasında kendilerinin de desteği alınmaktadır.

SONUÇ

İSG çalışmalarında çalışan desteği olmazsa olmazdır. Sivil havacılık sektörü ise endüstrileşmeye / makineleşmeye çok müsait olmayan, çok fazla regülasyon ve gerekliliği olan, emniyet – güvenlik ve yolcu memnuniyeti saç ayağı üzerine kurulu, hataya toleransı olmayan ve zaman temelli bir sektördür. Dolayısıyla çalışana diğer sektörlerden daha fazla yük binmekte ve çalışandan daha fazla beklenti söz konusu olmaktadır. Bu bağlamda mevcut İSG riskleri artmakta olup bu risklerin yönetiminde hali hazırdaki İSG profesyonellerinin tek başlarına çalışmasının yeterli olmadığı görülmüştür. Bu sebeple çalışanları İSG süreçlerinin içine çekebilmek adına İSGGUEP devreye alınmıştır. Bu proje ile THY uçuş ekibi İSG faaliyetlerinin içerisinde yer alarak İSG süreçlerinde söz sahibi olmuş ve sistematik bir şekilde görüşlerini paylaşmaya başlamıştır. Bu proje bağlamında İSGGUE, aşağıdaki beş başlık altında raporlanan hususlarda İSG birimine destek olmaktadır.

- Öncelikli olarak risk analizi çalışmalarına dahil olup risklerin belirlenmesinde etkin rol oynayıp risklerin etkilerinin azaltılması ya da yok edilebilmesi için fikirlerini paylaşmıştır.
- Herhangi bir zaman diliminde İSG profesyonellerinin orada bulunamayacağı Dünya'nın herhangi bir alanında uçak içi, otel, ekip araçları gibi alanlardaki tüm risk, tehlike ve ramak kalaları başta THY İSG birimi olmak üzere ilgililer ile paylaşıp sürecin çözümünde önemli rol oynamaktadır.
- İSG birimi ile birlikte uçuş ekibinin İSG farkındalığının arttırılmasında adına ekibine yaptığı bilgilendirmeler ile ekibin İSG farkındalık ve kültürünün gelişmesinde destek sağlamaktadır.

- Havacılık sektörü gibi kompleks, büyük ve detayların yoğun olduğu bir sektörde İSG biriminin ihtiyaç duyduğu tüm teknik desteği sağlamaktadır.
- İSG birimi tarafından yapılan büyük çaplı proje ve çalışmalarda İSG birimi ile birlikte çalışarak aynı zamanda çalışmanın kalite ve büyüklüğüne etki etmektedir.

THY bünyesinde tamamıyla gönüllülük esasına dayanan bu proje ekibi, İSG birimi tarafından periyodik olarak yenilenmekte ve bilgi anlamında sürekli güncellenmektedir. Sürekli geliştirilen proje katılımcılarının sayıları personel sayısının %0,5'ini geçmeyecek şekilde sistematik olarak arttırılmaya çalışılmakla birlikte ekibin sürekli zinde tutulması sağlanmaktadır. Farklı sektör ve çalışma gruplarında için yine farklı formatlarla geliştirilebilecek olan bu projenin çalışanların İSG süreçlerine dahil edilebilmesi adına önemli bir proje olduğu gerek Sivil Havacılık Sektörüne gerekse THY bünyesinde İSG bağlamında çok önemli katma değerler sağladığı görülmektedir.

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SİGORTACILIK MESLEK ELEMANLARININ PERFORMANSINI ETKİLEYEN MESLEKİ BECERİ VE YETKİNLİKLER ÜZERİNE BİR İNCELEME

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Özet
Bu çalışmanın temel amacı sigorta acentelerinde görev yapan personellerin performansını etkileyebilecek mesleki beceri ve yetkinliklerin neler olduğunun belirlenmesidir. Bilindiği üzere, sigortacılık birey ve kurumlara güven hizmeti sağlanmasında dünyanın birçok ülkesinde en önemli sektörlerden biri olup, aynı zamanda önemli bir istihdam sağlayan sektör konumundadır. Sigorta ürünlerinin soyut özelliklerinden dolayı üretilmesi ve pazarlanmasında sigorta acentesi teknik personellerine büyük sorumluluklar düşmektedir. Sigorta ürünlerinin bir *hizmet ürünü* olarak *muamma* olmaktan çıkartıp, sigorta şirketi ve müşteriler nezdinde güveni pekiştiren bir özelliğe bürünmesi için sigorta satış temsilcilerinin oldukça özel mesleki beceri ve yetkinliklere sahip olması gerekmektedir. Çünkü sigorta ürünleri çok az kişinin anlayabileceği karmaşık bir ürün ve hizmettir. Bundan dolayı da sigorta sektöründe görev yapan sigorta satış temsilcilerinin, güvensizlik çağrıştırabilecek her türlü olumsuz tutum ve davranışlardan kaçınması gerekmektedir. Diğer yandan da iletişim ve şeffaflık eksikliğinden kaynaklanabilecek olumsuzlukların neden olabileceği *güvensizlik* duygusunun oluşmaması ve müşteri bağlılığını güçlü bir şekilde oluşturmak için sigortacılığa has birtakım yeteneklere sahip olması önem arz etmektedir. Çalışmada nitel bir yöntem kullanılmıştır. İlgili literatürde dünyada ve Türkiye'de daha önce yapılmış ampirik ve teorik çalışmalardan konu ile ilgili olanlar incelenmiştir. Ayrıca sigortacılık ile ilgili kurum ve kuruluşlar tarafından hazırlanan standartlar incelenerek, sigorta acentelerinde görevli satış temsilcilerinin performansını etkileyebilecek mesleki beceri ve yetkinliklerin neler olduğu belirlenmeye çalışılmıştır. Çalışmanın kapsamı sigorta acentelerindeki satış temsilcileri ile sınırlandırılmıştır. Çalışmanın sonuçlarına göre, meslek standartlarında tanımlanmış olan görevler ve işlemleri yerine getirebilmek için kişilerde olması gereken bilgi ve beceriler, diğer yandan satış temsilcilerinin sahip olması gereken tutum ve davranışlar belirlenerek sektörde bulunan sigorta acenteleri satış temsilcileri için performans kriterleri de belirlenmeye çalışılmıştır. Bu çalışmanın sigorta acenteleri yöneticileri ve bu acentelerde görev yapan sigorta satış temsilcilerinin kendilerinin performanslarını değerlendirmelerinde bir kılavuz görevi görmesi beklenmektedir.
Anahtar Kelimeler: Sigorta, Sigortacılık sektörü, Sigorta Satış Temsilcisi, Mesleki Beceri, Mesleki yetkinlik

A REVIEW ON PROFESSIONAL SKILLS AND COMPETENCIES AFFECTING THE PERFORMANCE OF INSURANCE PROFESSIONALS

Abstract
The main purpose of this study is to determine the professional skills and competencies that can affect the performance of personnel working in insurance agencies. As it is known, insurance is one of the most important sectors in many countries of the world in providing trust services to individuals and institutions, and is also a sector that provides significant employment. Insurance agency technical personnel have great responsibilities in the production and marketing of insurance products due to their intangible features. Insurance sales representatives must have very specific professional skills and competencies in order for insurance products to cease being an enigma as a service product and to become a feature that reinforces trust in the insurance company and customers. Because insurance products are complex products and services that very few people can understand. For this reason, insurance sales representatives working in the insurance industry must avoid any negative attitudes and behaviors that may evoke distrust. On the other hand, it is important to have certain skills specific to insurance in order to avoid the feeling of distrust that may be caused by the negativities that may arise from lack of communication and transparency and to create strong customer loyalty. A qualitative method was used in the study. In the relevant literature, empirical and theoretical studies previously conducted in the world and in Turkey were examined. In addition, by examining the standards prepared by institutions and organizations related to insurance, it has been tried to determine what professional skills and competencies may affect the performance of sales representatives working in insurance agencies. The scope of the study is limited to sales representatives in insurance agencies. According to the results of the study, performance criteria for sales representatives of insurance agencies in the sector were tried to be determined by determining the knowledge and skills that people should have in order to fulfill the duties and transactions defined in the professional standards, as well as the attitudes and behaviors that sales representatives should have. It is expected that this study will serve as a guide for insurance agency managers and insurance sales representatives working in these agencies to evaluate their performance.
Keywords: Insurance, Insurance Industry, Insurance Sales Representative, Professional Skills, Professional competence

Giriş

Yirminci yüzyılın ikinci yarısından bu yana teknolojik gelişmeler başta olmak üzere iş dünyasında meydana gelen değişimler, işletmelerde ve işgücü piyasalarında yaşanan gelişmeler, yöneticileri, çalışanları seçme ve geliştirme konusunda yeni yollar bulmaya zorlamaktadır (Assunção ve Goulart, 2016; Roodt ve La Grange, 2001). Bir başka ifadeyle günümüzde yeni yönetim modellerinin benimsenmesi, tüketici davranışlarında meydana gelen değişimler işletme yöneticilerinin insan kaynakları potansiyeli ve yeterlilikleri hakkında yeniden düşünmeye yöneltmektedir. Le Boterf (2003), *yeterlilik* kavramının, "karmaşıklık ve karşılıklı bağımlılığın" yoğun olarak tezahür ettiği günümüzde yeni normaldeki zorlukların anlaşılmasına izin vermediğini ifade etmektedir. İşletmelere rekabet avantajı sağlayacak iş gücü kabiliyetlerinin arttırılması onlara yeni beceri ve yetkinliklerin kazandırılması konu hakkındaki akademik çalışmalara zemin hazırlamaktadır. Bu çalışma böyle bir dönemde, iş gücünün mesleki nitelik ve yeterlilik kabiliyet durumunu ve gelecekte hangi beceri ve yetkinliklerin lazım olabileceğini ele alan teorik bir çalışmadır.Bu çalışmanın temel amaçlarından biri sigorta acentelerinde görev yapan personellerin günümüz şartlarında performansını etkileyebilecek mesleki beceri ve yetkinlikler üzerine bir inceleme yapmaktır. Ayrıca bu meslek elemanlarının yakın gelecekte mesleklerini icra ederken başka hangi beceri ve yetkinliklere ihtiyaç duyabileceği hususu da çalışmanın bir diğer amacıdır. Kısaca çalışmada sigorta satış temsilcilerinin bugün ve gelecekte hangi beceri ve yetkinliklere ihtiyaç duyabileceği konusunda değerlendirmeler yaparak çeşitli öngörülerde bulunulması amaçlanmaktadır. Bilindiği üzere, sigortacılık birey ve kurumlara güven hizmeti sağlanmasında dünyanın birçok ülkesinde en önemli sektörlerden biri olup, aynı zamanda önemli bir istihdam sağlayan sektör konumundadır. Sigorta ürünlerinin soyut özelliklerinden dolayı üretilmesi ve pazarlanmasında sigorta acentesi teknik personellerine büyük sorumluluklar düşmektedir. Çünkü sigorta ürünleri çok az kişinin anlayabileceği karmaşık bir ürün ve hizmettir. Bundan dolayı da sigorta sektöründe görev yapan sigorta satış temsilcilerinin, güvensizlik çağrıştırabilecek her türlü olumsuz tutum ve davranışlardan kaçınması gerekmektedir. Diğer yandan da iletişim ve şeffaflık eksikliğinden kaynaklanabilecek olumsuzlukların neden olabileceği *güvensizlik* duygusunun oluşmaması ve müşteri bağlılığını güçlü bir şekilde oluşturmak için sigortacılığa has birtakım yeteneklere sahip olması önem arz etmektedir.Çalışmada nitel bir yöntem kullanılmıştır. İlgili literatürde dünyada ve Türkiye'de daha önce yapılmış ampirik ve teorik çalışmalardan konu ile ilgili olanlar incelenmiştir. Ayrıca sigortacılık ile ilgili kurum ve kuruluşlar tarafından hazırlanan standartlar incelenerek, sigorta acentelerinde görevli satış

temsilcilerinin performansını etkileyebilecek mesleki beceri ve yetkinliklerin neler olabileceği belirlenmeye çalışılmıştır. Çalışmanın kapsamı sigorta acentelerindeki satış temsilcileri (seviye 4) ile sınırlandırılmıştır. Çalışmanın sonuçlarına göre, meslek standartlarında tanımlanmış olan görevler ve işlemleri yerine getirebilmek için meslek elemanlarında olması gereken bilgi ve beceriler, diğer yandan bu kişilerin sahip olması gereken tutum ve davranışlar belirlenerek sektörde bulunan sigorta acentelerinde görevli satış temsilcileri için performans kriterleri de oluşturulmaya çalışılmıştır. İlgili literatürde konu hakkında fazla çalışma yapılmamış olması nedeniyle bu çalışmanın ilgili alanda önemli bir boşluğun doldurulmasına katkı yapması beklenmektedir. Ayrıca bu çalışmanın sigorta acenteleri yöneticileri ve bu acentelerde görev yapan sigorta satış temsilcilerinin kendilerinin performanslarını değerlendirmelerinde bir kılavuz görevi görmesi beklenmektedir.

2.Çalışma Alanı

2.1.Sigorta, Sigorta Şirketleri ve Sigorta Acenteleri

2.1.1.Sigorta

"Sigorta" hakkında tek bir tanım olmamakla birlikte, hukuk, ekonomi, tarih, aktüerya bilimi, risk teorisi ve sosyoloji gibi çeşitli disiplinlerin bakış açısından farklı tanımlamalar mevcuttur (Rejda ve McNamara, 2014; Teale, 2008). Bu çalışmada bütün sigorta tanımlarına yer verilmeyecektir. Ancak araştırma konusu bakımından bir tanım yapılması gerekirse, Türk Ticaret Kanunu (TTK, 2011) 6.Kitabında yer alan tanımına bakılabilir. Buna göre, sigorta;

> *"Sigortacının bir prim karşılığında, kişinin para ile ölçülebilir bir menfaatini zarara uğratan tehlikenin, rizikonun, meydana gelmesi hâlinde bunu tazmin etmeyi ya da bir veya birkaç kişinin hayat süreleri sebebiyle ya da hayatlarında gerçekleşen bazı olaylar dolayısıyla bir para ödemeyi veya diğer edimlerde bulunmayı yükümlendiği"*

bir sözleşme olarak tanımlanmaktadır (TTK, 1041). Amerikan Risk ve Sigorta Birliği Sigorta Terminolojisi Komisyonu da sigortayı şu şekilde tanımlamıştır (Rejda ve McNamara, 2014; Teale, 2008):

> *"Sigorta, tesadüfi zararların, bu tür zararlar için sigortalıları tazmin etmeyi, meydana geldiklerinde başka maddi faydalar sağlamayı veya riskle ilgili hizmetleri sağlamayı kabul eden sigorta şirketlerine bu tür risklerin devredilmesi yoluyla bir havuzda toplanmasıdır*."

Tanımlardan da anlaşılacağı üzere sigorta, birey ve/veya kurumlara, belli bir prim karşılığında güvence sunan bir risk yönetim uygulamasıdır. Sigortacı, önceden belirlenmiş olan bir prim karşılığında tesadüfen gerçekleşecek birtakım risklerin geçekleşmesi sonucunda, sigorta poliçesi hükümlerine göre, sigortalıya veya sigorta ettirene tazminat ödeyerek, güvence hizmetini sunmuş olmaktadır.

2.1.2.Sigorta Şirketleri

Dünya'da ve Türkiye'de finansal hizmetler sektörü, insanlara finansal ürün ve hizmet sağlayan çok sayıda kuruluştan oluşmaktadır. Bu kuruluşlardan bazıları, ticari bankalar, tasarruf ve kredi kuruluşları, kredi birlikleri, sigorta şirketleri, menkul kıymet satıcıları, özel ve devlet emeklilik fonları, finans şirketleri ve diğer kuruluşlar örnek olarak gösterilebilir (Rejda ve McNamara, 2014; Teale, 2008). Sigortacılık, ekonominin dolayısıyla finans sektörünün bir parçasıdır ve amacı şirketlerin ve bireylerin risklerini yönetmektir. Sigortacılık hizmetleri alanı, dünyanın diğer ülkelerinde olduğu gibi Türkiye'de de en dinamik ve hızla gelişen pazarlardan birisi olup, tamamıyla devletin yasal düzenlemelerine tabi olup, bu düzenlemeler sigorta sektöründe yer alan tüm paydaşları kapsamaktadır. Özetle, *sigorta şirketleri* kuruluş amaçları itibariyle risk altında bulunan birey ve kurumlara toplamış oldukları primler karşılığında risklerin gerçekleşmesi durumunda teminatlar veren iktisadi kuruluşlardır (Wagner ve Fuino, 2024). Sigortacılık sektöründe pazarlama çalışmaları hem müşterilerin hem de çalışanların kilit bir rol oynadığı bir alandır (Witkowska ve Stachowska, 2021).

Bilgi işlem teknolojileri ve genel bilgi düzeyleri arttıkça tüketici davranışları değişmekte ve müşteriler, kendilerine sigorta hizmeti sunan çalışanlara karşı giderek daha bilinçli ve daha fazla talepkar olmaktadırlar. Walkowiak'a (2008) göre, bunun bir diğer nedeni de uluslararası pazarlar da dahil olmak üzere yeni pazarlara girerek konumlarını genişleten sigorta şirketleri arasındaki artan rekabettir. Yeni sigorta şirketlerinin ortaya çıkışı, yeni ürünler, bu hizmetlerin sunulduğu kanallar, müşterilerin yeni ihtiyaç ve gereksinimleri, sigorta şirketlerini, müşterinin teklifinden vazgeçmemesi ve sigortayı kabul etmesi için hizmetlerini mükemmelleştirmeye zorlamaktadır. Zira, bu süreç içerisinde sigorta komisyonculuğu da önemli ve güvene dayalı bir hizmet olarak ortaya çıkmaktadır (Pieroway, 2024). Rudzewicz'e (2018) göre ortaya çıkan bu yeni durum yani sigorta pazarındaki rekabet, müşteriyle uzun vadeli ilişkiler kurabilecek ve onlara uzun dönemli uygun müşteri hizmetini sağlayarak güven sağlayan satış temsilcilerine olan ihtiyacı artırmaktadır. Bir başka ifadeyle, sigortacılıkta müşterilerin korunması, diğer şeylerin yanı sıra, sigorta dağıtımıyla ilgilenen gerçek kişilerin (satış temsilcilerinin) yetkinliği ve profesyonelliği ile sağlanabilmektedir (Korica ve Zarubica, 2021).

Pek çok müşteri için, bir komisyoncunun, özellikle de verilen fiyat karşılığında, iyi bir iş çıkardığını söylemek *neredeyse imkânsız* olabileceği ileri sürülmektedir (Pieroway, 2024). Ticari anlamda sigorta şirketlerinin çoğu sigorta acentelerine ve sigorta brokerlerine poliçe satış sürecinde güvenmek zorunda kalmaktadır. Çünkü bu söz konusu sigorta aracıları müşterilerin karşısında sigorta şirketlerini temsil etmektedirler.

2.1.3.Sigorta Acenteleri

Başarılı bir satış gücü, dünyanın her yerinde finansal hizmetler sektöründe başarının anahtarlarından biridir (Rejda ve McNamara, 2014; Teale, 2008). Günümüzde satılmakta olan sigorta poliçelerinin önemli bir çoğunluğu sigorta acenteleri ve brokerler tarafından satılmaktadır (Wagner ve Fuino, 2024). Sigortacılık Kanunu'na (SK) göre, sigorta acentesi şu şekilde tanımlanmaktadır (R.G., 2024a):

> *"Ticarî mümessil, ticarî vekil, satış memuru veya müstahdem gibi tâbi bir sıfatı olmaksızın bir sözleşmeye dayanarak muayyen bir yer veya bölge içinde daimî bir surette sigorta şirketlerinin nam ve hesabına sigorta sözleşmelerine aracılık etmeyi veya bunları sigorta şirketleri adına yapmayı meslek edinen, sözleşmenin akdinden önce hazırlık çalışmalarını yürüten ve sözleşmenin uygulanması ile tazminatın ödenmesinde yardımcı olan kişidir."*

Sigorta acentesi, sigorta şirketinin nam hesabına sigorta poliçelerinin satışına bir komisyon geliri karşılığında aracılık ederek, poliçeyi tanzim edip, müşteriye sunan gerçek veya tüzel kişidir. Sigorta acenteleri Türkiye'de 5684 sayılı sigortacılık kanununa atfen çıkartılan *Sigorta Acenteleri Yönetmeliğine* göre kurulan ve her faaliyeti yasal olarak tanımlanmış olan kurumlardır. Ayrıca yine yönetmelikte tanımlandığı üzere sigorta acenteleri, sigorta şirketi adına, "acente işlemleri" olarak adlandırılan, poliçe satışı için gerekli tanıtım ve pazarlama faaliyetlerinin yapılması, müşterilerin kayıt altına alınması, sigorta sözleşmelerine yönelik hazırlıkların yapılması, sigorta sözleşmelerinin yönetilmesi, hasarlarla ilgili konularda ve acentelik işlemlerinin organize edilmesi, denetlenmesi gibi faaliyetleri bir komisyon geliri karşılığında yapmaktadırlar (R.G. (2024b).

2.1.4.Sigorta Acentelerinin Poliçe Satışındaki Rolü ve Önemi

Sigorta sektöründe yaşanmakta olan ekonomik ve teknolojik değişimlerdeki süreklilik, diğer yandan sigorta şirketleri arasındaki artan rekabet ve üretkenlik baskısı, sigorta satış temsilcisine işlerini yaparken yüksek düzeyde özen göstermesini zorunlu kılmaktadır (Negrutiu ve diğ., 2020; Zadykowicz ve diğ., 2020). Witkowska ve Kucka'ya (2008) göre, bir sigorta acentesi, sigorta hizmetlerinin satışında hayati bir rol oynamaktadır. Yazarlara göre, acenteler sigortayı

teklif ederken bireysel davranışlarıyla ve katılımlarıyla müşteriyi sigortayı satın almaya teşvik edebilmeli, müşterilerin farklı beklentilerini de karşılayarak mümkün olan en yüksek kalitede hizmetleri sunabilme becerisine sahip olmalıdırlar. Li vd., (2021) göre, sigorta satış temsilcisi, bir anlamda sunmuş olduğu profesyonel hizmeti sayesinde müşteriyle ilgilenen ve müşterinin özel ihtiyaçlarını tanıyabilen müşterinin mali danışmanıdır. Çünkü sigorta şirketleri, satış temsilcileri aracılığıyla müşterilerini ikna etmek için etkili yollar ararlar; bu da onları çalışanlarının, bilgi, beceri ve tutumlarına dikkat etmeye teşvik etmektedir. Bir başka ifadeyle müşterinin sunulan hizmetlerin kalitesinden hiçbir şüphesinin olmaması oldukça önemlidir. Müşteri memnuniyeti, aynı zamanda sadakatlerin korunmasına da yardımcı olur (Witkowska, 2010; Ahmed ve diğ., 2020) ve bu, olumlu bir ilişki kurmanın ve daha uzun vadeli iş birliğinin temelini oluşturmaktadır.

2.2.Sigortacılık Meslek Elemanlarının Performansını etkileyen Mesleki Beceri ve Yetkinlikler

Rekabet ve bilgiye dayalı ekonomi koşullarında mesleki beceri ve yetkinliklerin önemi sürekli artmaktadır (Korica ve Zarubica, 2021). Bir ticari faaliyeti yürütme biçimindeki dinamik değişiklikler, bir şirketin pazar başarısının giderek daha sık olarak çalışanlarının uygun yetkinlikleri ve onların gelişimlerine yatırım yapılmasıyla belirlendiği anlamına gelmektedir (Macerinskiene ve Survilaite, 2019; Zygmunt, 2019). Beşerî sermayenin ekonomik büyüme üzerindeki etkisinin bu mekanizması, çalışanların bilgi ve becerilerinin tüm ekonominin gelişme kapasitesini önemli ölçüde artırdığı argümanına dayanmaktadır (De la Fuente ve Ciccione, 2002).

2.2.1.Yetkinlik Kavramı

Lester, (2014) çalışmasında "yetkinlik" kavramının için genel olarak bir kişinin neler yapabileceğini ifade etmek için kullanıldığını belirtmektedir. Yazar çalışmasında ayrıca bu kavram için "görevleri ve rolleri beklenen standartta yerine getirme yeteneği" olarak tanımlamaktadır. Bir başka çalışmada Uluslararası Standartlar Organizasyonu tarafından (ILO, 2012) yetkinlik "amaçlanan sonuçlara ulaşmak için bilgi ve becerileri uygulama yeteneği" olarak tanımlamaktadır. Bir başka ifade ile "yetkinlik" "yapabilmenin" kavramsallaştırılmış şeklidir (Lester, 2014). İlgili literatür incelendiğinde "yetkinlik" için birçok tanım yapılmıştır. Bu nedenle dilbilimciler yetkinliği, planlanan görevlerin gerçekleştirilmesi için bir kurum veya bireyin uygunluğu, yetkilendirilmesi, vekalet edilmesi, kişinin bilgi, beceri ve sorumluluklarının kapsamı olarak tanımlamaktadır (Korica ve Zarubica, 2021). İngilizcede "yeterlilik" (sufficiency-yeterlilik, qualification-vasıf, competence-yeterlilik) kavramı altında,

bir şeyi gerekli olduğu şekilde olarak yapabilme yeteneği, beceri anlaşılmaktadır. Bu tanım, yeterlilikler ve beceriler arasındaki kesin ilişkiyi açıklamaktadır. Ancak bir yetenek, görevleri yerine getirmek için gerekli olan becerilerle, özelliklerle ilişkilidir. Bahsedilen tanımlar kesin değildir; yeterlilikler ve yetenekler arasındaki net ayrımı yapmak mümkün değildir. İlgili alanda yapılan çalışmalar incelendiğinde "beceri" yerine "yetenekler" ve "yeterlilik" eşanlamlı terimleri kullanıldığı görülmektedir. Bir başka çalışmada "yeteneğin" bireyin fiziksel veya ruhsal karakteri olduğu ileri sürülerek, yetkinlik kazanma sürecinin bilgi, tutum ve değer sistemi ile belirlendiği ifade edilmektedir (Kajwang, 2022). "Beceri" kavramı için ise, çalışma, iyileştirme, uygulama ve danışmanlık yoluyla kazanılabilecek, görevin gerçekleştirilmesine ilişkin davranışlar olduğu ifade edilmektedir.

Ramos, (2006) yeterliliğin üç boyutu olduğunu ileri sürmektedir. Bunlar; birincisi, mezuniyet süreçlerini diplomaların değeri ile birleştiren kavramsal boyut; ikincisi mezuniyet sürecini pozisyonun sosyal olarak tanınmasıyla ilişkilendiren sosyal boyut; üçüncüsü ise, mezuniyetin niteliklerin gelişimi ile ilişkili olduğu deneysel boyuttur. Kısacası *yetkinlik*, üstün bir performansı tanımlayacak bir dizi bilgi, beceri ve tutum olarak anlaşılmaktadır (Witkowska ve Stachowska, 2021). Çalışanlara verilen görevlerin doğru şekilde uygulanması, onların temel yetkinlikler olarak kabul edilen uygun yeterliliklerini gerektirir. Çalışanların yetkinlikleri, belirli bir faaliyet alanındaki (örneğin, satışta sunulan hizmetlerin kalitesi) etkinliğini belirler (Korica ve Zarubica, 2021). İş yerinde yetkin kişiler, belirli sonuçlara ulaşma konusundaki beklentileri karşılar, rollerine atanan hedef ve standartlara ulaşmak için bilgi, beceri ve kişilik özelliklerini kullanabilirler. Yetkin çalışanlarla bir şirket en üst düzeyde hizmet verebilir. Hizmetlerin yüksek kalitesi doğrudan müşteri memnuniyeti ve sadakatine dönüşmekte, bu da şirket için kar yaratmaktadır ve üretkenliğini ve son olarak da pazar rekabet gücünü etkilemektedir (Kajwang, 2022).

Assunção ve Goulart (2016) göre, organizasyonun strateji ve hedeflerini çalışanların gelişimi ile birleştiren insan kaynakları yönetiminde yetkinlik bazlı bir yaklaşım giderek önem kazanmaktadır. Bu yaklaşımda yetkinlikler, bir çalışanın belirli bir değere dönüştürülebilen nitelikleri (özellikleri), yani uygulanan görevlerin ve iş sonuçlarının kalitesi olarak tanımlanabilir (Korica ve Zarubica, 2021). Bu nedenle şirketler, işlerinde arzu edilen yetkinliklere sahip çalışanları kazanmaya, elde tutmaya çabalamakta ve katma değer yaratarak rekabet güçlerinin artmasına katkıda bulunmaktadırlar. Bu açıdan bakıldığında işin kalitesini ve etkinliğini artırmak için çalışanların temel yetkinliklerinin ve gelişimlerinin uygun düzeyde

izlenmesi, geliştirmesi ve bunların sürdürülmesi esastır. Yetkinlik modeli iki açıdan ele alınabilir (Dingle, 1995): Bunlar, Bireysel ve Örgütsel Yetkinliklerdir.

Bireysel Yetkinlikler

Bu yaklaşım, çalışanların istenen sonuçlarına ulaşmaya katkıda bulunan davranışlarını ve belirli pozisyonlarda kurumsal rollerini başarıyla yerine getirmek ve şirketin hedeflerine ulaşmasına katkıda bulunmak için sahip olması gereken bilgi ve beceri alanlarını karakterize etmektedir. Verilen görevlerin yerine getirilmesi sırasında yeterliliklerin ortaya konulması ve belirli davranışların ortaya konulması olasılığı ile ilgili olduğunu belirtmek gerekir (Kajwang, 2022).

Örgütsel Yetkinlikler

Örgütün rekabet avantajını belirleyen unsurları olarak çalışanların yeterliliklerinin stratejik önemine dikkat çekilirken, ayırt edici yetenek ve süreçleri tanımlayan temel yeterlilikler benzersiz stratejik kaynaklar olarak kabul edilmektedir. Bu bakış açısıyla yetkinlik modelleri esas olarak çalışanların davranışlarını belirlemek ve istenilen iş sonuçlarına ulaşmaya katkıda bulunmak için kullanılmaktadır (Prahalad ve Hamel, 1990).

OECD tarafından yayınlanan rapora göre, (2005), 21.yüzyıl beceri ve yetkinlikleri şu şekilde belirtilmiştir:

- ✓ *Yaratıcılık/yenilik*
- ✓ *Kritik düşünce*
- ✓ *Bilgi okuryazarlığı*
- ✓ *Problem çözme*
- ✓ *Karar verme*
- ✓ *Esneklik ve uyarlanabilirlik*
- ✓ *Öğrenmeyi öğrenmek*
- ✓ *Araştırma ve sorgulama*
- ✓ *İletişim*
- ✓ *Girişim ve öz yönlendirme*
- ✓ *Verimlilik*
- ✓ *Liderlik ve sorumluluk*
- ✓ *İş birliği*
- ✓ *BİT işlemleri ve kavramları*
- ✓ *Dijital vatandaşlık*
- ✓ *Medya kur yazarlığı*

2.2.2. Sigortacılıkta Mesleki Beceri ve Yetkinlikler

Kajwang, (2022) çalışmasında sigorta şirketlerinde performans ölçümünün temel göstergeleri; çalışan memnuniyeti, çalışan eğitim süresi artış hızı, çalışan makul teklif artış hızı ve geliştirilen ürün sayısı olduğunu belirterek, sigorta sektöründe teknolojik değişimler yaşadıkça, çalışanların işe alınması ve işte tutulması için gereken istihdam edilebilirlik becerileri ve akademik niteliklerin de değiştiğini ve gelecekte de bu değişimin devam edeceğini ileri sürmektedir. Yazar çalışmasında sigorta sektörünün performansında eğitim ve becerilerin önemini araştırmış, İK yöneticilerinin çalışanlarının genel performansa katkıda bulunan becerilerini geliştirmek için kullandıkları çeşitli yollar hakkında tespitlerde bulunmuştur. Yazar

çalışmasında ayrıca sigorta sektöründe, çalışanların işlerini daha hızlı ve verimli bir şekilde yapmalarını ve bunun sonucunda genel performansa katkıda bulunmalarını sağlayan insurtech gibi sistemler konusunda çalışanlarına eğitim verilmesinin onların performansını arttırabileceğini ileri sürmüştür. Yazar çalışmasında "sosyal beceriler, teknik beceriler, iletişim becerileri, liderlik becerileri, organizasyon becerileri ve kişilerarası beceriler" olarak ifade edilen temel becerilerin tüm meslekleri kapsadığını belirtmekle birlikte bu becerilerin sigortacılık için de önemli olduğunu ileri sürmüştür.

Assunção ve Goulart (2016) çalışmalarında sigorta acenteleri de dahil olmak üzere müşteriyle yüksek düzeyde temas ile karakterize edilen hizmet şirketlerinde, çalışanlar ve onların yetkinlikleri özellikle önem kazanmakta olduğunu belirtmişlerdir. Çünkü müşterilerle temasın kalitesi onların memnuniyeti ve kalitenin değerlendirilmesi üzerinde önemli bir etkiye sahiptir. Literatürde (Carlzon, 1987) "gerçek anı" olarak tanımlanan bu temas, hizmet sağlayıcı ile müşteri arasında uzun süreli bir ilişki kurma olasılığını belirleyecektir. Hizmetler söz konusu olduğunda (özellikle yüksek temas halinde olanlar), müşteriler her şeyden önce ilk temasta bulunan çalışanların oynadığı rolleri (hizmet tarzı, tutum, davranışlar) hatırlar. Román ve Rodríguez (2015) de çalışmalarında müşteri odaklı olmanın satış performansını olumlu yönde etkilediğini ileri sürerek, bir satış elemanının müşteri odaklılığı arttıkça, müşterilerin çıkarları doğrultusunda çalışmaya ve onların ihtiyaçlarını karşılayan teklifleri belirlemeye daha fazla önem vereceğini belirtmektedir. Roodt ve La Grange, (2001) çalışmalarında satış elemanlarının artık sadece ürünü satmaya odaklanmadığını ayrıca güvenilir, kalite odaklı müşteri hizmetleri sunmanın yanı sıra, müşterilere sürpriz ve memnuniyet duygusu veren *müşteri memnuniyeti duygusunu* da sağlamaya çalışmalarının kendilerinin bireysel yetkinlik ve becerilerinden birisi olduğunu ileri sürmektedirler. Bunun için de satış temsilcilerinin kaynaklar, kişilerarası beceriler, bilgi, sistemler ve teknoloji konusunda yeterlilik sahibi ve kabiliyetli olmalarının gerekliliği ileri sürülmektedir (Assunção ve Goulart, 2016). Bu söz konusu hususlarda satış temsilcilerinin genel satış becerilerinin müşteri odaklı satış uygulamasında daha da başarılı olabilmesi için "temel okuma, yazma, aritmetik, konuşma ve dinleme becerilerinin yanında, problem çözme, akıl yürütmeye ilişkin düşünme becerilerine sahip olmalarının kritik öneme sahip olduğunu vurgulamıştır (Román ve Rodríguez (2015). Assunção ve Goulart (2016) çalışmalarında bireysel sorumluluk, sosyallik, öz yönetim, öz saygı ve dürüstlük gibi kişisel niteliklerinin de söz konusu yetkinliklerin kullanılmasında oldukça önemli olduğunu ileri sürmüşlerdir. Daha güçlü müşteri yeterlilik becerilerine sahip bir satış elemanının müşteri

odaklı satış yapma olasılığının daha yüksek olacağı da (Román ve Rodríguez (2015) tarafından çalışmalarında sıklıkla vurgulanmıştır.

3.Materyal ve Yöntem

Çalışmada, nitel araştırma yöntemi kullanılmıştır. Yazar araştırmasında sistematik ve kapsamlı bir literatür araştırması ile ampirik ve teorik ikincil verilerden yararlanmıştır. Araştırmacı çalışmanın amacı doğrultusunda ilgili literatürde dünyada ve Türkiye'de yapılmış konuyla ilgili seçilmiş araştırma sonuçlarına göre sigorta acentelerinde görev yapan personellerin performansını etkileyebilecek mesleki beceri ve yetkinliklerin neler olduğunu hususunda incelemeler yapmıştır. Bilindiği üzere nitel veri analizi, dilsel materyalin araştırmanın amacı doğrultusunda yorumlanarak sınıflandırılmasıdır (Flick, 2022; Kara, 2015). İkincil verilerin analizi, birincil verilerin analizi kadar yaratıcı olabilir ve araştırmacının analitik hayal gücünün akıllıca kullanılmasını gerektirir (James 2012; Kara, 2015). Literatür taraması belirli amaçları gerçekleştirmek veya konunun doğası ve nasıl ele alınması gerektiği hakkında belirli görüşleri ifade etmek için belirli bir bakış açısıyla yazılmış bilgi, fikir, veri ve kanıt içeren, konuyla ilgili mevcut belgelerin seçimi, incelenmesi ve bu belgelerin önerilen araştırmayla ilişkili olarak etkin bir şekilde değerlendirilmesi sürecidir (Bowen 2009; Kara, 2015).

4.Bulgular ve Tartışma

Türkiye'de 5544 sayılı Mesleki Yeterlilik Kurumu (MYK) Kanunu ile "Ulusal Meslek Standartlarının Hazırlanması Hakkında Yönetmelik" kapsamında yapılan çalışmalar neticesinde diğer meslek dallarında olduğu gibi sigortacılık alanında da meslek standartları belirlenmiştir (MYK, 2024). Bu standartlardan biri olan *Sigorta Acentesi Teknik Personeli (Seviye 4)* ulusal meslek standardı (R.G., 2024c) incelenmiş ve aşağıdaki bulgular tespit edilmiştir. Buna göre;

> *"Sigorta Acentesi Teknik Personeli (Seviye 4) iş sağlığı ve güvenliği ve çevre ile ilgili önlemleri alarak, kalite sistemleri çerçevesinde; sigorta acentelerinde sigortacılık işlemlerini (pazarlama bilgilendirme ve satış) yapan ve mesleki gelişime yönelik faaliyetleri yürüten nitelikli kişidir."*

Bu mesleğin uluslararası sınıflandırma sistemlerindeki yeri "ISCO 08:3321-Sigorta temsilcileri" olarak belirlenmiştir (ILO, 2012). Sigorta Acentesi Teknik Personeli (Seviye 4) meslek standardına göre bu kişiler, gerekli şartların sağlanmış olan ofis ortamında, işlerin yapılması için lazım gelen tüm ofis araçlarını kullanma yeterliliğine sahip olarak görevlerini yapma imkan ve kabiliyetine sahip olmalıdırlar. Ayrıca bu seviyedeki personelin gerektiğinde potansiyel sigorta müşterilere ulaşmak ve halihazırda mevcut müşterini ziyaret

etmek için ofis dışında da çalışabilmelidirler. Diğer yandan bunlara ek olarak bu personellerin gerektiği durumlarda esnek çalışma modeline uygun davranmaları gerekmektedir.

4.1. Sigorta Acentesi Teknik Personeli (Seviye 4) İçin Gerekli Yetkinlikler

Sigortacılık meslek elemanlarının performansını etkileyen mesleki beceri ve yetkinlikler üzerine yapılan araştırma sonuçlarına göre, *Sigorta Acentesi Teknik Personelinin (Seviye 4)* görev yaptığı acentede iyi bir performans elde etmek için aşağıdaki hususlarda yetkinliğe sahip olması gerekmektedir:

1.Önce iş organizasyonu yapma ve acentenin iş akışını planlama, görüşmelerin ve satışların raporlanması konusunda, gerekli çalışmaları yapma beceri ve yetkinliğine sahip olması gerekmektedir.

2.Müşteri portföyü oluşturma konusunda ve potansiyel müşterilere ulaşma, satış ve pazarlama odaklı görüşmeler gerçekleştirmek için gerekli çalışmaları yapma beceri ve yetkinliğine sahip olması gerekmektedir.

3.Müşterilerin ihtiyaç ve beklentilerine yönelik çalışmalar yapma, müşterinin ihtiyaç ve beklentilerini analiz etme, müşterilere çözüm önerileri geliştirme ve müşterilere fiyat teklifi verilmesi konusunda beceri ve yetkinliğine sahip olması gerekmektedir.

4.Sigorta şirketi/şirketleri adına sigorta sözleşmesi düzenleme, sigorta sözleşmesi düzenlemek üzere bilgi ve belge toplama, sigorta sözleşmesi hakkında müşteriyi bilgilendirme ve sigorta poliçesini müşteriye sunulması konusunda beceri ve yetkinliğine sahip olması gerekmektedir.

5.Mevcut müşteri ilişkilerini yönetme, mevcut müşteriler için sözleşme/poliçe takibi yapma, hasar durumunda mevcut müşterilere destek olma konusunda beceri ve yetkinliğine sahip olması gerekmektedir.

6.Mesleki gelişim faaliyetlerini yürütme mesleği ile ilgili mevzuatı takip etme, mesleki bireysel gelişimi konusunda çalışmalar yapması konusunda beceri ve yetkinliğine sahip olması gerekmektedir.

4.2. Sigorta Acentesi Teknik Personeli (Seviye 4) İçin Gerekli Bilgi ve Beceriler

1.Acil durum bilgisi

2.Adına poliçe düzenlediği sigorta şirketlerinin hizmet ve çalışma prosedürleri bilgisi

3.Araç, gereç ve ekipman bilgisi

4.Araştırma, veri toplama ve bilgi edinme becerisi

5.Beden dilini ve tüketici psikolojisini anlama becerisi

6.Bilgisayar ve bilgi teknolojileri okuryazarlığı (ofis programları dâhil) becerisi

7.Çevre koruma yöntemleri bilgisi

8.Dönüştürülebilen malzemelerin ayrılması ve geri dönüşüm faaliyetleri bilgisi

9.Hedef odaklı çalışma becerisi

10.İkna becerisi

11.İş sağlığı ve güvenliği bilgisi

12.İşindeki öncelikleri belirleme ve hareket etme becerisi

13.İşyeri çalışma prosedürleri bilgisi

14.MASAK mevzuatı bilgisi

15.Mesleki etik kurallar bilgisi

16.Mesleki terim bilgisi

17.Piyasadaki benzer ürün ve hizmet bilgisi

18.Raporlama bilgi ve becerisi

19.Sektörde yer alan düzenleyici ve denetleyici kurumlar, meslek kuruluşları, dağıtım kanalları ve diğer iş ortakları (tedarikçiler, anlaşmalı kurumlar, vb.) hakkında bilgi

20.Sigorta genel şartları, genel prensipleri, teminat kapsamı ve koşulları, sıkça karşılaşılan muafiyetler, özel şart ve istisnalar hakkında bilgi

21.Sigortacılığa ilişkin yasal mevzuat bilgisi

22.Sigortacılık piyasanın yapısı ve güncel piyasa uygulamaları hakkında bilgi

23.Sigortalanabilir risklere ilişkin bilgi

24.Sorun çözme becerisi

25.Sözlü ve yazılı iletişim becerisi

26.Temel çalışma mevzuatı bilgisi

27.Temel hukuk bilgisi

28.Zaman yönetimi bilgisi

4.3. Sigorta Acentesi Teknik Personeli (Seviye 4) İçin Gerekli Tutum ve Davranışlar

1.Bilgi, tecrübe ve yetkisi dahilinde karar vermek

2.Çalışma zamanını etkili ve verimli kullanmak

3.Çalışmalarında planlı, organize ve disiplinli olmak

4.Çalışmalarında yeniliklere açık ve geliştirici olmak

5.Çevre korumaya karşı duyarlı olmak

6.Çevre, kalite ve İSG mevzuatında yer alan düzenlemeleri benimsemek

7.Değişime açık olmak ve değişen koşullara uyum sağlamak

8.Görev tanımını, görevi ile ilgili talimatları ve sorumluluklarını bilmek ve yerine getirmek

9.Hizmet içi eğitim ve seminerlere katılma konusunda istekli olmak

10.Hizmet ve kalite odaklı yaklaşım sergilemek

11.İletişim kurduğu kişilerle etkili ve güzel konuşmak

12.İlgili kişi ve birimlere zamanında ve doğru bilgi aktarmak

13.İşyeri çalışma prensiplerine uymak

14.İşyerine ait araç, gereç ve ekipmanların kullanımına özen göstermek

15.Müşteri taleplerine karşı anlayışlı olmak ve empati kurmak

16.Kurum kültürüne ve meslek etiğine uygun davranmak

17.Sektöre ilişkin işini etkileyecek güncel olayları takip etmeye önem vermek

18.Soğukkanlı olmak ve sorunlara çözüm üretmek

19.Sorumluluğu dahilindeki iş ve işlemlerde inisiyatif almak

4.4.Gelecekte İhtiyaç Duyulacak Beceri ve Yetkinlikler

- *Yaratıcılık/yenilik*
- *Kritik düşünce*
- *Bilgi okuryazarlığı*
- *Problem çözme*
- *Karar verme*
- *Esneklik ve uyarlanabilirlik; öğrenmeyi öğrenmek*
- *Araştırma ve sorgulama*
- *İletişim*
- *Girişim ve öz yönlendirme*
- *Verimlilik*
- *Liderlik ve sorumluluk*
- *İş birliği*
- *BİT işlemleri ve kavramları*
- *Dijital Vatandaşlık*
- *Medya okur Yazarlığı*

5.Sonuçlar

Bu çalışmada, sigorta acentelerinde görev yapan personellerin performansını etkileyebilecek mesleki beceri ve yetkinliklerin günümüz ve gelecekte neler olabileceği konusu araştırılmıştır.

İlgili literatürde konu ile ilgili ikincil çalışmalar, sektör kuruluşlarının hazırlamış oldukları raporlar ve Türkiye'de MYK (Mesleki Yeterlilik Kurumu) tarafından hazırlanmış olan meslek standartları incelenerek teorik bir çalışma kapsamında söz konusu yetkinlik ve beceriler incelenmiş ve *Sigorta Acentesi Teknik Personeli (Seviye 4)* özelinde tespitler yapılmıştır.

Sigorta sektöründe prim üretiminde önemli, bir payı olan sigorta acentelerinde görev yapan personellerin performanslarını yakından etkileyebilecek söz konusu mesleki beceri ve yetkinliklerin belirlenerek başarı ölçütlerinin tanımlanması aynı zamanda acentenin de başarı performansına katkı sağlayacaktır. Bu maksatla yapılan incelemelerde sigorta acentesi teknik personellerinin görevlerini icra ederken sergilemeleri gereken mesleki beceri ve yetkinliklerin acente yönetim ve çalışanlarınca biliniyor olması, zaman zaman yapılacak gözden geçirmelerle değerlendirmelerin yapılması tüm sigorta acenteleri camiası için önemli bir kazanım olabilecektir. Örneğin bu çalışmada belirlenmiş ve tespit edilen kriterler, acente personeli işe alımlarında, çalışanların performanslarının değerlendirilmesinde, eğitim ihtiyaçlarının belirlenmesinde ve rekabet edilebilirlik gücünün artırılmasında bir yol haritası görevi görebilecektir. Çalışmada ayrıca gelecek perspektifinden sigorta satış temsilcilerinin ihtiyaç duyabileceği mesleki beceri ve yetkinlikler hususunda da değerlendirmeler yapılmış olması ayrı bir önem arz etmektedir. Zira, sigorta acenteleri mevcut personellerini geleceğe hazırlamak için söz konusu kriterleri göz önüne alarak eğitim faaliyetleri düzenleyerek hem çalışanlarının hem de acentenin performansını artırma şansını elde edebilirler.

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SERBEST DOLAŞIMLI SİSTEMDE YETİŞTİRİLEN ETLİK PİLİÇLERİN GEZİNTİ ALANINA ÇIKMA YAŞININ CANLI AĞIRLIĞA ETKİSİ

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Özet
Bu çalışmanın amacı serbest dolaşımlı sistemde yetiştirilen etlik piliçlerin farklı yaşlarda gezinti alanına çıkmasının canlı ağırlık ve canlı ağırlık artışı üzerine etkisini incelemektir. Bu amaçla, etlik piliçler yaşamlarının 10., 15., ve 25. Günlerinde gezinti alanına çıkmalarına müsaade edilmiştir. Araştırma 3 grup ve her grup 4 tekerrürden oluşturulmuştur. Her alt grupta 15 adet ve her grupta 60 adet olmak üzere toplam 180 adet hızlı gelişen etlik piliç genotipi kullanılmıştır. Yem ve su serbest olarak verilmiştir. Kapalı alanda yerleşim sıklığı 11 adet hayvan/m^2, gezinti alanında ise hayvan başı 2.5 m^2 alan oluşturulmuştur. Denemenin başında ve sonunda (42. gün) hayvanlar alt grup bazında tartılmıştır. Deneme sonu canlı ağırlık 10, 15 ve 25 gün gruplarında sırasıyla 2580 g, 2607 g ve 2688 g olarak tespit edilmiş olup gruplar arası farklılık istatistiki olarak önemsiz bulunmuştur ($P>0.05$). Kırkiki günlük canlı ağırlık artışı 10, 15 ve 25 gün gruplarında sırasıyla 2536 g, 2564 g ve 2645 g olarak tespit edilmiş olup gruplar arası farklılık istatistiki olarak önemsiz bulunmuştur ($P>0.05$). Sonuç olarak, canlı ağırlık ve canlı ağırlık artışı bakımından hayvanların gezinti alanına standart uygulamadan (25 gün) daha önce çıkarılmasında her hangi bir problem olmayacaktır.

Anahtar Kelimeler: Serbest Dolaşımlı Sistem, Gezinti Alanı, Broyler, Canlı Ağırlık, Canlı Ağırlık

EFFECTS OF OUTDOOR ACCESS AGE ON THE BODY WEIGHT OF BROILERS RAISED IN A FREE-RANGE SYSTEM

ABSTRACT
The aim of this study is to examine the effect of moving broiler chickens raised in a free-range system to the wandering area at different ages on live weight and live weight gain. For this purpose, broiler chickens were allowed to go to the wandering area on the 10th, 15th and 25th days of their lives. The research consisted of 3 groups and 4 repetitions in each group. A total of 180 fast-growing broiler chicken genotypes, 15 in each subgroup and 60 in each group, were used. Feed and water were provided freely. The settlement density in the closed area is 11 animals/m2, and in the promenade area, an area of 2.5 m2 per animal is created. Animals were weighed on a subgroup basis at the beginning and end of the experiment (day 42). The live weight at the end of the trial was determined as 2580 g, 2607 g and 2688 g in the 10, 15 and 25 day groups, respectively, and the difference between the groups was found to be statistically insignificant (P>0.05). Forty-two-day live weight gain was determined as 2536 g, 2564 g and 2645 g in the 10, 15 and 25 day groups, respectively, and the difference between the groups was found to be statistically insignificant (P>0.05). As a result, there will be no problem in removing the animals to the excursion area earlier than the standard practice (25 days) in terms of live weight and live weight gain.
Keywords: Free Range System, Roaming Area, Broiler, Live Weight, Live Weight

Giriş

Dünyada etlik piliç yetiştiriciliği çoğunlukla kapalı sistemlerde yapılmaktadır. Fakat son yıllarda tüketicinin tercihi yanında birçok faktöre bağlı olarak serbest dolaşımlı sistemde de etlik piliç yetiştiriciliği yapılmaya başlanmıştır. Hayvanların kapalı alanda yetiştirilmesinin hayvanların doğal davranışlarının kısıtlanması ve güneş ışığından yoksun bırakılmaları hayvan haklarının kısıtlayıcı faktörlerdendir. Tüketicilerin doğal ortamlarda yetiştirilen hayvanların ürünlerin daha sağlıklı olduğu görüşü de serbest dolaşımlı sistemde etlik piliç yetiştiriciliğini ön plana çıkarmaktadır. Serbest yetiştirme sisteminden elde edilen ürünlerin tüketiciler tarafından daha çok tercih edilmesi bu ürünlerin daha lezzetli olması, besleyiciliğinin yüksek olması, düşük yağ oranı, vitamin ve mineral miktarlarının yüksek olduğu ile alakalı olduğu söylenebilir (Fanatico ve ark., 2005; Wang ve ark., 2009; Michalczuk ve ark., 2014). Serbest dolaşımlı sistemde özellikle açık alan ya da gezinti alanın olması mecburiyeti vardır. Gezinti alanında yeşil bitki örtüsü olması zorunlu değildir. Fakat hayvanların en az sekiz saat gezinti alanına ulaşabilme imkânı tanınması gerekmektedir. Gezinti alanının maksimum kullanımı ve ekonomik olması önemlidir. Hayvanların yeşil bitki örtüsünden maksimum şekilde faydalanabilmelidir. Etlik piliç yetiştiriciliğinde hayvanların gezinti alanına çıkmalarına genellikle yaşam sürelerinin yarısından sonrasında müsaade edilmektedir (Aksoy ve ark., 2021). Serbest dolaşımlı sistemde hızlı gelişen hatlar kullanılması durumunda genel olarak 21 ile 28 günler arası gezinti alanına çıkarılmaktadır. Bu yaşalrad hayvnaların canlı ağırlkları …… ile ……arasında değişmekte ve hayvanlar canlı ağırlıklarından dolayı gezinti alalnına çıkma ihtimali düşmektedir. Hayvanalr daha çok kapalı alanda yemlik ve suluklara yakın durmaktadırlar. Serbest dolaşımlı sistemde hayvanların gezinti alanından maksimu şekilde faydalanmaları için gezinti alalnında daha fazla zaman geçirmeleri sağlanmalıdır. Bu amaçla hayvanların daha aktif olduğu dönemlerde gezinti alanına çıkmalarına müsaade edilmesi gerekmektedir. Mevcut literatür araştıamaalrımıza göre, yaşamla süreslerinin yarısından daha önce gezinti alanına çıkarılması ile ilgili literatür tespit edilememiştir. Bu çalışmanın da esas amacı erkan yaşlarda gezinti alanına çıkmalarına müsaade edilen broylerlerin canlı ağırlık ve canlı ağırlık artışı üzerine etkisi araştırılmıştır.

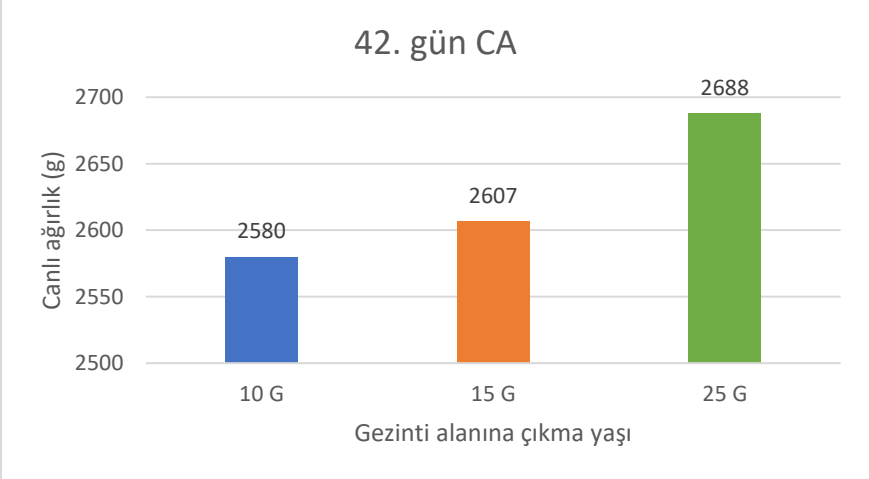
Materyal ve Yöntem,

Araştırma Selçuk Üniversitesi Ziraat Fakültesi Zootekni Bölümü Prof. Dr. Orhan DÜZGÜNEŞ Hayvancılık Araştırma ve Uygulama tesislerinde yürütülmüştür. Araştırma bireysel olarak sandviç panelden yapılmış 12 adet serbest dolaşımlı sistem kümeslerinde yapılmıştır. Bu kümesler 2.0x1.5x2.0 m (uzunluk x genişlik x yükseklik) ölçülerindedir. Her kümes bir

tekerrürü oluşturmuştur. Araştırma 3 gruptan ve her grup 4 tekerrürden oluşturulmuştur. Her tekerrürde 15 adet broyler ve her grupta 60 adet olmak üzere toplam 180 adet hızlı gelişen Ross-308 etlik piliç genotipi kullanılmıştır. Deneme grupları; gezinti alanına 10 günlük yaşta çıkmasına izin verilen (G10), gezinti alanına 15 günlük yaşta çıkmasına izin verilen (G15), ve gezinti alanına 25 günlük yaşta çıkmasına izin verilen (G25) gruplar olarak 3 grup oluşturulmuştur. Bütün gruplarda yerleşim sıklığı kapalı alanda 10 piliç /m^2 , gezinti alanında ise 2.5 m^2/piliç olarak düzenlenmiştir. Yem ve su serbest olarak verilmiştir. Her kümeste 2 adet damlalıklı nipel ayarlanmıştır. Yem olarak başlangıç, büyütme ve bitirme yemi verilmiştir (Ross, 2022). Aydınlatma programı ilk 3 gün 24 saat aydınlatma uygulanmış ve deneme sonuna kadar 16 saat/gün olacak şekilde ayarlanmıştır (Ozkan ve ark., 2012). Hayvanlar alt grup bazında denemenin başlangıcında ve denemenin sonunda hassas terazi ile tartılmıştır. Bu verilerden canlı ağırlık değeri (g) ve canlı ağırlık artışı (g) hesaplanmıştır. Elde edilen veriler tek yönlü varyans analizi ile test edilmiştir. Gruplar arasındaki farklılıklar Tukey çoklu karşılaştırma testi ile tespit edilmiştir. İstatistik analizler MİNTAB paket programı yardımıyla yapılacaktır.

Bulgular ve Tartışma

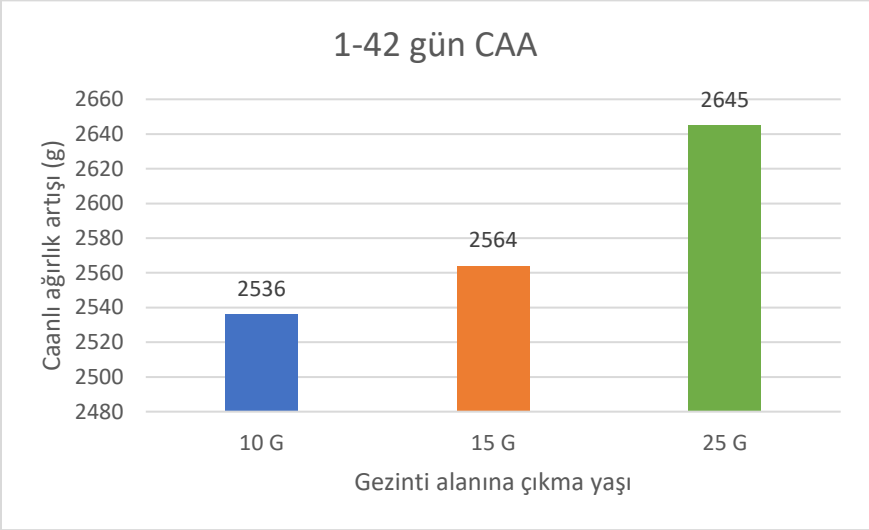
Deneme sonu (42. Gün) canlı ağırlık 10, 15 ve 25 gün gruplarında sırasıyla 2580 g, 2607 g ve 2688 g olarak tespit edilmiş olup gruplar arası farklılık istatistiki olarak önemsiz bulunmuştur (Şekil 1; P>0.05).



Şekil 1. Gezinti alanına çıkma yaşının canlı ağırlığa (g) etkisi

Çalışmamızdan elde edilen 42. gün canlı ağırlık değerleri (2580 – 2688 g) Ross-308 genotipi performans değerinden (2998 g) daha düşük bulunmuştur. Bunun sebebi Ross-308 hibrit kataloğunda (Ross, 2022) belirtilen canlı ağırlık değeri (2998 g) kapalı alanda yetiştirilen broylerlerin canlı ağırlık değeri olup, çalışmamızdan elde edilen canlı ağırlık değerleri serbest

dolaşımlı sistemde yetiştirilen hayvanlardan elde edilmiştir. Serbest sistemdeki hayvanların daha fazla hareket etme kabiliyetinde olduğu için canlı ağırlık değerleri daha düşük olmuş olabilir. Kırkiki günlük canlı ağırlık artışı 10, 15 ve 25 gün gruplarında sırasıyla 2536 g, 2564 g ve 2645 g olarak tespit edilmiş olup gruplar arası farklılık istatistiki olarak önemsiz bulunmuştur (Şekil 2; P>0.05).



Şekil 2. Gezinti alanına çıkma yaşının canlı ağırlık artışına (g) etkisi

Sonuçlar

Sonuç olarak, serbest dolaşımlı sistemde yetiştirilen etlik piliçlerin gezinti alanına erken çıkarmanın canlı ağırlık ve canlı ağırlık artışı üzerine olumsuz bir etkisi olmadığı görülmüştür. Bundan sonraki çalışmalarda hayvanların erkan yaşta gezinti alanına çıkmasının altlık kalitesine olumlu etkisi olabileceği düşünülmektedir. Ayrıca, hayvanların gezinti alanında doğal davranışlarını sergileyebilecekleri için hayvanların refahı ve davranışlarını olumlu etkisi olabilecektir. Benzer şekilde hayvanlardaki stress daha düşük olabilecektir. Bu faktörlerin ayrıca araştırılması faydalı olabilecektir.

Teşekkür

Bu araştırma Selçuk Üniversitesi BAP tarafından 23201067 no'lu proje ile desteklenmiştir.

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MEDİKAL GÖRÜNTÜLERİN SINIFLANDIRILMASINA YÖNELİK CONVNEXT, SWİN TRANSFORMATÖRLER VE RESNET-50 MODELLERİNİN PERFORMANS DEĞERLENDİRMESİ

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Özet
Yapay zekâ ve derin öğrenme, sağlık alanında devrim yaratmıştır. Özellikle, tıbbi görüntü analizi ve teşhis süreçlerinde, bu teknolojilerin katkısı, erken teşhis ve tedavi yöntemlerinin geliştirilmesinde kritik bir faktör olmuştur. Akciğer ve kolon kanserleri, dünya genelinde görülen en yaygın ve en ölümcül kanser türleri arasındadır. Bu kanser türlerinin doğru şekilde teşhis edilmesi ve sınıflandırılması için yöntemler geliştirmek, kanser araştırmalarında büyük bir önem taşımaktadır. Görüntü tanıma ve sınıflandırma gibi problemlerin çözümünde başarılı sonuçlar elde edilmesini sağlayan evrişimli sinir ağı (CNN) modelleri, bu bağlamda önemli bir rol oynar. CNN modelleri, bazı yapısal kısıtlamalarını aşmak ve verimliliğinin arttırılması amacıyla sürekli olarak gelişmektedir. Bu gelişmelerle paralel olarak, doğal dil işleme alanında kendini kanıtlayan transformer mimarilerinin görüntü verileri üzerine uygulanmaları ile birlikte yeni bir çalışma alanı doğmuştur. Her iki mimariden de etkilenerek oluşturulan ConvNeXt modelleri, standart evrişimli sinir ağı modellerinin bazı kısıtlamalarını gidermek ve daha başarılı sonuçlar elde etmek amacıyla geliştirilen evrişimli sinir ağı modellerinden olmuştur. Bu çalışmada, akciğer kanseri patolojik görüntü verilerinin ConvNeXt modelleri ile eğitiminden elde edilen sonuçlar incelenmiştir. ConvNeXt modellerinin esin kaynağı olan Swin Transformers ve ResNet-50 modeli ile de eğitim işlemi yapılarak sonuçlar karşılaştırılmıştır. Yapılan çalışma sonucunda, ConvNeXt modellerinin parametreden bağımsız olarak ele alınan veri seti üzerinde yüksek doğrulukla eğitim işlemi gerçekleştirdiği görülmüştür. Artık ağ yapısı ile bilinen ResNet-50 modelinin de ConvNeXt modelleri gibi yüksek doğrulukla aynı işlemi gerçekleştirebildiği sonucuna varılmıştır.
Anahtar Kelimeler: ConvNeXt, LC25000, Derin Öğrenme

PERFORMANCE EVALUATİON OF CONVNEXT, SWİN TRANSFORMERS AND RESNET-50 MODELS FOR CLASSİFİCATİON OF MEDİCAL IMAGES

Abstract
Artificial intelligence and deep learning have revolutionized the healthcare field. In particular, in medical image analysis and diagnostics, the contribution of these technologies has been a critical factor in the development of early detection and treatment methods. Lung and colon cancers are among the most common and deadly cancers worldwide. Developing methods to accurately diagnose and classify these cancers is of great importance in cancer research. Convolutional neural network (CNN) models, which provide successful results in solving problems such as image recognition and classification, play an important role in this context. CNN models are constantly evolving in order to overcome some of their structural limitations and increase their efficiency. In parallel with these developments, a new field of study has emerged with the application of transformer architectures, which have proven themselves in the field of natural language processing, on image data. ConvNeXt models, which are influenced by both architectures, have been one of the convolutional neural network models developed to overcome some limitations of standard convolutional neural network models and to obtain more successful results. In this study, the results obtained from the training of lung cancer pathological image data with ConvNeXt models are analyzed. The results were also compared by training with Swin Transformers and ResNet-50 models, which are the inspiration of ConvNeXt models. As a result of the study, it has been observed that ConvNeXt models perform training with high accuracy on the data set considered, regardless of the parameters. It has been concluded that the ResNet-50 model, known as the residual network structure, can perform the same operation with high accuracy like ConvNeXt models.
Keywords: ConvNeXt, LC25000, Deep Learning

Introduction

The advancement of artificial intelligence and the increasing digitalization of daily life make it possible to solve problems more effectively and quickly. This situation is of great importance for studies on data in the health sector [1]. The classification of image data obtained using medical imaging techniques facilitates early diagnosis. In particular, the effective detection and classification of cancer data represents an effective step in the treatment of the disease [2].While lung cancer is the most common cause of cancer-related deaths worldwide, colon cancer is also recognized as a major health threat. Early detection plays a critical role in the treatment of these diseases and can significantly improve patient survival rates. In this context, the accuracy and efficiency of imaging technologies used in the diagnosis of lung and colon cancer are central to the diagnosis and follow-up of the disease in its early stages. This study examines the effectiveness of some deep learning methods for lung and colon cancer classification.Deep learning is a branch of artificial intelligence that is capable of learning from large and complex datasets. These methods can distinguish cancerous tissues from normal tissues by identifying patterns and abnormalities in medical images [3]. One of the most famous structures used in deep learning is Convolutional Neural Networks (CNN). CNNs are highly effective in image recognition and classification tasks and are widely used in medical image analysis. CNN-based systems have the sensitivity to detect even small lesions in the early stages of lung or colon cancer. Thus, they can detect abnormal structures that may be missed by radiologists.The use of CNNs in deep learning gained popularity after the success of the AlexNet model on a high-dimensional dataset such as ImageNet [4]. However, as the research on CNN has increased over time, some limitations of these networks have emerged. To overcome these limitations and achieve more effective results, new and improved models have been continuously designed [5].In recent years, the successful results of transformers architectures in natural language processing have inspired the application of these architectures on image data [6]. In 2020, with the successful results of the pre-trained Vision Transformers (ViT) study on ImageNet and ImageNet-21k datasets, studies in this field gained momentum [7]. This architecture essentially applies the attention mechanism, which is used in natural language processing to understand context and access past information, to images.ViT architecture can provide more efficient results by using fewer computational resources compared to CNN models [7]. Unlike CNN, it treats the image as small fixed pieces. These image fragments are processed as a sequence as in words. These sequences are sent to the transformer encoder after being subjected to a process called positional embedding. The Transformer Encoder consists of a Normalization layer, a

Multi-Headed Self-Attention layer (MSA) and Multilayer Perceptrons (MLP). In addition, to facilitate the learning of more complex features in the model, GELU (Gaussian Error Linear Unit) was preferred as the activation function [6].With the success of the ViT architecture in image detection and classification problems, many studies have been conducted to improve this architecture. One of these is the DeiT model [8], which applies the transformer structure to images with less data and less computational resources [8]. This model, proposed by Facebook researchers, offers a structure similar to the ResNet architecture with the Distillation token in its structure.In 2021, Microsoft researchers published the BEiT model, which implements a preliminary, self-regulated mechanism and is inspired by the Bidirectional Encoder Representations from Transformers (BERT) model [9].Another work in 2021 is the Swin Transformer architecture, which implements the ViT architecture using a special windowing technique for images [10]. The shifted windowing technique used in this study is designed to increase efficiency by providing context with cross windows. With its structure and achievements, this model has brought a different perspective to the ViT architecture.

ConvNeXt

ConvNeXt stands out especially among CNN models with its claim of success in computer vision applications. Inspired by the Vision Transformers (ViT) architecture, this model is designed to achieve exceptional levels of accuracy in visual classification and processing tasks. One of the most important features of ConvNeXt is its impressive accuracy in visual tasks. Even when compared to models such as Swin Transformer, this model is capable of delivering superior results [11].

As it is known, with the deepening of CNN models, the complexity of training processes increases and common problems such as optimization difficulties and gradient loss are encountered. The ResNet architecture, which was introduced in 2017 to solve such problems, has managed to overcome these difficulties thanks to its residual network structure [12]. This structure has significantly improved the learning process by enabling the efficient transmission of information even in deeper networks during training.

Based on CNN architecture and Transformers architecture, the ConvNeXt model has a residual network structure similar to ResNet [11]. This unique combination enables efficient information flow even in a deep network structure and enables the model to succeed even in complex learning tasks. This similarity is illustrated in Figure 1. The model is available in five scalable sizes, starting from Tiny to XLarge, to serve various application requirements.

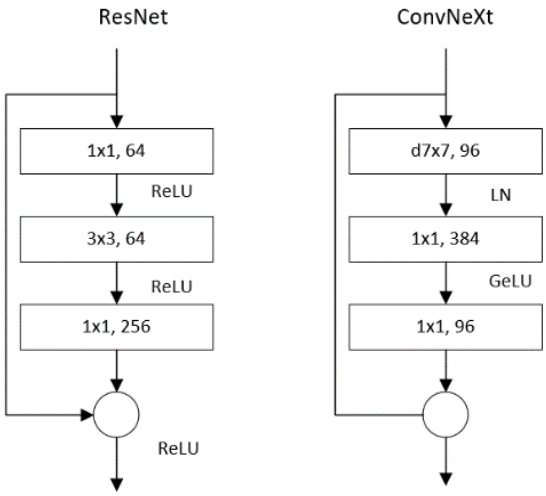


Figure 1. Residual network similarity of ResNet and ConvNext architectures

Materials and Methods

In this study, the LC25000 dataset [13] created from pathologic images of lung and colon cancer was used. The LC25000 dataset consists of 5 classes named lung_aca, lung_n, lung_scc, colon_aca, colon_n. In this dataset, 250 original images for each class were subjected to various data augmentation processes and the number of images was synthetically increased to 5000. The dataset contains a total of 25000 pathology images belonging to 5 different classes. An example of the dataset is given in Figure 2.

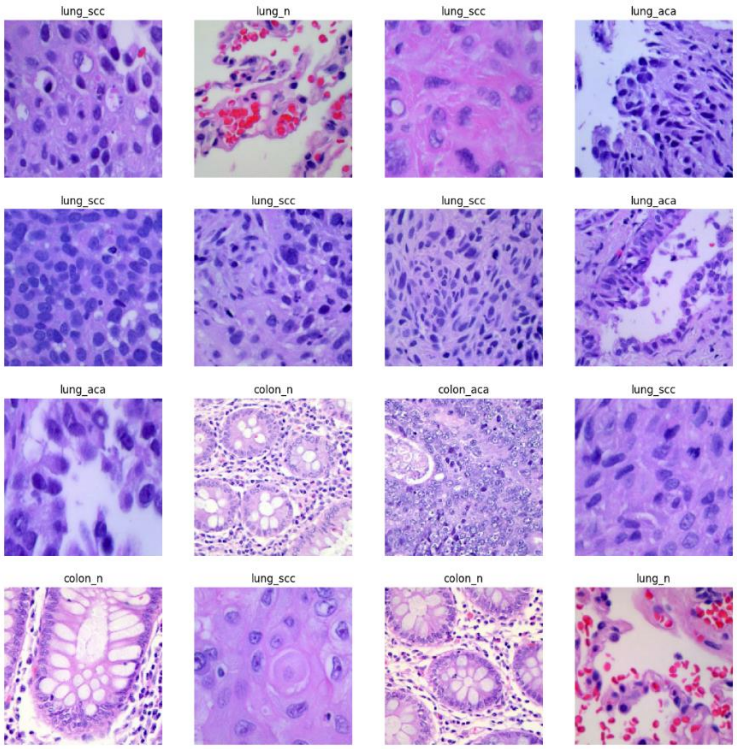


Figure 2. LC25000 dataset example

In this study, ConvNeXt, Swin Transformers and ResNet-50 models were selected and set to be trained on a large dataset in order to evaluate deep learning based classification performance. Each model is pre-trained and trained iteratively with the dataset for five full epochs during the training process. The training process was carried out using the A100 GPU in the Google Colab environment. The training accuracy obtained on the dataset with these pre-trained models was analyzed. The results obtained from this study are intended to provide important insights into the use of deep learning models in medical image classification and shed light on other potential applications of these models in the healthcare domain.

Findings and Discussion

As a result of the study, the training accuracies of ConvNeXt models are given in Table 1 below.

Table 1. Training and validation accuracy of ConvNeXt models on LC25000

Model	Train Accuracy	Validation Accuracy
ConvNeXtTiny	%99.14	%99.46
ConvNeXtSmall	%99.28	%99.44
ConvNeXtBase	%98.18	%98.46
ConvNeXtLarge	%98.29	%98.92
ConvNeXtXLarge	%98.46	%99.24

The training performance of the same dataset on Swin Transformers and ResNet-50 models is as shown in Table 2.

Table 2. Training and validation accuracy of Swin Transformers and ResNet-50 on LC25000

Model	Train Accuracy	Validation Accuracy
Swin Transformers	%83.72	%82.70
ResNet-50	%98.18	%98.60

When the results of the studies were analyzed, it was found that ConvNeXt and ResNet-50 models showed superior success in the training process. Considering that ConvNeXt models are sorted according to their size (starting with "Tiny" and ending with "XL"), all models have high training and validation performance. In conclusion, ConvNeXt models trained on LC25000 lung image data provide high accuracy rates and size does not have a significant effect on performance.

Conclusion and Recommendations

The ResNet-50 network model also appears to have validation accuracy that is competitive with ConvNeXt models. This shows that ResNet-50 has a robust architecture and can still be effective in many scenarios. Here, it is observed that the performance of the Swin Transformers model remains low. On the dataset in question, ConvNeXt models and the ResNet-50 architecture lagged behind.

This work in deep learning can be replicated using a variety of datasets and algorithms, and different results can be obtained. Different datasets can provide diversity and a broad perspective in training the model, which can strengthen its adaptability to real-world scenarios.

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OTİZMLE İLGİLİ ONLINE EĞİTİM PROGRAMININ YANSIMALARI

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Abstract
Online learning environments, which are transferred as one of the distance education methods, are the easiest and most effective environments for recording direct communication with pieces of space physically located in different places and receiving instant feedback. The purpose of this programming is to store online information about the process following a training program on the subject of Autism Spectrum Disorder (ASD). The research process includes a weekly preparation phase and a seven-week implementation phase. During the implementation phase, a different topic was discussed every week and was given simultaneously by experts in the field. This research of mixed research method includes 54 volunteer products. Participants consist of employees who are families of children known to ASD or who work with children known to ASD. During this process an evaluation formula is applied to pick parts of parts. In addition, there are interviews with four contents and half in order to determine the development of the training program after six months. The Evaluation Form includes open sections and optional questions. In the research, both the training program and the data collection process are carried out remotely. At the end of the research; These were achieved through a process in which they gained information about ASD, shared information, communicated with field members and families intensive about ASD, their legal rights, and differentiated their non-governmental services. However, it was stated that most technical problems were experienced during the process, but were resolved in a short time.
Keywords: Distance Education, Autism Spectrum Disorder, Special Education, Online Education Program

REFLECTIONS OF AN ONLINE TRAINING PROGRAM ABOUT AUTISM

Özet
Uzaktan eğitim yöntemlerinden biri olarak ifade edilen çevrimiçi öğrenme ortamları, fiziksel olarak farklı yerlerde bulunan alan uzmanları ile doğrudan iletişim kurmak ve anlık geri bildirim almak için en kolay ve en etkili ortamlar arasındadır. Bu araştırmanın amacı, çevrimiçi olarak gerçekleştirilen Otizm Spektrum Bozukluğu (OSB) konusunun ele alındığı bir eğitim programı sonrasında katılımcıların sürece ilişkin görüşlerini tespit etmektir. Araştırma süreci on haftası hazırlık aşaması ve yedi haftalık uygulamayı içermektedir. 7 hafta süren uygulama aşamasında, her hafta otizmli çocuğu olan ailelere yönelik farklı bir konu ele alınmıştır ve her konu o alanın uzmanı tarafından eş zamanlı olarak verilmiştir. Araştırmada hem eğitim programı hem de veri toplama süreci uzaktan yürütülmüştür. Karma araştırma yönteminin kullanıldığı bu araştırmada 54 gönüllü katılımcı yer almaktadır. Katılımcılar, OSB tanılı çocukları olan aileler ya da OSB tanılı çocuklarla çalışan öğretmenlerden oluşmaktadır. Sürecin değerlendirilmesi amacıyla katılımcı görüşleri, değerlendirme formu aracılığıyla toplanmıştır. Değerlendirme Formunda açık uçlu ve çoktan seçmeli sorular yer almaktadır. Eğitim programı tamamlandıktan altı ay sonra ise sürecin uzun süreli etkilerini tespit amacıyla dört katılımcı ile yarı yapılandırılmış görüşmeler yapılmıştır. Araştırma sonunda katılımcıların; OSB konusunda bilgi edindikleri, bilgi paylaşımı sağladıkları, alan uzmanları ve OSB konusunda deneyimli ailelerle etkileşim kurdukları, sahip oldukları kanuni hakları öğrendikleri, sivil toplum kuruluşlarının önemini fark ettikleri bir süreç geçirdikleri sonucuna ulaşılmıştır. Bununla birlikte süreç içerisinde ifade edilen tek olumsuzluk teknik sorunlar olmakla birlikte bu sorunların kısa sürede çözüldüğü ifade edilmiştir.
Anahtar Kelimeler: Uzaktan Eğitim, Otizm Spektrum Bozukluğu, Özel Eğitim, Çevrimiçi Eğitim Programı

Introduction

Online learning, one of the methods used in distance education implementations, can be defined as the learning process in which the educator and the participant are physically in different locations, various learning resources can be accessed simultaneously over a network, and where the learning environment and learning content interact (Moore 2013). Online learning environments are among the easiest and most effective environments to communicate directly with field experts in different locations and receive/provide instant feedback. Especially for adults who cannot attend professional or personal development seminars due to working hours (Sun, et al., 2008), or who cannot stay away from home for long periods due to their different responsibilities (Kolb, 2007) or who cannot continue their education due to their/their family members' special needs (Karal et al., 2008) online seminars/courses are posing great importance. Online education programs are a good alternative for families with children with special needs and full-time teachers (Bourdeaux & Schoenack, 2016; Douglas et al., 2014; Eck et al., 2016; Hamad et al., 2010; Kokoç et al., 2010; Meadan & Daczewitz, 2016; Walsh et al., 2005)ASD in the most general sense is a developmental disability manifested by problems in social interaction, communication and behavior (APA, 2013). If the necessary training is provided, most individuals with ASD can overcome most of these problems and continue their lives by integrating with their normally developing friends, family and environment (Güleç-Aslan et al., 2009). Family plays an important role in this process. Because families know their children best, and families who spend more time with their children than a specialist can be a good reinforcement tool for their children (Cavkaytar, 2014). However, since families with children with ASD do not have sufficient knowledge, skills and experience to help their children, they need help in this regard and are left alone in coping with this situation (Yakın, 2009). Families' lack of knowledge about ASD leads them into uncertainty. These unknowns further increase the fear and anxiety of families and increase the number of families who do not know how to react to the situation encountered (Güler-Selimoğlu et al., 2014; Kaya, 2014; Kaytez et al., 2015; Murphy & Tierney, 2006; Öztürk, 2011; Şanlı, 2012). One of the most effective ways to solve these problems is family education programs. Thanks to these programs, participants can learn about ASD, better recognize their children's characteristics, and even be a part of educational programs.

Among these programs classified as home-based, institution-based or distance education, generally home-based or institution-based education programs are preferred in Turkey. However, in recent years, there has been an increase in the number of programs carried out through distance education (Erden & Nuri, 2023; Kizir, 2021; Timuçin, 2018). Family education carried out through distance education is defined as educational activities carried out to facilitate the life of the individual and the family by using online technologies that include programmed educational strategies. Program development stages in online family education programs are expressed as problem analysis, determination of program content, instructional design, program implementation and program evaluation (Hughes et al., 2012).

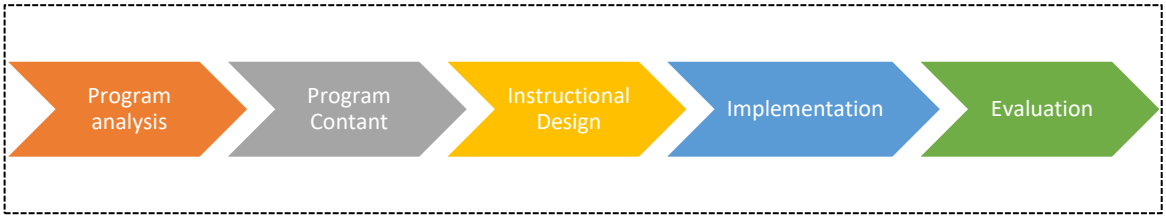


Figure 1. Stages of developing an online family education program (Hughes et al., 2012)

In this research, it was aimed to determine the opinions of the participants about this program at the end of an online training program on ASD developed within the framework mentioned above. Each week, a field expert participated in the sessions held over a period of 7 weeks via a video conferencing application. In this regard, answers to the following questions were sought in the research.

At the end of the online training program, participants;

• What are their opinions about the training program?

• How do they reflect the knowledge they gained from the training program into their daily lives?

• What are the negativities they encountered during the training?

• What are their suggestions regarding the training program?

Materials and Methods

This research was conducted with a mixed method design in which qualitative and quantitative research methods were used together. The aim of this approach is to provide a more in-depth and comprehensive understanding of a phenomenon by combining the advantages of qualitative and quantitative designs.Process Online trainings were given voluntarily by people who are experts in their fields (4 faculty members, an expert psychologist, a lawyer and a public institution administrator). The trainings started once a week at 22.00 and lasted an average of

90 minutes. Only one session was suggested as 180 minutes by a field expert speaker and was completed this way.The research process includes a ten-week preparation and a seven-week application and training program. During the preparation process, the content of the training program, participants and field experts who will provide the training were determined, and the training. Topics were determined under the headings given in Table 1.

Table 1. Online Training program topics and Expert Speakers

Session	**Title of the Seminar**	**Expert Speakers**
1	Education of Individuals with Autism	Special Education Expert, instructor, Master's
2	Behavioral Problems of Individuals with Autism	Special Education Expert, Ph.D.
3	Applied Behavior Analysis (ABA) Method in the Education of Individuals with Autism	Special Education Expert ABA Therapist, Master's
4	Sexual Development and Adolescence in Individuals with Autism	Special Education Expert, Ph.D.
5	Educational Rights of Individuals with Autism	Lawyer
6	Living with an Individual with Autism	Senior Psychologist, Ph.D.
7	State Support for Individuals with Autism	Family& Social Policies (ASP) Provincial Director

Each training topic was presented by a volunteer field expert in that field. The meetings were held in the form of presentations and questions and answers, moderated by the researchers.

Participants

The participant group of the research consists of families of individuals diagnosed with ASD and teachers working with these individuals. The process started with 54 volunteer participants, but ended with 31 participants after seven weeks of training.

Participants with children showing ASD PF1, PF2,

Teachers working with children showing ASD were coded as PT37, ..,PT54.

Data Collection Tools

During the training process, after each training, it was determined whether there were any problems the participants experienced and improvements were made accordingly. For this purpose, the "Session Evaluation Form", which includes Yes/No and Multiple Choice questions were used.At the end of the training program, the participants were given a "Training Evaluation Form". The form consisting of open-ended questions and multiple choice questions was developed by the researchers. Six months after the training program was completed, four participants were follow-up interviewed to determine the reflections of the training program. For this purpose, "Semi-Structured Interview Form" was used. To ensure the clarity of all three forms, questions were asked to two people from the target audience and feedback was received. For form validity, the opinions of three educational technologies field experts were referred. Table 2 shows which data collection tools were used for respective research problem.

Table 2. Data collection tools

Research Problem	Data Collection Tool
What are their opinions about the training program?	Semi-Structured Interview Form
How do they reflect the knowledge they gained from the training program into their daily lives?	Semi-Structured Interview Form Training Evaluation Form
What negativities did they encounter during their education?	Session Evaluation Form
What are their suggestions regarding the training program?	Semi-Structured Interview Form Training Evaluation Form

Data Analysis

Content analysis was performed to analyze open-ended questions. Frequencies are included to present the frequency of repetition of the determined codes. Frequencies were used in the analysis of multiple choice questions.

Data Analyses

Content analysis was performed to analyze open-ended questions. Frequencies are included to show the frequency of repetition of the determined codes. Frequencies were used in the analysis of multiple choice questions.

Findings and Discussion

Participants were asked "What are your opinions about the Online Training Program (OTP) process?" in the Seminar Satisfaction Survey administered at the end of the OTP process. In line with the data obtained from the answers to the question, participants' opinions about the OTP process are presented in Table 3.

Table 3. Participants' views on online education

Theme	Codes	%	*Expression*
Opportunities	Getting information from experts	3	*"It was an effective training. I was very pleased. "I was able to get information from experts that I would not be able to reach under normal circumstances." (PT49)*
	It was online	3	*"Online seminars were a unique opportunity and I think it was a first in this field, it was very successful." (PT41)*
	Out of working hours	2	*"It was very important for me that it happened in the evening and from a distance." (PF32)*
	Contact with experienced families	1	*"The experiences of experts and experienced families who have seen many cases are very valuable to us." (PF11)*
	Once in a week	1	*It was nice to have it once a week. (PF30)*
	Refreshing self trust	1	*Participating in and watching trainings renewed my self-confidence. I tried to look at my children from different perspectives. I was able to make an evaluation independent of daily problems. I feel like I have rearranged and adjusted my thoughts and behaviors. (PF26)*
Usability	Useful	5	*I tried to watch and listen as much as I had time. It was very useful and I think there is still a lot to learn." (PT37)*
	Productive	3	*"It was very productive in terms of information. "I would like to thank everyone who contributed." (PF32)*
	Yol gösterici olması	2	*"...it has become a step-by-step guide for families new to autism." (PF12)*

The findings obtained from the participants' opinions as a result of the interview conducted after the training process coincide with the Usefulness theme in Table 3. Participants state that the seminars are useful (PT3, PT18, PT44). PT3's views on this subject are as follows;

*"... Of course, educators have different goals in their fields, but the priority for us was how we can be useful to our children. I think seminars provide many benefits in this field. " (PF3)*According to the interview findings, participants think that the training process offers opportunities to reach experts (PF11, PF18), be at a time convenient for them (PF18), and be online (PF3, PF18, PF44). In this regard, the participants expressed their thoughts as follows.*"Was it possible for me to meet with the teacher living in America in Turkey? I live in Zonguldak Ereğli. No way. Or was it possible for me to meet a sexual education teacher? You may say that it is possible, that I can leave the child behind, but I do not have the opportunity to leave my child behind. I do not have time. Therefore, it is really a great thing to get this information in such an environment, plus we chat with each other, meet with the camera and have the chance to talk. (PF18)*

Opportunities offered by the online education process was expressed as having online seminars, interacting with field experts and sharing with other families. This situation is compatible with the response level of the Kirkpatrick evaluation model (Kirkpatrick, 1996). Morgan and Casper (2000) stated that participant reactions could occur in different dimensions; Trainers state that the way the training is implemented and the benefits of the training program will create positive reactions in the participants. Cömert (2015) stated in his research that the participants' positive reactions to the trainers positively reflected on their learning. Üstündağ & Yalın (2014) reached similar results in their study. Other results from the current study also show that participants had positive reactions to the training process.However, the online education process offers various opportunities to both families and teachers working with individuals with autism. In his research, Kolb (2007) suggested online education programs. Kolb (2007) stated that face-to-face education programs pose a significant difficulty especially for families because these families cannot leave their children and come to the training. Similarly, Vismara et al. (2013), McDevitt, (2021), Straiton et al. (2021) and Zimmerman (2013) state that family education provided through distance education offers very favorable environments for individuals with such limitations.

Table 4. The participants' reflection of the knowledge they acquired during the training in their daily lives

Expressions	**f***
I shared all the information I gained with other families/teacher friends.	19
I found ways to make time for myself.	8
I researched in more detail the opportunities provided by the state for individuals with ASD.	8
I did research on the Applied Behavior Analysis (UDA-ABA) method.	4
I observed the situations before and after my child/student's behavioral problems. I created charts.	3
I met again with my child's teacher/student's family about the behavioral problems. We created an evaluation plan	3
I became a member of associations working on autism.	3
I applied to benefit from the opportunities provided by the government.	2
I talked to my child's teacher/student's family about the Applied Behavior Analysis (ABA) method.	2
I realized where I was lacking in my child's sexual development process and took action to correct these deficiencies.	1
I found solutions to the problems my student experienced during his sexual development process.	1
I researched associations related to ASD.	1
No answer	6
*Participants marked more than one inscription.	

When Table 4 is examined, it is seen that the participants mostly (f = 19) shared the information they acquired with other families, teachers or friends. Other prominent topics are that the participants found ways to spare time for themselves (f=8), researched in more detail the opportunities provided by the state for individuals with ASD (f=8), conducted research on the UDA method (f=4), and examined the behavior problems of their child or student before they started to develop a research program. and observing subsequent situations (f=3), and meeting with the child's family/student's parent about behavioral problems (f=3).The findings obtained in the interviews conducted at the end of the research support the statement "I shared all the information I acquired with other families/teacher friends." Participants PF3, PF18 stated that they shared the information they acquired during the OTP process with people who have other children showing ASD, and PT44 stated that they shared this information with the families of the children studying at the institution where they work and other teachers working in the institution. PF3 and PT44 expressed their opinions respectively;"…I have several friends and acquaintances from families with children with autism. I have both families I met on social media and friends in my own social life. I shared with them. I already informed the people around me about the seminars at the beginning of the seminars. I shared the links to your seminars with my friends. "For their benefit, too."" … there was a conversation about the rights our children have. I realized that we did not have enough information about him and we informed our families about this issue. We informed them about their legal rights and at this point we learned a lot of things... I shared it not only with the family but also with my colleagues."They expressed it as above: In addition, the participants stated that they tried to solve the behavioral problems they observed in their children/students in line with the information they obtained in the seminar (PF3, PF11, PF18, PT44). PF18's and PF11's thoughts on the subject are as follows, respectively;"...identifying the antecedent of behavior was emphasized. Currently, my daughter is a teenager and she is 15 years old. Of course, we are experiencing a lot of behavioral problems. We have tantrums. In that sense, your presentation was very helpful to me. "So, I started to observe my child more carefully, wondering why this child did this, why he got angry, what happened before."" …Our child's future sexual situations and puberty-related situations are always a question mark. Getting practical information on this subject relieved us psychologically. We learned what kind of precautions should be taken regarding sexual development and adolescence so that it can adapt to society more easily, avoid problem behaviors, and perhaps avoid being abused when we are around or not. How one should behave in the toilet, or not showing one's genitals as 'shameful' rather than as a taboo,

closing the door in the toilet, and the insistence of the family on this issue. “These are the points we benefit from concretely.”The behavioral level of the Kirkpatrick evaluation model (Kirkpatrick, 1996) is how individuals reflect the knowledge and skills they have in their daily lives. Determining this situation is a little more difficult than determining reaction and learning levels. Because participants' behavioral changes may not occur immediately and this may take some time (Üstündağ & Yalın 2014). It is expected that the new behavior acquired will be reflected in the participants' lives (Kirkpatrick, 1998). In order to ensure this situation in the current research, interviews were held with the participants after the online seminars were completed and it was tried to determine whether they reflected the information they acquired in their daily lives. Among the research findings, families "sharing their information" attracted attention. In particular, there were families who re-watched the online seminar recordings with other families with ASD, and they also benefited from this opportunity. Zimmerman (2013) states that families experiencing similar problems are emotionally supported by such sharing. The trainings conducted try to help parents develop more positive interactions and increase parental knowledge and skills as well as confidence in managing problematic behaviors (O'Nions et al. 2018)The problems encountered by the participants after the online seminars were obtained by analyzing the relevant questions in the Session Evaluation Forms. The answers given by the participants to the question about whether they had problems in the seminars are presented in Table 5.

Table 5. Situation of participants' experiencing problems

Situation of experiencing problems	Seminar1	Seminar 2	Seminar 3	Seminar 4	Seminar 5	Seminar 6	Seminar 7
	f	f	f	f	f	f	f
I had problems	24	9	3	3	2	4	2
I had no problems	11	14	27	13	18	11	12
Toplam	35	23	30	16	20	15	14

When Table 5 is examined, it is seen that the participants had the most problems in the first seminar, Seminar 1 (f = 24). At the end of each online seminar, at least two participants stated that they had problems during the seminar sessions. After the online seminar held in the second week, there was a significant decrease in the number of participants who stated that they had problems. The answers given by the participants to the question asked to determine what the problems were are presented in Table 6.

Table 6. Problems experienced by participants in online seminars

Problems	Seminar1	Seminar 2	Seminar 3	Seminar 4	Seminar 5	Seminar 6	Seminar 7
Audio and Video interruption	22	7	2	1	2	2	2
Inability to log in to the system	1	-	1			2	
Flow of power point presentation		1					
Poor Internet connection				2			
Inability to provide audio and video connection	1	1					
Total number of problems	24	9	3	3	2	4	2

When Table 6 is examined, it is seen that the most common problem was "interruption of audio and video" (f = 22) in the first seminar. Almost all of the twenty-four participants who attended the first seminar and said they had problems encountered this problem. Other problems experienced in the first seminar were expressed as "not being able to log in to the system" (f = 1) and "not being able to provide audio and video connection" (f = 1) to ask questions to the speaker during the presentation. In other seminar sessions, the "cutting of audio and video" situation has decreased considerably since Seminar 2 (f = 7). Other problems expressed by the participants were "not being able to log in to the system", "not being able to provide audio and video connections" and "poor internet connection". When Table 4 is evaluated in general, it is seen that participants experience more technical problems in online seminars. In his research, Özaydın-Özkara (2016) talked about the technical problems of the participants arising from the internet or the participants themselves, on the theme of undesirable features of online environments. Similarly, Dai et al. (2021) mention technical problems as a negative experience in their research. *Participants' Suggestions About the Training Process* Participants' suggestions regarding the training process were made through the Seminar Satisfaction Form applied at the end of the process and the question "What are your suggestions regarding the online training process?" The data regarding these suggestions were analyzed and presented in Table 5. In addition, participants' suggestions on this subject were received through semi-structured interviews at the end of the OTP process. Some of the participants responded to the question "What are your opinions about the OTP process?" in the Seminar Satisfaction Form. They answered the question by offering various suggestions. These suggestions of the participants are presented in Table 7.

Table 7. Participants' suggestions regarding the online education process

Codes	f	Expressions
Continuation of seminars	10	"It continues to be repeated and thus many people become aware of it. "Our children with special needs have increased in number, although the reason is unknown. As a society, we now need to know what autism is." PF36 "I recommend that it continue at regular intervals." PF18
Practical seminars	5	"I think it would be very useful if real-life sample development videos from successful applications could be published." PF26 "There should be more effective information in dealing with behavioral problems." PT38
Technical problems	4	""I have no suggestions except for technical issues, it was very well thought out in many respects." PF3
Organizing separate seminar sessions for families and teachers	3	"Families with autism seek salvation from autism no matter what seminar they take place. These seminars were held in this dimension. That's why I'm in favor of giving family and specialist seminars separately." PT36 "Special session(s) should be held for families to share their experiences." PF4
Certificate	3	"Participants should be given a certificate of participation." PT37
Organizing repeat seminars on some topics	2	"I would be happy if there was a detailed seminar series specifically for Aba" PF31 "It would be great if a longer and more intense seminar was held on sex and sex, many of our children have behavioral problems." PF17
Editing the duration	2	"The sessions could have been long. " PF33
Other	5	"Seminars should be shared on social media to appeal to a wider audience" PF11 "Questions to be asked by participants should be asked before or at the end of the training". PT51

Table 7 presents that the participants expressed their opinion regarding the training process in favor of "continuing the seminars" (f=10), which are mostly held online. Participants' other suggestions regarding the OTP process; "the seminars should be practical" (f=5), "removing technical problems" (f=4), "organizing separate seminar sessions for families and teachers (f=3), "giving certificates" at the end of the education process, "the topics covered during the education process" "holding repeat seminars on some subjects" (f=2), "determining the duration of online seminars" (f=2). Some participants (f=5) who answered the relevant question in the Seminar Satisfaction survey stated that they found the seminars successful and positive, but did not make any suggestions.The suggestions of the participants in the semi-structured interviews held with the participants at the end of the online training process are similar to the suggestions in 5. One of the suggestions offered is that online seminars should be practice-oriented (PF11 and PF18). Participant PF11's thoughts on the subject are as follows;"… everything should be practical, illustrated with examples from daily life, and videos if necessary. It should be shown on children's behavior, like look, do this, look, it changes like this…. "They can use such materials." PF11Another suggestion made by the participants was to detail the seminar topics, especially the UDA (ABA) method (PF18, PF11). PF18 expressed his views as follows;"I thought the behavior issues were great. Sexual development was very, very good. The ABA method was very good, but it was not enough. "I think a seminar just for ABA can be held."One

of the participants, PT44, commented on the duration of the seminar, addressing different topics and eliminating technical problems. PT44's opinions;;“I can personally say that different issues should be discussed. He can talk about many topics. It may be a longer-term seminar. Not 8 weeks old. It may spread week by week throughout the year. Apart from that, there are problems caused by the internet environment. They can be fixed. Maybe it could be better.”He expressed it as follows. PF3 stated that he could not offer any suggestions regarding the seminar as follows.“I don't have any suggestions. The contact hours, the contact topics, and the people giving the seminar were all very good. I think they were good people in their field. I don't know who is very good in the field, but after watching the seminars, I realized how good the people are. I realized what other issues there are related to autism that I wouldn't have thought of. I had no knowledge of these matters before. I never thought about these because we were newly diagnosed. That's why all the subjects were quite good for me.” (PF3)Participants stated that the OTP process was useful, efficient and guiding for them and made suggestions that it should continue for a longer period of time. Dai et al. (2021) state in their research that families found the online education program useful and efficient. While discussing "Motivation and role of the instructor", one of the factors affecting the efficiency of online courses, Bayraktar (2016) drew attention to the selection of instructors from people who are willing to take part in online courses. The attitudes and sharing approaches of the speakers who gave a seminar for the first time with online applications during the seminar may have affected the positive thoughts of the participants about the efficiency of the seminars. When we look at family/professional trainings conducted online, the general opinion is in line with the research findings, and online applications are described as efficient and effective by the participants (Douglas et al., 2014; Douglas et al., 2017; Özlü, 2012; Wainer & Ingersoll, 2014).).

Conclusion and Recommendations

In the research conducted for the purpose of implementing and evaluating the effectiveness of seminars held online via distance education in line with the needs of families with children with autism and teachers working with individuals with autism, the following results were obtained in line with the research problems.Opportunities offered by the online education process; Gaining information, holding online seminars, interacting with field experts, and sharing with other families. Participants stated that the CAP process was useful, efficient and guiding for them and expressed their opinion that it should continue for a longer period of time.Ten percent of the participants criticized that content presentation should be more effective and that there should be more application-oriented presentations rather than theoretical explanations.The

knowledge and experiences that almost all of the participants gained during the online education process; It has been determined that they use the education provided in their daily lives by sharing it with other families/colleagues around them, applying the information they have acquired on their children/students, researching the opportunities offered by the state to individuals with autism and taking relevant initiatives. It was observed that almost all of the negative situations experienced during the online education process were technical problems arising from the participants' internet access, and these problems were solved spontaneously or by the researcher. Depending on this entire process, in future research;It may be recommended to conduct studies specifically for the participant group, families with children with autism, or teachers who work only with autism.It may be suggested to design a holistic education process in which the research period is spread over a period of one year and covers more comprehensive topics, and to compare the results.It is among the suggestions to investigate the effect of the process on skill teaching by providing simultaneous practical training in which issues related to behavior and skill training of individuals with autism are discussed.

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KARBON FİBER TAKVİYELİ NANOKOMPOZİT YÜZÜCÜ PALETİ TASARIMI

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Özet
Bu çalışmada yüzücü paletinin bazı mekanik özelliklerinde iyileşmeler sağlanmıştır. Malzeme numunesi üzerinde yapılan çekme dayanımı, burkulma dayanımı, yorulma dayanımına yönelik laboratuvar ortamındaki araştırmalar olumlu yöndedir. Yüzücü paletin nanokompozit yapısına % 0,5 oranında ilave edilen karbon nanotüpler elyaflara fiziksel bir şekilde saplanmakta ve pürüzlü bir yapı oluşmasını ve böylelikle epoksi reçine ve fiberler arasında arayüzey bağlarının gelişmesini sağlayarak bir çalışma mekanizması ortaya koymaktadırlar. Ayrıca karbon nanotüpler kimyasal olarak fonksiyonelleştirildikleri için reçine ile kimyasal olarak bağlanmakta ve ara yüzey bağının kalitesi daha da artmaktadır. Karbon nano tüplerin reçine ve elyaf arasında bir köprü görevi görerek epoksi matristen kuvveti elyaflara daha dengeli ve verimli aktarmasını sağlayarak paletin kırılma hasarına karşı daha dayanıklı olmasını sağlamaktadır.
Anahtar Kelimeler: Nanokompozit, epoksi, KNT, yüzücü paleti.

CARBON FIBER REINFORCED NANOCOMPOSITE SWIMMING FINLET DESIGN

Abstract
In this study, improvements were achieved in some mechanical properties of the swimming fins. Laboratory studies on tensile strength, buckling strength on material samples are positive. Carbon nanotubes added at a rate of 0.5% to the nanocomposite structure of the swimming fins are physically embedded in the fibers and provide a working mechanism by creating a rough structure and thus the development of interfacial bonds between the epoxy resin and fibers. In addition, since carbon nanotubes, are functionalized they chemically bond with the resin and the quality of the interfacial bond increases further. Carbon nanotubes act as a bridge between the resin and fiber, allowing the fins more resistant to breakage damage.
Keywords: Nanocomposite, epoxy, CNT, swimming fins.

Giriş

Yüzme yüzgeçleri, su sporları aktivitelerinde (sörf, yüzme, tüplü-tüpsüz dalış, su topu vb.) suda hareket etmeye yardımcı olmak için ayağın üzerine giyilen yüzgeç benzeri ayakkabılardır. Bu faaliyetlerin farklı taleplerini karşılamak için, çeşitli yenilikçi şekillere sahip çok sayıda yüzücü paleti tasarlanmış ve literatürde bunların özel yöntemler ile testleri yapılmıştır [1]. Palet tasarımı geometri, kütle, yoğunluk ve sertlik açısından modüle edilebilmektedir. Bu parametrelerin ayarlanmasının ilerleme hızının yanı sıra yüzme ekonomisini ve verimliliğini de iyileştirdiği görülmüştür [1-4].



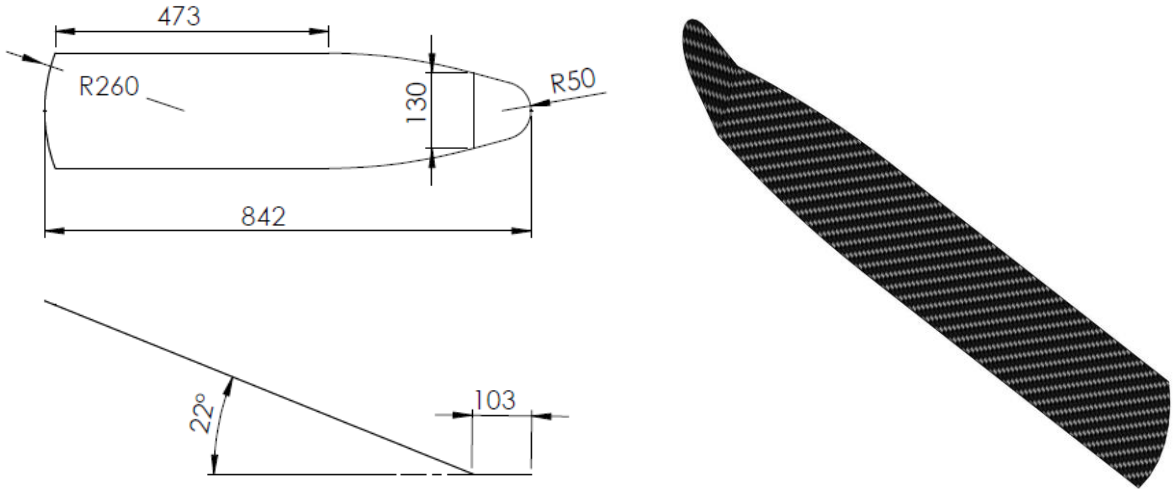
Şekil 1. Farklı tipteki paletler [1].

Önceki çalışmalarımızda nanopartikül modifiyesinin mekanik özellikler üzerindeki etkileri araştırılmış ve olumlu sonuçlar elde edilmiştir [5-9]. Bu çalışmada ise bize umut veren önceki çalışmalarımızın ticari bir ürüne uygulanabilirliği üzerinde durularak işin pratiğe dökülmesi sağlanmıştır.

Malzeme ve Yöntem

Yüzücü paleti başlıca iki kısımdan oluşmaktadır bunlardan ilki ayaklık diğeri ise pala denilen itici kısımdır. Bu çalışmada ayaklık kısmı hazır olarak tedarik dilmiş olup araştırmanın konusunu pala kısmı oluşturmaktadır. Pala kısmının üretiminde 200 gr-m^2 ağırlığındaki karbon twill dokuma kumaşlar kullanılmıştır. Reçine olarak palet deniz suyunda çalışacağı için üstün kimyasal dayanım özelliğinden dolayı epoksi reçine tercih edilmiştir. Palanın nanokompozit özelliğini kazanabilmesi için nano partiküller gereklidir. Nano partikül olarak çoğul duvarlı karbon nanotüpler tercih edilmiştir. Reçine ve sertleştiricisi üretici firmanın önerisi doğrultusunda % 70-30 olarak karıştırıldıktan sonra bu karışıma ağırlıkça % 0,5 çoğul duvarlı karbon nanotüp ilave edilmiştir. Bu oranın seçilmesinin neden önceki çalışmalarımız da KNT oranının dayanıma etkisinin araştırılmış olması ve en ideal değerin bu olduğunun tespit edilmiş olmasındandır. Karbon nanotüpler ilave edildikten sonra karışım 10 dk. mekanik karıştırılarak nano partiküllerin karışım içerisinde homojenizasyonu sağlanmıştır. Daha sonra kumaşlar Şekil 2'de verilen ölçülerde kesilerek hazırlanan bu karışım el yatırması yöntemi ile bir rulo

kullanılarak kumaşlara uygulanmıştır. Ardından kumaşlar ısıya dayanıklı yapışmaz mumlu kağıtların üstüne, ayaklığın takıldığı kısım 8 tabakalı olacak şekilde ve sonrasında kademeli olarak azalarak 6 tabaka, 4 tabaka ve son olarak uç kısımda 2 tabaka olarak istiflenmiştir. Bunun nedeni gerilmenin ayak ucunda maksimum değerini alması ve uç kısma doğru gittikçe azalmasıdır. Yüzücü paletinin pala kısmına kalıp yardımı ile sıcak presleme esnasında 22° açı verilmiştir (Şekil 2).

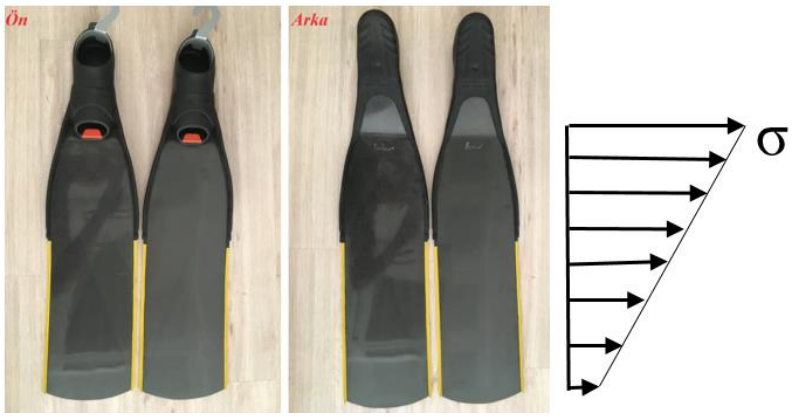


Not: Tüm ölçüler mm'dir.

Şekil 2. Palanın teknik resim çizimi ve üç boyutlu gösterimi.

Bulgular ve Tartışma

Çalışmaya ilham kaynağı olan numune bazında elde ettiğimiz deneysel çalışmalarımız çekme ve yorulma deneyleridir. Karbon nano tüp modifikasyonu ile önceki çalışmalarımızda farklı oryantasyonlardaki tabakalı karbon fiber kompozitlerde % 28'e varan çekme dayanımı artışı ve yorulma dayanımında hatırı sayılır iyileşmeler gerçekleştirilmiştir. Bu iyileştirmeler şu şekilde sağlanmaktadır; yüzücü paletin nanokompozit yapısına % 0.5 oranında ilave edilen karbon nanotüpler elyaflara fiziksel bir şekilde saplanmakta ve pürüzlü bir yapı oluşmasını ve böylelikle epoksi reçine ve fiberler arasında arayüzey bağlarının gelişmesini sağlayarak bir çalışma mekanizması ortaya koymaktadırlar. Ayrıca karbon nanotüpler kimyasal olarak fonksiyonelleştirildikleri için reçine ile kimyasal olarak bağlanmakta ve ara yüzey bağının kalitesi daha da artmaktadır. Karbon nano tüplerin reçine ve elyaf arasında bir köprü görevi görerek epoksi matristen kuvveti elyaflara daha dengeli ve verimli aktarmasını sağlayarak paletin kırılma hasarına karşı daha dayanıklı olmasını sağlamaktadır. Elde edilen olumlu sonuçlar doğrultusunda Şekil 3'deki nanokompozit karbon fiber yüzücü paleti fikri ortaya çıkmış ve uygulama olanağı bulmuştur.



Şekil 3. Nanokompozit yüzücü paleti.

Sonuç ve Öneriler

Sonuç olarak üzerinde çalışmalar yapılarak geliştirilen bir malzeme günlük hayatta kullanılan bir ekipmana uygulanmıştır. İleri çalışma konusu olarak elde edilen bu ürünün komponent halinin mekanik deneylerinin yapılması hedeflenmektedir. Ayrıca bu ürün E-cam/epoksi/KNT üretilerek maliyeti azaltılabilir.

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ARI ALGORİTMASI KULLANILARAK FABRİKA İÇİ LOJİSTİK SÜRECİNDE MALZEME TAŞIMA ROTASININ OPTİMİZASYONU

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Özet
Bu çalışmada, fabrika içi lojistik sürecinde; hammadde, yarı mamul, hazır parça, yardımcı malzeme gibi malzemelerin taşımasında kullanılan bir taşıyıcının rotasının Arı Algoritması kullanılarak optimizasyonu gerçekleştirilmiştir. Her türlü malzemenin fabrika içerisindeki depodan üretim hattına taşınması son derece önemlidir. Her geçen gün alanları büyüyen fabrikalarda malzeme taşıyıcıların verimli kullanılmaması, kat ettikleri mesafelerin uzun olması ve fabrika içerisinde sebep olduğu trafik gibi problemler sıkça gözlemlenmektedir. İster otonom isterse operatör tarafından kullanılan bir malzeme taşıyıcı olsun rotasının en uygun şekilde planlanması ile bu problemlerin üstesinden gelmek mümkündür. Bu sayede; operasyonel verimlilikte artış, üretim yeteneklerinde gelişme, aksama sürelerinde azalma ve maliyette tasarruf sağlanabilir. İhtiyaç duyulan malzemelerin doğru miktarda ve kalitede, doğru zamanda temin edilmesini sağlayan iş operasyonları dizisinin planlanmasına da yardımcı olunabilir. Bu amaçlar doğrultusunda; 150.000 metre kare büyüklüğündeki bir fabrikada malzeme taşıyıcının rotasının matematiksel modeli türetilmiş ve metasezgisel bir algoritma olan Arı Algoritması kullanılarak kat ettiği mesafe minimize edilmiştir. Malzeme taşıyıcının kat ettiği mesafede ciddi bir azalma sağlanmıştır. Sayısal uygulama ve sonuçları tablolar halinde ve grafiksel olarak verilmiştir.
Anahtar Kelimeler: Fabrika içi lojistik, Malzeme taşıyıcı, Arı Algoritması, Optimizasyon, Rota planlama

OPTIMIZATION OF MATERIAL TRANSPORTATION ROUTE DURING THE IN-FACTORY LOGISTICS PROCESS USING THE BEES ALGORITHM

Abstract
In this study, during the in-factory logistics process, the optimization of the route for material transport, including raw materials, semi-finished products, ready-made parts, and auxiliary materials, has been achieved through the application of the Bees Algorithm. It is extremely important to transport all kinds of materials from the warehouse in the factory to the production line. In factories whose areas are growing day by day, problems such as inefficient use of material carriers, long distances they travel and traffic they cause inside the factory are frequently observed. Whether the material transport is autonomous or operator-driven, optimal route planning can address these challenges, leading to increased operational efficiency, improved production capabilities, reduced downtime, and cost savings. Additionally, it aids in planning business operations sequence, ensuring timely acquisition of materials in the right quantity and quality. To achieve these objectives, a mathematical model for the route of the material carrier in a 150,000 square meter factory has been developed, and the Bees Algorithm, a metaheuristic algorithm, has been employed to minimize the travel distance. The results demonstrate a significant reduction in the material carrier's travel distance, presented numerically and graphically in tables.
Keywords: In-factory logistics, Material carrier, The Bees Algorithm, Optimization, Route planning.

Giriş

Fabrika içi lojistik veya başka bir deyişle iç lojistik, bir şirket içerisinde malzemelerin hareketi ve destek faaliyetlerinin gerçekleştirilmesi olarak tanımlanabilir. Malzeme ve ekipman kontrolü, depolama ve otomasyon sistemleri, stok kontrolü ve iç malzeme akışlarının koordinasyonu gibi bir dizi süreci içerir. İç lojistiğin temel amacı organizasyon içindeki malzeme hareketlerini düzenlemek, ürünlerin doğru zamanda, doğru miktarda ve doğru yere teslim edilmesini sağlamaktır. Örneğin, bir şirketin dağıtım sürecinde gecikmeler varsa, iç lojistik yöneticisi sorunun temel nedenini belirlemek için şirketin dağıtım merkezini analiz edecektir. Bu analiz, verimli malzeme akışını engelleyen envanter hatalarını veya yerleşim sorunlarını ortaya çıkarabilir. Yönetici, bu sorunları ele alarak, tedarik zinciri süreçlerini optimize etmek ve genel çevikliği artırmak için ek ekipman satın almak veya düzeni yeniden düzenlemek gibi düzeltici eylemlerde bulunabilir. İç lojistik, çeşitli nedenlerden dolayı şirketlerin başarısında kritik bir rol oynamaktadır. İlk olarak, üretim sürecini destekleyerek ve eksiklikleri veya darboğazları önleyerek organizasyon içindeki malzemelerin düzgün akışını sağlar. Şirketler, dahili lojistiği etkili bir şekilde yöneterek, iyi senkronize edilmiş bir tedarik zincirini koruyabilir ve zamanında ve doğru teslimatlara yönelik müşteri taleplerini karşılayabilir. Ayrıca iç lojistik, şirket stratejilerinin uygulanması ve pazarda büyüme için hayati öneme sahiptir. Verimli iç lojistik olmadan, stratejik planların geliştirilmesi ve uygulanması zorlaşır ve şirketin etkili bir şekilde rekabet etme yeteneği engellenir. Bu nedenle, iç lojistiği iş operasyonlarının stratejik bir bileşeni olarak önceliklendirmek, uzun vadeli başarı için çok önemlidir. Günümüz dünyasında lojistiğin zorluğu her tür şirket için giderek daha önemli hale gelmektedir. Lojistikten bahsederken, günümüzün araştırmaları genellikle endüstrilere ve onların tedarik zincirlerine geniş kapsamlı bir açıdan odaklanmaktadır. Pazarın genişlemesi ve artan nüfus nedeniyle büyüme fırsatlarının önemi esastır. Mal ve hizmetlere olan talep artıyor ve bu da bir işletme içinde malların taşınması, malzeme taşıma, tam zamanında teslimat, depolama elleçleme vb. süreçleriyle ilgili malzeme ve bilgilerin daha iyi akışını ve işlenmesini gerektiriyor [1]. Bu çalışmada da fabrika içi lojistik sürecinde; önemli hususlardan birisi olan hammadde, yarı mamul, hazır parça, yardımcı malzeme gibi malzemelerin fabrika içerisindeki ilgili istasyonlara taşımasında kullanılan bir taşıyıcının rotasının Arı Algoritması kullanılarak optimizasyonu gerçekleştirilmiştir. Malzeme dağıtımı için günlük rotaları, ulaşımı ve zamanlamayı planlamak önemlidir. Rota optimizasyonunun amacı operasyonel maliyeti azaltmak, verimliliği artırmak ve müşteri hizmetlerini geliştirmektir. Dikkate alınan faktörler miktar, zamanlama, en kısa rota planlaması, teslim alma ve teslimatların programlanması vb.

'dir. Hem dış hem de iç lojistikte kullanılmaktadır ve rota optimizasyonuna başlamanın ilk adımı, işin ihtiyaçlarını ve kısıtlamalarını belirlemek ve ardından ya matematiksel hesaplamalar yoluyla ya da bir yazılım sistemi edinerek çözümler bulmaktır. İkinci olarak optimal çözümlerin iş ihtiyaçlarına göre revize edilmesi gerekmektedir. Bu, günlük talep dalgalanması olabileceği gibi, kısıtlamalara uygun daha uzun bir zaman diliminde de olabilir. Bu çalışmada, sadece en kısa rota planlaması dikkate alınarak malzeme taşıma rotası optimize edilmiştir.

Gezgin Satıcı Problemi

Bu çalışmada, fabrika içi lojistik sürecinde malzeme taşıma işi bir depodan ilgili istasyonlara tek bir malzeme taşıyıcı ile tek bir seferde malzemelerin taşınması olarak tanımlanmıştır. Bu problem gezgin satıcı probleminin benzeridir. Malzeme taşınacak istasyonlar gezgin satıcı problemindeki şehirler olarak malzeme taşıyıcı ise gezgin satıcı olarak kabul edilmiştir. Genel olarak gezgin satıcı problemi, özellikle bir şehirden başlayarak n şehri ziyaret etmek isteyen, tüm şehirlerden yalnızca bir kez geçmesi gereken ve daha sonra seyahat acentesinin toplam en kısa mesafeyi kat etmesini gerektiren ayrılış şehrine geri dönmesi gereken seyahat eden bir satıcıyı ifade eder. Dantzig–Fulkerson–Johnson formülasyonuna göre matematiksel modellenmesi şu şekildedir [2]. Ağırlıklandırılmış tamamen yönsüz bir grafikte en küçük ağırlığa sahip bir Hamilton döngüsü bulmak gerekir. Yani, G= (V, E), V={1, 2, …, n} köşeler kümesini ve E kenarlar kümesini temsil etsin ve e=(i, j) ∈ E her kenar negatif olmayan bir m(e) ağırlığa sahip olsun. Şimdi C 'nin $M(C)=\Sigma_{E(C)}.m(e)$ toplam ağırlığı en küçük olacak şekilde G 'nin C Hamilton döngüsünün bulunması gerekir. c_{ij}; **i** şehri ile **j** şehri arasındaki mesafeyi temsil etmek üzere;

$$c_{ij} > 0, \qquad i, j \in V$$

$$x_{ij} = \begin{cases} 1 & \boldsymbol{i}\ şehrinden\ \boldsymbol{j}\ şehrine\ gidiliyorsa \\ 0 & diğer\ durumlarda \end{cases}$$

olmak üzere gezgin satıcı probleminin matematiksel modeli aşağıdaki gibidir:

$$\min \sum_{i=1}^{n} \sum_{j \neq i, j=1}^{n} c_{ij} x_{ij}$$

Ve kısıtlar:

$$\sum_{i=1, i \neq j}^{n} x_{ij} = 1, \qquad j \in V$$

$$\sum_{j=1, j \neq i}^{n} x_{ij} = 1, \qquad i \in V$$

$$\sum_{i \in Q} \sum_{j \neq i, j \in Q} x_{ij} \leq |Q| - 1, \qquad \forall Q \subseteq \mathrm{V}, |Q| \geq 2$$

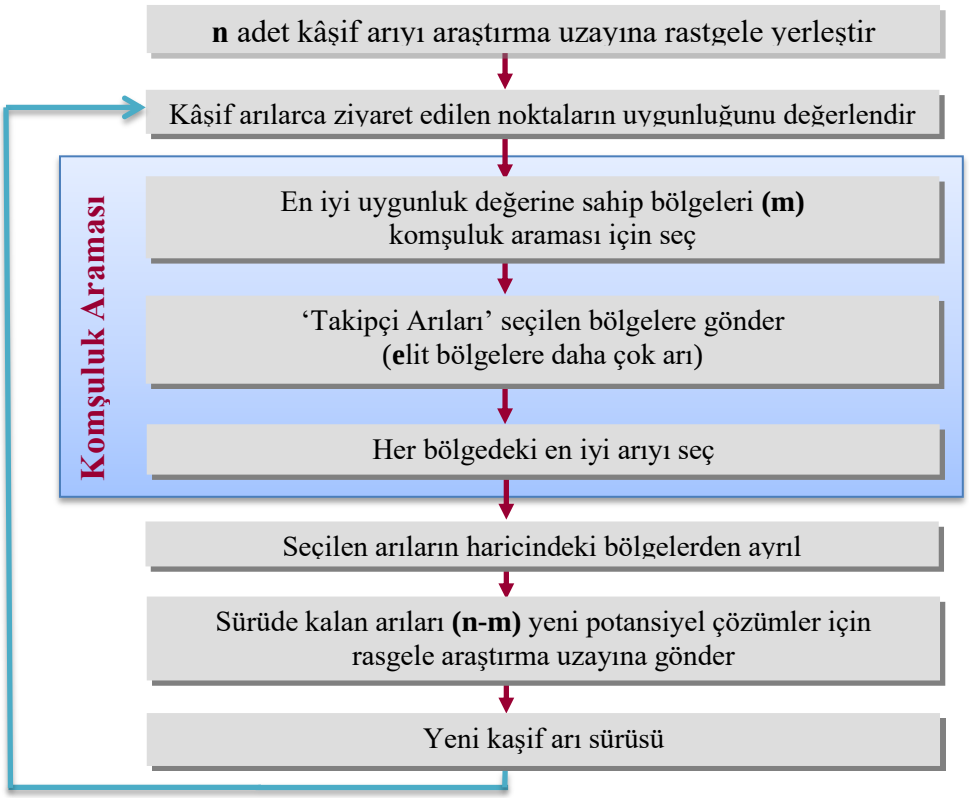
$$x_{ij} \in \{0, 1\}, \qquad i, j \in V$$

şeklindedir. Burada |Q|; Q kümedeki köşe sayısını temsil eder. İlk iki kısıtlama, her köşe için yalnızca bir gelen ve bir giden kenar olduğunu, son kısıtlaması ise alt tur eliminasyon kısıtlaması olarak adlandırılır. Hiçbir uygun alt küme Q 'nun bir alt tur oluşturamayacağını garanti eder. Dolayısıyla döndürülen çözüm, daha küçük turların birleşimi değil, tek bir turdur. Bu, üstel sayıda olası kısıtlamalara yol açtığından, pratikte satır oluşturma ile çözülür.

Arı Algoritması

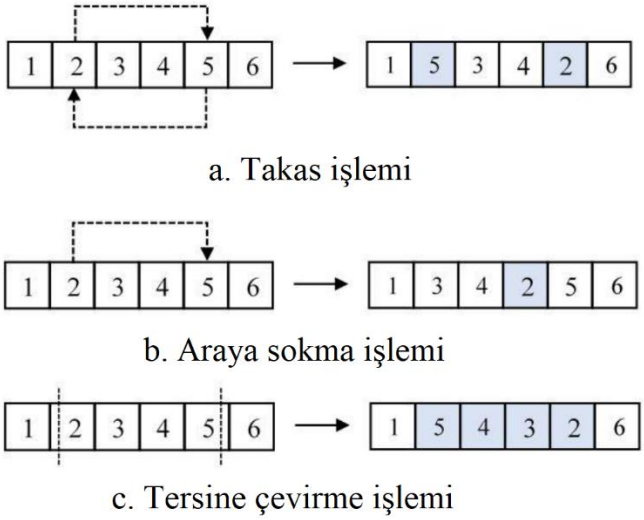
Bu çalışmada, optimizasyon probleminin çözümü için meta-sezgisel optimizasyon algoritması olan Arı Algoritması kullanılmıştır. İlk olarak 2006 yılında Pham ve ark. tarafından geliştirilmiş olan Arı Algoritması, bal arılarının kaynak (nektar, su vb.) arama davranışını taklit eden sürü zekâsı temelli bir tarama algoritmasıdır [3-17]. Şekil 1 'de Arı Algoritması 'na ait akış şeması görülmektedir. Arı Algoritması optimizasyon yapılırken ayarlanması gereken bir dizi parametre içerir. Bunlar, ziyaret edilen n nokta içinden seçilen en uygun tarama bölge sayısı (m), kâşif arı sayısı (n), en iyi e tarama bölgesine gönderilen arı sayısı (nep), seçilen m adet tarama bölgesi içindeki elit tarama bölge sayısı (e), kalan (m-e) tarama bölgesine gönderilen arı sayısı (nsp), tarama bölgesi boyutu (ngh) ve durdurma kriteri olarak kabul edilen iterasyon sayısı (itr)'dır. Optimizasyon problemi n adet kâşif arının tarama uzayına rastgele olarak gönderilmesi ile başlar. İkinci adımda kâşif arılarca taranan noktaların uygunlukları değerlendirilir. Üçüncü adımda n adet tarama bölgesi içerisinde daha uygun değere sahip m adet tarama bölgesi seçilir. Dördüncü ve beşinci adımda m adet tarama bölgesinde en iyi uygunluk değerine sahip elit tarama bölgeleri (e) ve geriye kalan tarama bölgeleri (m-e) seçilir. Bu bölgeler için komşuluk tarama boyutu (ngh) belirlenir. Seçilen tarama bölgelerinde komşuluk taraması için, daha gelecek vaat eden çözümler olan en iyi e tarama bölgesine seçilen diğer tarama bölgelerine göre daha fazla takipçi arı (nep), diğer tarama bölgelerine ise daha az takipçi arı (nsp) gönderilerek daha detaylı arama yapılır. Her tarama bölgesi içerisinde en uygun değere sahip arı seçilir. Altıncı, yedinci ve sekizinci adımda ise her tarama bölgesine en uygun değere sahip arı haricindeki diğer arılar tarama uzayından ayrılır. Sürüdeki diğer arılar (n-m) yeni potansiyel çözümler elde etmek için tekrar, rastgele olarak tarama uzayına gönderilirler. Optimizasyonun durdurulma kriteri (itr) sağlanıncaya kadar işlemlere devam edilir. Her bir iterasyondan sonra

yeni sürü; seçilen her bir tarama bölgesinin temsilcileri ve rastgele tarama yapan kâşif arılardan oluşur.



Şekil 1. Arı Algoritması akış şeması

Bu çalışmada, malzeme taşıma rotası gezgin satıcı problemindekine benzetilerek optimize edilmiştir. Gezgin satıcı problemindeki tarama ve komşuluk tanımları sayısal problemlerden farklıdır. Genel olarak şehirlerin rota üzerindeki yerleri belirli kurallara göre değiştirilerek daha az maliyetle yeni rotalar bulunmaya çalışılır. Arılar algoritması için Ismail ve ark. yerel arama bölümünde üç farklı operatör kullanmıştır [18]. Bu süreçler benzer şekilde diğer sezgisel algoritmalarda da kullanılmaktadır. Takas işleminde rastgele seçilen iki şehrin sırası birbiriyle değiştirilir. Araya sokma işleminde rastgele seçilen bir şehrin sıralaması yine rastgele seçilen farklı bir sıraya eklenir. Tersine çevirme ise rastgele belirlenen iki şehir arasındaki sıralama tersine çevrilir. Bu işlemler Şekil 2 'de basitçe gösterilmiştir [19]. Bu işlemler yerel tarama kısmında rastgele kullanılmaktadır, elit sitelerde daha fazla sayı, en iyi sitelerde ise daha az sayı bulunmaktadır.



Şekil 2. Arı Algoritması ile optimizasyon sırasındaki bazı işlemler

Sayısal Uygulama

Sayısal uygulama için 150.000 metre kare büyüklüğünde olan MEMAK Plastik Gıda Makina Sanayi Ticaret A.Ş. 'nin fabrikası kullanılmıştır. Fabrikanın büyük olması sebebiyle malzeme taşıma rotasının optimize edilmesi iç lojistik açıdan son derece önemlidir. Problem, depodan bir malzeme taşıyıcı ile rastgele olarak belirlenen 50 adet istasyona bir turda ve bir istasyona bir defa uğranarak malzemelerin taşınacağı şeklinde tanımlanmıştır. Optimizasyon çalışmalarında kullanılan Arı Algoritması 'na ait parametreler Tablo 1 'de verilmiştir.

Tablo 1. Arı Algoritması parametreleri

n	m	e	nep	nsp	ngh	itr
30	20	4	9	5	0.02	450

Fabrika içerisinde rastgele olarak belirlenen istasyonların koordinatları Tablo 2 'de verilmiştir. Optimizasyon çalışmaları neticesinde yapılacak olan turun minimum mesafede olması amaçlanmıştır. Optimizasyon sonucunda malzeme taşıma rotasının uzunluğu 2183.4 metre olarak hesaplanmıştır. Her bir iterasyonda elde edilen sonuçlar Şekil 3 'te verilen yakınsama grafiğinde görülmektedir. Yapılan optimizasyon çalışmaları sonrası istasyonların ziyaret sıralaması 1 → 36 → 4 → 18 → 24 → 10 → 12 → 20 → 39 → 13 → 9 → 2 → 23 → 44 → 15 → 25 → 21 → 37 → 29 → 43 → 26 → 50 → 31 → 48 → 8 → 47 → 14 → 38 → 7 → 45 → 16 → 35 → 32 → 11 → 3 → 40 → 34 → 22 → 6 → 30 → 33 → 17 → 28 → 42 → 41 → 46 → 5 → 49 → 27 → 19 → 1 olarak bulunmuştur. Fabrikanın içerisinde istasyonların konumları ve optimizasyon sonucunda elde edilen rota planlaması Şekil 4 'te görülmektedir.

Düzensiz ve rastgele izlenecek bir rotanın uzunluğunun 8000 metrelerin üzerine çıkabileceği Şekil 3 'te görülmektedir.

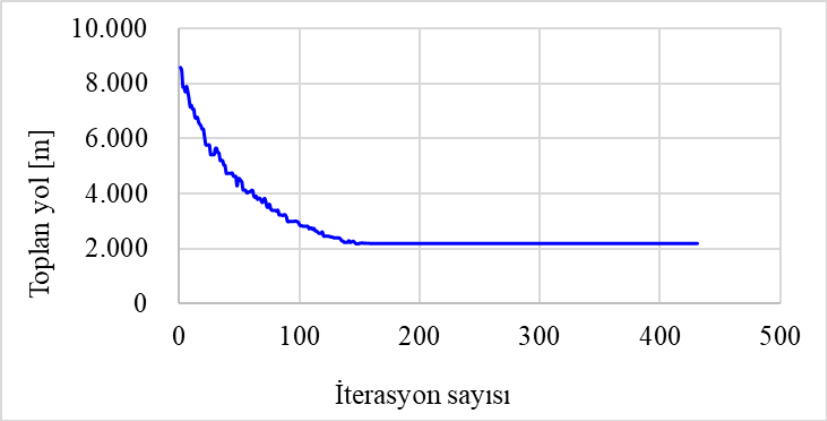
Tablo 2. İstasyon numaraları ve fabrika içerisindeki koordinatları (X, Y)

No	X [m]	Y [m]	No	X [m]	Y [m]	No	X [m]	Y [m]
1	407	83	**18**	458	42	**35**	49	275
2	453	204	**19**	396	45	**36**	412	86
3	63	197	**20**	480	77	**37**	347	227
4	457	49	**21**	328	252	**38**	159	226
5	316	36	**22**	18	76	**39**	475	114
6	49	150	**23**	425	244	**40**	17	170
7	139	288	**24**	467	73	**41**	219	23
8	273	102	**25**	339	279	**42**	191	16
9	479	176	**26**	379	105	**43**	383	159
10	482	67	**27**	372	59	**44**	398	234
11	79	225	**28**	196	75	**45**	93	280
12	485	77	**29**	328	185	**46**	245	39
13	479	152	**30**	86	142	**47**	223	171
14	243	210	**31**	353	105	**48**	323	141
15	400	267	**32**	16	249	**49**	355	4
16	71	288	**33**	138	176	**50**	377	101
17	211	164	**34**	23	165			

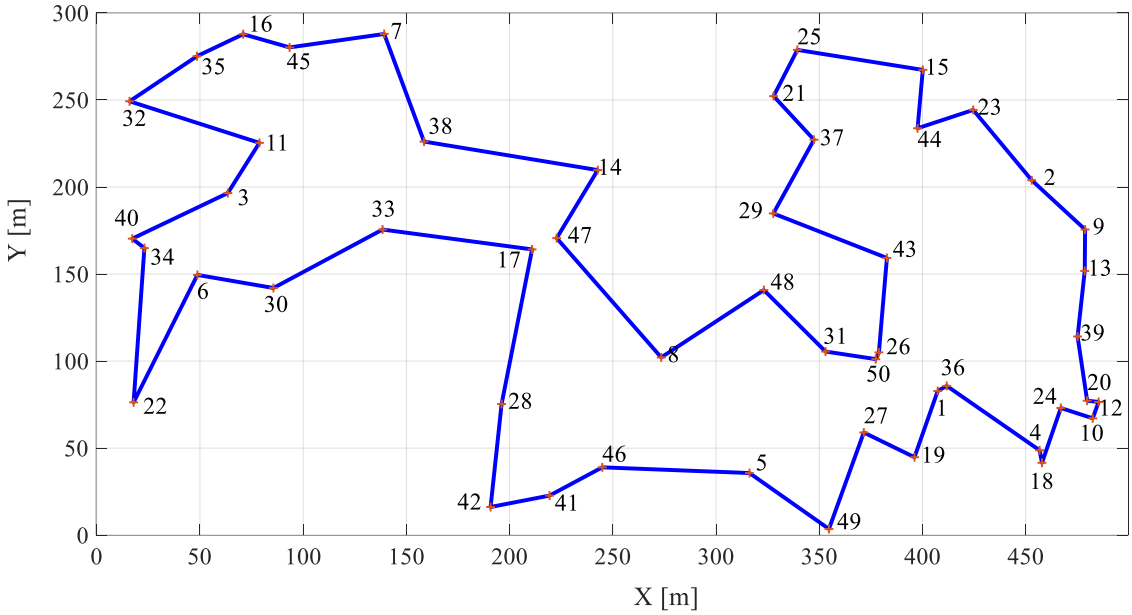
Sonuç

Bu çalışmada, MEMAK Plastik Gıda Makina Sanayi Ticaret A.Ş. 'nin fabrika içi lojistik sürecinde; hammadde, yarı mamul, hazır parça, yardımcı malzeme gibi malzemelerin taşımasında kullanılan bir taşıyıcının rotasının Arı Algoritması kullanılarak optimizasyonu gerçekleştirilmiştir. Fabrika içerisinde yapılan malzeme taşıma işini daha etkin ve üretim alanlarında bekleyen stok miktarlarını en aza indirebilmek amacıyla rota planlaması yapılmıştır. Malzeme tedariğini yapacak aracın fabrika içerisinde depodan ilgili istasyonlara kadar rotasını tespit edecek bir matematiksel model Dantzig–Fulkerson–Johnson formülasyonu kullanılarak elde edilmiştir. Rota bilgisi ve diğer kısıtlar en kısa rotayı tespit edebilmek için bir matematiksel model türetilmiştir. Malzeme taşıyıcının bir tur içerisinde her bir istasyona sadece

bir defa uğrayacağı düşünülerek matematiksel model formüle edilmiştir. Minimum tur mesafesi için elde edilen matematiksel model Arı Algoritması kullanılarak optimize edilmiştir. Elde edilen sonuçlar değerlendirildiğinde, bu yöntem ile atılan tur sayısında, toplam stok ve taşıma maliyetinde ve malzeme taşıyıcının doluluk oranında önemli iyileştirmeler yapılabileceği görülmüştür. Bu yaklaşımın, depodan istasyonlara taşımanın yanı sıra operasyonlar arası malzeme taşıma ve akışının fazla olduğu fabrikalarda düzensiz taşıma ve yarı mamul stoklarından kaynaklı maliyetlerin önemli ölçüde düşürebileceğini söylemek mümkündür. Bu çalışmada kurulan matematiksel model benzer fabrika ve malzeme akışları için etkin bir şekilde kullanılabilir. Diğer yandan problemin çözümü için metasezgisel bir algoritma olan Arı Algoritması 'nın kullanımı; farklı problemlerin çözüm yaklaşımlarının geliştirilmesi ve problemlerin farklı varsayımlar ile farklı üretim süreçlerine uygulanabilirliğinin gösterilmesi bakımından alternatif bir yaklaşım olarak kullanılabileceğini göstermiştir.



Şekil 3. Yakınsama grafiği



Şekil 4. İstasyonlar arası rota planlaması

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TÜRKİYE'DE HİNDİ YETİŞTİRİCİLİĞİNİN GENEL DURUMU

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ÖZET
Dünyadaki kanatlı hayvan eti ve sofralık yumurta üretiminin önemli bir kısmı ticari tavuk yetiştiriciliğinden sağlanmaktadır. Hayvansal kökenli gıdaların çeşitliliğini sağlamak ve nüfus artışına paralel olarak ihtiyaç duyulan protein açığının kapatılması için ördek, kaz ve hindi gibi kanatlı hayvan türlerinden de yararlanılmaktadır. Dünya genelinde kanatlı hayvanlar içerisinde varlığı en fazla olan türler sırasıyla tavuk, ördek, kaz ve hindi şeklindedir. Dünya nüfusunun beslenmesinde ve ihtiyaç duyulan protein açığının kapatılmasında kümes hayvanları içerisinde hindiler de önemli bir yere sahiptir. Hindi yetiştiriciliğinin tavuk yetiştiriciliğine göre en önemli avantajı karkas randımanının yüksek olmasıdır. Dünya genelinde hazır gıda ve fast-food yiyeceklerin tüketici kitlesindeki artışı ve hindi etinin kırmızı etlerle birlikte sucuk, salam ve sosis gibi işlenmiş et ürünlerinin yapımında büyük oranda kullanımı hindi yetiştiriciliğini canlı tutmaktadır. Ayrıca tüm dünyadaki birçok kültürde bazı özel zamanların sofralarında özellikle tercih edilen önemli bir kanatlı hayvan etidir. Türkiye'de tavuktan sonra en fazla hindi yetiştiriciliği yapılmaktadır. Türkiye'de yetiştiriciliği yapılan kanatlı hayvan türlerinin varlığı en fazla olanlar sırasıyla tavuk, hindi, kaz ve ördek şeklindedir. Türkiye'de hindi varlığının ikinci sırada yer alması ülkenin her coğrafyasında yetiştirilmesiyle ve etinin her kesimden insanın damak lezzetine uygun olması ile açıklanabilir. Türkiye'de tavuktan sonra endüstrileşen hindi yetiştiriciliği yegane kanatlı hayvancılık sektörü haline gelmiştir. Türkiye'de hindi yetiştiriciliği en yaygın ekstansif veya yarı entansif olarak küçük sürüler halinde meraya dayalı otlatmaya uygun koşullarda da yapılmaktadır. Etlik piliç yetiştiriciliğinde olduğu gibi entansif koşullarda ticari hibritler kullanılarak hindi eti üretimine yönelik yatırımlar yapılmaya başlanmıştır. Ülkemizde ilk entegre hindi yetiştiriciliği işletmesi 1995 yılında Bolu'da kurulmuş ve izleyen yıllarda birçok işletme kurulmaya devam ederek hindi eti üretiminde ön plana çıkmıştır. Kurulan bu işletmelerde damızlık tesisi, kuluçkahane, yetiştirme kümesleri, kesimhane, parçalama, paketleme, şoklama, muhafaza tesisleri ve dağıtım firmaları ile tam entegre üretim yapılmaya başlanmıştır.
Anahtar kelimeler: Hindi eti, kanatlı hayvan yetiştiriciliği, Türkiye'de hindi yetiştiriciliği

GENERAL SITUATION OF TURKEY BREEDING IN TÜRKİYE

ABSTRACT
A significant portion of the world's poultry meat and table egg production is provided from commercial chicken breeding. Poultry species such as duck, goose and turkey are also used to ensure the diversity of animal-based goods and to close the protein gap needed in parallel with population growth. The most populated species of poultry around the word are chicken, duck goose and turkey respectively. Turkeys have an important place in poultry farming to fulfile the protein deficit in feeding the world population. The most important advantage of turkey farming compared to chicken farming is the high carcass yield. The increase in the consumption of ready-to-eat and fast-foods throughout the worldwide and the use of turkey meat in the production of processed meat products such as sausage and salami along with red meat keeps turkey breeding alive. It is also an important poultry meat that is especially preferred on the tables of some special days in many cultures around the world. Turkey breeding is the second largest poultry species after chicken in Türkiye. The most common poultry species bred in Türkiye are chicken, turkey, goose and duck, respectively. The second place in the presence of turkey in Türkiye can be explained by the fact that it is breeding in every geography of the country and it’s meat is suitable for the taste of all people. In Türkiye, turkey breeding has become the unique industrialised poultry sector after the chicken. In Türkiye, turkey are the most commonly bred as extensive or semi-extensive in small flocks in conditions suitable for pasture-based grazing. Investments have begin to be made for turkey meat production by using commercial hybrids under intensive conditions as in broiler breeding. The first integrated turkey farming enterprise in Türkiye was established in Bolu in 1995 and many enterprises continued to be established in the following years and came to the forefront in turkey meat production. In these constructed enterprises, poultry breeding facility, hatchery, bird’s houses, slaughterhouse, shredding unit, packaging, shocking, preservation facilities were established and fully integrated production was started to be carried out with distribution companies.
Key words: Poultry breeding, turkey breeding in Türkiye, turkey meat

GİRİŞ

Birçok çiftlik hayvanı yetiştiriciliklerine göre kanatlı hayvan yetiştiriciliklerinin daha ekonomik ve etinin sağlıklı olması yetiştiriciliğine olan ilgiyi her geçen gün artırmaktadır. Kanatlı hayvan türleri içinde dünyada popülasyonu en fazla olanları sırasıyla tavuk, ördek, kaz ve hindi şeklindedir (FAO 2022). Kanatlı hayvan eti ve sofralık yumurta üretimi bakımından ticari tavuk yetiştiriciliği dünyada birinci sıradadır. Nüfus artışına paralel olarak hayvansal kökenli gıdaların çeşitliliğini sağlamak, ihtiyaç duyulan protein açığının kapatılması için alternatif olarak ördek, kaz ve hindi gibi kanatlı hayvanlar da yetiştirilmektedir. Bu kümes hayvanlarının yetiştirilmesinde asıl amaç et üretimi olsa da yumurta, yağlandırılmış karaciğer ve tüy üretimi gibi amaçlarla da yetiştiricilikleri yapılabilmektedir (Grzinic ve ark. 2023).Alternatif kanatlı hayvanlar içerisinde yer alan hindiler dünya nüfusunun beslenmesinde önemli bir yere sahiptir. Dünya genelinde hazır gıda ve fast-food yiyeceklere gittikçe artan talep ve hindi etinin kırmızı etler ile birlikte sucuk, salam, sosis gibi işlenmiş et ürünlerinde kullanımı yetiştiriciliğini canlı tutmaktadır. Hindi etinin dünya genelinde hemen her kültürden insanın damak tadına uygun olması ve özel gün menülerinde yer alması da yetiştiriciliğinde diğer alternatif kanatlı hayvanlara göre avantaj sağlamaktadır (Konca 2001, Ribarski ve Oblakova 2016). Hindi etini diğer kanatlı hayvan etlerinden ayıran en önemli özelliği protein içeriğinin yüksek ve yağ içeriğinin de daha düşük olmasıdır. Bu nedenle hindi eti diyet menüleri için de oldukça önemli bir yere sahiptir. Hindi etinde protein oranı %25-26, yağ oranı %0,31-%0,90 düzeyindedir (Ribarski ve Oblakova 2016). Etinin 100 gramında ise 160 kcal enerji bulunduğu bildirilmektedir (Özer ve Özbey 2013).Hindinin anavatanı Amerika kıtasıdır. Evcil hindiler; zoolojik sınıflandırmada *Galliformes* takımı, *phasianidae* ailesi ve *meleagris* cinsinden *Meleagris gallopova* olarak bilinmektedir (Brant 1998). Dünya genelinde yetiştiriciliği yapılan hindilerin birçoğu Kuzey Amerika Bronz hindilerinden köken almıştır ve ıslah çalışmaları sonucunda birçok hindi genotipi oluşturulmuştur (Brant 1998). Amerikan Bronz, Geniş Göğüslü Bronz, Geniş Göğüslü Beyaz ve Küçük Beyaz Beltsville yaygın olarak yetiştiriciliği yapılan ve çeşitli hindi genotip ve hatlarının geliştirilmesinde kullanılan hindi ırklarındandır (Brant 1998, Makarynska ve Vorona 2019, Arslan ve Çetin 2022). Hindilerin yemden yararlanma oranı yüksek olup, karkas randımanı da oldukça iyi düzeydedir (Brant 1998). Hindiler üzerinde yapılan ıslah çalışmaları sonucunda yemden yararlanma oranı ve canlı ağırlık artışında önemli gelişmeler sağlanmıştır. Islah çalışmaları sonucunda elde edilen hindi genotiplerinin neredeyse tamamının Amerika Bronz ve Geniş Göğüslü Bronz ırk hindilerden geliştirildiği bildirilmektedir (Makarynska ve Vorona 2019).

Amerika Bronz hindileri yetiştiriciliği en yaygın hindi ırkı olarak tanınmaktadır. En önemli özellikleri yüksek döl ve et veriminin yanı sıra yemden yararlanma oranının da iyi düzeyde olmasıdır. Orta cüsseli hindi ırklarındandır. Geniş Göğüslü Bronz hindiler ise yetiştiriciliği yaygın olarak yapılan bir diğer ırktır. Ağır cüsseli hindi ırkları içerisinde yer almaktadır. Bu ırkın en önemli özelliği göğüs etinin karkastaki payının yaklaşık %40 düzeyinde olmasıdır. Göğüs etinin ekonomik değerinin yüksek olması yönünden birçok hindi hattı geliştirilmiştir ve 1940'lı yıllarda İngiltere'de Geniş Göğüslü Bronz hindiler en fazla tercih edilen hindi ırkı olmalarının yanı sıra günümüzde de halen birçok ıslah çalışmalarında kullanılmaya devam etmektedir (Brant 1998, Arslan ve Çetin 2022). Hindilerde yıllık yumurta verimi 60 ve 100 adet arasındadır. Yumurtaları beyaz renkli olup üzerinde açık kahve renkli benekler vardır. Hindilerde yumurta ağırlığı ortalaması 70-90 g (Mroz ve ark. 2014, Erişir ve Yıldız 2000, Arslan ve Çetin 2022) ve şekil indeksi ortalaması ise %73 düzeyindedir (Mroz ve ark. 2014, Alaşahan ve ark. 2019). Hindi yumurtalarının kuluçka süresi 28 gün, döllülük oranı %80-90, çıkış gücü %70-90 ve kuluçka randımanı ise %70-80 aralığındadır (Byerly ve Marsden 1938, Erişir ve Yıldız 2000, French 2000, Mroz ve ark. 2014). Hindiler cüsselerine göre hafif, orta, orta ağır ve ağır olmak üzere dört grupta sınıflandırılmaktadır. Bakım ve besleme koşullarına bağlı olarak dişi ve erkek hindilerin canlı ağırlıkları ortalama; hafif gruptaki dişiler 5-8 kg ve erkekler 18 kg'a kadar çıkmakta iken; orta gruptakilerde dişiler 8-10 kg ve erkeklerde 25 kg'a kadar canlı ağırlık artışı olmaktadır. Orta ağır gruptaki hindilerde dişiler 9-11 kg ve erkekler 30 kg'a kadar çıkmakta iken, ağır gruptaki hindilerin canlı ağırlığının dişilerde 10-13 kg ve erkeklerde ise 40 kg'a kadar çıktığı bildirilmektedir (Makarynska ve Vorona 2019).Hindilerde ideal kesim yaşı canlı ağırlığa bağlı olmakla birlikte 16 ve 24 hafta arasında değişmektedir (Majumdar ve ark. 2005, Makarynska ve Vorona 2019). Genel olarak hindilerde karkas randımanının %70-75 oranında olduğu, göğüs eti oranının ise yaklaşık %30 düzeyinde olduğu bildirilmektedir (Ojewola ve ark. 2001, Majumdar ve ark. 2005). Son yıllarda yapılan ıslah çalışmaları sonucunda hibrit hindilerin yemden yararlanma oranında ve karkas randımanlarında oldukça iyi sonuçlar elde edilmiştir. Dişi hindilerin 10. haftada canlı ağırlığı yaklaşık 3 kg, yemden yararlanma oranı ise 2.1 olarak, erkek hindilerde ise 8 haftalık yaştaki canlı ağırlık 3 kg ve yemden yararlanma oranı ise 1.8 olarak bildirilmiştir (Karki 2005, Özer ve Özbey 2013). Hindilerde yemden yararlanma oranı erken yaşlarda en iyi düzeydir ve ileriki yaşlarda bu oranın düzeyi artış göstermektedir (Karki 2005). Dünya genelinde hindi varlığı 255.767.000 baş düzeyindedir (FAO 2022). Ülkeler düzeyinde hindi varlığı en yoğun Amerika Birleşik Devletleri'nde %46 düzeyinde ve Avrupa Birliği ülkelerinde %35 düzeyindedir. ABD 70

milyon baş hindi varlığı ile dünyada en büyük hindi eti üreticisi ülke konumundadır. ABD'yi yaklaşık 27 milyon baş ile Şili, 15 milyon baş ile Fransa, yaklaşık 15 milyon baş ile Polonya ve yaklaşık 14 milyon baş ile Fas takip etmektedir. Hindi, Amerikan kültür ve mutfağı için önemli bir kümes hayvanı konumundadır. ABD'inde her yıl Kasım ayında kutlanan ve gelenek haline gelmiş 'Şükran Günü' (Thanksgiving Day) için yapılan ritüel ve kutlamalarda hindi eti ile yapılan yemekler önemli bir yere sahiptir (Kurtiş ve ark. 2010, Roth 2010). ABD'de hindi sadece et elde etmek için yetiştirilmemekte bunun yanı sıra törenlerde ve dekoratif amaçlı tüy üretimi için de yetiştiricilik yapılmaktadır (Sponenberg ve ark. 2000). Dünya genelinde tavuk, ördek, hindi ve kazlardan elde edilen toplam et miktarı 139.200.561.400 tondur. Elde edilen toplam et üretimi içerisinde %88,82 oran ile tavuk eti en büyük paya sahip ve birinci sırada, %4,36 ile ördek eti ikinci, %3,65 ile hindi eti üçüncü ve %3,17'lik oran ile kaz eti dördüncü sırada yer almaktadır (FAO 2022). Dünya hindi eti ihracatında Polonya 168 bin ton ile birinci, ABD yaklaşık 134 bin ton ile ikinci ve Almanya yaklaşık 90 bin ton ile üçüncü sırada yer almaktadır. Dünya hindi eti ithalatında ise 102.6 bin ton ile Meksika birinci sırada yer almaktadır. Meksika'yı 89.6 bin ton ile Almanya, 47.4 bin ton ile Benin ve 38.7 bin ton ile ABD takip etmektedir (FAO 2022).

TÜRKİYE'DE HİNDİ YETİŞTİRİCİLİĞİ

Dünya genelinde olduğu gibi Türkiye'de de kırmızı et fiyatlarının yüksekliği nedeniyle kümes hayvanları yetiştiriciliğine ilgi artmaktadır. Türkiye'de yetiştiriciliği yapılan kanatlı hayvan türlerinin varlığı en yüksekten düşüğe doğru tavuk, hindi, kaz ve ördek şeklindedir (TÜİK 2022). Dünya genelinden farklı olarak Türkiye'de ticari tavuklardan sonra hindi ikinci sırada yer almaktadır. Türkiye'de hindi yetiştiriciliğinin geçmişi uzun yıllar öncesine dayanmakla birlikte ticari hindi yetiştiriciliği çok eski değildir. Devlet Üretme Çiftlikleri (DÜÇ) tarafından yetiştiricilere palaz desteği lokomatif güç olmuştur (Eratalar ve Bulut 2007, Arslan ve ark. 2020, İnci 2020). Çeşitli illerde kurulmuş olan DÜÇ'leri zamanla yerini modern üretim tesislerine ve özel çiftliklere bırakarak kapatılmıştır (Eratalar ve Bulut 2007, Koyubenbe ve Konca 2010, İnci ve ark. 2018). Ülkemizde ilk özel entegre hindi yetiştiriciliği tesisi 1995 yılında Bolu'da kurulmuş ve ilerleyen yıllarda birçok işletme kurulmaya devam ederek birçok ticari firma hindi eti üretiminde ön plana çıkmıştır. Böylece biyogüvenlik standartları ve teknik kapasitesi yüksek olarak projelendirilen kümeslerde üretim yapılmaya başlanmıştır (Eratalar ve Bulut 2007). Kurulan bu işletmelerde damızlık tesisi, kuluçkahane, yetiştirme kümesleri, kesimhane, parçalama-paketleme-şoklama, depolama tesisleri ve dağıtım firmaları ile tam entegre üretim yapılmaktadır. Bugün İstanbul, Sakarya, Bolu ve İzmir gibi illerde bulunan özel

sektöre ait işletmelerde hindi yetiştiriciliği yapılmaktadır (İnci 2020). Hindi eti üretimi yapan bu kuruluşlar 2007 yılında birleşerek 'Hindi Yetiştiricileri Platformu'nu kurmuşlardır (Eratalar ve Bulut 2007). Ayrıca bu işletmeler tavuk yetiştiricilerinin de bünyesinde bulunduğu Beyaz Et Sanayicileri ve Damızlıkçıları Birliği Derneği (BESD-BİR) üyeleridir (BESD-BİR 2024). Kaz ve ördek yetiştiriciliği yapan yetiştiriciler için henüz birliktelik sağlayan bir kuruluş bulunmazken tavuk ve hindi yetiştiricilerinin birlik içerisinde olduğu görülmektedir.Türkiye'deki hindi varlığının büyük bir çoğunluğunu yerli genotipler ile Amerikan Bronz hindiler oluşturmaktadır (Özer ve Özbey 2013, Arslan ve Çetin 2022). Türkiye'de hindi yetiştiriciliği 30-40 yıl öncesine kadar sadece küçük ailesel işletmelerde tamamen ektansif ve ya yarı entansif koşullarda yapılmakta iken son yıllarda sanayi ile entegre olan entansif koşullarda ticari yetiştiricilik yapılmaya başlanmıştır. Bugün halen ekstansif ve yarı entansif yetiştiricilik kırsal kesimlerde yapılmaya devam etmekte ve aile ihtiyacı dışında küçük sürüler halinde yılbaşı tüketimine yönelik olarak da yetiştiricilik yapılmaktadır (Polat ve ark. 1999, Eleroğlu ve ark. 2012). Ekstansif yetiştiricilik; özellikle kırsal kesimde küçük aile tipi işletmelerde yapılmakta ve hindiler büyükbaş hayvanlar gibi sürüler halinde merada otlatılmaktadır. Kırsal kesimdeki ailesel yetiştiriciler için hindi önemli bir gıda kaynağı olmasının yanı sıra çeşitli türden kanatlı hayvan yumurtalarının doğal kuluçkasında yetiştiriciler tarafından verimli bir şekilde kullanılmaktadır. Yerli genotipten hindilerde annelik içgüdüsünün fazla olması ve yüksek gurk olma özelliği kırsaldaki yetiştiriciliğinin sürekliliğinin sağlamaktadır. Yarı entansif yetiştiricilikte de Bronz veya siyah hindi ırklarıyla küçük-orta sürüler halinde yetiştiricilik yapılmaya devam etmektedir (Arslan ve Çetin 2022).

Ekstansif ve yarı entansif yetiştiricilikte 4-5 haftalık yaşta merada otlatılmaya başlayan hindi palazlarının yetiştirme maliyetinde en az %20 düzeyinde tasarruf edilmektedir. Bu iki yetiştiricilik sisteminde kesim yaşı, palazların temin edilme mevsimi veya civcivlerin kuluçkadan çıkış zamanı dikkate alınarak belirlenmektedir. Yarı entansif koşullarda yetiştirilen hindilerin kesimi 5-6 aylık yaşta, ekstansif koşullarda ise 35 haftalık (8-9 ay) yaşa kadar uzayabilmektedir (Şengül ve Ekinci 2017, İnci ve ark. 2018). Günümüzde ticari olarak daha çok entansif koşullarda ticari hibritlerin yetiştiriciliği yapılmaktadır. Entegre yetiştiriciliğin yaygınlaşması ve kurulan modern işletme sayısının artış göstermesi sonucu hindi yetiştiriciliği Türkiye'de endüstrileşmiş ve hindi besiciliği gelişme göstermiştir (Eleroğlu ve ark. 2012). Entegre yetiştiricilikte ise hindilerin kesim yaşı canlı ağırlığına bağlı olarak 16 ve 24 haftalık bir zaman periyodunu oluşturmaktadır (Majumdar ve ark. 2005, Özer ve Özbey 2013, Makarynska ve Vorona 2019). Türkiye 2022 yılında 3.670.000 baş hindi varlığı ile dünya

genelinde 12. sırada yer almaktadır (FAO 2022). 2023 yılı verilerine göre ise Türkiye'de hindi varlığı azalarak 3.378.790 baş düzeyindedir (TÜİK 2023). İller düzeyinde 936.117 baş hindi varlığı ile Bolu birinci sırada yer alırken sıralamayı, 933.811 baş ile Manisa, 210.972 baş ile İzmir, 174.184 baş ile Sakarya ve 87.658 baş ile Diyarbakır illeri takip etmektedir (TÜİK 2023). Bu iller Türkiye'de tavuk varlığı ile de öne çıkmakta ve beyaz et üretiminde öne çıkmış firmalar ile çalışmaktadır. Türkiye'de modern işletmelerin kurulması hindi varlığında artışa neden olmuş ve birçok ilimiz hindi varlığı ile öne çıkmıştır. Bu illerimiz dışında Türkiye genelinde uzun yıllardır tanınmış olan Kandıra ve Eflani hindileri oldukça popülerdir. Özellikle Kandıra hindileri ülke çapında adeta kendiliğinden marka haline gelmiş ve Kandıra hindi etine fazlaca talep bulunmaktadır. Kocaeli'nin bir ilçesi olan Kandıra'da yaklaşık 155 yıldır ekstansif koşullarda hindi yetiştiriciliği yapılmaktadır. Türkiye'de ilk kez 1980 yılında dönemin Tarım ve Köy İşleri Bakanlığına bağlı olarak Hindi Üretim Çiftliği Kandıra'da kurulmuştur. Böylece 'Kandıra Hindisi' olarak bilinen siyah hindi yetiştiriciliğine ilgi giderek artış göstermiştir (Anonim 2024a, Anonim 2024b). Geleneksel yöntemlerle ağırlıklı olarak merada otlatılarak yetiştirilen Kandıra hindilerinin etlerine ülke genelinde gösterilen talep fazlalığının yanı sıra dış ülkelerden de talep fazla olmaktadır. Birleşik Arap Emirlikleri başta olmak üzere Azerbaycan ve Rusya gibi ülkelere ihracat gerçekleştirilmektedir. Ayrıca hindi eti tüketiminin sadece yılbaşlarıyla sınırlı olmadığı, yıl içerisinde de tüketiminin arttığı bildirilmektedir (Anonim 2024c). Kandıra'da 11-12 kg canlı ağırlığındaki hindi fiyatları 2023 yılı Aralık ayında 1.500 ila 2.500 TL arasında, etinin kg fiyatının ise 300-350 TL/kg düzeyinde olmuştur (Anonim 2024c, Anonim 2024e). Kandıra hindisi ile meşhur olan Kocaeli 35.019 baş hindi varlığı ile 13. sırada yer almaktadır. İlin ilçeler düzeyinde hindi varlığında Kandıra ilçesi 22.070 baş ve %63 üretim düzeyi ile birinci sıradadır. İlçeler düzeyinde ikinci sırada 10.550 (%30) baş hindi varlığı ile İzmit yer almaktadır (TÜİK 2023). Ancak Kocaeli ilinin 2021 ve 2022 yılları hindi varlığı sırasıyla 112.131 baş ve 132.043 baş düzeyindedir (TÜİK 2024). Ülkemizde hindisi ile meşhur olan bir diğer yerleşim yeri ise Karabük'ün Eflani ilçesidir. Eflani hindilerine de talep fazla olmaktadır. İlçede hindiler önemli bir kümes hayvanı olup ilçe merkezinde heykeli bulunmaktadır. Ekstansif koşullarda hindi yetiştiriciliği yapılan ilçede, canlı ağırlığı 5 ila 8 kg arasında değişen hindiler 2023 yılı Aralık ayında 1600 TL'den başlayan fiyatlarla satışa sunulmuştur. İlçede hindi etinin kg fiyatı ise 300-350 TL/kg'dır (Anonim, 2024c, Anonim 2024d). Ayrıca ilçede sevilerek tüketilen 'Eflani Hindi Bandırması' isimli yöresel bir yemekte 12.09.2017 yılında tescillenmiş ve coğrafi işaret almıştır (Anonim 2024f). Karabük ili hindi varlığı ile ülke genelinde 53. sırada yer almaktadır. İlin ilçeler düzeyindeki hindi varlığında öne çıkan ilçesi 2.750 baş ile il genelinin %53'üne sahip olan Eflani'dir (TÜİK 2023).

Türkiye'de kümes hayvanlarından kaz ve ördek etinin üretim miktarı ile ilgili herhangi bir istatistik bilgi bulunmadığından hindi eti üretim miktarının toplam kanatlı hayvan eti üretimi içerisindeki genel payı bilinmemekle birlikte, ülke geneli hindi eti üretimi 47.575 ton düzeyindedir (TÜİK 2023). Türkiye hindi etini taze, dondurulmuş, bütün veya parçalar halinde ihraç etmekte ve ihracatta ilk 20 ülke arasına girmektedir. Dünya hindi eti ihraç eden ülkeler arasındaki sıralamada Türkiye 7.446 ton ile 16. sırada yer almaktadır. Türkiye'nin hindi eti ithalatı bulunmamaktadır (FAO 2022). Bu üretim miktarıyla Türkiye'de kişi başı hindi eti tüketimi hindi yetiştiriciliğinde öne çıkmış ülkelere göre oldukça düşük düzeydedir. Hindi yetiştiriciliğinde öne çıkmış ülkelerde kişi başı yıllık hindi eti tüketimi minimum 6 kg düzeyinde iken Türkiye'de bu değer 0,56 kg düzeyindedir (Tarım ve Orman Dergisi 2022).Türkiye'de yapılan hindi yetiştiriciliğinde sözleşmeli yetiştiricilik modeli benimsenmiştir. Yurt dışı entegre firmalar ile anlaşmalar yapılıp kuluçkalık hindi yumurtalarının hepsi ithal edilerek kuluçkalanmaktadır (Tan ve Dellal 2002, Eratalar ve Bulut 2007). Hindi yetiştiriciliğinde en yaygın olarak hepsi içeri-hepsi dışarı sistemi kullanılmaktadır. Bu yetiştiricilik sisteminde kuluçkadan çıkan hindi civcivlerinin kesimine kadar aynı kümeste bakım ve beslemesi yapılmakta ve topluca kesime sevk edilmektedir. Diğer yaygın kullanılan yetiştiricilik sisteminde ise kümeslerin daha kullanışlı olması amaçlanmış ve hindi palazları belirli haftalık yaşa kadar aynı kümeste yetiştirilmekte ve daha sonra farklı bir kümese alınıp boşaltılan kümese yeni yaş grubu civcivler yerleştirilmektedir. Böylece işletme içerisinde farklı haftalık yaşta civciv ve hindi palazları bulunabilmektedir (Eratalar ve Bulut 2007). Türkiye'de hindilerin kesim ve karkas özellikleri üzerine yapılmış sınırlı sayıda çalışma bulunmaktadır. Amarikan Bronz x Betina melezi erkek hindilerin 84. gün sonunda kesim ağırlıklarının yaklaşık 8 kg civarında olduğu, karkas ağırlığının yaklaşık 6 kg ve karkas randımanının ise %75 olduğu bildirilmektedir (Değirmencioğlu ve ark. 2003). Entansif ve yarı entansif sistemlerde farklı besi şekillerinde yetiştirilen ve 8-19 hafta sonunda kesimi yapılan Beyaz ırk hindilerde dişi ve erkeklerin entansif şartlarda karkas ağırlığı ve karkas randımanları sırasıyla 5 kg ve %74 ile 6 kg ve %75; yarı entansif şartlarda aynı sıra ile 4 kg ve %76 ile 5 kg ve %76 olduğu bildirilmiştir (Özer ve Özbey 2013).Türkiye'de hindi önemli bir yere sahip kümes hayvanıdır. Karkas randımanın yüksek olması, hazır gıdalarda hammadde olarak kullanımı, yılbaşı gibi özel günlerde sofraların vazgeçilmez lezzeti haline gelmesi, son yıllarda artış gösteren kalp ve damar hastalıkları gibi çeşitli hastalıkların önüne geçebilmek için özel diyet menülerinde yer alması hindi yetiştiriciliğine bir sektör özelliği kazandırmıştır. Ancak ülkemizde hindi eti tüketimi ve ihracatının üretim düzeyine göre henüz yeterli düzeyde olmadığı görülmektedir. Bu durumun

en önemli nedenleri arasında; beslemede kullanılan yem hammaddelerinin büyük bir çoğunluğunun ve kuluçkalık yumurtaların tamamına yakınının ithal edilmesi yetiştiricilik maliyetini oldukça artırmaktadır. Bu iki konu ülkemiz hindi yetiştiriciliğinin önünde biran önce uygun politikalar ile aşılması gereken en önemli sorunların temelini oluşturmaktadır. Ayrıca ülkemizde kişi başı hindi eti tüketimi de gelişmiş ülkelerin oldukça gerisindedir. Hindi etinin tüketimine yönelik özendirici tanıtımların yapılması gerekmektedir (Arslan ve ark. 2020, Sipahi ve Cevger 2021).

SONUÇ

Türkiye'de hindi yetiştiriciliği ve besiciliği hızlı bir gelişme göstererek endüstrileşmiştir. Hindi etinin lezzetli olması, yağ ve kolesterol içeriğinin düşük olması ve çoğu gıda ürünleri ile birlikte işlenebilmesi yetiştiriciliğine ilginin artmasını sağlamaktadır. Türkiye, bugün sahip olduğu modern tesisler ve uluslararası standartlara uygun üretim metotlarıyla hindi eti üretimi yapmaktadır. Ancak yem hammaddelerinde ve diğer girdilerde dışa bağımlılık üretim maliyetlerini artırmakta ve bu durum yetiştiricileri zorlamaktadır. Ülkemizde hindi yetiştiriciliğinin önündeki engellerin biran önce uygun politikalar ile aşılması gerekmektedir. Kuluçkalık yumurtaların dış ülkelerden temin edilmesi yerine hindi yetiştiriciliğinin yoğun yapıldığı bölgelere damızlık işletmelerinin kurulması ticari yetiştiriciliği daha ekonomik hale getirecektir. Türkiye'de hindi yetiştiriciliği ve hindi eti üretiminde küçük aile işletmelerinin önemli bir payı bulunmaktadır. Bu işletmelerin hindi yetiştiriciliği ve hindi eti üretimine teşvik edilmesi ve desteklenmesi kırsal kesimdeki üretimin sürekliliğini sağlamak açısından önemli olacaktır. Türkiye'de hindi eti üretimini arttırmaya yönelik etkili bir politika bulunmamaktadır. Politikalar daha çok tavukçuluk açısından ele alınmakta ve hindi eti ile ilgili yapılan çalışmalar tavukçuluk alanında yapılanlarla göre sınırlı kalmaktadır. Kırmızı et tüketim açığını kapatmak için iyi bir alternatif olan hindi eti üretimine yönelik politikaların oluşturulmasının ülkemiz hindi eti üretimi ve yetiştiriciliği için önemli olacağı değerlendirilmektedir.

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DİJİTAL DÜNYANIN YENİ TÜKETİCİLERİ VE HEDİYELEŞME GELENEĞİNİN DİJİTALLEŞMESİ

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ÖZET
Dijital dönemde mecralar kadar onu kullanan kullanıcıların da önem taşıdığı görülür. Dijital öncesi dönemde reklamveren işletmeden hedef kitleye doğru yönelen tek taraflı iletişim sona ermiş, dijitalleşmeyle daha interaktif, sesi daha çok yükselen, daha üretken, daha net bir kullanıcı yapısı karşımıza çıkmıştır. Günümüzün gelişen dijital ortamı ise, hediye verme ve alma şeklimizi değiştirmiştir. Geleneksel hediye verme uygulamaları, dijital hediye kartlarının yükselişiyle devrimsel bir etki yaratmıştır. Ulusal Perakende Federasyonu (National Retail Federation-NRF)'ndan elde edilen verilere göre son 5 yılda dijital hediye kartı satışlarında yılda ortalama %200 artış yaşanmıştır. Buna göre örneğin sadece 2022 yılında dijital hediye kartı satışlarında 15 milyar dolara ulaşılmıştır (Gu,2023).Dijital hediye vermenin sunduğu kolaylık, kişiselleştirme ve esneklik sunma özellikleri ve sosyal media alanındaki gelişmeler ise hediye alışverişi yapma şeklimizi ve hediyenin anlamını değiştirmiştir. Özellikle sosyal medyada ünlü fenomenlerin, video akımcıları ve influencerların yeni dijital hediyeleşme geleneğinin devamlılığında önemli bir yere sahip olduğu gözlenmiştir. Bu gelişmeler ışığında çalışmada betimsel bir yaklaşımla örnek çalışmalara dayanarak, dünyada hediyeleşme geleneğini dijitalleşmenin nasıl etkilediği ve pazarlama iletişimi çalışmalarının burada nasıl bir öneme sahip olduğu ortaya konmaya çalışılmış; gelecekte dijital mecralardaki gelişmelerden ve yeni neslin hediyeleşme geleneğine yükleyeceği anlamdan hediye kültürünün birebir etkileneceği ve sektör taraflarının buna şimdiden hazırlıklı olması gerekliliği bulgusu ortaya çıkmıştır.
Anahtar Kelimeler: Dijitalleşme, Yeni Tüketici, Hediye, Dijital Hediyeleşme, Pazarlama İletişimi

NEW CONSUMERS OF THE DIGITAL WORLD AND THE DIGITALIZATION OF THE GIFTING TRADITION

ABSTRACT
In the digital era, it is seen that the users who use it are as important as the media. In the pre-digital era, one-sided communication from the advertiser business to the target audience has come to an end, and with digitalization, we have come across a more interactive, more vocal, more productive and clearer user structure. Today's evolving digital environment has changed the way we give and receive gifts. Traditional gift-giving practices have had a revolutionary impact with the rise of digital gift cards. According to data from the National Retail Federation (NRF), there has been an average annual increase of 200% in digital gift card sales in the last 5 years. Accordingly, for example, in 2022 alone, digital gift card sales reached $15 billion (Gu, 2023).The convenience, personalization and flexibility offered by digital gifting, and the developments in social media have changed the way we exchange gifts and the meaning of gifts. Especially in social media, it has been observed that famous phenomena, video streamers and influencers have an important place in the continuity of the new digital gifting tradition. In the light of these developments, in the study, based on case studies with a descriptive approach, it was tried to reveal how digitalization affects the tradition of gifting in the world and what importance marketing communication studies have here. It has been found that the gift culture will be directly affected by the developments in digital media in the future and the meaning that the new generation will attribute to the gifting tradition, and that the sector parties should be prepared for this in advance.
Keywords: Digitalization, New Consumer, Gift, Digital Gifting, Marketing Communication.

GİRİŞ

Günümüzde harcama, var olan yapıya karşı çıkma ve kendi zenginliğini karşıdakine anlatmada kullanılan önemli bir eylemdir. Çünkü birey her şeyin yeniden üretildiği ve çabucak tüketildiği bir dünyada kendini ancak yaptığı tüketim eylemiyle ifade etmekte ve tanımlamakta; güç ya da iktidara ancak harcama yapılarak erişilmektedir. Dolayısıyla modern anlayışa göre "sahip olmak" bireyi özgürleştirmektedir. Ancak her şeye ya da en iyisine sürekli sahip olma ihtiyacı bireyi metalar dünyasına hapsetmekte ve onu kölesi haline getirmektedir. Hyde'nin de dediği gibi bugünün dünyasında hediyenin doğal yapısında olan "kendiliğindenlik" kuralının "zorunluluk" haline dönüşmesi, farklı bir hediye anlayışının ortaya çıkmasında bunun etkisi göstermektedir. Dolayısıyla almak, vermek ve tekrardan vermek toplumsal ve ekonomik yaşamın devamlılığında önemli bir role sahip olmuştur.Bununla birlikte arkaik toplumlardan modern toplumlara kadar geçen süre içerisinde hediye kavramının içeriksel açıdan değişime uğradığı dikkat çekmektedir. Öyle ki hediye ilişkilerinde ideal olan verilen armağan karşılığında bir şey verme zorunluluğunun olmamasına karşın, özellikle küreselleşmeyle ve dijitalleşmeyle birlikte hızla yayılan Anneler Günü, Babalar Günü, Sevgililer Günü ve Yılbaşı gibi Batı'ya özgü modern hediye geleneklerinin ve dijitalleşmenin "hediye" anlayışını önemli ölçüde etkilediği ve değiştirdiği gözlenmiştir. Bu açıdan çalışmanın amacı, öncelikle dijitalleşen dünyanın yeni tüketicilerini açıklamak ve ardından dijitalleşmenin hediyeleşme geleneğini nasıl etkilediği ve pazarlama iletişimi çalışmalarının bu alandaki rolü hakkında örnekler üzerinden değerlendirme yapmaktır.

DİJİTAL DÜNYANIN YENİ TÜKETİCİLERİ

Tarihsel süreçte meydana gelen ekonomik, teknolojik ve sosyo-kültürel gelişmeler tüketici yapısında bir değişim yaşanmasına neden olmuştur. Markalar arasındaki rekabetin bugünkü kadar hissedilmediği dönemlerde "ne üretirsen satılır" anlayışı hakimdir ve satın alım kararlarında fizyolojik istekler ve gereksinimler temeldir. Burada tüketici ürünün fonksiyonel vaatlerine daha çok odaklanılmaktadır. Rekabetin yoğunlaşmaya başladığı Sanayi Devrimi ile ürünlerin fonksiyonel özelliklerinin hem rekabet söylemlerinde hem de tüketici nezdinde fark yaratmak için çok yeterli kalmadığı görülmüştür. Bu durum da, markaların tüketicileri ile psikolojik bağ kurmasına imkan verecek imaj, statü, kimlik gibi öğelerin iletişim çalışmalarında devreye girmesine yol açmıştır. Özellikle postmodern dönemde popüler kültür, gösterge ve hazcı tüketimin öne çıktığı görülmüştür. Öyle ki bu dönemde ürünlerin tüketimi yerini statü göstergelerinin tüketimine bırakmıştır. 2020 yılında başlayan Covid 19 süreci de küresel ölçekte çevrimiçi satın alma davranışlarını, ürünlerde sağlık ve hayatta kalma amaçlı ürünlere

yönelimi artırmıştır. Bununla birlikte işyerinin eve taşınması ile Zoom, Teams gibi online uygulamalar üzerinden dersler ve toplantıların yapıldığı görülmüştür. Bunun yanı sıra insanlarda sosyal medya, e-ticaret platformlarına ve çevrimiçi oyunlara yönelim ve abonelik esasına dayanan TV yayınlarına yönelim (Netflix gibi) artmıştır (Gedik ve Pirol, 2022:147-149).2021 yılında Deloitte tarafından 14 ülkeyi kapsayan dijital tüketici trendleri araştırmasında yeni tüketicilerin hayatla bağını elektronik cihazlar üzerinden kurduğu, akıllı saat ve fitness bilekliklerine rağbet ettikleri, hızlı internet ve 5G'yi talep ettikleri belirtilmiştir. Türk tüketicilerin ise akıllı TV, robot süpürge ve akıllı ev aletlerine yönelik taleplerinin global ortalamanın üstünde olduğu kaydedilmiştir. Globalde en çok sahip olunan elektronik cihazlar ise sırayla akıllı telefon, diz üstü bilgisayar ve kablosuz kulaklıklar olarak sıralanmaktadır. Tüm akıllı nesne kategorisinde 25-34 yaş grubu katılımcıların en yüksek sahiplik ve erişim oranına sahip olduğu gözlemlenmektedir. Bununla birlikte pandemi öncesi ile global ölçekte karşılaştırıldığında Türk tüketicisinin daha çok TV izlediği ve sosyal medya kullanmaya başladığı, çevrimiçi bankacılık işlemlerinin pandemi sonrası arttığı, dolayısıyla bu evreden itibaren Türkiye'de tüketicilerin dijital alışkanlıklarının değiştiği belirtilmiştir. Katılımcıların ödeme yaptıkları hizmetler ve abonelikler değerlendirildiğinde ise ilk sırayı müzik yayın hizmetleri alırken, onu bulut tabanlı depolama araçları ve oyun hizmetlerinin aldığı gözlemlenmiştir (Önder, 2022).Son dönemlerde ise görsel odaklı kültürün popülerlik kazanmasıyla çevrimiçi sohbetlerde milenyum tüketiciler için görselliğin kayda değer bir yere sahip olduğu vurgulanmıştır. Lee bu durumu bugün "Görseller sözcüklerden daha yüksek sesle bağırmaktadır." Şeklinde ifade etmiştir (Lee vd.2015:552). Pek çok uygulamacı ve akademisyenin ise marka iletişiminde görsel paylaşımların değerini ve müşteri katılımı üzerindeki pozitif etkisini vurguladığı ileri sürülmüştür (Kim vd., 2022:2371).

HEDİYE EKONOMİSİ

Hediye alıp verme geleneğinde tüketiciler, kendileri için özenle seçilmiş ve dikkatlice paketlenmiş eşsiz bir hediyeye sahip olurlar. Bu hediyeler mağazalarda satılan ürünler olabileceği gibi, ev yapımı mallar ve hizmetler de olabilir (Solomon, 2006:552-553).Hediye alıp vermeye ekonomik bir değişim biçimi olarak bakan araştırmacılar, vericinin bu hediyeye artı bir değer kattığını ve alıcının da bu değerden etkilendiğini ortaya koymaktadırlar. Bununla birlikte hediye alıp verme, sembolik bir değişimi de içine almaktadır. Bu doğrultuda hediyeyi veren kişi, hediyeyi verdiği kişiye aslında elle tutulamayan bir anlam sunmaktadır. Bazı araştırmalarda ise hediye alıp verme, sosyal bir anlatım biçimi olarak ifade edilir. Buna göre, bir ilişkinin ilk evresinde hediye daha çok araçsal bir özellik taşımaktadır. İlişkinin gelişme

evresinde ise, hediye fedakârlık anlamına gelebilmektedir. Bugünün dünyasında ise hediye alıp vermede bir bireyin diğer bireyler üzerinde hediyenin karşılığını verme konusunda baskı yarattığı gözlenmiştir. Buna göre hediye, bireylerarası ilişkileri etkileyebilme gücüne sahiptir (Solomon, 2006:552-553).Diğer taraftan hediye seremonilerine geleneksel topluluklardan itibaren bütün insan ilişkilerinde rastlanılmaktadır. Hediye seremonileri sembolik toplumsal ilişkilerin belki de en açık biçimde gözlemlendiği alışverişlere konu olması nedeniyle başka bir önem kazanmaktadır. Hediye kavramı, sosyal, ekonomik, politik, dini tapınmalar gereği vb. işlevleri olan, oldukça karmaşık bir yapıya sahiptir (Kar, 2005:63).Hediye değişimi ile ilgili aslında farklı yaklaşımlar bulunmaktadır. Klasik antropoloji yazarları hediye değişiminde toplumun, kültürün devamlılığı ve varoluşunda hediye alıp vermenin önemli bir işlevi yerine getirmiş olduğunu vurgulamaktadırlar (Komter, 1996:8).Bu yazarlar, hediye alışverişinde insanların karşılıklı hislerinin nasıl olduğu konusunda bazı örnekler vermişlerdir. Sosyologlar, hediye vermenin toplumsal fonksiyonlarını anlamada önemli kuramsal önerilerde bulunmuşlar ve konuyu "bağlılık", "minnettarlık" ve "karşılıklılık" gibi kavramlarla açıklamaya çalışmışlardır (Komter, 1996:8).Yine antropolog ve sosyologlar verilen hediyeye karşılık vermenin bir zorunluluk olması konusuyla ilgilenmişlerdir. Buna göre, bireyler toplumda varlığını sürdürebilmek veya topluma uyum gösterebilmek için verilen hediyeye bir karşılık vermeye kendilerini zorunlu hissetmektedirler (Komter, 1996:8).Hediye aynı zamanda güç gibi sembolik anlamlarla örtüşen boyutlara sahiptir. Bu noktada ise hediye, söz konusu temel duyguların ifade edilme aracıdır. Onların hediyeye yükledikleri bu anlam, düzenli bir toplum içinde onlara öngörülen rolleri hakkında bilgi vermektedir. Hediye verme, kültürlerde yaygın bir fonksiyon olarak görülür. Diğer yandan ise hediye verme diğer insanlarla etkileşim kurmayı sağlayan sembolik bir etkileşim aracıdır. Burada hediye vermenin sembolik yaklaşımları üzerinde durulmakta ve yaratılmış bir aktivite olarak hediyeleşme bireyler arasındaki bağları pekiştiren bir niteliğe bürünmektedir (Komter, 1996:10).Hediye, en klasik anlamıyla gönüllü olarak bir kişiden ya da bir gruptan bir başkasına verilen mal ya da hizmettir. Bu yönüyle hediye, bir alan ve bir verenden olmak üzere iki taraf arasında gerçekleşen bir ilişkidir. Hediyenin anlamı, onun fiziksel özelliklerinde değil, veren ile alan arasındaki ilişkilerde ve sunuluş biçimlerinde yatmaktadır (Kar, 2005:63)Dolayısıyla hediyenin tanımı ve işlevleri dikkate alındığında, toplumsal ilişkilerin doğasından gelen bir takım karşıtlıkları içerdiği ortaya çıkmaktadır (Kar, 2005:64);

- **Kendiliğindenlik- Zorunluluk**: Hediye ister geleneklere uygun davranmak ya da dini inançlar gereği, isterse de sosyal ilişkiler geliştirmek veya rasyonel hesaplar adına

verilsin, veren kişinin gönüllülüğünü gerektirmektedir. Bu açıdan her armağanın kendisini kurallardan bağımsız kılan ve sadece iradi bir olgu olarak yaşanmasını sağlayacak kendiliğindenlik öğesini içermesi şarttır (Godbourt,148). Buna karşın, armağanın verilme amacına bağlı olarak bir beklentiye eşlik ettiği alan ve veren kişilerin açıklayamadığı ya da açıklamak istemediği bir tür zorunluluk duygusu yarattığı da bir gerçektir. Modern armağan ilişkilerinde kısmen kendiliğindenlik olgusunun ağır bastığı söylenebilir (Kar, 2005:64).

- **Çıkar Gözetmezlik –Karşılık Bekleme**: Karşılıksız hediye yoksa da, hediye hesap yapılmadan verilmesi kabul gören bir davranıştır. Bu koşula rağmen, hediye verenin dile getirmediği ancak, öyle ya da böyle karşılığında bir beklentisinin de olduğu yadsınamaz.

Marcel Mauss, döneminin tabiriyle ilkel toplumlarda, yani pazar ekonomisi ilişkisinin ve meta düzeninin izinin rastlanmadığı toplumlarda, toplumsal ilişkinin temelinde hediye ilişkisinin yattığını belirtmektedir. Marx'ın "nakit para ile ödeme sistemi olarak tanımladığı" meta düzeninde, toplumsal ilişkinin temel aracı paradır. Metanın fiyatı vardır. Değişim bu fiyata göre yapılır. Mal ve hizmet satın alındığında, karşılığında fiyatı neyse ödenir ve ilişki biter. Kapitalizm düzeninde, sermaye birikimi ve meta ilişkisi, toplumsal düzenin sinir sistemini oluşturmaktadır. Bu düzende insanlar arası ilişki, mal ve hizmet değişimin aracıdır. İnsanın meta değişiminin aracı olma konumu, gerçekte hiçbir zaman tam olarak gerçekleşmese de, modern toplum varoluşunu bu şekilde tasarlamaktadır (Godbourt, 2003:10).Bununla birlikte meta toplumunun başlıca simgesi "meta"dır. Bu çerçevede insanlar da metalaşmaktadır. Varoluş anlamlarını, diğerleriyle ilişkilerini sermaye ve metanın dilinden ifade etmektedirler. Hediye ekonomisi dolayısıyla alınan ve verilenin, karşılıklı bir eşitlik içinde düşünülmediği, katı kuralları olan ancak ucu açık bir ilişki düzenidir. Verilenin karşılığı alındığında onu alanın yeniden aynı kişiyle ya da başka bir kişiyle maddi ya da simgesel bir değişim ilişkisi içinde bulunacağını taraflar bilmektedir. Almak, geri vermek ve tekrardan vermek zorunluluğu, aslında toplumsal ilişki için gerekli görülmektedir. Bu sadece cömertlik değil, aynı zamanda güç, yarışma, diğerine üstün çıkma amaçları da taşıyan, onur ve saygınlık arayışının can verdiği çatışma ve uzlaşmayı, gönüllülük ve zorunluluğu, toplumsal beraberliği ve kişisel stratejiyi birlikte var etmektedir (Godbourt, 2003:11).Hediye verme davranışı ile ilgili modellere bakıldığında karar süreci açısından en kapsamlı modelin Bank (1979) ve Sherry (1983) tarafından geliştirilen tüketim ve tüketim sonrası satın alma davranışını içeren; satın alma, etkileşim (ya da değişim), tüketim ve iletişimden oluşan dört aşamalı model olduğu ileri

sürülür. Bu, tüketici davranışı modellerine çok benzeyen bir model olarak dikkat çekmektedir (Clarke, 2008:531-532).

Hediyeleşme, Hollenbeck vd'ne göre (2006:573) onaylanmış sosyal bir eylem ve sosyal etkileşim yaratan, markalar açısından tüketicilerin önemli olduğunu göstermenin bir yoludur ve daha güçlü bir marka-müşteri ilişkisi oluşturulmasına yardımcı olmaktadır. İşletmeler tarafından tüketicilerine sunulan hediyeler özellikle dijital mecralar aracılığı ile daha kolay ve etkili şekilde aktarılabilmektedir. Bu bağlamda B2C hediyeleşmenin son zamanlarda kritik bir pazarlama stratejisi olduğu belirtilmektedir. İşletme perspektifinden markaların hediye vermesi karşılıklılık teorisine dayanmaktadır. Hediye vermek, alıcıları iyiliğe karşılık vermeye motive etmektedir. Bu süreçte sosyal medya uygun bir iletişim aracıdır. Diğer bir deyişle, marka ve işletmelerle tüketicileri arasında sosyal bağları ve etkileşimi geliştirmeye yardımcı olmakta; işletmelere karşı daha olumlu bir algı yaratmayı sağlamaktadır (Hollenbeck, 2006:2371).Romele ve Severo 2016 yılında yaptıkları bilimsel bir çalışmada ise, çevrimiçi sosyal medyadaki hediye değişim değerini tartışmışlardır. Buna göre hediyeleşme klasik Pazar ekonomisine alternatif bir alan olarak değerlendirilmiştir. Bugün artık hediyeleşme artık sadece somut ürün değişimi ve karşılıklılık ile ilgili bir şey demek değildir, Dijital hediyeleşmede "topluluk" ve "iletişim" kavramları arasında çok güçlü bir bağ vardır. İnternet ise iletişim ve topluluğun bir araya gelmesini sağlayan en açık kanıttır. İnternetteki topluluklar internet temelli bir iletişim yapısında yorumlar, etiketlemeler, beğenmeler vb. ile sembolik bir değişim sağlamaktadır ve bu iletişim topluluk odaklıdır. Buna göre internet üzerindeki hediyeleşme aslında anti-ekonomik bir eylemdir. Sosyal medya platformlarında hediyeleşme ise örneğin Facebook'ta "Beğenme", Twitter'da ise "Söz Etme" butonu ile sağlanabilmektedir. O nedenle burada "Beğenme Ekonomisi (Like Economy)" diye yeni bir terimin de karşımıza çıktığı vurgulanmaktadır (Romele, ve Severo, 2016: 43-44).Dijital hediyeleşmenin ise literatürde tarihsel olarak 1990 ve 2000'ler arasında büyüdüğü ve kapitalist ekonomi hegemonyasının sonunu getirdiği ileri sürülmüştür (Romele ve Severo, 2016:46).Yine burada çevrimiçi hediyeleşmede hediyenin ritüel sunumu zayıftır ve hediyeyi veren ya da bağışçıların veya alıcıların isimleri anonim olabilmektedir. Yine sosyal medya ortamındaki hediyeleşmenin sosyal bağların korunmasına, sanal kimliklerin oluşmasına ve katılımcıların sürekli varlığını sağlamaya hizmet etmektedirler. Yine dijital hediyeleşmenin emtia formunun içine dahil edildiği ve doğrudan kar elde etmek amacıyla kullanıldığı; bu bağlamda da dijital hediyenin ideolojiyi meşrulaştırma işlevi gördüğü ifade edilmektedir. Özetle dijital hediyeleşme sosyal

bağ yaratma ve inşa etmek amaçlı yazılı ve sembolik etkileşimdir (Romele, ve Severo, 2016: 47-52).

Aynı şekilde tek Tanrılı dinlerde de hediye ekonomisi; bağışta bulunmak, zekat vermek gibi uygulamalarla sürdürülmektedir. Bununla birlikte kapitalizmin gelişmesi ile zengin burjuva sınıfı zenginliklerini bankalarda saklar hale gelmiştir (Akay, 1999:14). Küçük burjuvalar ve orta sınıf, bu tip harcama biçimlerini yok eden bir tavra bürünmüştür. Çünkü kapitalist zihniyet içinde buna imkan verilmemektedir. Burada zenginlerin harcamaları "harcama ekonomisinin" oluşmasında etkili olmuştur (Akay 1999:14).18.yy'ın kapitalist ekonomisinde ise Werner Sombart'a göre, 18. yy sonunda artık Batı toplumlarında devasa boyutlara ulaşmış bir lüks tüketimden bahsetmek mümkündür. Lüks çılgınlık ve aşırılıkla ilişkilendirilmekte; harcamayı yapanı tüketmeye doğru sürüklenmektedir (Akay, 1999:15).Ekonominin temeli bu harcama ile gelişmekte ve bu şekilde de harcama eylemi, harcayanı rahat bırakan ruhları memnun etmekte, lanetlemeyi engellemektedir. Bu açıdan bakıldığında, harcama yapmak için üretilmekte ve ürün elde edilmektedir (Akay, 1999:10). Aslında hediyeleşme geleneği, toplumsal duyguları birleştirerek güçlendirebilmektedir. Ancak yine de göreli bir konu olsa da hediyeleşmenin altında metaryalist anlamın, sembolik anlamdan daha önemli olduğu dile getirilmektedir (Takayama, 2001:138). Bu noktada hediyenin işlevleri ve modern hediyelerden söz etmek önemlidir.

Hediyenin İşlevleri ve Modern Hediyeler

Hediye vermenin sosyal, ekonomik ve tarafları yansıtmak gibi bazı işlevleri olduğu gözlenmektedir. Bunları şu şekilde detaylandırmak mümkündür:

•**Sosyal İşlevi:** Hediyenin sosyal işlevleri üzerinde çalışanlar, onun toplumsal ağların kurulmasını sağlayan yollardan biri olduğunu belirtmektedirler. Bu açıdan hediye, yeni ilişkilerin kurulmasına, var olan ilişkilerin sürdürülmesine, dönüştürülmesine ya da kesilmesine aracılık etmektedir (Larsen ve Watson, 2001: 889-906). Hediyenin sosyal sınırları birleştirmek, yeni bir gruba entegrasyon, sosyal farklılığı biçimlendirmek ve yansıtmak için de kullanıldığı gözlenir (Kar, 2005:65). Bir hediyenin değeri kısmen ilişkinin ağırlığını yansıtırken, ilişkinin değişken doğası da hediyenin değerinde yansıtılmaktadır. Yine hediyenin çok fazla büyük veya tersine küçük olması ya da zamanından geç verilmesinin de ilişkilerin zedelenmesine yola açabileceği kaydedilmiştir. Hediyenin ayrıca insanlar arasında hissedilmeden iyi niyet bağları ve sosyal ilişkileri kurma gibi sosyal rolleri mevcuttur (Kar, 2005:65).

•**Ekonomik İşlevi:** Hediye verilen kişi maddi olarak kazançlı bir duruma gelmiş gibi görülmektedir. Hediye ilişkilerinde ideal olan, verilen hediyenin karşılığında bir şey verme zorunluluğu yaratmamasıdır. Ancak uygulamada verilen hediyeye karşılık almak baskısı, karşılıklı alışverişin diğer biçimlerinden daha fazla hissedilmektedir. Hediyeyi alan kişi, karşı tarafa karşı mahçubiyet yaşamamak için aldığı hediyeye karşılık vermektedir. Alınan hediyeye uygun bir karşılık verilmezse asimetrik ilişkiler doğabilmektedir (Kar, 2005:65).Ayrıca hediyenin maliyet hesabı ancak, ona harcanan zaman ve para açısından ölçülürse taraflar arasında anlamlı hale gelmektedir. Çünkü, hediye değişimi yapan taraflar ilişkilerini arzu ettikleri mesafede tutabilmek için hediyeleri kullanabilmektedir (Kar, 2005: 66).

•**Armağan Veren ve Alan Tarafları Yansıtma İşlevi:** Hediye, alan ve veren kişilerin birbirlerinin kimliklerini nasıl algıladıklarını da yansıtmaktadır. Kişinin kendi kimliği, başkalarına aldığı armağanların formunda nesnelleşir ya da armağanın gösterişçi sunuluş şekli, veren kişinin kimliğinin karşı tarafça onaylanmasını sağlayabilmektedir. Buna göre hediye hem alan hem de onu veren kişinin kimliğini yansıtan semboller taşımaktadır (Kar, 2005: 66-67).
Arkaik hediye, gruplar arasında elden ele dolaşmaktadır. Modern hediyenin ise doğal alanı mahremdir ve çoğu zaman bireyler arasındadır. Modern hediye her bireye, çalıştığı yerdekinin ya da sıklıkla yerine başkasının geçebileceği bir rolü yerine getirdiği ticaret ilişkilerinde olanın aksine kendisinin bu kişisel ağda özel olduğunu, kendisinin özel varlıklardan oluşan bir ağda var olduğunu hatırlatmalıdır. Dolayısıyla hediyenin ilkesi, önceden düşünülmemiş olanı, ele avuca sığmayan, kim bilir nerden gelen, özdeş yeniden üretim zincirini kıran, simgesi montaj bandı değil, doğum olan fazladan bir şeyi cisimleştirmektir (Godbourt, 2003:214-215). Bununla birlikte hediye ile başka bir şeyin daha açığa çıktığı gözlenir: Çok büyük ihtiyaç duyduğumuz bir iyilik. Bir alıcıya sunulan her modern hediye, bu kişiyi toplumdan bireyselleştirmeye hizmet eder ve yoksa arkaik hediye gibi, kişinin toplum içindeki bireyselleşmesini pekiştirmez. Bu noktada toplumsal ağ, özel bireyleri bir araya getirmekte ve hediye bu özel bireyleri birbirine bağlayan yörüngeleri, yolları çizmekte ve sürdürmektedir (Godbourt, 2003:215). Diğer taraftan " Hediye vermenin zamanı yoktur, her an hediye verebilirsiniz, yeter ki yaratıcı olun" sloganı, hediyelik eşya sektörünü, dünyanın en gelir getiren iktisadi alanlarından biri haline getirmiştir. Bu sektörde çalışanlar, "kimin, ne zaman, hangi hediyeyi, hangi anlamlarla / hatta hangi sözlerle" verileceğini belirler hale gelmişlerdir. Bu kapsamda hediye profesyonelleri, önce "anlamı", daha sonra da bu anlamın sembolü olan ürünü yaratarak ve pazarlayarak / tükettirerek verimliliği ve karlılığı yüksek sektörlerini yaratmışlardır."(Sakarya, 2006:131). Dolayısıyla hediyenin sahip olduğu bu anlamsal değer ve bu değerinin aktarımının hediye

sektörünün gelişiminde kayda değer bir yere sahip olduğu söylenebilir.Kültürel hayatımıza küreselleşmeyle beraber giren gelenek dışı özel günler ise son derece fazladır. Ancak halk arasında kabul görenlerin ve kutlanan günlerin sayısı ise oldukça azdır. Buna göre kültürel bakımdan tek türleşmeden bahsetmek mümkündür. "Bizde olanı dünyaya vermek, başkasında olanı almak" olarak basit bir şekilde tanımlanan küreselleşmeye, özel günler bakımından baktığımızda sadece başkasında olanı alma konusu ile sınırlı kaldığımız (23 Nisan Çocuk Bayramı dışında) kaçınılmaz bir gerçektir. Burada önemli olan, gelenek dışından kendi kültürümüze giren bu günlerin kendi geleneklerimize göre kutlanabilirlik ölçütüdür. Eğer bu günler diğer kültürlerde kutlandığı şekilde kutlanıyor ve kendi kültürümüzden hiçbir şey katmıyor olsaydık bu özel günlerin bu kadar süre kutlanıyor olması mümkün olmazdı (Sakarya, 2006:132). Bu noktada ise ilgili sektörün dünya genelinde devamlılığını sağlamada küreselleşmenin getirdiği yeni özel günlerin de önemli bir gücü olduğu söylenebilir. Zira özellikle bugünün dijital kanalları, sosyal medya hesapları ve influencerların yönlendirme gücü ile Türkiye özelinde "Bekarlığa Veda", "Baby Shower", "Bebeğin Cinsiyetini Duyurma" gibi popüler etkinliklerin de hediye ekonomisi açısından önemli bir güce sahip olduğu belirtilebilir. Modern hediyeleşme geleneğinin geleneksel hediyeleşme geleneklerinden daha yaygın olarak kutlanmasının en önemli nedeni de kent kökenli hediyeleşme geleneğinin "duygusal ve zihinsel alt yapısının" kitle iletişim araçları ve pazarlama iletişimi çalışmaları ile hazırlanıyor oluşudur. Bu bağlamda kitle iletişim araçlarındaki yayınlarda kent yaşamı kökenli özel günlerde hangi hediyelerin, kime ne zaman alınması gerektiği ve ne şekilde sunulması gerektiği ayrıntılarıyla benimsetilmeye çalışılmaktadır. Günümüz köylerinde yaşayan kişilerin sevgililer gününü kutlama gereği duymalarının nedeni de, yine kitle iletişim araçlarının etkisiyle oluşmaktadır (Sakarya, 2006: 132).

Dijitalleşen Hediye Kültürü ve Pazarlama İletişimi Çalışmalarının Önemi

İletişim ve pazarlama literatüründe hediyeleşmenin evriminde üç paradigmaya odaklanan holistik bir perspektif vardır. Bunlardan ilki, fiziki ürünlerin değişiminde yer alan ekonomik değişim modelidir. Burada satın alma kararı ve değişimde geleneksel yüz yüze iletişim mekanizması vardır ve hediyeleşmede sosyal ilişkilerde "karşılıklılık" prensibi vurgulanmaktadır. İkinci paradigma, ilişkileri yeniden düzenlemek için bir araç olarak hediye vermenin ilişkisel modeline dayanmaktadır. Sherry tarafından 1983 yılında ortaya konan bu paradigmada, ekonomik ve sosyal alışverişin önemsizleştirildiği belirtilir. Burada hediyeyi veren, bağışçı ve diğerlerini içeren belirli ilişkisel etkileşimler önemlidir. Üçüncü paradigma ise dijital hediye ağlarına ve canlı yayın mekanizmaları ile süreci kolaylaştıran topluluk odaklı

hediyeleşme modeline dayanmaktadır. Bu paradigmada hediye verenler ve bağışçılar sosyal ağlardaki hediyeleşme topluluklarına katılırlar. Bu topluluklar içinde hediyelerin değiş-tokuş edilme sirkülasyonu vardır. Özetle buradaki hediyeleşme sadece hediyeyi alan ve veren arasında kalmaz, topluluk üyeleri arasında da paylaşılır. Bu sosyal ağlar topluluğun değer ve normlarını yansıttığı için hediye verenin davranışlarında önemli bir role sahiptir (Chen, 2021:867).

Hediyeleşmek teknolojinin etkilediği insan ilişkilerinin temel bir parçasıdır. İnternet teknolojisi uzak mesafelerde olan insanların son dakikada birbirlerine hediye alıp vermesini sağlamıştır. Sosyal medya ortamında çevrimiçi hediye vermenin nasıl hızla yaygınlaştığını anlamak bu anlamda önemlidir Bununla birlikte internet hediyeleşmedeki sosyal normları değiştirmiş, hediye kartlarına eğilimi artırmıştır. Bu noktada çevrimiçi ortamda hediye almak ve paylaşmak uygulamada yaygınlaşmıştır. Örneğin arkadaşların doğum günü için Amazon birçok sayıda sosyal özelliği, dilek listelerini hediye kartlarına entegre etmiştir. Yine Apple'ın iTunes mağazası hediye kartı alma ya da hediye özellikli albümler, film ve uygulamalar alma gibi işlemleri mümkün kılmıştır. Starbucks müşterilerine "1 Kahve Tweetleyerek" arkadaşınıza kahve hediye etmenizi sağlarken; popüler mesajlaşma uygulaması Line ve WeChat ise çevrimiçi hediyeleşmeye imkan vermiştir. Bununla birlikte çevrimiçi ortamda iTunes, Starbucks gibi elektronik hediye kartları ve çiçek /çikolata gibi fiziksel hediyelerin internet ortamında alınması gibi durumlar kullanıcıların kredi kartını kullanabilmesi için 18 yaşı ve üzeri olmasını gerekli kılmaktadır. Ayrıca hediye alan için hediyeyi gönderen hediye ile birlikte özel bir mesaj da gönderme şansına sahip olabilmektedir. Hediyeyi alan da sosyal medya üzerinden aldığı hediyeleri (fotoğrafını çekerek ve yorum yaparak) diğer arkadaşları ile paylaşabilmektedir (Kizilcec vd., 2018).Hediyeleşmek katılımı içine alan bir süreçtir ve her yıl yeni trendler ve uygulamalarla karşımıza çıkmaktadır. Dijital hediye pazarı hızla büyürken, bu pazarın 2023 yılına kadar 1.101 milyar dolara ulaşacağı öngörülmüştür. Hediye kartları dijital ortamda (mail aracılığı ile) verilebilirken, aynı zamanda somut bir hediye kartı şeklinde de kişilere verilebilmektedir. İlk olarak dijital kartlar hediye ilişkisinde yeni bir buluştur ve fiziki somut kartların dijital karşılığıdır. Bu kartların kullanım süresi normal hediye kartlarına göre daha uzundur. İkinci olarak dijital hediye kartları fiziksel hediye kartlarından daha az kuralcıdır. Dijital kartların kullanımı için ayrıca daha az zaman ve çaba harcarsınız. Yine fiziksel hediye kartlarını birine hediye almak istediğinizde son dakika alamazsınız. Oysa dijital hediye kartlarını alabilirsiniz. Yine dijital hediye kartları fiziksel hediye kartlarına göre daha yaygın kullanılmaktadır. Fiziki hediye kartlarında sahiplenme duygusu daha yüksek olsa da, dijital

hediye kartlarının kullanımı daha kolay kaybetmesi ise daha zordur (Reshadi, Givi ve Das, 2022:970-972).

Bu bağlamda dijital hediyeleşmenin pazarlama iletişimi çalışmaları açısından faydalarını şu şekilde sıralamak mümkündür (Gu, 2023):

- ***Elde Etme Kolaylığı ve Esneklik***: Dijital hediyeleşme geleneğinin yükselmesindeki öncelikli nedenlerden biri elde etme kolaylığı ve esnekliktir. Dijital hediye kartlarının fiziksel dağıtım ihtiyacını elemine etmiş, tüketicilere hediye alma ve verme konusunda e-posta ya da mobil platformlara yerine bırakmıştır. Ayrıca dijital hediye alışverişinin son dakika alışverişi yapan tüketicileri ve aralarında uzak mesafe olan tüketiciler için de çekici geldiği görülmüştür.
- ***Kişiselleştirme***: Dijital hediye kartları hem alıcıların hem de verici tarafın hediye deneyimlerini kişiselleştirmeye imkan vermektedir. Bu doğrultuda perakendeciler müşterileri için hediyelere kişisel mesajlar ekleme, çeşitli tasarım şablonları seçme ve hatta fotoğraf ya da video gibi dijital öğeler ekleme imkanı sunmaktadır. Kişiselleştirmenin seviyesi ise alıcı ve verici arasındaki duygusal bağlantıyı güçlü kılmakta, bu özellik de hediyeleşmeyi daha anlamlı ve unutulmaz kılmaktadır (Gu, 2023).
- ***Bütüncül Kanal Yaklaşımı***: Dijital hediyeleşmenin yükselmesi perakende markalarının çevrimiçi ve çevrimdışı kanalların birlikte kullanımını benimseyen bütüncül kanal yaklaşımını özümsemelerine yol açmıştır.
- ***Kusursuz Deneyimlerin Paraya Çevrilmesi***: Dijital hediye kartlarının mobil cüzdan ve ödeme platformları ile sağlanması, bu hediye kartlarının kolaylıkla çevrimiçi alanda ve mağazada kullanılabilmesine imkan vermektedir. Barkod ya da karekod entegrasyonu gibi inovatif teknolojiler de hediye kartlarını paraya çevirme süreçlerinde kullanılmaktadır.
- ***Veri Yönelimli İçgörüler***: Hediyeleşmenin dijitalleşmesi, müşterilerle ilgili çok değerli verileri eşsiz şekilde biraraya getirme fırsatı sunmaktadır. Hediye kartı satın alma ve tercih etme davranışlarının çevrimiçi alanda takip edilmesi bu verinin elde edilmesi, kişisel seçeneklerin sunulması, pazarlama kampanyasının biçimlendirilmesi ve müşteri sadakatinin yönetilmesi ve bu alandaki gelirin büyümesinde etkilidir.
- ***Müşteri Katılımının Sağlanması***: Dijital hediyeleşme perakende markaları ve tüketicileri arasındaki bağı güçlendirmekte ve uzun soluklu bir marka-tüketici ilişkisi

sağlayabilmektedir. Burada özellikle dijital platformların perakendecilere dengeli şekilde takip etme, satın alma tarihi, ekstra promosyonlar gibi ek değerli hizmetler sağlayabilmektedir. Dolayısıyla müşteri merkezli stratejiler ve veri yönelimli içgörülerin gücü müşterilerin farklı istek ve gereksinimlerinin karşılanmasını sağlamaktadır. Bu bağlamda hediyeleşmede dijitali benimsenin, sürekli değişen ve gelişen bir sektörde başarılı olmak isteyen perakendeciler için artık bir seçenek değil, bir zorunluluk olduğu vurgulanmaktadır (Gu, 2023).

Andrew Wernick ise, reklam sektörünün toplumsal yeniden üretim ve denetim süreçleriyle olan ilişkilerini incelediği "Promosyon Kültürü" adlı yapıtında, reklamın dolayımsız ekonomik yönüyle, hedef alınan toplumun değerleri, normları, amaçları ve isteklerinin karşılaştırılmasının gerekli olduğuna işaret etmektedir. Buna bağlı olarak Wernick'e göre reklamlar yalnızca metayı bir anlamla ilişkilendirecek etkili resimler ve sözlü araçlarla sunmamalı, aynı zamanda anlamı anlaşılmış kültürel kodun unsurları üzerine kurmalıdırlar. Dolayısıyla reklamın unsurları, kültürel unsurlara belli imajlar yükleyerek ortaya çıkmakta ve bir sembol haline dönüştürülmekte, metalaşmış sembol ise bir promosyon işlevi görmektedir (Uyanık, 2006:79-80).2019 Covid-19 salgını bireylerin hayatını ve alışveriş davranışını "yeni normal" olarak değiştirmiştir. 2021 Küresel Tüketici İçgörüleri Araştırmaları'na göre yeni normal süreçte sosyal ve fiziksel aktivitelere yapılan harcamaların %49 oranında azaldığı kaydedilmiştir. Aynı zamanda ürün / hediye satın alımlarının %45'inin mobil, %41'inin bilgisayar, %33'ünün de tabletler üzerinde olduğu ve çevrimiçi hediyeleşme oranının arttığını ve hediye satın alma durumlarının değiştiğini ortaya koymuştur. Hediyeleşme alanındaki dijitalleşmenin tüketicilerin ihtiyaçlarını daha çok karşılamakta ve çevrimiçi hediyeleşme pazarının da büyümesine fırsat vermiştir. Burada özellikle etkileşimli bilgi alışverişi çevrimiçi platformlarda popüler markaları bulmayı da kolaylaştırmıştır. Özellikle çevrimiçi ortamda popüler olan markaların hediye olarak seçilmesi de mümkün hale gelmiştir. Buna göre hediyeyi alan kişi popüler bir hediye seçtiğinde bunun diğer süperstar hediyelerden olup olmadığını değerlendirme imkanı vermektedir. Buna göre özellikle dijital ortamda insan markaları (ünlüler ve influencerların) e-pazarlama çalışmaları üzerinden hedef kitleleri yönlendirme gücüne sahiptirler. Etkileyicilerin bu gücü dolayısıyla hediye pazarındaki uzmanların dikkate aldıkları önemli bir konudur. Medyada popüler olma konusu geleneksel yayıncılık dönemindeki geleneksel reklamlar aracılığı ile sağlanırken; bugünün dünyasında medyada popüler olma konusu YouTube, Instagram ve Facebook gibi sosyal medya mecralarındaki popülerliğe dönüşmüştür. Hediye pazarlama uzmanları medya reklamlarını özellikle tüketiciler arasında

hediyenin satın alınmasını teşvik etme, markaya yönelik pozitif bir tutum yaratma ve hediyeye yönelik bir talep yaratmak amacıyla kullanmaktadırlar. Burada özellikle deneyimsel hediye olarak ifade edilen bir gece otel konaklaması, bedava yemek pişirme atölyesi, akşam yemeği, konser gibi hediyelerin gençler arasında sosyal medya aracılığı ile de oldukça popüler hale geldiği belirtilmiştir (Chen, Wu ve Tai, 2022: 2199-2200).Parasal olmayan ve kâr amacı gütmeyen hediye alışverişini ifade eden hediye ekonomisi, hediyelerin karşılıklı ve zorunlu olarak değiş tokuş edildiği yer olarak tanımlanır (Mauss, 1990). Ancak dijital içeriğin hediye edilmesi çok az farklılık arz eder. İlk olarak, geleneksel ve çevrimiçi hediye verme arasındaki farklar üzerine yapılan çalışmalarda Skågeby (2010), çevrimiçi hediye verme ve geleneksel hediye vermenin farklı olduğunu vurgulamıştır. Geleneksel hediye vermede doğrudan birbirine sıkı sıkıya bağlı ve nispeten küçük "çevreler" içinde karşılıklı hediye verme söz konusudur; çevrimiçi hediye vermede ise tanımadığınız çok daha büyük ölçekte insanı bir araya getirme potansiyeli vardır**.** Dijital dünyada hediyeler ise her zaman bilinmeyen büyük bir gruba verilir, bu da karşılıklık yükümlülüğü daha az istenir (Kollock,1999). İkinci olarak, hediye ekonomisinde hediye verme işlemine hediyeyi verenin o nesneyi karşı taraf verince kaybetmesi eşlik eder. Ancak dijital hediyelerin soyut olma ve sonsuza kadar tekrarlanabilme özelliği vardır. Bununla birlikte dijital hediyeleşme geleneğinde kazanmak ve kaybetmek gibi kavramlar bulunmaz. Bu nedenle "Digi-Gratis (Ücretsiz Dijital) ekonomisi" (Booth, 2010) türetilmiştir. Ücretsiz Dijital Ekonomi terimi çağdaş medya ve kültür alanındaki Pazar ekonomileri ve hediyeleri arasında karşılıklı fayda ilişkisini anlatmak için kullanılan bir terim olmuştur (Jenkins, 2010).2015'te Özeltürkay ve Bozyiğit tarafından yapılan araştırma ise konumuz açısından dikkat çekicidir. Y kuşağını bugünün pazar ortamında hediye vermeye iten güdüleri ortaya çıkarmak ve bu güdülerin medya araçlarındaki reklamlarla arasındaki ilişkiyi belirleme amacı taşınan araştırmada Y kuşağı üniversite öğrencilerini hediye vermeye iten deneyimsellik, zorunluluk ve pratiklik gibi 3 güdünün olduğu; onları dijital medya araçlarından kullanıcı blogları, haber siteleri, mobil uygulamalar, e-posta gibi dijital araçlarla gazete ve dergi mecralarının etkili olduğu tespit edilmiştir. Kullanıcı bloglarında kişilerin deneyimlerini aktarmaları, çeşitli ürün ve hizmetleri tanıtıp tavsiye etmeleri bu genç kuşağın ilgisini yoğun olarak çekmektedir. Zorunluluk faktörü bakımından ise, öğrenciler kendilerini hediye vermeye zorunlu hissettikçe, mobil uygulamalar, özel şirket web siteleri, e-posta gibi dijital medya araçlarında ve dergide çıkan reklamların daha çok dikkatlerini çektiğini ifade etmişlerdir. Tüketicilerin kendilerini hediye vermeye zorunlu hissettikçe daha çok araştırma yapmaya yöneldikleri belirtilmiştir. Bu nedenle de, deneyimsellik güdüsünden farklı olarak burada özel

şirket web siteleriyle karşılaşıldığı düşünülmektedir. Pratiklik faktörü ile ne geleneksel ne de dijital medya araçlarında çıkan reklamlardan etkilenme arasında bir ilişki çıkmamıştır. İlişki çıkan her iki faktöre bakıldığında, dijital araçlardan mobil uygulamaların ve e-postanın, geleneksel medya araçlarından ise dergilerin, katılımcıların reklamlarından en çok etkilendikleri medya araçları olduğu anlaşılmaktadır. Bu nedenle, çeşitli mecralara reklam veren işletmelerin, özellikle hediye verme davranışlarının arttığı özel dönemlerde mobil uygulamalar, e-posta ve dergilere reklam vermesinin satışların artmasına yardım edeceği düşünülmektedir (Özeltürkay ve Bozyiğit, 2015: 287).

Dijital hediye kültüründe önemli gelişmelerden biri de canlı videoların hayatımıza girmesiyle gerçekleşmiştir. Buna göre özellikle Covid 19 salgını döneminde insanların eve kapanmasıyla küresel canlı video yayını akımı büyümüş, müşteriler sadece bu videoları izlemekle kalmamış; aynı zamanda yayıncılarla sanal hediyeleşme aracılığıyla etkileşim kurmuşlardır. Bu noktada sanal hediyeleşme aracılığı ile yayıncılarla etkileşim kurma işleme modelinin özellikle gelir sağlamada kritik bir öğesi olmuştur. Hsieh, Kunz ve Wu tarafından yapılan araştırmada ise toplu hediye verme ve yüz yüze müzakere teorisi perspektifinden, canlı video akımları üzerinden hediyeleşme davranışı incelenmiştir. Bu değerlendirmede sohbet (chat) odalarının rekabetçi alışveriş çevresi yarattığı ve kullanıcı üyelerdeki sanal hediye satın alma ve devamlılığı konusunda rekabet duygusunun artırıldığı sonucuna ulaşılmıştır. Burada ayrıca sanal hediyenin estetik ve sembolik tasarımının iyi olması, çekici olması gibi öğelere de dikkat edildiği vurgulanmıştır. Yine canlı video yayını akımlarında yayıncı karakterin çekici, imajı güçlü bir karakter olmasının da sanal hediye satın alımında yönlendirici bir özellik olduğu kaydedilmiştir. Ayrıca tekrar sanal hediye satın alımında yayıncıya duyulan bağlılığın da önemli olduğu belirtilmiştir (Hsieh, Kunz ve Wu, 2023).2021 yılında Chen tarafından yapılan başka bir bilimsel araştırmada ise “Canlı yayın akımlarındaki kişisel marka topluluklarında dijital hediyeleşme parasosyal ilişki” perspektifinden değerlendirilmeye çalışılmıştır. Sosyal devrim sosyal medya araçlarında pek çok yeni türü hayatımıza dahil etmiş, bu durum da gerçek zamanda dijital hediye ve izler kitleler arasında yeni aktarım mekanizmasının oluşmasına hizmet etmiştir. Buna göre dijital hediye bağışı izleyicilerin favori akımcılardan ödüller almasına fırsat yaratırken, gerçek zamanda hem akımı yaratan, hem de onu takip edenler dikkat çeker olmuştur. Böylece video akımcıları kendi kişisel marka topluluklarında izleyicileri ile ilişkilerini yönetme ve kendilerini dijital ünlü olarak konumlayarak kendi markalarını yönetebilmektedirler. Bu konu bağlamındaki araştırmalarda ayrıca video akımı yaratan

fenomenle izleyicileri arasında parasosyal bir ilişki kurulduğu ileri sürülmüştür (865-866).2022 yılında Kim vd. tarafından yapılan bilimsel çalışmada B2C pazarındaki müşteriler üzerinde Instgram ve Snapchat gibi iki sosyal medya hesabında paylaşılan somut ve deneyimsel hediyeler açısından hediye türünün ve mesajın duygusal ya da bilgi odaklı olmasının nasıl etkilediği ortaya konmaya çalışılmıştır. Buna göre somut hediyelerin promosyonel çalışmalarının Instagram mecrasına kıyasla daha etkili olduğu; deneyimsel hediyelere yönelik promosyonel çalışmaların ise Instagram mecrasında Snapchat'e göre daha etkili olduğu kaydedilmiştir. Yine deneyimsel hediyelere yönelik promosyonel çalışmalarda duygusal mesaj çekiciliği kullanımının Instagram'da Snapchat'e göre daha etkili olduğu vurgulanmıştır. Somut hediyelere ilişkin promosyonel çalışmalarda ise bilişsel çekicilik kullanımının Snapchat üzerinde daha etkili olduğu sonucuna ulaşılmıştır (2369).Geleneksel olarak hediyenin somut bir materyal olduğu görülmektedir. Hediye hediyeyi veren tarafından alıcıya vermek üzere oluşturulan fiziki bir öğe olarak değerlendirilmektedir. Fakat son yıllarda hediye alıp verme eğiliminin daha dijital hale geldiği ve hatta bazı hediyelerin de tamamen dijital olduğu ileri sürülmüştür (Hoelzl ve Faber,1).Bununla birlikte hediye alışverişinde alıcının isteğine uygun bir hediye seçme konusunda hediyeyi verecek olanda sık sık bir endişe yaşandığı belirtilmektedir. Burada normal hediyeleşme evresinde uygun hediye bulma konusunun hediye verecek olan kişinin çok fazla zamanını alması konusu üzerinde durulmaktadır. Buna karşılık dijital hediyelerin hediyeyi alacak kişinin arama ve hediye satın alma konusunda daha az zamanını aldığı vurgulanmaktadır. Bunun yanı sıra dijital ortamda alınan hediye, bu hediyeyi alacak kişi üzerinde kendisine hediye alma konusunda çok ince düşünülmediği algısı da yaratabilmektedir. 200 katılımcı üzerinde yapılan bir çalışmada katılımcılara arkadaşları arasında özel bir kişi için onların boş zaman alanıyla ilgili hediye vermeleri söz konusu olsa hangisini düşündükleri sorulmuştur. Katılımcıların burada 6 aylık müzik üyeliği hakkı, ya doğum günü kartı gibi unsurlara yöneldikleri dikkat çekmiştir (Hoelzl ve Faber,1).

SONUÇ

Arkaik dönemden dijital döneme uzanan yolculukta hediye özellikle bireyler arasındaki ilişkileri güçlendirmede önemli bir yere sahip olmuştur. Markalar bu gücü bugün hedef kitlenin takip ettiği mecralarda reklam aracılığı ile kullanmakta, bunun için de popüler olma yarışına girmektedirler. Bu popülerliğin sağlanmasında ise pazarlama iletişimi çalışmalarında fenomenlerin, influencerların ya da vlogger'ların kayda değer bir yeri olduğu görülmüştür. Bugünün dünyasında özellikle fenomen, influencer ya da vlogger'lar ile kendini özdeşleştiren kullanıcıların bu kişilere bağlılığı arttıkça ilgili taraflara gönderdikleri dijital hediyelerin de

yoğunluk kazandığı ifade edilmiştir. Dolayısıyla dijital mecralardaki bu kanaat önderlerinin dijital hediye kültürünün yaygınlaşmasında önemli bir yönlendirici güce sahip oldukları söylenebilir.Süreç içerisinde gönüllü olmadan, zorunluluğa doğru kayan hediyeleşme geleneğinin ise yine dijital aracılığı ile hem kişiselleştirilme hem de topluluk odaklı hediyeleşmeye yöneldiği gözlenmiştir. Dijitalleşme, geleneksel hediye ritüelini ve karşılıklık yapısını azaltmış, egemen ekonomik sisteme karşı bir anti ekonomi modeli de sunmuştur. Bu durum da meta değeri üzerinden değerlendirilen hediye anlamını dolaylı yoldan değer değerlendirmesi yapılan bir alana kaydırmıştır. Bu noktada özellikle sosyal medya araçlarında video akımcılarının canlı yayınlarının gerçek zamanlı toplu hediyeleşme eylemini beraberinde getirmesi dikkat çekmiştir. Buna göre hediyenin kendisinin ve hediye olarak ifade edilen eylemlerin (söz etme, beğenme vb.) değiştiği gözlenmiştir.

Ayrıca yapılan araştırmalarda görüldüğü üzere hediyeleşmede kitle iletişim araçları ve reklamın hediyeleşme, hediye ritüelini gösterme gibi edimlerde yönlendirici bir gücü olduğu gözlemlenmiştir. Özellikle dijital hediyeleşmeyi teşvik etmede kullanılan sosyal mecraların ve bu mecralarda verilecek olan reklamların bilişsel ya duygusal boyutta hangisinin daha etkili olacağı konusunda mecraların birbirinden farklı etkilere sahip olduğu; bu noktada verilecek olan hediyenin somut ya da deneyimsel hediye olup olmadığı faktörü kadar hangi mecranın reklam iletişim aracılı olarak kullanılacağına da dikkat etmek gerekmektedir. Yine hediye alımını teşvik etmede özellikle özel günlerde mobil mecra, e-posta ve dergilerin reklam mecrası olarak kullanımının etki sağlayacağı da vurgulanmaktadır.Bununla birlikte dijital hediyeleşme kolay erişebilme, kişiselleştirme, son dakikada alabilme gibi esnek alanlar yaratsa da, “hediyenin büyüğü küçüğü olmaz” düşüncesine karşı o dönemde seçilen hediyenin süper star hediye olması gibi popülerlik unsurlarına bakılması ya da alıcının kendine alınan hediyenin fiyatını internette bulup, karşılık vermede aynı fiyattaki hediyeleri alması gibi etik ve sosyal ilişkiler açısından bu alanın eleştirilebilir taraflarının olduğu görülmüştür.Sonuç olarak gelecekte dijital mecralardaki gelişmelerden ve yeni jenerasyonun hediyeleşme yükleyeceği anlamdan hediye kültürünün birebir etkileneceği ve hediye sektörü taraflarının buna şimdiden hazırlıklı olması gerekliliği açıktır.

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SUSTAINABILITY 2.0: HARNESSING THE POWER OF INNOVATION TO HEAL OUR PLANET

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Abstract
Embark on an odyssey through the kaleidoscopic realm of the environment, where the symphony of nature intertwines with the harmonies of cutting-edge technology to sculpt a future of boundless possibility. This abstract unveils the dynamic interplay between humanity and the natural world, weaving a tapestry of innovation, resilience, and transformative potential. At the heart of this narrative lies biodiversity, nature's magnum opus, adorned with the hues of genetic diversity and ecological intricacy. Yet, amidst the backdrop of escalating environmental challenges, the stage is set for a technological renaissance that promises to redefine our relationship with the Earth. Venture into the frontier of conservation technology, where drones soar through the skies, mapping ecosystems with unparalleled precision and guiding conservation efforts with surgical accuracy. Witness the rise of bioremediation techniques, where microbial marvels and nano-technological wonders collaborate to cleanse polluted waters and rejuvenate degraded landscapes. Peer through the looking glass of climate tech, where carbon capture innovations harness the power of nature to mitigate greenhouse gas emissions and forge a path towards climate neutrality. Journey alongside the pioneers of agro-tech, as vertical farms and aquaponics systems revolutionize food production, offering a glimpse into a future of sustainable abundance. Yet, innovation alone cannot bear the mantle of environmental stewardship. It is in the crucible of collective action and social innovation that the true alchemy of change unfolds. From block chain-powered conservation finance to citizen science initiatives leveraging the power of crowdsourcing, the abstract celebrates the catalytic role of human ingenuity in nurturing a thriving planet. As we stand at the precipice of a new era, let us embrace the convergence of nature and innovation as the catalyst for an eco-revolution. Through bold experimentation, audacious collaboration, and unwavering commitment, we illuminate the path towards a future where humanity and the environment dance in harmony, bound by a shared destiny of flourishing and resilience.
Keywords: Sustainability, innovation, environmental challenges, planetary healing, transformative, technology, renewable energy, sustainable development, ecological balance, biodiversity, climate change, resilience.

Introduction:

Sustainability 2.0 represents a paradigm shift in how we approach environmental challenges, emphasizing the integration of technology and innovation into sustainability practices. In the face of escalating environmental crises such as climate change, biodiversity loss, and resource depletion, there is an urgent need for transformative solutions. This paper explores how technological advancements can play a pivotal role in mitigating these challenges and fostering a more sustainable future.

Overview of the Environmental Landscape:

The current environmental landscape is characterized by a multitude of interconnected challenges. Climate change is exacerbating extreme weather events, disrupting ecosystems, and threatening livelihoods. Biodiversity loss is accelerating at an alarming rate, jeopardizing the stability of ecosystems and the services they provide. The depletion of natural resources, including freshwater and arable land, poses further risks to global sustainability. Addressing these challenges requires a comprehensive understanding of the complex interactions between human activities and the environment.

The Role of Technology in Sustainability:

Technology offers promising solutions to environmental challenges, ranging from renewable energy to sustainable agriculture. Innovations such as drones, bioremediation techniques, climate tech, and agro-tech have the potential to revolutionize how we manage natural resources and mitigate environmental impacts. By harnessing the power of technology, we can enhance efficiency, reduce waste, and minimize environmental harm.

Conservation Technology:

Drones have emerged as powerful tools for ecosystem monitoring and conservation. These unmanned aerial vehicles enable researchers to conduct high-resolution mapping of habitats, monitor wildlife populations, and detect illegal activities such as poaching and deforestation. Furthermore, drones can facilitate rapid response efforts during natural disasters, providing crucial data for disaster management and relief operations.

Bioremediation Techniques:

Bioremediation offers a sustainable approach to cleaning up polluted environments and restoring ecosystems. Microbial and nanotechnological innovations have been developed to target contaminants such as oil spills, heavy metals, and chemical pollutants. These techniques harness the natural processes of microorganisms to break down pollutants and detoxify

contaminated sites. By leveraging bioremediation, we can mitigate the impacts of pollution and restore the health of ecosystems.

Climate Tech:

Carbon capture technologies play a crucial role in mitigating greenhouse gas emissions and combating climate change. Nature-based solutions such as afforestation, reforestation, and wetland restoration sequester carbon dioxide from the atmosphere, helping to offset emissions from human activities. Additionally, renewable energy technologies such as solar, wind, and hydropower offer clean alternatives to fossil fuels, reducing our dependence on carbon-intensive energy sources.

The Importance of Collective Action:

Achieving sustainability requires collective action and social innovation at all levels of society. Collaborative initiatives and community-driven projects play a vital role in mobilizing resources, raising awareness, and fostering a culture of environmental stewardship. By engaging stakeholders from diverse backgrounds, we can harness the collective wisdom and creativity needed to address complex environmental challenges.

Conclusion:

In conclusion, Sustainability 2.0 offers a transformative vision for a more sustainable and resilient future. By embracing innovation and collective action, we can harness the power of technology to heal our planet and secure a prosperous future for generations to come. However, achieving sustainability requires a concerted effort from governments, businesses, civil society, and individuals alike. It is imperative that we work together to implement bold solutions and safeguard the health of our planet for future generations.

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KÜLTÜRLERARASILIK VE DERS KİTABI: KRİTİK BİR ANALİZ

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Özet
21. yüzyılda dünya, çeşitli etkileşim biçimleri nedeniyle dramatik bir şekilde değişmektedir. Önemi giderek artacak olan önemli bir faktör de kültürlerarası iletişim yetkinliğidir (ICC). Küreselleşme ve teknolojik ilerlemeler, çeşitli alanlarda iş birliği ve ekip çalışması gerektiren küresel bir manzara yaratmıştır. Kültürlerarası yetkinlik, 21. yüzyılda akademi, staj, spor, sanat, film, festival, okul, iş yeri, hastane gibi çeşitli bağlamlarda başarılı olmak için kilit becerilerden biridir. Ancak, kültürlerarası iletişim yetkinliğine (ICC) eğitim materyallerinde özellikle de müfredat geliştirmede yeterince önem ve öncelik verilmemektedir. Bu çalışmanın amacı, Heinle Cengage tarafından yayınlanan ve National Geographic ve TED'den içeriklere yer veren "World English, Second Edition for Real People Real Places Real Language" adlı İngilizce öğretimi ders kitabında yer alan "Food from the Earth" başlıklı bir üniteyi kültürlerarası yetkinlik (KİY) açısından incelemektir. Ders kitabı, A2-B1 yeterlik düzeyine sahip lise öğrencileri için tasarlanmıştır. Veriler, nitel bir araştırma yöntemi olan doküman analizi tekniği ile toplanmıştır. Hem ders kitabının içeriği numaralandırılmış, hem de bir ünitenin etkinlikleri bütünlükleri açısından gruplandırılmış ve Hofstede'nin Kültürel Boyutlar Teorisi ve Deardorff'un Kültürlerarası Yeterlilik Modeli temel alınarak analiz edilmiştir. Sonuçlar, analiz edilen İngilizce öğretimi ders kitabının öğrencilerin kültürlerarası farkındalığını ve yeterliliğini geliştirme uygun olduğu belirlenmiş olup öğretimin amaç ve hedeflerini başarıyla karşılamaya yönelik olduğu belirlenmiştir.
Anahtar Kelimeler: Kültürlerarasılık, Kültürlerarası İletişim Yetkinliği (ICC), Eğitim Programları

INTERCULTURALISM AND COURSEBOOK: A CRITICAL ANALYSIS

Abstract
The world is changing dramatically in the 21st century due to various forms of interaction, and one important factor that will increasing become important is intercultural communication competence (ICC). Globalization and technological advancements have created a global landscape that demands cooperation and teamwork across a range of domains. Intercultural competence is one of the key skills to succeed in the 21st century in various contexts such as academia, internships, sports, the arts, movies, festivals, schools, workplaces, hospitals. Yet, intercultural communication competence (ICC) is not given enough attention and priority in educational materials especially in curriculum development. This study aims to examine a unit titled "Food from the Earth" in terms of intercultural competence (ICC) in an English language teaching coursebook named "World English, Second Edition for Real People Real Places Real Language," published by Heinle Cengage, featuring content from National Geographic and TED. The coursebook has been designed for students in high school with a proficiency level of A2- B1. The data was collected through the technique of document analysis, which is a qualitative research method. Both the contents of the coursebook are numbered, the activities of a unit are grouped for their unity and analyzed based on Hofstede's Cultural Dimensions Theory and Deardorff's Intercultural Competence Model. Results suggested that the analyzed English language teaching coursebook has developed learners' intercultural awareness and competence and successfully met the aims and goals of the teaching.
Keywords: Interculturalism, Intercultural Communication Competence (ICC), Curriculum

Introduction

Education is a process that prepares us to be standers of our choices, lifestyles, beliefs, and personal goals rather than simply being a bystander or receiver of knowledge through memorization. As Tom Hierck, an education consultant and author, highlights, "21st Century kids are being taught by 20th-century adults using 19th-century curriculum and techniques on an 18th-century calendar," Tom Hierck (2019). However, researchers and educators in all fields need to pay more attention to the power of the continually changing nature of learning and learners. The curriculum is not a fixed notion or independent of a child's experience and world; where it is a whole something unique, fluent, embryonic, and vital. It is an endless notion deriving from the child's own experience into organized truth (Dewey, 1902). 21st-century skills, including intercultural competence, critical thinking, teamwork, collaboration, problem-solving, creativity, and communication skills, are vitally essential to prepare future young adults to overcome challenges in a global world. How ready is our curriculum? How good is it? Are we really addressing the needs of the learners and helping to actualize their potential and improve their strengths, and fulfill their desires? These are some of the questions we must tackle. Suppose we do not develop a better curriculum, better teaching, and better tests. In that case, 21st-century skills will be merely words that carry no meaning and no action in reality, which also means that we sacrifice long-term gains over short-term progress (Rotherham & Willingham, 2010). In fact, developing an updated curriculum based on intercultural competence is an educational imperative in the 21st century (Fantini, 2009). It must be tackled in a wide variety of settings and contexts in all parts of the world.In this paper, as an educational scientist and curriculum developer, the researcher aims to analyze an English language teaching coursebook in terms of often neglected 21st-century skill intercultural competence (ICC) with the help of Hostede's Cultural Dimensions Theory (Hofstede, 1984) and Deardorff's Intercultural Competence Model (Deardorff, 2006). Reasons for incorporating Hofstede's Cultural Dimensions Theory into the study include the roles that the theory plays in understanding values in the context of cross-cultural understanding, communication and cooperation, global business management, human resource management, education, and policy development. This theoretical framework offers a structured approach to understanding the various values, beliefs, and behaviors that shape societies, providing insightful information about the nuances of cultural differences within the study's scope (Hofstede & Usunier, 2003). In addition, Darla Deardorff's Intercultural Competence Model is a comprehensive framework offers both theoretical and practical aspect of communication across diver cultural contexts.

Three interrelated components make up the model: attitudes, skills, and knowledge. While the knowledge component entails learning about different cultures and developing cultural awareness and understanding, the skills component emphasizes the useful strategies for facilitating successful cross-cultural interactions, such as communication, flexibility, and conflict resolution across cultural divides. Moreover, attitudes blend in open-mindedness and engagement by non-judgmental approach. The coursebook that we are going to examine is called World English, Second Edition for Real People Real Places Real Language, published by Heinle Cengage, Featuring content from National Geographic and TED. The authors of the book are Kristin Johannsen and Rebecca Tarver Chase. High school students with a proficiency level of A2-B1 have been aimed to teach through this coursebook.

Historical and Theoretical Context of Interculturalism

Despite the fact that it is now attained a great deal of attention in the 21st century, interculturalism has always been a part of world cultures since antique civilizations such as Akkadians, Achaemenids, Khazars, and Romans (Menek, 2020). Since those old times, people at the time managed to create long-lasting peaceful periods, for example, Pax Khazarica and Pax Romana. Wars, trade, and diplomatic relations were some ways to make interactions between different groups of people (Akıncı, 2019; Tite, 1995). Interestingly, however, as people of the so-called modern world, we now can learn, collaborate and work with anyone with internet access and improve ourselves with new perspectives and understanding.Thanks to the technological improvement that eased the ways to transport from one place to another, people tremendously benefitted from studying, traveling, and working together. As the world evolved into a place where everyone, regardless of personal and cultural background, religion, or race, can interact and move, interculturalism, also known as the art of living together, emerged as a new phenomenon. Since the 21st-century term, global citizenship has become more prominent, and interculturalism and intercultural competence (ICC) studies have drastically increased due to the high volume of interaction among different cultures. Intercultural competence is one of the necessary 21st-century skills that must be attained to work in today's intercultural setting (Anand & Lui, 2019; Düger, 2020). According to Hofstede, it comprises six main categories. They are, respectively, power distance, individualism vs. collectivism, masculinity vs. femininity, uncertainty avoidance, long-term vs. short-term orientation, and finally, indulgence vs. restraint.

A Brief Overview of Hofstede's Cultural Dimensions Theory (1984)

According to Geert Hofstede's Cultural Dimensions Theory, the cultural dimension consists of five main dimensions identity, power, gender, uncertainty, and time. The framework presents a structural framework for cross-cultural communication to foster a better understanding among different groups through various societal and behavioral dynamics (Hofstede, 1984). Within this scope of the study, we will tackle how important it is to understand and eliminate misunderstandings that lead to possible stereotypes and enhance the positive impact of interculturalism.

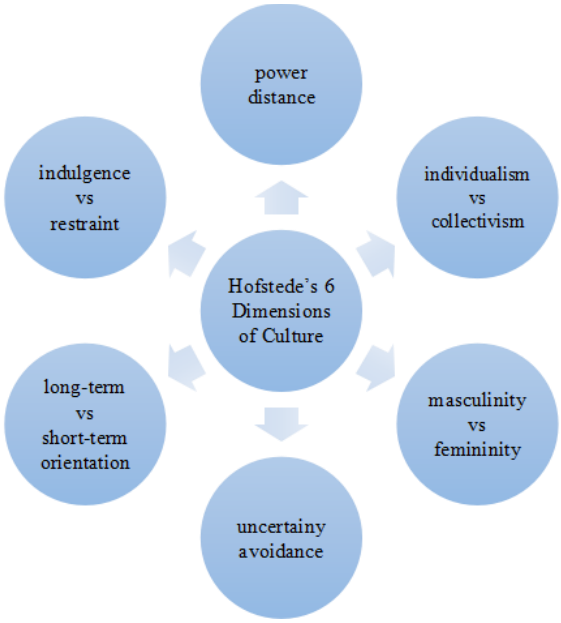


Figure 1: Hofstede's Cultural Dimensions Theory (Hofstede, 1984)

Within this scope of the study, we will tackle how important it is to understand and eliminate misunderstandings that lead to possible stereotypes and enhance the positive impact of interculturalismHere are the brief explanations of each dimension follows (Hofstede, 1984; Hofstede, 2011).- Power Distance Index (PDI) is about how power is distributed amongst members of a society and how equal and unequal it is. Power and inequality are a feature of all societies in the world, but only the discrepancy matters.- Individualism-Collectivism (IDV) is two opposite types of social organization. While the previous one focuses on the individual's worth and prioritizes its value, the latter puts so much importance on group dynamics and the needs of a particular group of people.- Masculinity-Feminity (MAS) is about societal norms which describe to what extent ambition, wealth, assertiveness or caring, solidarity, and helping affect individuals and societies.

- Uncertainty Avoidance (UAI) portrays a culture or society's resilience to unusual and unstructured circumstances, which advises social standards, commerce practices, and human behavior.

- Long-term-short-term orientation portrays to what extent a country is more concerned about its past and present as short-term orientation values, while long-term orientation emphasizes future and future-oriented goals.

- Indulgence-restraint (IVR) deals with humans' needs and desires differently in society. For example, an indulgent society is one that emphasizes the fulfillment of human needs and wants. In contrast, a restricted society limits and controls a person's wants and withholds joys in adapting to superior acclimate to social standards.

A Brief Overview of Deardorff's Intercultural Competence Model (2006)

According to Darla K. Deardorff's Intercultural Competence Pyramid Model, attitude, knowledge, skills, internal outcomes, and external outcomes are the five main components involved in Intercultural Competence (ICC) (Deardorff, 2006). This model provides a framework that guides a well-organized curriculum that advances intercultural competence and assessment of learning outcomes.

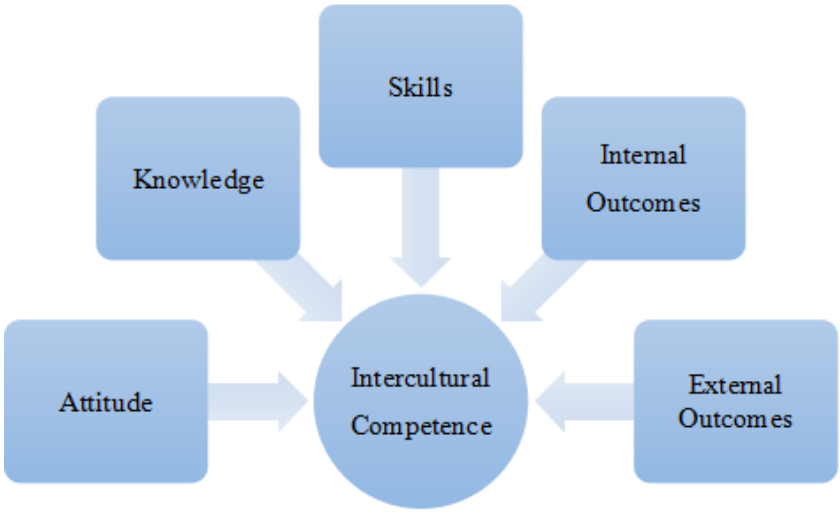


Figure 2: Deardorff's Intercultural Competence Model (Deardorff, 2006)

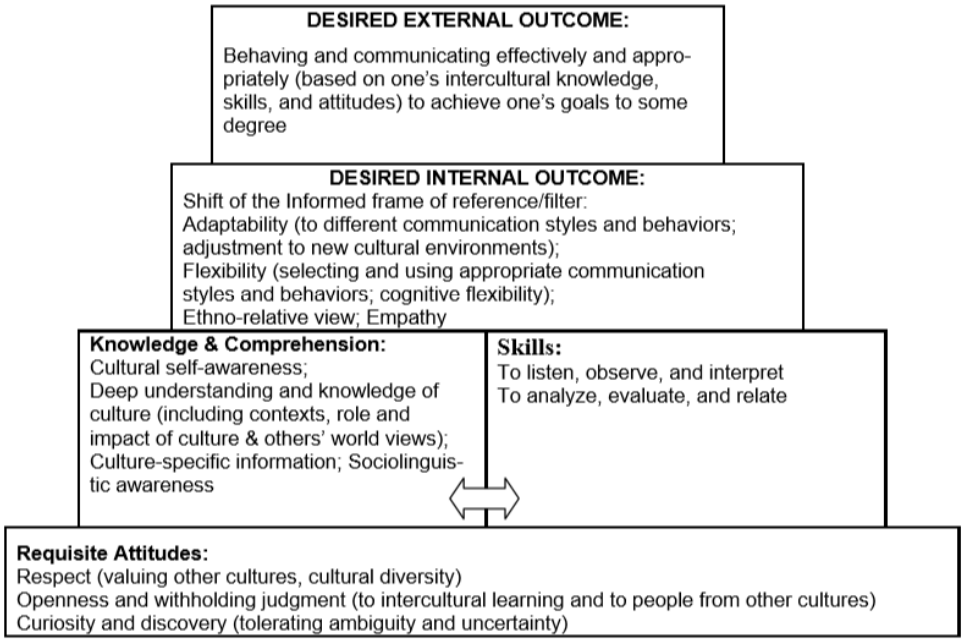


Figure 3: Pyramid model of intercultural competence (Deardorff, 2006).

Here are the brief explanations of each component follows:

Attitudes: There are three key attitudes: respect, openness, and curiosity.

Respect indicates that you value others from different backgrounds and who hold different views. You share openness and curiosity to appreciate their uniqueness while stepping out of your comfort zone and letting them be who they are. These three attitudes are fundamental to developing the knowledge and skills necessary for intercultural competence.

Knowledge: In order to achieve intercultural competence, you are required to have cultural self-awareness, culture-specific knowledge, deep cultural knowledge (understanding of other world views), and socio-linguistic awareness. Seeing the world through the lenses of others is vital to develop intercultural competence.

Skills: Observing, listening, evaluating, analyzing, interpreting, and relating are skills fundamental to figuring out knowledge. While interacting with others from various backgrounds, you cannot simply count on your mere knowledge. You are also required to utilize these skills to perceive and process information.

Internal Outcomes: The attitudes, knowledge, and skills lead to an internal outcome that consists of flexibility, adaptability, and empathy. These skills enable individuals to attain intercultural competence at some level successfully. You are able to begin to look from the

other person's perspective and respond to others according to how you would like them to be treated.

External Outcomes: These skills consist of behaviors and communication skills displayed by an individual found in their attitudes, knowledge, skills, and internal outcomes are the external outcomes encountered by people around them. Effective and appropriate attitude and communication are the observable external outcomes of intercultural competence.

Materials and Methods

In this study, case study design, one of the qualitative research methods, was used. Case study is a method in which a single situation or event is examined in-depth longitudinally, data are collected systematically and what happens in the real environment is examined. With the results obtained, it reveals why the event occurred the way it did and what should be focused on in future studies (Davey, 1990). Additionally, document analysis was used in this study. Document analysis or analysis is a research method on its own or it can function as an additional source of information when other qualitative methods are used (Yıldırım & Şimşek, 2013). In addition to providing additional data, document analysis can also provide an additional perspective on the event, compensate for the possible bias that a single data collection method may bring, and all of these have the potential to increase the reliability of the study (Patton, 2002). In this study, a unit titled "Food from the Earth" in the English language teaching textbook "World English, Second Edition for Real People Real Places Real Language" published by Heinle Cengage, which includes content from National Geographic and TED, was analyzed in terms of intercultural competence (ICC).This study consists of a content analysis that aims to examine an English language teaching coursebook within the scope of cultural values primarily based on Hofstede's Cultural Dimensions Theory and Deardorff's Intercultural Competence. While Hostede's Cultural Dimensions Theory examines the cultural values of diverse groups of people in their workplace through six main elements such as power distance, uncertainty avoidance, masculinity/femininity, individualism/collectivism, long-term/short-term avoidance, and indulgence/restraint, Deardorff's Intercultural Competence Theory, focuses on four main components including attitude, knowledge, skills, internal outcomes, and external outcomes. One of the goals of this article is to analyze the contents of a language coursebook with the help of these cultural theories to develop a better curriculum for future generations to reach their full potential and improve their intercultural communication competence (ICC). Articles and theses were examined within the scope of the study as categorical and theme analyses and classified according to their features.

Interpretation of Findings

Including intercultural communication competence (ICC) as a main element in language teaching coursebooks fosters better understanding while helping learners of all ages and levels develop tolerance, respect, and empathy, and build deeper cultural awareness. Besides fostering better understanding, it also helps learners gain a deeper understanding of their own culture through an ethno-relative and comparative view. Here are two tables analyzing the unit activities:

Table 1: Analysis of the Unit based on Hofstede's Cultural Dimensions Theory

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Power Distance				x											x		x
Individualism/Collectivism		x									x						x
Masculinity/Femininity		x		x					x								
Uncertainty Avoidance			x	x								x				x	x
Long-term/Short-term Avoidance																	
Indulgence/Restraint			x												x	x	x

Table 2: Analysis of the Unit based on Deardorff's Intercultural Competence Pyramid Model (2006)

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Requisite Attitudes: (respect, openness, curiosity)	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Knowledge & Comprehension: Cultural Awareness Deep Understanding Culture-Specific Information socio-linguistics Awareness	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Internal Outcome Adaptability: Flexibility Ethnorelative view Empathy	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x
External Outcome Behaving & Communicating effectively		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x

The coursebook World English, Unit Food from the Earth is analyzed through 17 main sections, including vocabulary, grammar (simple present tense vs. present continuous tense), conversation 1, listening, communication 1, pronunciation, language expansion, grammar (simple past tense), conversation 2, reading, communication 2, writing, before you watch, while you watch, video summary, after you watch, communication 3. As each section is assessed with the help of Hofstede's Cultural Dimensions Theory and Deardorff's Intercultural Competence Model (2006), relevant comments and evaluations are also shared.

In the first activity, the first section vocabulary, a travel blog about Argentina, highlights requisite attitudes such as respect, openness, and curiosity. Regarding knowledge and

comprehension, the activity stimulated learners' understanding by creating cultural awareness while sharing culture-specific information. It also increases appreciation, empathy, and adapting to a new country and circumstances.

In the second activity, grammar is taught through a short text about a staple food, enchiladas, in Mexican cuisine. Learners from all cultures can get a brief picture of eating with different people at the same table by the picture representing the collectivist values of Mexican culture. Also, a girl named Celia and her mother working together can give us a clue about gender roles in Mexican society. Moreover, the students learn to respect another culture and foster intercultural appreciation through respect and curiosity while also becoming more aware of culture-specific details and creating a deep understanding of a new culture. In addition, it fosters adaptability, empathy and flexibility. As the second part of the activity requires the learners to speak about their own experiences, they also create cultural awareness and communicate effectively in a different cultural setting.

In the third activity, conversation 1 starts with a listening track where two interlocutors talk about a vacation, also mentioning some of the eating habits of local people in the visited place. Besides activating the learners' schemata about their own experiences, they are also required to share traditions and formalities as uncertainty avoidance. Since indulgence vs. restraint deals with humans' needs and desires, the learners are supposed to share their beliefs about social standards while talking about the tradition and eating habits during a special day or holiday in the relevant culture. As they talk about their culture, they open up and mention the core values and beliefs of the culture, which gives them a chance to express their ethno-relative view, increase cultural self-awareness, and foster better empathy.

In the fourth activity, listening begins with a peer discussion where students are required to talk about farmers growing rice. Then, it follows an interview with a rice farmer talking about various issues, including rice paddy, and climate. Besides a photo of a woman working in a rice paddy in Taiwan, there is also a Welsh fisherman working; these photos can give us a clue about gender roles in different cultures. Moreover, a question on finding new ways to increase food production aims to engage the learners about the hierarchical relations, also known as power distance, between different occupations, such as farmers and scientists. While talking about rice plants and rainfall necessitates the learners to express their ideas about a culture or society's attitudes toward unpredictable and unstructured circumstances, which develops uncertainty avoidance skills and builds a new understanding of human nature. Additionally, the learners develop requisite attitudes such as respect, openness, and curiosity about different

cultures, which leads them to improve their cultural awareness and deep understanding of one another and socio-linguistic awareness through empathy, flexibility, and effective communication.

In the fifth activity, communication 1 is a comparison activity about two different regions in students' home countries. As the students open up more about descriptions of the land, the climate, and the food in different regions, they become more aware of the culture and develop cultural self-awareness, attaining culture-specific information about two different regions. Besides interacting about several features, they learn to see through others' perspectives and learn how to behave right by using useful intercultural communication strategies through real-life experiences.

In the sixth activity, pronunciation is emphasized, the students pay attention to linking words in the context of foods and cultures. As one of the goals of this activity is to help them identify some of the staple foods in their region and country, they share culture-specific information while creating socio-linguistic awareness in the target language. They learn to move out of their comfort zone, observe, listen to each other, and share ideas through empathy while communicating effectively.

In the seventh activity, language expansion activity about staple food crops captures the learners' attention through colorful pictures emphasizing useful words such as corn, wheat, rice, oats, millet, soybeans, lentils, black beans, red beans, potatoes, yucca, yams with the help of sentences in the context of eating habits in various places including China, South America, and India. The learners not only have a chance to talk about the staple foods they eat and also learn to respect different eating habits and become flexible as they understand why some food is available in certain countries across the world and why they consume it regularly.

In the eighth activity, grammar (simple past tense) focuses on improving the learners' socio-pragmatic awareness in the context of interculturalism, specifically food, travel, and past experiences. For instance, they are required to complete a dialogue about a journey to Greece, and the students learn to express past experiences with the help of specific information about cultures.

In the ninth activity, conversation 2 starts with a dialogue between two interlocutors talking about couscous, a food in North Africa generally eaten on special occasions. Since the details in the discussion highlight some useful expressions and culture-related information, including ingredients of traditional food couscous, when it is eaten, and why it is important, the learners understand food from its unique perspective and develop empathy. In addition, they express

ideas about a dish unique to their own local culture and increase a better intercultural awareness about cultural values.

In the tenth activity, a reading passage called "A Slice of History" stimulates the learners' interest in pizza, which used to be a regional food in Naples, Italy soon became one of the most famous and popular food internationally. It takes the attention and curiosity of the learners to understand cultures and appreciate the similarities and differences on a deeper level; for instance, it is mentioned in the text that Brazilians, Russians, Indians, and Japanese prefer various and diverse ingredients. With the help of these ideas, the learners develop better cultural empathy, respect different tastes and preferences and learn to behave accordingly in an acceptable manner in an intercultural setting.

In the eleventh activity, communication 2 requires working in a small group, where the learners are asked to come up with a new pizza invention for a pizza restaurant. They are required to agree on its toppings, sauce, and crust types, which is an excellent way to learn to negotiate and develop socio-linguistic awareness in the target language. In addition to this, they raise consciousness about respect for each other, become open and curious as well as communicate effectively.

In the twelfth activity, exchanging letters as a writing activity benefits the students by asking more about the eating habits of a country they will soon visit. For example, they are curious to find out what the people in the visited country eat for breakfast, what they have in restaurants, what their staple foods are, and finally, some of the things they eat for lunch and dinner. Moreover, they also introspectively tackle food from their region or country popular in other places and why they are popular and common there, which is a great way of creating cultural awareness about their own culture and having a better grasp of deep understanding about one another. With the help of this activity, they improve their communication in an effective manner through critical analysis.

According to the analysis of the ***thirteenth, fourteenth, fifteenth and sixteenth activity*** in the unit, a video journal is represented about a forbidden fruit in four main sections, including before you watch, while you watch, video summary, and after you watch, respectively. Firstly, the students are familiarized with some of the relevant adjectives in a context with the help of a regional map of Southeast Asia during the first main activity. After that, it is followed by a while-you-watch activity where they get a chance to watch a video and observe people's actions and reactions of hotel staff, hotel guests, and hotel cleaning staff toward a forbidden fruit called durian. And also, they become aware of cultural elements and learn the culture and location-

specific information regarding architecture, foods, animals native to that specific country, and a special kind of shopping way, a floating market through photos. Thirdly, they build a better understanding of a real-life situation in the video summary part, where the main problem is reflected in the smelly fruit durian. And finally, they critically tackle three foods popular in the learners' home culture which might be disgusting or intolerable to people from different cultures by giving reasons and commenting on them. These activities emphasize the importance and significance of intercultural competencies on requisite attitudes, deeply understanding both local and international cultures, and learning to appreciate similarities and differences simultaneously through useful phrases and expressions in the target language through first-hand experiences.

In the seventeenth activity, communication 3 helps the learners to solve problems aiming to prevent people from bringing durian into their rooms in hotels so that they work on effective communication styles without offending anyone and also acting out of respect and addressing people in a kind and empathetic way; it is the kind of targeted awareness level in deeply understanding various cultures while improving intercultural communication and communication strategies.

Conclusion and Recommendations

As the 21st century leads us to new ways of communication, the world has been reshaped through various forms of interaction, one of the most integral elements of this interaction is undoubtedly intercultural communication competence (ICC). Globalization and multiculturalism through technological developments paved the pathway for a world where collaboration and working together are a new must in all fields. People from all backgrounds, cultural heritages, and linguistic variations come together in diverse settings such as exchange student programs, academic conferences, work opportunities, internships, sports, arts, cinema, festivals, etc (Anand & Lui, 2019; Düger, 2020). However, sadly enough, despite these interactions, conflicts, wars, and violence in all parts of the world have never been declining. In fact, according to the World Population Review (2022), an independent organization without political affiliations, many people are heavily affected by destructive causes like civil war, terrorist insurgency, drug war, ethnic violence, and political unrest, and their impacts are exacerbated to use fundamental human rights, including access to education, the right to life and liberty, freedom from slavery and torture, freedom of opinion and expression, the right to work and education. Consequently, it is tremendously crucial to implement ideas based on the universal needs and humanistic values of all people in the world. We educators, therefore, must

tackle teaching in the most suitable manner to ensure that peace and mutual understanding between one single human to another are achievable through the educational programs we develop and practice.

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PİSA SINAVI SONUÇLARI KONUSUNDA FARKLI ÜLKELERLE İLGİLİ ARAŞTIRMALARIN BİR İÇERİK ANALİZİ

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Özet
Dünya üzerinde etkileşimin her geçen gün daha çok artması ulusların eğitim sistemlerini üzerinde de etkili olmaktadır. Artan etkileşim sonucunda PİSA gibi uluslararası sınavlar ile ülkeler birbirleriyle karşılaştırılmaktadır. Türkiye ve pek çok ülkenin PİSA sınavının boyutları kapsamından karşılaştırılacağı bu çalışmada PİSA sınav sonucuna etki eden çeşitli dinamiklerin varlığının incelenmesi amaçlanmaktadır. Yayınlardan elde edilen ilgili veriler içerik analizi yöntemi kullanılarak kategorize edilmiştir. Araştırma süresinde 10 makalenin sonuçları karşılaştırılmış olup araştırma bulguları sistematik olarak sınıflandırılmıştır. Çalışma kapsamında ülkelere ilişkin veriler eğitim felsefesi, eğitim projeleri, öğretmen yetiştirme programları ve okul idarecilerinin yetiştirilmesi olarak dört ana grupta incelenmiştir. Toplanan bilgiler ışığında ilgili ülke bölümünde yer verilmiştir. PİSA sonuçlarının incelenmesi ve sınav hakkında farkındalık kazanmak adına çalışmanın bilgilendiricilik yönünden önemli olduğu söylenilebilir. Çin'in, PISA sınavındaki üstün başarısında eğitim ve psikoloji gibi alanlarda yüksek lisans derecesine sahip olan okul müdürlerinin etkisi bulunmaktadır. Singapur eğitim programlarında önemi vurgulanan temel beceriler arasında öz farkındalık, eleştirel düşünme, etkili iletişim, sorgulama, başarılı ekip çalışması ve yenilikçi vatandaşların yetiştirilmesi yer almaktadır. Finlandiya eğitim sisteminde fırsat eşitliği, eşitlik, süreklilik, demokrasi ve her yönüyle eğitime bağlılığa odaklanmaktadır. 500 yıl sonra devlet ve kilisenin ayrılmasını deneyimleyen Norveç, eğitim sisteminde laikliğe ve dini kurumların özerkliğine olan bağlılığını yansıtmaktadır. İngiltere 2003-2005 yılları arasında ilk ve ortaöğretim kademelerinde teknoloji alanında 50 milyon poundluk bütçe ayırarak başarısını geliştirmiştir. Japonya'nın uluslararası değerlendirmelerdeki güçlü performansı, öğretmen eğitimine, okul liderliğine ve eğitim girişimlerine verdiği önem ile ilişkilendirilirken, Güney Kore'nin performansı eğitim felsefesi, programları ve girişimlerine bağlanabilir. Rusya'nın değerlendirmelerdeki başarısı eğitim felsefesine, program ve projeleri ile ilişkilendirilebilir. Türkiye'nin eğitim çıktılarının iyileştirilmesi amacıyla eleştirel düşünme, sorgulama ve yenilikçi vatandaşların yetiştirilmesine öncelik veren politikaların geliştirilmesinin önemi vurgulanmaktadır. Eğitim kalitesi değerlendirme sonuçlarının ilgili topluluklar ve kamuoyu ile şeffaf şekilde paylaşılması eğitimin iyileştirilmesinde etkili olacağı belirtilmektedir.
Anahtar Kelimeler: PISA Sınavı, Karşılaştırmalı Eğitim Çalışmaları

A CONTENT ANALYSIS OF RESEARCH FROM DIFFERENT COUNTRIES ON PISA EXAM RESULTS

Abstract
The increasing interaction in the world has an impact on the education systems of nations. As a result of increased interaction, countries are compared with each other through international exams such as PISA. This study, in which many countries including Turkey will be compared through the PISA exam, aims to examine the existence of various dynamics affecting the PISA exam results. The relevant data obtained from the publications were categorized using content analysis method. During the research period, the results of 10 articles were compared and the research findings were systematically categorized. Within the scope of the study, the data related to the countries were examined in four main groups as educational philosophy, educational projects, teacher training programs and training of school administrators. In the light of the information collected, the relevant country section is included. It can be said that the study is informative in terms of analyzing PISA results and raising awareness about the exam. China's superior success in the PISA exam is attributed to school principals who have master's degrees in fields such as education and psychology. Self-awareness, critical thinking, effective communication, questioning, successful teamwork and raising innovative citizens are among the basic skills emphasized in Singapore's education programs. Finland's education system focuses on equal opportunity, equality, continuity, democracy and commitment to education in all its aspects. After 500 years of experiencing the separation of state and church, Norway reflects its commitment to secularism and the autonomy of religious institutions in its education system. The UK has built on its success with a 50-million-pound budget for technology at primary and secondary levels between 2003 and 2005. Japan's strong performance in international assessments can be attributed to its emphasis on teacher training, school leadership and educational initiatives, while South Korea's performance can be attributed to its educational philosophy, programs and initiatives. Russia's success in international assessments can be attributed to its educational philosophy, programs and projects. In order to improve Turkey's educational outcomes, the importance of developing policies that prioritize critical thinking, questioning and raising innovative citizens is emphasized. Transparent sharing of education quality assessment results with relevant communities and the public is considered effective in improving education.
Keywords: PISA Exam, Comparative Educational Studies

GİRİŞ

Ekonomik Kalkınma ve İş birliği Örgütü (OECD) tarafından 1997 yılından beri faaliyette olan ve dünya genelinde eğitim kazanımlarının karşılaştırılması amacıyla oluşturulmuş olan PİSA sınavı ülkemizin eğitime yaptığı yatırımların ve eğitim sistemimizin başarısı üzerine çalışma yapmamız üzerinde etkilidir. Tüm dünya ülkelerinin eğitim sisteminde sorunlar olduğu ancak bu sorunların diğer ülkelerin çalışmaları incelenerek iyileştirilebileceği düşünüldüğünde PİSA gibi uluslararası sınavların önemi ortaya çıkmaktadır. Nitekim PISA web sitesindeki resmi verilere göre, 2000'li yıllarda Almanya ve Brezilya PİSA sınavında OECD ülkelerinin ortalamasının altında puan almasına rağmen bu belirtilen ülkelerdeki eğitim uzmanlarının ve politika yapıcıların ortak çalışması sonucu eğitim sistemleri geliştirilmiş ve vatandaşlarının nitelikli eğitime erişimleri kolaylaştırılmıştır.

Ekonomik Kalkınma ve İş birliği Örgütü (OECD) tarafından her üç yılda bir yapılan Uluslararası Öğrenci Değerlendirme Programı olarak da bilinen PİSA sınavı, aşağıda belirtilen ana boyutlardan oluşmaktadır (Savran, 2004):

- Okuduğunu anlama
- Matematik okuryazarlığı
- Fen bilimleri yazarlığı

Ana boyutların yanında, motivasyon ve problem çözme gibi temel beceriler de ölçülmektedir.

Yöntem

Model ve Desen

Makalelerden toplanan verileri açıklayabilmek üzere nitel araştırma yöntemlerinden durum çalışması deseni kullanılmıştır. Durum çalışması; tek bir durum ya da olayın derinlemesine boylamsal olarak incelendiği, verilerin sistematik bir şekilde toplandığı ve gerçek ortamda neler olduğuna bakıldığı bir yöntemdir. Elde edilen sonuçlarla olayın neden o şekilde oluştuğu ve gelecek çalışmalarda nelere odaklanılması gerektiğini ortaya koyar (Davey, 1991).

Araştırmanın Çalışma Grubu

Araştırmanın çalışma grubu oluşturulurken kolay ulaşılabilir örnekleme yönteminden yararlanılmıştır. Singleton ve Straits (2005), çalışmalarında kolay ulaşılabilir örnekleme yöntemini, araştırmacının hali hazırda var olan öğeler içerisinden yeterli miktardaki öğeyi örneklem olarak belirlemeyi sağlayan bir örnekleme yöntemi olarak tanımlamışlardır. Bu araştırmada da PİSA sınavındaki durumlarını anlatır en fazla veri toplanabilecek ülkeler araştırma kapsamına alınmıştır. Araştırma kapsamında incelenen araştırmalar Google

Akademik aracılığıyla belirlenmiştir. Makalelerin seçilme kriterleri olarak şu hususlar dikkate alınmıştır:

- Makalelerin Türkçe veya İngilizce yayınlanmış olması,
- PİSA sınavında ortalamanın üstünde başarı sağlamış ülkelerle ilgili olması,
- Makalelerin yayın yıllarının 2004-2023 yıllarını kapsaması olarak ifade edilebilir.

Çalışmanın amacına uygun olmadığı tespit edilen makaleler inceleme dahilinde tutulmamıştır. Arzu edilen miktarda veri toplayabilmek adına diğer ülkelerin PİSA sınavı kapsamında elde ettikleri sonuçlar dahil Türkiye'nin durumu hakkında bilgi verebilen çalışmalar incelenmeye alınmıştır. Makalelerde elde edilen bilgiler doğrultusunda ülkeler hakkında daha detaylı bilgilere ulaşmak adına ilgili ülkenin resmi sayfası üzerinden raporlar da incelenmeye alınmıştır.

Tarama sürecinde Türkçe makalelerden yararlanılmış olsa da özellikle İngilizce OECD countries, PISA exam, national reports, comparative education olmak üzere çeşitli anahtar kelimeler aracılığıyla araştırma yapılmıştır.

Araştırma evreni PİSA sınavı ile ilgili yayımlanan Türkçe makaleler oluşturmaktadır. Örneklem olarak ise şu dergilerde yayımlanan makalelerden yararlanılmıştır; Çağdaş Yönetim Bilimleri Dergisi, Manas Sosyal Araştırmalar Dergisi, Bilgi Sosyal Bilimler Dergisi, Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi, Türk Eğitim Bilimleri Dergisi, Uludağ Üniversitesi Eğitim Fakültesi Dergisi, Akademik Bilişim Dergisi, Electronic Turkish Studies, Journal of STEAM Education, Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi, Buca Eğitim Fakültesi Dergisi, E-International Journal of Pedandragogy olarak sıralanmaktadır.

Verilerini Analizi

Araştırma kapsamında elde edilen veriler içerik analizi ile analiz edilmiştir. İçerik analizi, metin içinde tanımlanan belirli karakterlerden sistematik ve tarafsız sonuçlar çıkarmak için kullanılan bir araştırma tekniğidir (Stone vd., 1996). Krippendorff (2018) "İçerik analizi: Metodolojisine bir giriş" isimli kitabında içerik analizini Webster sözlüğünden alıntılayarak şöyle açıklamıştır: Bir iletişim materyalinde (bir kitap veya film gibi) bulunan tema ve sembolleri gruplandırarak, sayarak ve anlamını ve olası etkisini değerlendirerek analiz etme sürecidir. Bu çalışma kapsamında ülkelere ilişkin veriler dört ana grupta incelenmiştir ve toplanan bilgiler ışığında ilgili ülke bölümünde yer verilmiştir.

Bu çalışma kapsamında ilişkili bilgiler içerik analizi yöntemi göz önüne alınarak sınıflandırılmış olup yapılan araştırmalarda vurgulanan bilgiler analiz edilmiştir.

BULGULAR VE YORUMLAR

Bu bölümde incelenen çalışmalar sonucunda Çin, İngiltere, Japonya, Güney Kore, Norveç, Finlandiya, Singapur ve Rusya gibi ortalama üstünde başarı sağlayan ülkelerin PİSA sonuçlarına etki eden etmenler hakkında değerlendirmelerde bulunulmuş olup ülkelere ilişkin bilgiler ülkemiz Türkiye ile karşılaştırılarak aşağıda sunulmuştur.

Çin

Dünyanın en kalabalık nüfusu olan ve en büyük eğitim sistemine sahip olan Çin, PİSA sınavına ilk kez Şangay ile girmiş ve birinci sırada yer almış olup, ülkenin nüfusunun fazla olduğu kıyı alanlarında kırsal kesimlere bakarak ciddi farklılıklar gözlemlenmektedir (Ministry of Education MOE, 2018a; Tanrısevdi & Kıral, 2018). Sosyo-ekonomik olarak yüksek statüde olan Şangay, Jiangsu, Guangdong ve Pekin gibi eyaletlerde katılım gösteren öğrencilerin özellikle matematik ve fen bilimleri testinde Türkiye'nin çok daha ilerisinde başarı kazandıkları çalışmalarca ortaya konmuştur (Tanrısevdi & Kıral, 2018). Türkiye ve Çin'in arasındaki farklılıkların belirgin olmasının bir sebebi sınava giren öğrencilerin sahip olduğu bölgeler arasındaki farklılıklar olduğu gibi okul müdürleri arasındaki çarpıcı farklılıklar da gösterilebilir. Nitekim, Çin'de görevlerine atanmış müdürlerin hepsi eğitim ve psikoloji gibi alanlarda yetkinlik gösteren yüksek lisans sahibi uzmanlardır. Aynı zamanda öğretmen değerlendirmeleri belirli formlar aracılığıyla sağlanmakta olup öğretmenlere değerlendirme sonuçlarına göre terfi, ödüllendirilme ve promosyon verilmektedir. Bu durum bizlere öğretmenlerin mesleki yeterliliklerinin arttırılması konusunda önem verildiğini göstermektedir (Maya & Yılmaz, 2017). Temel öğretmen eğitimi iki yıl ön lisans eğitiminden sonra lisans eğitimi ile verilmektedir (Kadınşah vd., 2023). Öğretmenliğe yeni başlayan genç öğretmenler, üç yıl boyunca kendilerinden daha tecrübeli meslektaşları tarafından gözlem, öğretim durumları, yöntem-teknik ve sınama durumları açısından desteklenmektedir (Kadınşah vd., 2023).

İngiltere

PISA ve TIMMS gibi uluslararası sınavlarda adını duyuran ülkelerden biri olan İngiltere'nin eğitim felsefesi ilerlemeciliktir (Aydın, 2012). Teknolojinin eğitimde büyük bir rolü olduğuna inan İngiltere, 2003-2005 yılları arasında ilk ve ortaöğretim kademelerinde eğitim kurumlarını teknolojiyle donatmak adına 50 milyon poundluk bütçe ayırmıştır. Bununla birlikte öğrencilerin çağın bilgi ve donanımına sahip olabilmeleri için kodlama, programlama ve eğitim teknolojilerinin etkin kullanımına önem vermektedirler (Lai, 2010; Özerbaş & Safi, 2021).

Okul öncesi eğitimle birlikte konuşma, yazma, okuma, dinleme, matematik ve fen alanlarında resmi sınavlar yapılmaktadır. Ancak, İngiltere eğitim sisteminde en belirleyici rol GSCE

(General Certificate of Secondary Education) üstlenmektedir. Bu sınavla ve diğerleri ile öğrencilerin hangi seviyede eğitim alacakları ve hangi üniversiteyi tercih edecekleri belirlenmektedir (Eurybase, 2010). Temel öğretmen eğitimi lisans eğitimi boyunca ve pratik eğitimi ise lisans eğitiminin son iki yılının her haftasında verilmektedir (Kadınşah vd., 2023). Öğretmenlik mesleğine başladıktan sonra üniversite hocaları ve danışman gözetiminde bir yıl süren staj eğitimi zorunludur (Kadınşah vd., 2023).

Japonya

Meiji restorasyonu ve II. Dünya Savaşı zamanlarından itibaren yapılan eğitim reformlarıyla ülkede köklü değişiklikler başaran Japonya, günümüz eğitim sistemleri arasından en yüksek standardı yakalamayı başarmış nadir ülkelerden biridir ve en yüksek okuma yazma oranlarından birine sahip olan bir ülkedir (OECD, 2015). Japonya'nın bu standardı ve başarıyı yakalamasında en büyük etken her 10 yılda bir yaptığı eğitim planlamaları olmaktadır. Merkeziyetçi bir yapıyı benimseyen Japonya'nın bu planlamaları ise Eğitim, Kültür, Spor, Bilim ve Teknoloji Bakanlığı (MEXT) tarafından yapılmaktadır (Aoki, 2017). Parvanova (2013)'dan alıntılama yapan Maya ve Yılmaz (2017)'ye göre, okulların değerlendirmesi öncelikle öz değerlendirmesi, okul paydaşlarının değerlendirmesi ve dışsal değerlendirme olmak üzere üç ana aşamadan yapılmaktadır. Bu değerlendirmelerde özellikle toplumun istek ve ihtiyaçları ön plana alınır ve velilerin ve öğrencilerin öz değerlendirme formlarıyla süreçte aktif oldukları görülmektedir (Maya & Yılmaz, 2017). Bu değerlendirmeler sonucunda öğretmenler terfi edilmekte ya da promosyon almaktadırlar. Öte yandan, Japonya'da 2009 yılında konulan bir kanuna göre, her on yıldan sonra öğretmenlerin pedagojik formasyonlarını yenilemeleri gerekmektedir (Akiba, 2013). Dünyada en önemli teknoloji devlerinden biri olan Japonya amaçladığı ideal insanı olan teknoloji okuryazarı vatandaşlarını yetiştirmek adına eğitim programlarına yapay zeka, kodlama ve robotik dersi içeren çeşitli sayıda teknoloji esaslı dersleri eklemiştir (Özerbaş & Safi, 2021). Ölçme ve değerlendirme aşaması ise etkinlik ve kısa sınavlar aracılığıyla yapılmaktadır (Türkoğlu, 1998).Dört yıllık lisans eğitiminin son döneminde dört-beş hafta olarak verilen öğretmen uygulaması dersleri ile yeni başlayan öğretmenlere deneyim kazandırılması hedeflenmektedir (Kadınşah vd., 2023). Okul idarecileri için de çeşitli düzenlemelere sahip olan Japonya'da 20 yılı başarılı bir öğretmen olarak tamamlayan öğretmenler müdür yardımcısı olurken, müdür olmak içinse 5 yıl müdür yardımcılığı yapmış olmak gereklidir (MEXT, 2021b; Yavuz & Çakır, 2022).

Güney Kore

Eğitim alanında merkeziyetçi bir politika izleyen Güney Kore, her üç yılda bir gerçekleştirdiği okul değerlendirmelerini uzmanlar, yirmi yıllık deneyime sahip öğretmenler, okul müdürleri, müdür yardımcıları, denetçiler, araştırmacılar, üniversite öğretim üyeleri ve genel yönetim personeli aracılığıyla edinip bu okul değerlendirmelerini eğitim sistemlerinin kalitesini ve başarısını arttırmada önemli bir etmen olarak görmektedir (Maya & Yılmaz, 2017). Özellikle merkezi hükümet ve il eğitim ofisleri birlikte ve uyumlu bir şekilde çalışarak planlamalarını günlük hayattaki uygulamalardan ve okullardan toplanan bilgiler doğrultusunda analiz ederek geliştirilir (KEDI, 2010). Aynı zamanda, öğretmen yeterlilikleri ve iş performansı, okul müdürü, müdür yardımcıları, meslektaşları tarafından da değerlendirilmektedir (Maya & Yılmaz, 2017). Öğretmen yetiştirme uygulaması Türkiye'ye benzeyen Güney Kore'de öğretmen adayları lisans eğitimleri süresince beş kredilik dersleri boyunca staj eğitimi almaktadır (Kadınşah vd., 2023). Zorunlu stajyerlik eğitimi olmayan Güney Kore'de diplomasını alan öğretmenler atanabilme imkanları bulunmaktadır. Atandıktan sonra bulundukları okul ve profesyonel ağ gereği mesleki gelişim gerekmektedir (Kadınşah vd., 2023). Okul idarecilerinde de benzer şartlar aranmaktadır. Nitekim, okul müdürü ve müdür yardımcısı olmak için yüksek lisans ve doktora gibi tecrübe de belirleyici olmaktadır (Yavuz & Çakır, 2022).

Norveç

Her ne kadar 2012 yılında ülke anayasasındaki ülkenin benimsediği belirli bir dinin olmadığı şeklinde değiştirse de Norveç, özellikle din eğitiminin milli eğitim müfredatında özellikle Luteran perspektifinden verilmesi AB İnsan Hakları Mahkemesinin uyarısıyla daha nesnel bir anlatıma geçmiştir (Macaulay, 2021). Norveç eğitim sistemi öğretmenler arasında iş birliğinin önemini vurgularken toplum için hedeflediği ideal bireylerin düşünsel ve entelektüel olarak gelişmiş olması olarak belirtmektedir (Özerbaş & Safi, 2021). Ancak özellikle dini değerlere önem veren gelecek nesillerin yetişmesi adına Hristiyan öğretilerinden, İncil betimlemelerine yer verilmesi Norveç'teki eğitim sisteminin ne kadar laik ve evrensel değerlere özellikle eşitlik ilkesine bağlı kaldığı bağlamında incelemeye değerdir (Özerbaş & Safi, 2021). Caballero (2017) yayımlanan haber metninde Norveç Kilisesi ve Norveç hükümetinin yaklaşık 500 yıllık bir birlikteliğin ardından 2017 yılının başında yollarını ayırmaya hazırlandığını belirtmiştir. Türk eğitim sistemi ile farklılığı konusunda özellikle dikkat çekicidir ki, II. Mahmut döneminde 1824 yılında zorunlu eğitime geçen ülkemize karşısında Norveç 1937 yılında zorunlu eğitimi kabul etmiştir. Bir başka şaşırtıcı nokta ise 2012 yılına kadar herkesin kiliseye üye olması

zorunluluğunun varlığı Norveç hakkında şaşırtıcı detaylardan birkaçıdır (Özerbaş & Safi, 2021). Ancak unutulmamalıdır ki, Norveç varoluşçu teoloji ve yapılandırmacılık felsefelerini birleştiren bir ülke konumundadır. Anayasal olarak öğrenenlerin eğitim hakları gerek yaşamboyu öğrenme açısından hem de zorunlu eğitim açısından korunmuş olmakla beraber, eğitime büyük miktarda fonlar ayıran Norveç herkes için eğitim anlayışı benimsenmiştir. Söz gelimi, okulların genel yapısı açısından ele alındığında bütün öğrencilerin teknolojik olanakları eşit bir şekilde erişim sağlayabildikleri görülmektedir ve her dersin kendine ait sınıfı bulunmaktadır. Birinci ve ikinci sınıf kademesinden yedinci sınıfa kadar zorunlu sınavların yapılmadığı Norveç'te üçüncü kademede yer alan sekizinci ve onuncu sınıflarda not verme amaçlı sınavlar yapılmaktadır (Özerbaş & Safi, 2021). En düşük notun bir ve en yüksek notun altı olarak aşamalandırıldığı Norveç'te üçüncü kademe sonrasında ülke genelinde bir değerlendirme yapılmaktadır (European Commission, 2020; Özerbaş & Safi, 2021). Dört yıllık lisans eğitimine ek olarak bir yıl alan eğitimi gerektiren Norveç öğretmen yetiştirme uygulamaları ile lisans eğitiminin her yılında en az yüz olması planlandırılır ve zorunlu bir staj eğitimi bulunmamaktadır (Kadınşah vd., 2023).

Finlandiya

Snellman'ın yönetimi altında, bir refah devleti olan Finlandiya önemli eğitim reformları gerçekleştirmiştir. Yaşam boyu öğrenme fikrini benimsemiş olan Finlandiya, Eğitim ve Kültür Bakanlığı'nın çabalarıyla gençlik politikaları, spor, bilim ve kültür -özellikle eğitim alanında- geliştirmekle sorumludur. Bakanlık, toplumun her üyesinin tam potansiyeline ulaşmasını ve kendi potansiyelini gerçekleştirmesini sağlamak için eğitim ve kültür hizmetleri, kişisel gelişim fırsatları ve uluslararası iş birliği sunmaktadır (EDUFI, 2022). Finlandiya dünyadaki en iyi eğitim politikalarından bazılarına sahip olmasına rağmen, öğretmen nitelikleri ve okul niteliklerinde hala bazı eşitsizlikler bulunmaktadır. Örneğin, Avrupa Komisyonu ve PISA 2012 sonuçlarına göre Finlandiya'da her beş öğrenciye bir bilgisayar düşmektedir (Özerbaş & Safi, 2021). Benzer şekilde, Finli eğitimciler arasında teknoloji kullanımı ve bilgisayar tabanlı araçların öğrenme ortamlarına entegrasyonu konusunda önemli farklılıklar bulunmaktadır. Finlandiya eğitim sistemindeki değerlendirme aşaması, farklı eğitim girdilerini ve kurumlarını karşılaştırmaktan ziyade büyüme ve gelişmeye odaklanmakta; rekabetten ziyade iş birliği ve ekip çalışması üzerine inşa edilmektedir. Üç yıllık bir lisans programını iki yıllık bir yüksek lisans programının takip ettiği Finlandiya'da, üniversite fakülteleri ve öğretmen yetiştiren kurumlar yakın iş birliği içindedir ve her bir üniversite kendi öğretim üyelerini yetiştirmek için uygulama okullarını kullanmaktadır (Kadınşah vd., 2023). Yüksek lisans derecesini aldıktan

sonra adaylar, bir danışman öğretmenin ve üniversitenin rehberliğinde isteğe bağlı olarak bir yıllık staj yapmayı tercih edebilirler (Kadınşah vd., 2023).

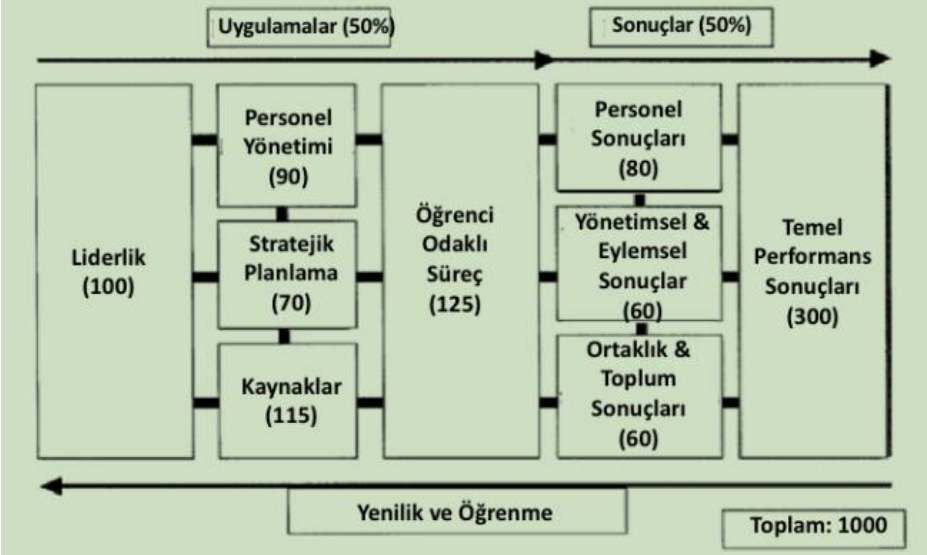
Çelen ve diğerleri (2011) Finlandiyalı öğrencilerin başarısına katkıda bulunan faktörleri kapsayan dört ana başlık belirlemiştir:

- Öğretmen hazırlama programı
- Geleneksel okullaşma
- Öğretimin kültürel statüsü
- Hizmet içi öğretmenler için eğitim

Singapur

Öğrencilerin sahip oldukları gizil güçlerini ve potansiyellerini en üst düzeyde kullanabilmelerini hedefleyen Singapur, 2016 yılındaki PİSA sınavında ölçülen ülkeler arasında birinci sıraya yükselmiştir (OECD, 2018). Singapur ve Finlandiya eğitim sistemlerini incelediğimizde bu iki ülkenin eğitim çıktılarının da pek çok açıdan benzediği görülmektedir. Nitekim, 1997 yılında eğitim çıktılarına ilişkin hedeflerini belirleyen Singapur'un hedefleri ile kendisine yol gösterici olarak belirlediği Finlandiya arasında eğitim programlarının temelinde yatan ana becerilerin ciddi benzerliklere sahip olduğu dikkat çekicidir. Söz gelimi, Singapur eğitim sistemi kendini tanıyan, eleştirel düşünebilen, etkili iletişim kurabilen bireylerin yanı sıra sorgulayan, takım çalışmasını başarılı bir şekilde gerçekleştirebilen ve yenilikçi vatandaşların yetiştirilmesini amaçlamaktadır. Çok uluslu bir etnik yapıya sahip olan Singapur'da eğitim ücretsizdir ve zorunlu eğitime 6-15 yaşları arasında gerçekleştirilir (Özerbaş & Safi, 2021). Bilişim teknolojilerinden eğitim durumlarının her aşamasında ve öğretmenlerin iş birliği boyutunda da yararlanmayı amaçlayan Singapur eğitim sisteminde, ilgili paydaşların dizüstü bilgisayarlar, masaüstü bilgisayarlar, tabletler, cep telefonları gibi teknolojik araçlar arasından hangilerinden yararlanmak istediği ve onların isteklerine göre planlaması yapılmaktadır. Böylece, okullar öğretmenlerin kararlarıyla hangi programları, yazılımları ve hangi çevrimiçi platformu kullanacakları konusunda aktif bir karar verici olarak görülmektedir (Özerbaş & Safi, 2021). Eğitim sisteminde kodlama, robotik ve 3D teknolojisi gibi dersleri dahil etmekte olan Singapur, teknoloji okuryazarı vatandaşlar yetiştirmeyi amaçlamaktadır (Zhao, 2017). İlkokul bitirme sınavı (PSLE) zorunlu olan Singapur eğitim sisteminde öğrenciler hiyerarşik olarak normal (teknik), normal ve akademik yeteneklilikler olarak üç ana kategoride sınıflandırılırlar (Özerbaş & Safi, 2021).

Şekil 1: Okul Mükemmellik Modeli Kategorileri ve Kalite Kriterleri



Kaynak: Okul Mükemmellik Modeli (Pak Tee, 2003; Maya & Yılmaz, 2017)

Singapur eğitim sisteminin başarısının sürdürülebilir kılan en önemli etmenlerden biri okul mükemmellik modelini benimsemiş olmasıdır. Okul mükemmellik modeli ile okulların eksiklikleri planlı bir şekilde incelenir ve eğitimin her bir boyutuna ilişkin çalışmaları bütünsel ve nesnel olarak değerlendirme sağlanır. Buna ek olarak, uzmanlarca başarılı olarak belirlenen okullara çeşitli ödüller verilir (Maya & Yılmaz, 2017). Aynı zamanda, öğretmenlerin bireysel olarak değerlendirildiği ve bu değerlendirmelerde başta öğretim faaliyetleri olmak üzere veli ve öğrenci görüş ve düşünceleri de etkili olmaktadır (Maya & Yılmaz, 2017). Öğretmen yetiştirme modeli Türkiye'deki modele benzeyen Singapur, dört yıllık lisans eğitimi boyunca ilk iki yıl sınıflarda gözlem ve son iki yıl aktif ders anlatımı gerektirmesi özelliğinden ülkemizden farklılaşmaktadır (Kadınşah vd., 2023). İş garantili meslek olarak ilan edilen Singapur'da, öğretmenlerin eğitim bakanlığı tarafından düzenlenen çalıştaylara ve eğitimlere katılma hakkı ve zorunluluğu bulunmaktadır (Kadınşah vd., 2023). Dünya standartlarında öğretmen yetiştirmek amacıyla Singapur Milli Eğitim Enstitüsü, Eğitimde Liderlik Programı (LEP) ve Okullarda Yönetim ve Liderlik Programı (MLS) programları oluşturulmuştur (NIE).

Rusya

Tarihinde köklü değişikler geçirmiş devletler arasında olan Rusya, özellikle ideal insan olarak siyasal ideolojisi olan sosyalizmi temel alan yurttaşların yetişmesini amaçlamaktadır. Bu bağlamda sosyalist görüşü temel alan ve bilişsel yapılandırmacılığı ortaya atan J. P. Piaget'ye karşı çıkan L. S. Vygotsky'nin Sosyo-Kültürel Gelişim Kuramı ile Rusya'da dil ve kültür olgularının işlevselliğine dayalı bir eğitim sistemi oluşturulmuştur (Aydın, 2012).

Eğitim programına dahil ettiği her kitabın online ortamlarda erişimini sağlayan Rusya Eğitim ve Bilim Bakanlığı'nın 2025 yılına kadar gerçekleştirmeyi hedeflediği bazı projeler aşağıdaki gibidir:

- Rusya Federasyonu'nda Modern Dijital Eğitim Ortamı Projesi: Eğitimin dijitalleşmesini sağlayarak 2025 yılına kadar 11 milyon öğrencinin çeşitli alanlarda dersler alması ve uzmanlaşmasıdır.

- İleri teknolojiler için çalışanlar: Amacı rekabete dayanan orta mesleki eğitim sistemi sağlayarak yüksek nitelikli uzman ve işçi gücü aracılığıyla modern standartlara ve ileri teknolojilere uygun eleman yetiştirmektir.

- İnovasyon yaratma alanı olarak üniversiteler: Amacı sürdürülebilir küresel rekabetçiliği sağlamak adına Rus üniversitelerinin niteliklerini ve kalitelerini arttırmaktır.

İlkokula başlayan öğrencilerin entelektüel seviyelerinin ölçülmesinin ardından ortaöğretim sonunda ortak devlet sınavı yapılmaktadır, bu sınavın sonucu ile öğrencilerin yüksek öğretime yerleşmeleri sağlanmaktadır (Çelik, 2015).

Türkiye

Türkiye, eğitim girişimlerini denetlemek için MEB yapısını kullanmakta olup politikaları için merkezi bir yapı benimsemektedir. Eğitimde teknolojiyi kullanmak ve okul temelli eşitsizlikleri ortadan kaldırmak için "Temel Eğitim Projesi", "Gelecek için Intel Eğitim" ve "FATİH Projesi" gibi girişimler kurulmuştur. Türkiye, genç nüfusun çokluğu nedeniyle 2018 yılında sınav odaklı bir sisteme geçmiştir ve TYT ve AYT olmak üzere iki aşamalı yükseköğretim sınavları düzenlenmektedir (Özerbaş & Safi, 2021).Gerçek anlamda çözüme kavuşturulmamış sorunları ele almak için aceleyle alınan kararlar nedeniyle Türk eğitim sistemi henüz istenilen düzeye ulaşamamıştır. Gerçekte, OECD ülkeleri arasında ortalamanın altında bir performans sergileyen Türkiye, başarılı ülkelerin eğitim yaklaşımlarını inceleyerek ve hem öğrencilerin hem de okulların ihtiyaçlarını karşılamak için gerekli esnekliğe izin vererek eğitim girişimlerini modernize etmelidir (Özerbaş & Safi, 2021). Güncelliğini yitirmiş bir kaynak olarak kabul edilse de Savran'ın (2004) önerileri göz ardı edildiği için aynı hatalar hala geçerlidir:- Öğrencilerin gelişim görevleri ışığında, müfredat güncellenmeli ve şiir ezberleme gibi teknikler küçük yaşlarda seçilmemelidir (Savran, 2004). Bunun sonucunda çocuklar kaçınılmaz bir başarısızlık duygusuyla büyüyebilirler. Özellikle fen ve matematik derslerinde öğretim, daimici ve özcü bir bakış açısı yerine deney, gözlem ve sorgulama üzerine kurulmalıdır (Savran, 2004).
- Öğrencilerin ilgi ve ihtiyaçlarına göre öğretim materyalleri çoklu zeka kuramı ışığında çeşitlendirilmelidir (Savran, 2004).

Sınav odaklı eğitim sistemimizin ve ezberciliğin, diğer ülkelerin ihtiyaç duyduğu eleştirel düşünme ve sorgulama becerilerine sahip öğrenciler yetiştirmekte başarısız olduğu açıktır. PISA ve LGS gibi sınavların aynı bilişsel becerileri ölçmemesi ve okuduğunu anlamanın iki sınavın birbirinden önemli ölçüde farklılaştığı bir alan olması bu durumun temel nedenlerinden biridir (Çiçek & Dilekçi, 2022). Benzer şekilde, derslerdeki ezber algısı ve matematik dersine yönelik duyuşsal engellerin yaygınlığı, PISA sınavının matematik bölümündeki başarısızlığının altında yatan nedenlerdir (Güler, 2013). Ayrıca, Ceylan'ın (2009) çalışmasından yola çıkan Çelen ve diğerlerine (2011) göre, Türkiye'de yüksek başarı gösteren okullardaki öğrenciler günlük yaşamda daha iyi performans göstermekte ve bu da eğitim programlarındaki canlılık kavramıyla örtüşmektedir. Türkiye, bir kez daha, fen bilimlerinde ortalamanın çok altında puan almıştır.Aradan geçen zamana rağmen çalışmalar arasındaki boşlukların giderilememiş olması talihsiz noktalardan biridir. Örneğin; Savran (2004) ile Çiçek ve Dilekçi'nin (2022) çalışmaları bu durumu açıkça göstermektedir. Benzer şekilde, Güler'in (2013) SBS sınavı üzerine yaptığı çalışma, sınavların isimleri değişse de içeriklerinin ve başarılarının gelişmediğini ortaya koymaktadır. Anıl'ın (2009) fen bilimleri sınavı için Çelen ve diğerlerinden (2011) aktardığına göre, babanın eğitim durumu bu durumun nedenlerinden biridir. Başarı, sosyoekonomik durumun yanı sıra okulların bölgesel konumlarından da etkilenmektedir (Çelen vd., 2011).Dünya Bankası'nın (World Bank) 2022 yılına dair paylaşılan verilerine göre Türkiye, dünyanın en büyük yirmi ekonomisinden biridir (World Bank, 2023). Daha önceki araştırmalarda ulusal eğitim harcamaları ile PISA puanları arasında bir bağlantı olduğuna dair kanıtlar bulunmaktadır. Bu ilişki, özellikle Finlandiya gibi ülkelerin GSYH ve eğitim harcamaları karşılaştırıldığında açıkça görülmektedir. Kılıçaslan ve Yavuz (2019) ise bu senaryoya katılmamış ve araştırmaları için ne kadar para harcadıklarından ziyade bu kaynakların nasıl kullanıldığının daha önemli olduğu sonucuna varmıştır. Eğitim Müfettişleri Başkanlığı, Türkiye'deki eğitim denetimi süreçlerini denetlemektedir. Saha uzmanları da rehberlik çalışmalarını denetler ve denetim grubu raporlarını gözden geçirir (Maya & Yılmaz, 2017). Eğitim kalitesinde hedeflenen standarda ulaşılması, denetim sonuçlarının şeffaf ve sürekli bir şekilde kamuoyuna, şehre ve ilgili mahalleye duyurulmasıyla büyük ölçüde desteklenebilir.

Araştırma Kapsamında yer alan Ülkelerin Eğitim sistemine ait Bulguların Karşılaştırılması

İçerik kapsamına göre incelenen çalışmalar PİSA sınavında ortalama üstünde başarı sağlayan ülkelerden Çin, İngiltere, Japonya, Güney Kore, Norveç, Finlandiya, Singapur ve Rusya olup bu ülkelere ilişkin bilgiler gruplandırılarak aşağıdaki çizelgede sunulmuştur.

Çizelge 1: **Araştırma Kapsamında yer alan Ülkelerin Eğitim sistemine ait Verilerinin Karşılaştırılması**

	Eğitim Felsefesi	**Eğitim Projeleri**	**Öğretmen Yetiştirme Programları**	**Okul İdarecilerinin Yetiştirilmesi**
Çin	*	*	- Temel eğitim eğitimleri 2 yıl ön lisans eğitiminden sonra lisans eğitimi ile verilmektedir (Kadınşah vd., 2023).	- Görevlerine atanmış müdürlerin hepsi eğitim, psikoloji gibi alanlarda yetkinlik gösteren alanlarda uzmanlardır (Maya & Yılmaz, 2017).
İngiltere	İlerlemecilik (Aydın, 2012).	- 2003-2005 yılları arasında eğitimde teknoloji yatırımına £50 milyon bütçe ayırmıştır (Lai, 2010; Özerbaş & Safi, 2021).	- Temel öğretmen eğitimi lisans eğitimi boyunca ve pratik eğitimi ise lisans eğitiminin son iki yılının her haftasında verilmektedir. Ek olarak, mesleğe başladıktan sonra üniversite hocaları ve danışman hocalar gözetiminde bir yıl süren staj eğitimi zorunludur. (Kadınşah vd., 2023).	*
Japonya	*	- Her 10 yılda bir eğitim planlamaları yapılmaktadır (Aoki, 2017).	- Dört yıllık lisans eğitiminin son döneminde dört-beş hafta olarak öğretmen uygulaması dersleri verilmektedir (Kadınşah vd., 2023).	- 20 yılı başarılı bir öğretmen olarak tamamlayan öğretmenler müdür yardımcısı olurken, müdür olmak için 5 yıl müdür yardımcılığı yapmış olmak gereklidir (MEXT, 2021b).
Güney Kore	*	- Merkezi hükümet ve il eğitim ofisleri birlikte çalışarak planlamalarını günlük hayattaki uygulamalardan ve okullardan toplanan bilgiler doğrultusunda analiz ederek geliştirilir (KEDI, 2010). Her üç yılda bir gerçekleştirdiği okul değerlendirmelerini	- Öğretmen adayları lisans eğitimleri boyunca beş kredilik dersleri boyunca staj eğitimi almaktadır (Kadınşah vd., 2023). - Zorunlu stajyerlik eğitimi yoktur. - Diplomasını alan öğretmenler atanabilme imkanları bulunmaktadır, atandıktan sonra	- Okul müdürü ve müdür yardımcısı olmak için yüksek lisans ve doktora gibi tecrübeler belirleyici olmaktadır (Yavuz & Çakır, 2022). - Okul idarecilerinin görev kapsamında, öğretmen yeterlilikleri ve iş performansını değerlendirilme

		gerçekleştirilmektedir (Maya & Yılmaz, 2017).	bulundukları okul ve profesyonel ağ gereği mesleki gelişim gerekmektedir (Kadınşah vd., 2023).	bulunmaktadır (Maya & Yılmaz, 2017).
Norveç	Varoluşçu teoloji ve yapılandırmacılık felsefelerini birleştiren bir ülkedir.	*	- Dört yıllık lisans eğitimine ek olarak bir yıl alan eğitimi gereklidir. - Öğretmen yetiştirme uygulamaları ile lisans eğitiminin her yılında en az yüz olması planlanır ve zorunlu bir staj eğitimi bulunmamaktadır (Kadınşah vd., 2023).	*
Finlandiya	Yapılandırmacılık	*	- Üç yıllık lisans eğitiminin ardından iki yıl yüksek lisans eğitimi gereklidir. - Her üniversitenin uygulama okulları vardır (Kadınşah vd., 2023). - Yüksek lisans eğitimi sonrasında isteğe bağlı bir yıl üniversite ve danışman hoca gözetiminde staj yapılabilmektedir (Kadınşah vd., 2023).	*
Singapur	Yapılandırmacılık	- Eğitimde teknolojiden yararlanmayı misyon edinen Singapur'da bilgisayarlar, tabletler, cep telefonları gibi teknolojik araçlar arasından hangilerinden yararlanmak istenildiği okulların ve öğretmenlerin isteğine bırakılmaktadır (Özerbaş & Safi, 2021). - Kodlama, robotik ve 3D teknolojisi gibi dersler ile teknoloji okuryazarı vatandaşlar yetiştirmeyi amaçlamaktadır (Zhao, 2017). - Eğitimde Liderlik Programı (LEP) - Okullarda Yönetim ve Liderlik Programı (MLS) programları oluşturulmuştur (NIE).	- Öğretmenlerin eğitim bakanlığı tarafından düzenlenen çalıştaylara ve eğitimlere katılma hakkı ve zorunluluğu bulunmaktadır (Kadınşah vd., 2023).	*
Rusya	Sosyalist görüşü temel alan ve Vygotsky'nin Sosyo-Kültürel Gelişim Kuramı ile Rusya'da dil ve kültür olgularının işlevselliğine dayalı bir eğitim sistemi	- Modern Dijital Eğitim Ortamı Projesi - İleri teknolojiler için çalışanlar için projeler - İnovasyon yaratma alanı olarak üniversiteler	*	*

	oluşturulmuştur (Aydın, 2012).			
Türkiye	*	- Temel Eğitim Projesi - Intel Gelecek için Eğitim - FATİH Projesi	*	- Okul idarecilerinin belirlenmesi adına yazılı sınav gereklidir. -Maarif Müfettişleri Başkanlığı aracılığıyla yürütülmekle birlikte denetim grupları raporları incelenmektedir ve aynı zamanda alan uzmanları tarafından rehberlik çalışmaları denetimi yapılmaktadır (Maya & Yılmaz, 2017).

* İncelenen makaleler kapsamında bu bilgiye erişilememiştir.

SONUÇ ve TARTIŞMA

Ülkelerin etkileşiminin arttığı günümüzde devletlerin eğitim politikalarının uluslararası sınavlarda başarılı bir noktada olan ülkelere dayanarak kendi eğitim bağlamlarına aktarmaları hayati bir rol oynamaktadır. Bu çalışma Uluslararası Öğrenci Değerlendirme Programı (PISA) sınavında her ülkenin sonuçlarını etkileyen değişkenlerin kapsamlı bir analizini sunmaktadır. Çin, İngiltere, Japonya, Güney Kore, Norveç, Finlandiya, Singapur ve Rusya gibi ortalamanın üzerinde performans gösteren ülkelere odaklanarak, çeşitli ülkelerin PISA sınavında ne kadar iyi performans gösterdiklerine ilişkin verilerin analizine odaklanmaktadır. Çalışma, bu ülkelerde kullanılan etkili stratejilere dayanarak, Türkiye'ye eğitim uygulamaları ve politikaları için içgörü ve öneriler sunmayı amaçlamaktadır. Öğretmen yetiştirme programları ve okul liderliği ile ilgili on iki farklı makaleden elde edilen verileri içeriksel olarak düzenlemek ve incelemek için araştırmada içerik analizi kullanılmıştır. 21. yüzyılın taleplerini karşılayabilmek için eğitimde eleştirel düşünme, sorgulama ve yenilikçi becerilerin nasıl geliştirilmesi gerektiği de bu çalışmada incelenen kaynaklarda vurgulanmaktadır. Müreffeh ülkelerin eğitim sistemlerine ilişkin sonuçlar ve analizler, Türkiye'nin eğitim sisteminde yapılabilecek iyileştirmeler hakkında aydınlatıcı bilgiler sunmaktadır. Türkiye'nin bu ülkelerdeki iyi örnekleri inceleyerek eğitim sisteminde uygulamaya koyması oldukça önemlidir. Genç nüfusu fazla bir ülke olarak Türkiye, eğitim sistemini kısa zaman içerisinde güncellemeli ve başta PISA sınavı gibi sınavlarda başarılı sonuçlar elde eden ülkeleri örnek alarak nitelikli hedefler yönünde ilerlemelidir.

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TARIHSEL AÇIDAN GÜNÜMÜZE RUSYA FEDERASYONUN AVRASYACILIK, ORTA DOĞU VE AKDENİZ POLİTİKASINDA SURİYE ARAP CUMHURİYETİ

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Özet
Suriye Arap Cumhuriyeti Orta Doğu bölgesinde sahip olduğu önemli jeopolitik konumu gereği bağımsız olduğu 1946 yılından günümüze bölgede kilit rol oynamış bir ülkedir. Soğuk Savaş döneminde bölgedeki kritik konumu sebebiyle ABD ve SSCB arasında mücadele alanlarından biri olsa da kısa zaman diliminde Suriye Arap Cumhuriyeti SSCB ile ilişkilerine öncelik verdi. Özellikle, Orta Doğu coğrafyasındaki Mısır, Suriye ve Irak gibi devletlerde hükumet olan Arap milliyetçiliği ve Sosyalizm ideolojisinin hakim olduğu BAAS Partisi döneminde SSCB bölgede önemli güç olmuş ve bu devletler tarafından ABD öncülüğündeki Batı Bloğuna karşı doğal müttefik olarak görünmüştür. Suriye ile SSCB arasında ilişkiler Soğuk Savaş döneminde ilişkilerin en üst düzeye çıkması Suriye Devlet Başkanı Hafız Esat ile gerçekleşmiştir. Soğuk Savaş sonrasından günümüze kadarda Suriye hala SSCB'nin varisi olan Rusya Federasyonu tarafından Orta Doğu jeopolitiğine en önemli müttefiki görülmektedir. Özellikle, Akdeniz'in doğusunda yer alan Suriye Rusya için aynı zamanda Akdeniz'e çıkış kapısı olarak da görünmektedir. 2011 yılında başlayan ABD ve Batı destekli Arap Baharı ile beraber Orta Doğu coğrafyasının yeniden dizayn edilmesi sonucunda Rusya Suriye'nin kaybedilmemesi için 2011-2015 yılları arasında uluslararası arenada siyasi olarak desteklemiş, 27 Eylül 2015 tarihinde Suriye Hükumetinin davet ile bölgeye yerleşerek günümüze kadar devam eden yeni bir jeopolitik denklemi yaratmıştır.
Anahtar Kelimeler: *SSCB, Rusya Federasyonu, Suriye, Orta Doğu, Doğu Akdeniz*

SYRIAN ARAB REPUBLIC IN THE EURASIANISM, MIDDLE EAST AND MEDITERRANEAN POLICY OF THE RUSSIAN FEDERATION FROM HISTORICAL PERSPECTIVE TO THE PRESENT

Abstract
The Syrian Arab Republic is a country that has played a key role in the region since 1946, since its independence, due to its important geopolitical location in the Middle East region. Although it was one of the areas of conflict between the USA and the USSR due to its critical location in the region during the Cold War, the Syrian Arab Republic prioritized its relations with the USSR in a short period of time. Especially during the period of the Baath Party, which was dominated by the ideology of Arab nationalism and Socialism, which was the government in the states in the Middle East such as Egypt, Syria and Iraq, the USSR became an important power in the region and was seen by these states as a natural ally against the Western Bloc led by the USA. Relations between Syria and the USSR reached their highest level during the Cold War period with Syrian President Hafez Assad. After the Cold War until today, Syria is still seen as the most important ally of the Russian Federation in Middle East geopolitics by the Russian Federation, the heir of the USSR. In particular, Syria, located in the east of the Mediterranean, also appears to be a gateway to the Mediterranean for Russia. As a result of the redesign of the Middle East geography with the Arab Spring supported by the USA and the West, which started in 2011, Russia supported Syria politically point of view in the international area between 2011 and 2015 to prevent it from being lost. It has created a geopolitical equation.
Keywords: The USSR, The Russian Federation, Syria, Middle East, Eastern Mediterranean

Giriş

XX. yüzyıldan itibaren dünya üzerinde devam eden jeopolitik çatışmaların ana merkez bölgelerinden biri Orta Doğu coğrafyası olmuştur. Birinci Dünya Savaşı döneminde stratejik hedeflerden biri olan Orta Doğu coğrafyasının kaderi aslında Birinci Dünya Savaşı'nın bitişi sonrası Osmanlı İmparatorluğu'nun elinden çıkması ile değişti. Bölgede günümüze kadar devam eden sınır anlaşmazlıklarının temel sebeplerinden biri de 16 Mayıs 1916 tarihinde imzalanan Büyük Britanya ve Fransa arasında imzalanan Sykes-Picot antlaşması olduğunu da belirtmek gereklidir (Konu hakkında geniş bilgi için bkz: Barr, 2016). Birinci Dünya Savaşı sonrasında Fransa mandası altında kalan Suriye 1946 yılında bağımsızlığını elde ettikten sonra bölge jeopolitiğinde yeni dönüşümler yaşanmıştır. İkinci Dünya Savaşı sonrası dünyada mevcut olan 2 kutuplu düzen çerçevesinde uluslararası hareketlenmeler kendisini göstermekteydi. Kapitalist Batı Bloğunun lideri olan ABD ile Sosyalist Doğu Bloğunun lideri olan SSCB arasında jeopolitik mücadele farklı coğrafyalarda askeri, ekonomik, kültürel, ideolojik seviyede devam etmekteydi. Özellikle, iki süper gücün de nükleer silaha sahip olması sebebiyle iki devlet de birbirilerine karşı direkt savaş açmaktan çekinmekteydiler. Bu sebepten farklı bölgelerde devam eden mücadele alanlarından biri de Orta Doğu olmuştur. SSCB her ne kadar 14 Mayıs 1948 tarihinde kurulan İsrail'i ilk tanıyan devletlerden biri olsa da zamanla İsrail ve ABD yakınlığı sebebiyle Orta Doğu'da kendisine yeni müttefikler aramaya başlamıştır. Bu zaman SSCB yönetimi bölgede Suriye ile ilişkilerini güçlendirmeye karar verdi. Özellikle, Suriye'nin Akdeniz'in doğu bölgesinde denize çıkışı olması, Batı bloğu devleti olan Fransa'nın manda himayesinden kurtulması gibi faktörler SSCB'nin Suriye'ye yönelmesinde kritik faktörlerden biri olmuştur. Soğuk Savaşı yıllarında Orta Doğu'da Mısır ile Suriye gibi ittifaklarla bölgede güç sahibi olan SSCB Nasır sonrası Mısır'da hükumete gelen Enver Sedat'ın Batı ile ilişkilere öncelik vermesi gibi faktörler sebebiyle SSCB bölgede Suriye Arap Cumhuriyetleri ile ilişkilerini daha da artırdı. Özellikle, BAAS partisinin Suriye'de iktidarı SSCB için büyük fırsattı. Soğuk Savaş'ın bitişine kadar SSCB ve Suriye ilişkileri en üst düzey müttefiklik seviyesinde devam etmiştir.Soğuk Savaş sonrası SSCB'nin liderlik ettiği Sosyalist Doğu Bloğunun çökmesi ile beraber ABD'nin önderlik ettiği tek kutuplu dünya düzeni çerçevesinde yeni bir jeopolitik denklem yaranmıştır. Dönemin Suriye Devlet Başkanı Hafız Esat Batı ile ilişkileri iyileştirmeye çalışsa da, 2000'li yıllardan itibaren Hafız Esat'ın oğlu Beşşar Esat'ın devlet başkanı olmasıyla bu politika yeniden değişmiş ve Rusya Federasyonu ile ilişkilerine tekrardan önem ve öncelik veren bir dış politikayı esas almıştır. Beşşar Esat'ın dış politikada

böyle bir hamle yapmasına temel sebep ABD'nin 11 Eylül 2001 olayı sonrası Afganistan'a ve 2003 yılında da Irak'a yaptığı müdahale ana sebep olmuştur.

Son olarak 2011 yılında dünya üzerinde başlayan Batı destekli 'Arap Baharı' Arap coğrafyasında hız kesmeden yayılması sonucunda Suriye'de de halk ayaklanmaları başlamış ve ülke büyük bir iç savaş yaşamıştır. Bu zaman diliminde Suriye yakın çerçevede Rusya Federasyonu ve İran İslam Cumhuriyeti ile, uzun çerçevede de Çin Halk Cumhuriyeti ilişkilerini en yüksek düzeyde tutarak mücadelesini sürdürmüştür. 2011-2015 yılları arasında Beşşar Esat'ın başkanı olduğu Suriye hükumeti rejimini destekleyen Rusya 27 Eylül 2015 tarihinde Suriye Hükumetinin daveti ile resmen askeri olarak bölgede yerini almıştır. Bununla da bölgede yeni bir jeopolitik denklem yaranmış ve günümüze kadar etkileyici bir dönem devam etmiştir. Bu çalışmamızda ilk önce SSCB'nin Soğuk Savaş döneminde Suriye Arap Cumhuriyeti ile ilişkileri ele alındıktan sonra Rusya Federasyonu'nun Orta Doğu ve Akdeniz ekseninde Suriye politikalarını incelenecektir.

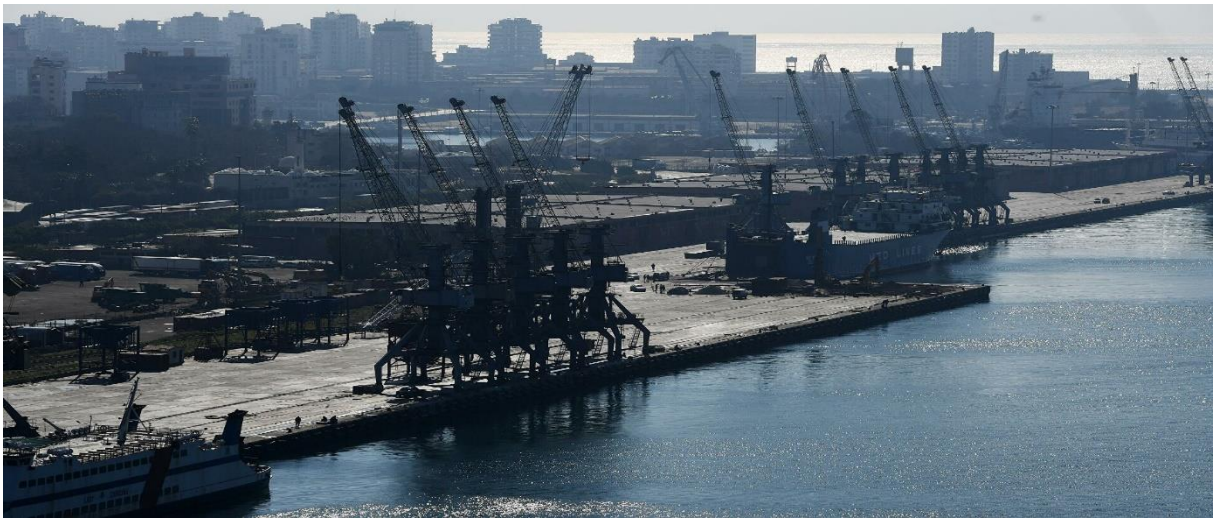
SSCB'nin Orta Doğu Politikasında Suriye Arap Cumhuriyeti'nin Önemi

İkinci Dünya Savaşı yıllarının sonunda dünyanın jeopolitik dengesi değişmeye başlamıştı. XIX. Yüzyıldan itibaren en büyük güç sahibi olan Büyük Britanya imparatorluğu her ne kadar İkinci Dünya Savaşı'nın galipleri arasında yer alsa da, savaş sonunda büyük bir darbe alarak artık elindeki hegemonya gücünü ABD'ye devretti. Yalnızca İngiltere değil aynı zamanda Avrupa'daki ülkelerde başta Fransa olmakla büyük bir jeopolitik yıkım yaşadılar. Bu dönemde ABD özellikle SSCB'nin Doğu Avrupa'ya yerleşmesi üzerine bölgeye müdahale ederek SSCB'nin Atlantik kıyılarına yerleşmesine izin vermedi. Almanya'yı karada durduran en büyük gücün SSCB olduğunu hem Avrupa, hem de ABD çok iyi bilmekteydi. Böyle bir ortamda artık ABD ve SSCB arasında bir mücadele başlayacağını tahmin etmek zor değildi.

İkinci Dünya Savaşı sonlarında özellikle Büyük Britanya ve Fransa mandaterliği altında olan bölgelerin bağımsızlık çabaları artmaktaydı. Bu bağımsızlık arayışına giren ülkelerden biri de Suriye idi. Birinci Dünya Savaşı sonrası Fransa mandaterliği altına düşen Suriye İkinci Dünya Savaşı'nın sonlarına kadar bağımsızlığına sahip olamadı. Ancak İkinci Dünya Savaşı'nın ilk başlarında 2 hafta gibi kısa sürede Almanya ordusuna yenilen Fransa büyük bir işgal dönemi yaşamıştır. Bu şartlar altında mandaterliği altında olan bölgeleri elinde tutamayacağını anlayan Fransa başta Suriye olmakla mandaterliği altında olan diğer bölgelerden geri çekilmeye başladı. İkinci Dünya Savaşı sonrası Suriye Fransa'nın bölgeden çekilmesi sonrası artık bağımsızlığını elde etmek için hareket geçti. 1920 yılında bölgede ilk hakimiyetinin kuran Fransa'nın 25-26 yıl sonra geri çekilmesi ile birlikte Suriye 17 Nisan 1946 tarihinde bağımsızlığını ilan etmişti.

Büyük Britanya ve Fransa'nın bölgedeki mandaterliği altındaki bölgelerden geri çekilmesi sonrası Orta Doğu'daki güç boşluğu SSCB ve ABD arasında mücadele için yeni bir alan yaratmıştı. SSCB bu bağlamda ikili hareket ederek hem Suriye ile hem de bölgede yeni kurulma aşamasında olan İsrail ile ilişkilerini yüksek seviyeye getirmeye çalıştı. Bu bağlamda ilk önce daha Fransa Orta Doğu'dan resmen çekilmeden 1944 yılında Suriye'yi egemen bir devlet olarak tanımıştır. Ek olarak, yukarıda da belirttiğimiz gibi SSCB İsrail'in de tanınmasında etkin rol oynayarak bölgede güç sahibi olmak istese de İsrail'in kuruluşundan kısa bir süre sonra SSCB yerine ABD ile ilişkilerini güçlendirme çabalarını gören SSCB buna karşın bölgede Suriye Arap Cumhuriyeti ile ilişkilerine öncelik vermiştir (Dilek; 2017: 59).10 Şubat 1946 tarihinde ise SSCB ve Suriye arasında resmi antlaşma imzalanarak tanınma resmileşmiştir. SSCB 1950'li yıllarında Arap Coğrafyasının önemli bir kısmında resmen bir altın çağı yaşamıştır. Özellikle, Arap coğrafyalarının önemli bölgelerinde Arap Milliyetçiliği ve Sosyalizmi kendi bünyesinde barındıran BAAS Partisinin Irak, Mısır ve Suriye gibi ülkelerde iktidarı ele geçirmesi ve bu ülkelerin ABD başta olmakla Batı ülkelerine karşı duruş sergilemesi SSCB'nin bu coğrafyada altın çağı yaşamasında en önemli faktörlerin başında gelmektedir. SSCB Mısır ve Suriye'nin bölgedeki konumunu iyi analiz etmekteydi. Arap coğrafyasında çok kritik bir güce sahip olan bu iki ülke ile ilişkilerini iyi tutan bölgeye müdahale etme gücüne sahip olabilir. Bildiğimiz gibi bölge için *"Orta Doğu'da Mısırsız barış, Suriyesiz savaş* olmaz*"* deyimi kullanılmaktadır (Doster, 2016: 66). ABD'de de ulusal güvenlik danışmanı olan dünyaca ünlü stratejist ve uzman Henry Kissinger'in bu,deyiminin altında aslında bu gerçeklik yatmaktadır. SSCB ile Suriye ilişkilerinde en önemli olaylardan biri Kuruluşu sonrası istikrarlı bir hükumet kurulamayan Suriye'de sık sık darbeler yaşanmıştır. Suriye'de bir darbe ile hükumete gelen Albay Edip Çiçekli'nin 1954 senesinde kendisinin de bir darbe ile devrilmesi sonrası Suriye'de de BAAS partisi artık iyice güçlenmeye başlamıştır. Ek olarak, Suriye Hükumeti 1954 yılında sosyalist bloğu ülkesi olan Çekoslovakya ile antlaşma imzalaması SSCB için çok önemli olmakla beraber Suriye Orta Doğu coğrafyasında sosyalist bloğu ile resmi antlaşma yapan ilk Orta Doğu ülkesi olmuştur (Çalışkan, 2016: 1). Bununla da yetinmeyen Suriye Hükumeti Savunma Bakanı Halit El-Azm'ı SSCB ile antlaşma imzalamak için Moskova'ya gönderdi. Temmuz-Ağustos 1954 tarihlerinde iki tarafın görüşmeleri sonucu mutabakat sağlanmış ve 7 Ağustos 1954 tarihinde antlaşma imzalanmıştır. Bu bağlamda Suriye'nin Doğu Akdeniz kıyısında limanlarından olan Lazkiye limanına SSCB için bir liman yapılması, SSCB'nin Suriye Arap Cumhuriyeti'ne 500 milyon dolarlık ekonomik yardım yapması ve askeri gücünü pekiştirmesinde yardımcı olunması kararlaştırıldı (Armaoğlu, 2019: 387). Bununla da

günümüze kadar devam eden Rus jeopolitik güç ve aklının Orta Doğu'da yerleşmesi planının ilk adımı atılmıştır.



Lazkiye Limanı

Kaynak: Sputnik, 2021

Suriye'nin SSCB ile bu yakınlaşmasını gören ABD 24 Şubat 1955 tarihinde Dwight Eisenhower doktrini çerçevesinde Orta Doğu'da yeni stratejik işbirliği yaratmak için kurdurduğu Bağdat Paktı'na (Sonraki ismi CENTO) dahil etmemiştir. Buna karşın Suriye'yi yalnız bırakmayan SSCB Çekoslovakya üzerinden 1956 yılında 60 askeri uzman ve 18 milyon dolarlık askeri yardım yapmış, 1957 yılında Bağdat Paktı ülkelerinin Suriye'ye yaptığı ekonomik ambargosuna karşı SSCB Suriye ile 570 milyon değerinde olan ekonomik ve teknik antlaşmalar imzalamıştır (Araz, 2018: 2). CENTO ABD'nin beklediğinin aksine bölgeyi birleştirmekten ziyade üç yere bölmüş ve SSCB'nin bölgeye girişini kolaylaştırmıştır. En önemlisi Arap Dünyası'nı birleştirmek isteyen Mısır Devlet Başkanı Cemal Abdülnasır'ın Bağdat Paktı ve 1956 yılında gerçekleşen Süveyş kanalı sorunu ile Batı karşıtı politika kurarak SSCB'ye yanaşmıştır. Ayrıca SSCB bu dönem Mısır'a silah satarak Orta Doğu ve Arap coğrafyasında prestijini büyük ölçüde yükselmiştir (Özel, 2012: 125-127). Ayrıca Suriye ve Mısır'ın da bu sürede ilişkilerini güçlendirmesi SSCB için Orta Doğu'da büyük fırsatları beraberinde getirmekteydi. Bu bağlamda en kritik dönem 1958 yılında yaşamıştır. BAAS Partisinin iktidarda olduğu Mısır ve Suriye Hükumetleri birleşme kararı olarak Birleşik Arap Cumhuriyetinin kurulmasına karar verdiler. Ancak 28 Eylül 1961 tarihinde darbe ile bu birleşme dönemi bitmiştir. Buna karşılık General Ziyad Hariri komutasında toplanmış bulunan Baascı, Nasırcı ve Sosyalist Subaylar 8 Mart 1963 tarihinde darbe ile yeni rejime son verdiler

(Hasanzadeh, 2021).Suriye ile ilişkilerini stratejik olarak üst düzeye taşıyarak Orta Doğu coğrafyasında varlığını sürdürmek isteyen SSCB için 60'ların sonu, 70'lerin öncesi sorunlarla devam etmiştir. Suriye'de devam eden hükumetlerin istikrarsızlıkları ve darbe girişimleri, Mısır'da suikast sonucu hayatını kaybeden Cemal Abdülnasır'ın yerine devlet başkanı olan Enver Sedat'ın Nasır'ın aksine bir dış politika izleyerek ABD ve Batı ile işbirliğine öncelik vermesi SSCB'nin Orta Doğu politikalarında sorunlara sebep olmuştur. Mısır'da Enver Sedat'ın yürüttüğü dış politika sonrası Suriye SSCB için Orta Doğu coğrafyasında artık en önemli ülke haline gelmiştir. Suriye'nin SSCB ile ilişkilerini en yüksek düzeye getirmesi Hafız Esat'ın devlet başkanlığı döneminde gerçekleşmiştir. BAAS Partisinin tanınan isimlerinden olan Hafız Esat 1966 yılında savunma bakanı görevini yapmış, 1971 yılında ise devlet başkanı olmasıyla Suriye'nin iç istikrarı ve dış politikasında kritik dönem başlamıştır. Mısır'da Enver Sedat'ın Batı ile işbirliğini gören Hafız Esat artık Suriye'nin SSCB için Orta Doğu'da hayati öneme sahip olduğunu biliyordu. Devlet balkanı olduğu 1971 yılında Hafız Esat ilk devlet ziyaretini Moskova'ya yaparak SSCB ile ilişkilerini güçlendireceğinin mesajını hem SSCB'ye, hem de ABD'nin öncülük ettiği Batı Bloğuna verdi. Bu görüşme çerçevesinde alınan en kritik kararlardan biri Suriye'nin Doğu Akdeniz kıyısında kritik bir konuma sahip Tartus limanında SSCB'ye deniz üssü ve tesis kurma yetkisinin verilmesiydi. (Çalışkan, 2016: 2). Bu tesisin jeopolitik etkisi günümüze kadar devam etmektedir. SSCB'nin varisi Rusya Federasyonu en zayıf zamanlarda bile bu limanı elinden bırakmamış ve bu liman aslında Orta Doğu coğrafyasında Rus varlığının en temel sembollerinden biri olmuştur.



Tartus Limanı

Kaynak: DW Türkçe, 2020

Sonraki dönemde de Hafız Esat SSCB ile bir sıra antlaşmalar imzaladı. Bu bağlamda imzalanan antlaşmalardan biri olan 8 Ekim 1980 tarihindeki antlaşma ile Suriye ordusunun subayları askeri eğitim almak için SSCB'ye gittiler. 14 Kasım 1980 tarihinde SSCB ve Suriye Arap Cumhuriyeti arasında ilişkileri en üst düzeye çıkaran ve 20 yıllık süreyi kapsayan 15 maddelik Dostluk ve İşbirliği antlaşması imzalandı (Aslanlı, 2018: 2). 1979 yılında Camp David süreci çerçevesinde Mısır ve İsrail yakınlaşmasını kendi egemenliğine bir tehdit olarak algılayan Suriye SSCB ile bu antlaşmayı imzalaması farklı bir anlamda beraberinde taşımaktaydı. Bu antlaşma ile artık iki ülke neredeyse bir birine garantör olmuştur. Ek olarak, Suriye bu antlaşma ile 1979 sonunda başlayan SSCB'nin Afganistan işgalini tanımış, bunun karşısında SSCB'de İsrail üzerinden mevcut olan Siyonizm'i bir ırkçılık olarak tanımlamıştır(Çalışkan, 2016; 2-3). Ayrıca bu dönemde binlerce Sovyet uzmanı Suriye'ye gelerek orduyu eğitme, teknik ve ekonomik kalkınma, eğitim seviyesi gibi meselelerde görev aldılar. Ek olarak, Suriyeli öğrenciler de SSCB'nin farklı bölgelerine giderek eğitimlerine devam ettiler ve bir kısmı zamanla devlet kademesinde önemli yerlere geldiler. Bununla da SSCB Suriye üzerinden ağırlığını Orta Doğu coğrafyasında devam ettirmekteydi.

Soğuk Savaş Sonrası Rusya Federasyonu ve Suriye Arap Cumhuriyeti İlişkileri

1945-1990 yıllarında SSCB ve ABD arasında devam eden Soğuk Savaş'ın sonucunda SSCB ve Sosyalizm mağlup olmuş ve dünyada yeni bir jeopolitik düzen yaranmıştır. ABD öncülüğünde tek kutuplu dünya düzeninin devamı bütün dünyayı yeni bir dönemden geçirmekteydi. SSCB sonrası onun esas varisi olan Rusya Federasyonu 'Kozırev Doktirini' ile Batı karşısında teslimiyetçi bir tutum sergilemiştir. Ancak ülkede milliyetçi ve Avrasyacı toplumun tepkileri karşısında dönemin Rusya Devlet Başkanı Boris Yeltsin 'Yakın Çevre' doktrinini ilan ederek eski Sovyet coğrafyasına tekrardan yönelmiştir. Bir dönem sonra Batı ile işbirliğini hedefleyen 'Kozırev Doktirini' aksine 'Primakov Doktrini' öne çıkmış ve yeni bir dönem başlamıştır. 2000 yılında devlet başkanı olan Vladimir Putin'in Rusya'nın bir Avrasya ülkesi olduğunun altını çizmesi de Rusya için yeni bir dönemi başlatmıştır (Perinçek, 2016: 37-38; Avrasyacı yaklaşımın Rus jeopolitiğinde önemi hakkında bkz: Dugin, 2018). SSCB sonrası Rusya'nın Batı ile yakınlaşmasını gören Suriye Devlet Başkanı Hafız Esat da Batı ile işbirliğine yönelmiş ve Suriye için farklı müttefikler aramaya başlamıştır. Ölümü sonrası iktidara gelen oğlu Beşşar Esat da aynı politikalara başvursa da, kısa bir süre sonra bu politikadan dönmüştür. ABD'nin 11 Eylül 2001 olayı sonrası Afganistan'a ve 2003 yılında da Irak'a yaptığı müdahale ve sergilediği tutum Batı'nın Arap coğrafyasında imajının değişmesine sebep olmuştur. Bu bağlamda babası Hafız Esat gibi Rusya ile ilişkileri artırmak isteyen Beşşar Esat 2005 yılında

Moskova'yı ziyaret ederek Rusya ile antlaşma imzalayarak Rusya ve Suriye arasında yeni bir dönemin açılmasına sebep olmuştur. Suriye'nin Soğuk Savaş döneminde SSCB için nasıl önemli olduğunu iyi analiz eden Vladimir Putin Avrasya coğrafyasında Rusya'nın etkin olması için hem Orta Doğu'da, hem de Akdeniz coğrafyasına deniz üzerinden çıkışı olan Suriye ile ilişkileri yükseltmeye çalışmaktaydı. 2005-2010 yılları arasında Suriye'ye 3 milyar dolara yakın değerde silah ihracatı planlayan Rusya 2006 yılında da Suriye'den Rusya'ya yapılan tekstil ürünlerine gümrük vergisini de %25 oranda indirerek Suriye ekonomisine büyük katkı sağlamıştır. Bu bağlamda İran ile de ticaretini ve ilişkilerini iyi tutan Suriye Rusya'nın silah ihracatında iki önemli devlet olmuştur. 2002-2009 yılları istatistiklerinde Rusya'nın Suriye ve İran'a yaptığı silah ihracatı dünya üzerindeki bütün silah ihracatının %10'unu kapsamaktadır. 2018 yılına geldiğimizdeyse Suriye Ortadoğu'da İran'dan sonra Rusya'dan en büyük ikinci silah ithalat eden ülkedir (Hasanzadeh, 2021).

Arap Baharı çerçevesinde Rusya Federasyonu'nun Suriye'ye gelişi

25 Aralık 2010 tarihinde Tunus'ta kendini işinin elinden alınması sebebiyle kendini yakan 26 yaşındaki Muhammed Buazizi'nin ölümü ile birlikte ilk önce Tunus'ta, sonra ise Orta Doğu coğrafyasında yeni bir dönem başlamıştır. SOROS destekli devrimler 2000'li yıllarda Gürcistan, Kırgızistan'da kazanımlar elde ettikten sonra ABD'nin yeni dünya düzeninde Orta Doğu politikalarında da önemli rol oynadı (ABD'nin Soğuk Savaş sonrası Orta Doğu politikaları hakkında bkz: Taşçıoğlu, 2009). ABD'nin Orta Doğu ve Afganistan'da 2000'li yıllarda güçlendiğini gören Rusya Arap Bahar'ının ABD lehine döndüğünü anlamıştı. Özellikle, Libya'da Kaddafi'nin devrilmesi sonrası sıranın artık Suriye'ye gelmesi Rusya için bir dönüm noktası oldu. Mart 2011 tarihinde Suriye'de başlayan halk hareketleri kısa süre sonra iç savaşa döndü. BM Güvenlik Konseyi Libya'da olduğu gibi Suriye Hükumetine de yaptırım uygulamaya çalışsa da, Rusya ve Çin'in 3 kere vetosu karşısında bu kararlar alınamamıştır (Hasanzadeh, 2021). İç savaşın başlamasıyla ilk günden Suriye Hükumetine siyasi desteğini esirgemeyen Rusya 2013 yılına kadar 600 milyon dolarlık askeri sözleşmeler ile de rejimin arkasında olduğunu ve desteğinin devam edeceğini göstermiştir (Gafarlı, 2018: 189). Suriye'nin günümüzde Rusya için önemini sıralarsak Moskova Suriye'de rejimin devrilmesi sonrası sıranın ABD ve İsrail tarafından İran'a karşı mücadelesine geleceğini ve Rusya'nın güneyinde yeni bir mücadele başlamasını istememekteydi. Aynı zamanda Sünni rejimlerin süreçte desteklenmesi Rusya'nın iç ve dış güvenliği açısından da kritik bir anlam taşımaktaydı. Ek olarak, yukarıda belirttiğimiz gibi Tartus askeri üssünün varlığı Rusya'nın Orta Doğu'da tek askeri üssü özelliğini taşımasıyla beraber Irak ile yaptığı enerji ticaretinde de kritik role

sahipti (Demirağ, 2016: 79). Ek olarak, Suriye'de %15 Ortodoks mezhebine sahip Hristiyanlığının bölgede mevcut olması da Rusya'nın bölgede var olmasının esas faktörlerindendir. Bildiğimiz gibi Rusya kendisini Ortodoks Hristiyanlığının hamisi olarak görmektedir ve bu kozu kullanarak İstanbul'da ikamet eden Fener Rum Patrikhanesine karşı da mücadele etmektedir (Ağır&Takar: 2016: 296).

Rusya'nın Suriye'ye askeri olarak yerleşmesi ise 2015 yılında gerçekleşmiştir. ABD, Batı ve İsrail tarafından kuşatma altına alınan Suriye Arap Ligası tarafından da darbe almaktaydı. 2013 yılında Suriye Hükumetine askeri yönden destek İran İslam Cumhuriyeti tarafından gelmiş ve bölgede Şii milislerin faaliyeti başlamıştır. 2015 yılında ise iyice büyüyen tehdit karşısında Suriye hükumeti Rusya'dan resmen askeri yardım talep etmiştir. Bu bağlamda Rusya 27 Eylül 2015 tarihinde bölgeye gelmiş ve Suriye rejiminin başarılarında en kritik pay sahibi olmuştur. Rusya'nın bu kararı almasında Esat'ın muhalifler ve IŞİD'e %18 oranında toprak kaybetmesi ve Temmuz 2015'de dönemin İran Devrim Muhafızları Kudüs Gücü Komutanı olan Kasım Süleymani'nin Moskova ziyareti de önemli olmuştur. Bu bağlamda Suriye'ye gönderilen Rus askeri sevkiyatının İran ve Irak üzerinden devam etmesi de dikkat çekici husus olarak karşımıza çıkmaktadır (Erşen, 2021: 75). Askeri olarak Suriye rejimine destek veren Rusya Federasyonu Suriye'nin siyasi egemenliği ve toprak bütünlüğünün mevcudiyeti için de önemli girişimlerde bulunmuştur. 23 Ocak 2017 tarihinde Rusya Federasyonu, İran İslam Cumhuriyeti ve Türkiye Cumhuriyeti kapsamında günümüze kadar devam eden görüşmelerinde, 17 Eylül 2018 tarihinde Rusya Federasyonu ve Türkiye Cumhuriyeti çerçevesindeki Soçi Görüşmesinde taraflar Suriye'nin toprak bütünlüğünü resmen tanımıştır. Suriye'nin toprak bütünlüğünün korunmasında önemli pay sahibi olan Rusya aynı zamanda Suriye topraklarında varlığı iyice artırmaktadır. 13 Haziran 2019 tarihinde Rus jeopolitik gücünün Orta Doğu'da en temel varlığı olan Tartus limanının Suriye Hükumeti tarafından Rusya'ya 49 yıllığına kiralanmasının onaylanması Rusya'nın ABD ve Batı'ya karşı büyük zafer adımıydı (Aydınlık, 2019). Doğu Akdeniz'de güç mücadelesinde Rusya için önemli bir dayanak noktası olan Tartus Limanı Rusya'nın Akdeniz ve Kuzey Afrika mücadelesinde de kritik bölge niteliği taşımaktadır. Ayrıca Libya'da var olan ve Hafter hükumetini destekleyen Rusya'nın paralı gücü olan Wagner grubu Suriye'den devamlı olarak askeri ve lojistik destek de almaktadır. Aynı zamanda Mısır'da Sisi Hükumeti ile de ilişkilerini devam ettiren Rusya Doğu Akdeniz'de mevcut olan enerji mücadelesinde de önemli bir aktör rolündedir.

Sonuç

Genel olarak, baktığımızda Orta Doğu coğrafyasında özellikle Arap Baharı farklı bir jeopolitik denklem yarattı. Batı destekli Arap Baharı Orta Doğu ve Arap coğrafyasında yeni dönemlerin kapısını aralamakla beraber Rusya'nın da bölgeye askeri olarak gelmesine neden oldu. Arap Baharı sonrası Tunus, Mısır ve Libya gibi ülkelerde liderlerin devrilmesi Suriye'nin de aynı akıbeti yaşayacağını düşündürse de senaryo tamamen farklı olmuştur. Özellikle, Rusya Federasyonu'nun yanında İran İslam Cumhuriyeti'nin ve Çin Halk Cumhuriyeti'nin de Suriye'deki Esat rejimine destek durması ABD ve Batı'nın planlarını büyük ölçüde sekteye uğratmıştır. Günümüzde Suriye hükumetinin en büyük garantörü olan Rusya Federasyonu Suriye'de gücünü pekiştirmek için askeri takviyelerini artırmakla beraber stratejik noktalarda da varlığı artırmaktadır. Kısa ve orta vadede Batı'ya karşı devam eden mücadele uzun vadede Suriye üzerinde Rusya-İran-Çin mücadelesine de şahitlik etmektedir. Rus Avrasyacı jeopolitiğinde eski Sovyet coğrafyasına ek olarak SSCB ile ilişkilerini üst düzey tutan Sosyalist ülkeler de yerini almaktadır. Ayrıca Doğu Akdeniz'e çıkışı olan Suriye Rusya Federasyonu'nun sıcak denizlere inmede en kritik kapısı olmağa da devam edecektir. Avrasya jeopolitiğinde devam eden büyük mücadelede Soğuk Savaş'ta olduğu gibi günümüzde de farklı coğrafyalarda devam etmektedir. Soğuk Savaş'ın sonlarında yaşandığı gibi Suriye Rusya ile ilişkilerini en üst düzeye çıkarması Batı ile mücadelesinde en temel dayanak noktası olmaktadır. Ayrıca Orta Doğu'da günümüzde Rusya-İran-Çin işbirliği aynı zamanda Avrasya coğrafyasının temel kalbi sayılan Orta Asya'da da kendisini gösterebilir ve ABD ile Batı'nın Rusya'nın Avrasya jeopolitik kavramında en hassas bölgesini zayıflatmak planlarını sekteye uğratabilir.

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FORMULA ÖĞRENCİ ARABASI ŞASİSİNDE FARKLI MALZEMELER KULLANILAN MODAL ANALİZ ÇALIŞMASI

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Özet
Şaside, şasinin maksimum kayma gerilmesi ve maksimum yük altında deformasyon tasarım ve analiz için önemli kriterlerdir. Formula öğrenci arabaları söz konusu olduğunda diğer şasilere göre hem daha güçlü hem de daha hafif bir tasarıma ulaşmak gerekir. Bu çalışmada Formula öğrenci araç şasisinin tasarımı ve analizi anlatılmaktadır. Araç şasisinde yüksek mukavemetli AISI 4130 ve S355 çeliklerinin yanı sıra ultra yüksek mukavemetli Usibor 1500 çeliği kullanılmış olup, Formula öğrenci arabası şasisinin yapısal analizi ve modal analizi için sonlu elemanlar analizi (FEA) yöntemi kullanılmıştır. Formula öğrenci arabasının şasi tasarımı CATIA V5R21 programıyla tasarlandı. Üç farklı yüksek mukavemetli çelik üzerinde ön yüklemeli titreşim analizi yapıldı ve on farklı modda analiz edildi. AISI 4130 ve S355 çeliklerinin frekans değerleri karşılaştırıldığında S355 çeliğinin sonuçlarında ortalama %0,53 oranında artış gözlenmiştir. Ultra yüksek dayanımlı Usibor 1500 çeliğinin frekans değerlerinde S355 çeliğinin frekans değerlerinde ortalama %1,99 oranında azalma gözlendi. AISI 4130 çeliğinin eşdeğer gerilme değeri 400 MPa, S355 çeliğinin 395 MPa ve ultra yüksek mukavemetli çeliğin eşdeğer gerilme değeri 396 MPa idi. Ultra yüksek mukavemetli çelik, AISI 4130 malzemesinden 2,33 kat, S355 malzemesinden 3 kat daha yüksek güvenlik faktörüne sahiptir. Titreşim analizi sonuçlarından onuncu modda en yüksek değer 256,46 Hz ile S355 çeliğinden elde edildi. Onuncu modda en düşük deformasyon, 20.263 mm ile ultra yüksek mukavemetli Usibor 1500 çeliğinden elde edildi.
Anahtar Kelimeler: Formula Öğrenci Arabası, Şasi, Yapısal Analiz, Sonlu Elemanlar Analizi, Ultra Yüksek Mukavemetli Çelik

A MODAL ANALYSIS STUDY USING DIFFERENT MATERIALS IN THE FORMULA STUDENT CAR CHASSIS

Abstract
In the chassis, the chassis maximum shear stress and deflection under maximum load are important criteria for design and analysis. When it comes to Formula student cars, it is necessary to achieve a design that is both stronger and lighter than other chassis. This study describes the design and analysis of the formula student vehicle chassis. High-strength AISI 4130 and S355 steels as well as ultra-high-strength Usibor 1500 steel were used in the vehicle chassis and the finite element analysis (FEA) method was used for structural analysis and modal analysis for the Formula student car chassis. Formula student car chassis design was designed with the CATIA V5R21 program. Preloaded vibration analysis was performed on three different high-strength steels and analyzed in ten different modes. The frequency values of AISI 4130 and S355 steels were compared and an average increase of 0.53% was observed in the results of S355 steel. The frequency values of ultra-high strength Usibor 1500 steel were observed to decrease by an average of 1.99% in the frequency values of S355 steel. The equivalent stress value of AISI 4130 steel was 400 MPa, S355 steel was 395 MPa and ultra-high strength steel was 396 MPa. Ultra-high strength steel has 2.33 times higher safety factor than AISI 4130 material and 3 times higher safety factor than S355 material. From the vibration analysis results, the highest value in the tenth mode was obtained from S355 steel with 256.46 Hz. The lowest deformation in the tenth mode was obtained from ultra-high strength Usibor 1500 steel with 20.263 mm.
Keywords: Formula Student Car, Chassis, Structural Analysis, FEA, Ultra High Strength Steel

Introduction

The chassis is the central skeletal structure of a vehicle that must carry all its components and support all loads. The weight of each component and the forces during acceleration, deceleration, and cornering are included in these loads. A well-designed chassis becomes critical to the vehicle's safety, performance, and roadworthiness (Mat & Ghani, 2012). Formula SAE is a student competition sponsored by the Society of Automotive Engineers (SAE) in which students plan, build, and complete a small equation-style racing car. The FSAE competition was undertaken to provide students at the school with an educational experience that is practically equivalent to the kind of initiatives they would encounter in business energy (Lavanya et al., 2014). The most important point of focus in the chassis design of the Formula Student racing car is to comply with the rules and to consider the width and weight, which are the most basic problems of vehicle chassis. The chassis designed for the Formula Student race car is quite complex. This compactness leads to several ergonomics-based problems. It is very difficult to make a change or arrangement in the engine part or the pedal part located at the very tip of the nose (Oymak & Feyzullahoglu, 2021).

Patil and Chikkali (Patil & Chikkali, 2020), in their research paper, basically made an analysis of the FSAE chassis. This chassis was designed in accordance with the FSAE rules. The material of choice for the FSAE chassis is AISI4130 chromium and Molybdenum alloy, which has high strength as well as low weight. The analysis was performed on standard results to obtain the maximum possible strength and minimum weight. The software tools used for the analysis are ANSYS. Khan (Khan, 2021) defined the AISI-4130 material into the space frame chassis, resulting in a design that took structural analysis and ergonomics into consideration. Torsion analysis was performed to analyze the increasing forces acting on the chassis. After verification by a simplified version of the models and analytical comparison, the one-dimensional beam model was analyzed and the results were compared with the theoretical equations. The stress and deformation results of the design were also found by using the same parameters in the three-dimensional model analysis. Rosenow (Rosenow, 2022) worked on the development of an FSAE-EV chassis in his capstone project. The design went through several iterations, driven by analytical test results that will be discussed in this document, as well as design considerations developed by stakeholders discovered during the project. Overall, this document has provided an overview of the initial design requirements developed for the chassis concept, the design process for the development of the chassis under this project how the influencing factors were considered, and how the design was refined accordingly. Singh (Singh,

2010) in his research paper introduces various concepts related to load distributions and associated deformation modes of the chassis. Dynamic and static load distributions were calculated numerically and the boundary conditions to be applied during various FEA tests were determined. The safety factor was found by analyzing the stress distributions and lateral displacements occurring in dynamic, static, and frequency modes. Torsional stiffness was found to be 615.98 Nm/degree, which is 2.46 times that of the old design. The weight of the chassis was measured at approximately 32 kg, making it 1.13 times less than the previous chassis. As a result of the study, the ratio of the percentage increase in torsional stiffness to the percentage decrease in weight was found to be 13.15:1. Hiller (Hiller, 2020) designed and analyzed a Formula-style vehicle in his project. The carbon fiber monocoque chassis system was designed to be lightweight, considering packaging constraints, Formula SAE rules, and design parameters set by Formula SAE. The monocoque geometry was modeled using SolidWorks, the carbon composite was simulated and tested using ANSYS and quasi-static load frame testing. The newly designed monocoque chassis reduced the weight by 8.24 kg compared to the old one and reduced the cost by $3,442.57. Anas et al. (Anas et al., 2018) worked to identify weak points and life in the design of a Formula car chassis. While the chassis design was done with the CAD program, fatigue analysis, static analysis, and modal analysis were done in ANSYS. It was stated that vibration transmission path analysis is an alternative to the modal analysis approach in determining noise and vibration problems and reflects the performance of the chassis. Hagan et al. (Hagan et al., 2014) studied a Formula-style race car designed, built, and tested by Cal Poly's Formula SAE Team. The team raced in 2012 with a heavy and underdeveloped chassis, resulting in high vehicle weight (450 lb. total, 122 lb. of which was in the chassis itself and 143 lb. in the entire chassis subsystem). It was developed with composite materials in mind for low weight and driver safety. The design, analysis, and production of a monocoque chassis were studied. Ryan (Ryan, 2008) aimed to identify methods for using an engine in a Formula SAE racing car chassis and verify the results through simulation and testing. Modal analysis with the beam web of the chassis was used to verify the increase in chassis stiffness. The results revealed that the stiffness increased with the structural support at the engine connection points of the chassis, and the initial elastic vibration mode changed from bending to torsion. Chassis deformation was determined by static analysis and it was discovered that there was a reduction in deformation by providing structural support at the engine mounting points of the chassis. Kumar et al. (Kumar et al., 2014) examined various material selection methods and design optimization techniques using ANSYS. The basic design is based on

human anthropological data and allows the racer to enter and exit the vehicle quickly. After the design decision, a static analysis of the vehicle was made. The design and analysis processes were carried out with the FSAE 2013 rule book and historical knowledge of automobile design and production.

This study aims to investigate the equivalent stresses, deformations, safety factors, and natural frequencies of the Formula car chassis under the loadings specified in the FSAE rules using three different materials for design.

Materials and Methods

Material properties are taken from Azom for AISI 4130 Steel (Azom, 2024). S355 material properties are taken from MatWeb and MatMach (MatMach, 2024). AISI4130 material and Usibor 1500 material features were taken from Arcelormittal group (Arcelormittal, 2024). The features of the materials are given in Table 1.

Table 1. Characteristics of materials

Materials	Density (kg/m^3)	Young's Modulus (GPa)	Poisson's Ratio	Tensile Yield Strength (MPa)	Tensile Ultimate Strength (MPa)
AISI 4130	7850	210	0.27	460	560
S355	7800	210	0.3	355	630
Usibor® 1500	7860	205	0.29	1100	1500

In this research, CAD program and FEM software were used for design and analysis. Owing to these programs, the theoretical results of our study were presented. The image of the design created through the Keyshot 12 program is shown in Figure 1.

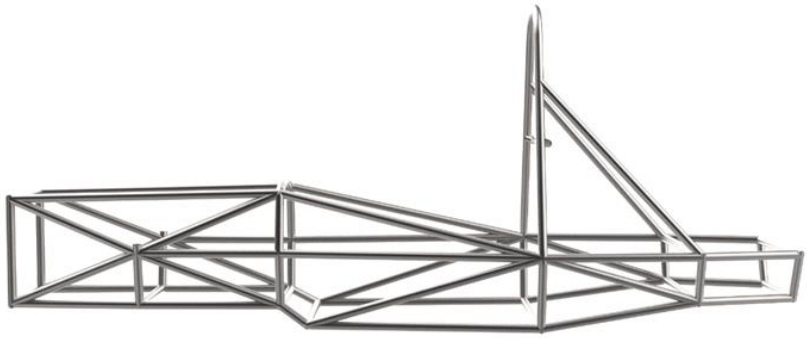


Figure 1. Formula student car design in keyshot 12

The dimensions of the Formula car chassis designed through the CATIA program are 2250 mm in length and 925 mm in height. ANSYS creates the engineering approach by combining CAD and FEA related files. ANSYS allows you to import CAD data and create geometry through a "pre-processing" process. At the same time, the mesh model required for calculation is created in the same preprocessor. Once the loadings are defined and the analysis is performed, the results can be displayed numerically and graphically (Figes, 2016). The mesh model for the chassis was created as shown in Figure 2. The optimal number of elements is 293394 and the number of nodes is 445293. The most widely used and closest to reality mesh quality criterion is skewness, i.e. curvature-based mesh quality criterion. In this analysis, the average curvature quality value was determined as 0.23846.

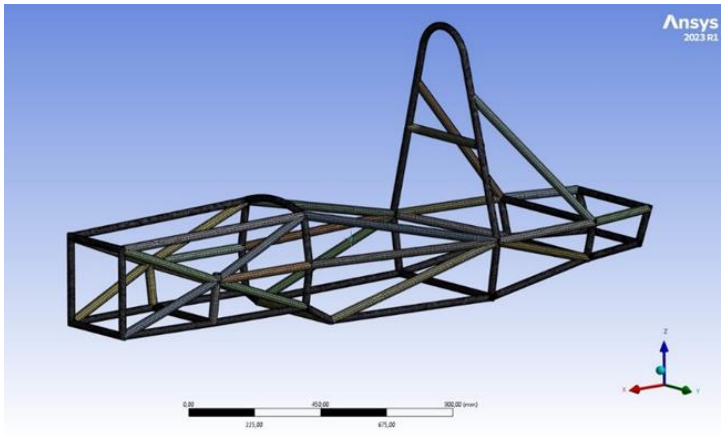


Figure 2. Isometric view of the frame after meshing

Fixed supports for the frame are placed at the swing positions. The total number of supports is sixteen. The force applied to the frame was 60 kN at the top point. FSAE standards were taken as a reference when determining the magnitude of the force. The boundary conditions determined for the analysis are shown in Figure 3.

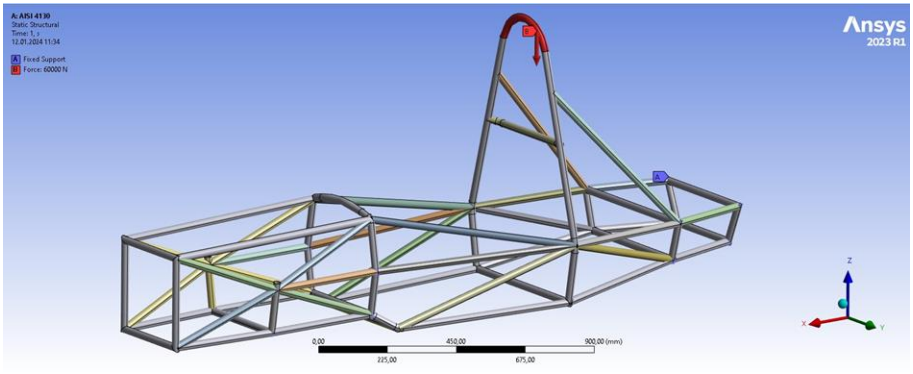


Figure 3. Boundary conditions set for the analysis

Findings and Discussion

As a result of the analysis, the deformation value of AISI 4130 and S355 steels was obtained as 2.9 mm. In ultra-high strength steel material, this value was 3 mm. The equivalent stress value of AISI 4130 steel was 400 MPa, S355 steel was 395 MPa and ultra-high strength steel was 396 MPa. The safety factor of our AISI 4130 steel was 1.159. The lowest value was obtained in S355 steel, and the safety factor value of S355 is 0.9. The safety factor of ultra-high strength steel was 2.7 and the highest safety factor was obtained. The values obtained are shown in Table 2.

Table 2. Results of structural analysis

	AISI 4130	**S355**	**Usibor 1500**
Total Deformation (mm)	2.9	2.9	3
Equivalent Stress (MPa)	400	395	396
Safety Factor	1.159	0.9	2.7

The images of the three steels as a result of the analysis are indicated in Figure 4 and Figure 12.

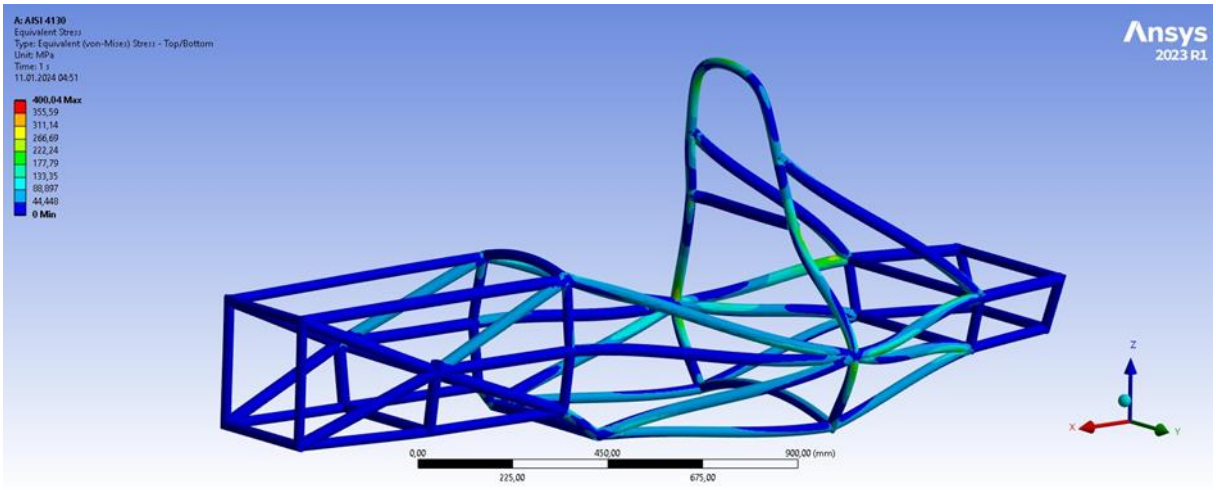


Figure 1. Equivalent stress distribution of AISI 4130 steel

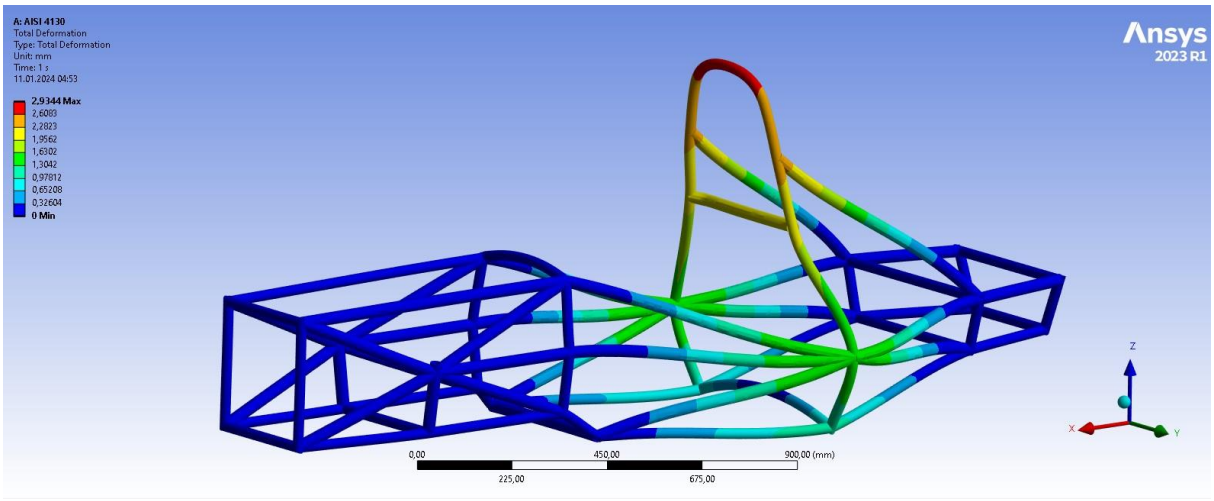


Figure 2. Total deformation of AISI 4130 steel

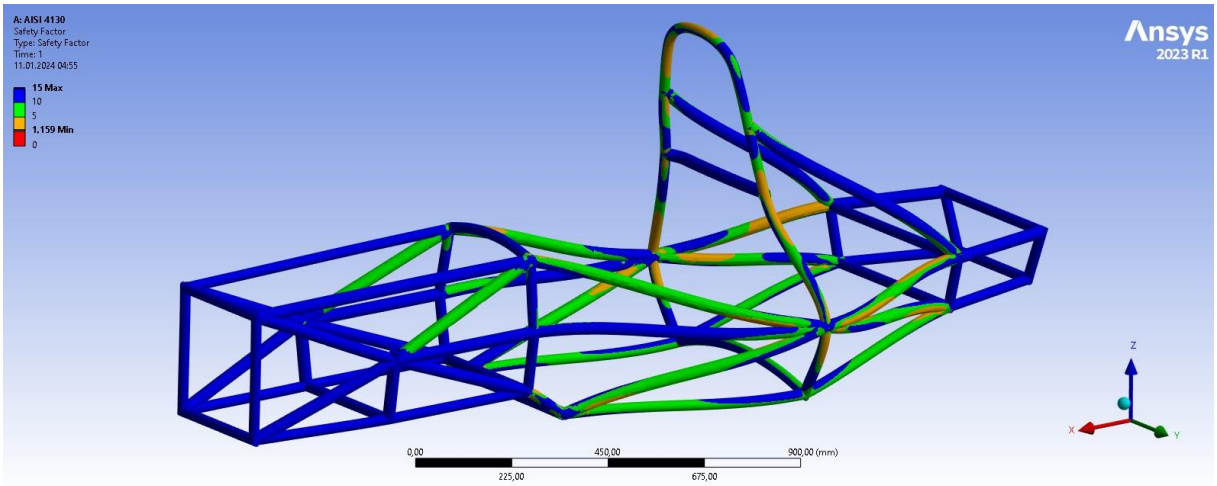


Figure 3. Safety factor of AISI 4130 steel

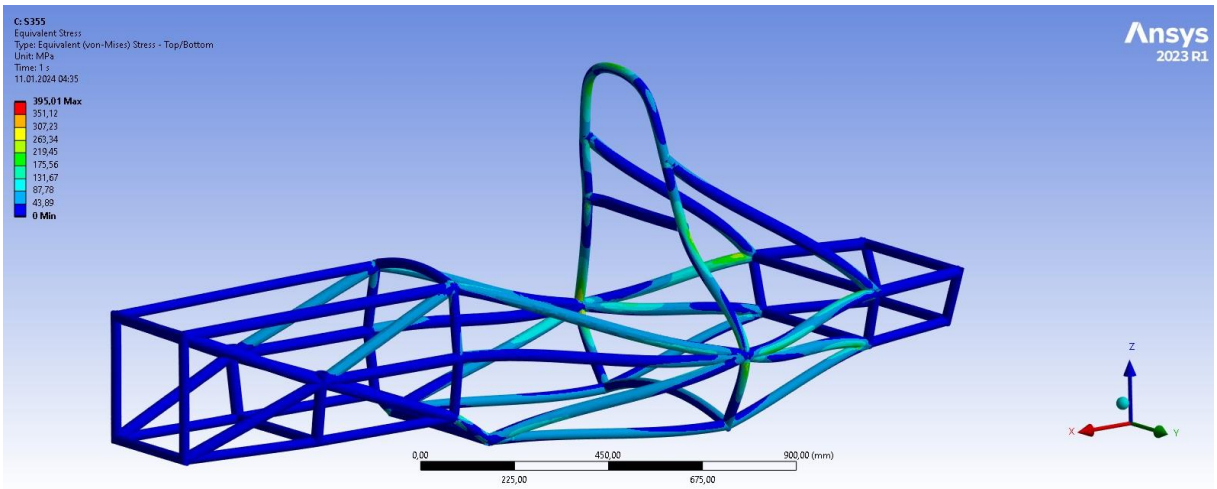


Figure 4. Equivalent stress distribution of S355 steel

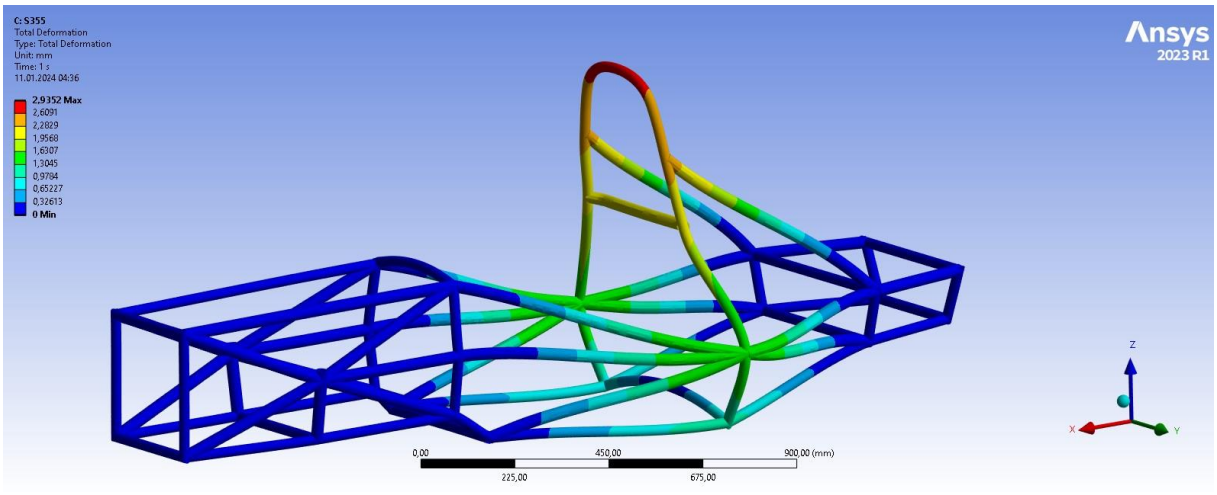


Figure 5. Total deformation of S355 steel

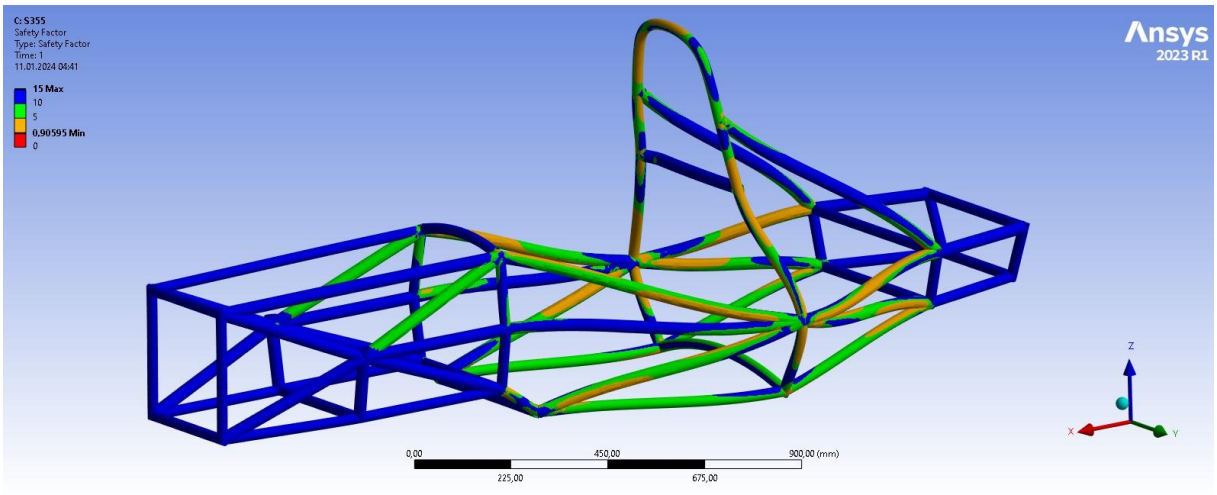


Figure 6. Safety factor of S355 steel

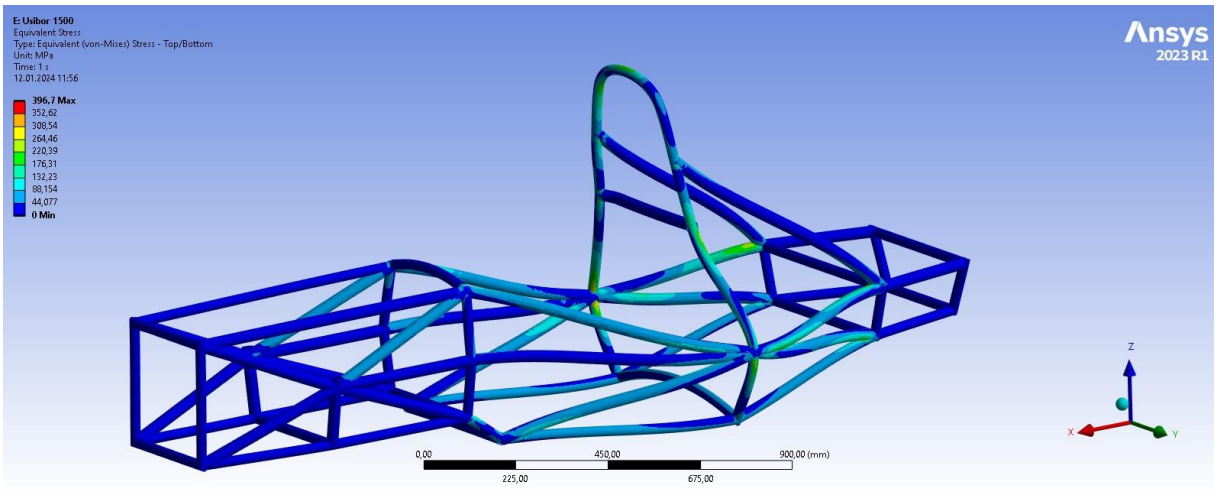


Figure 7. Equivalent stress distribution of Usibor 1500 steel

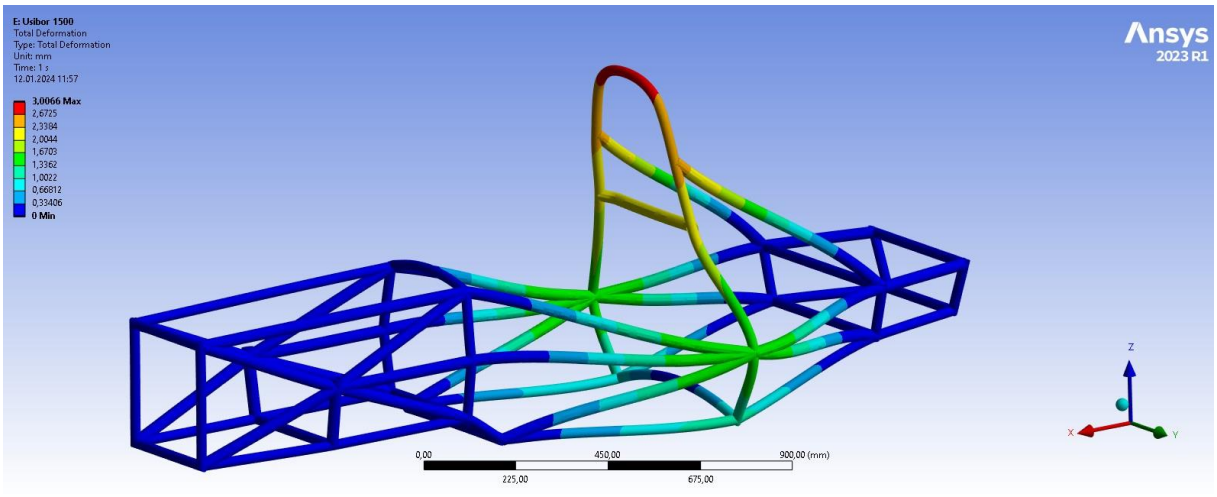


Figure 8. Total deformation of Usibor 1500 steel

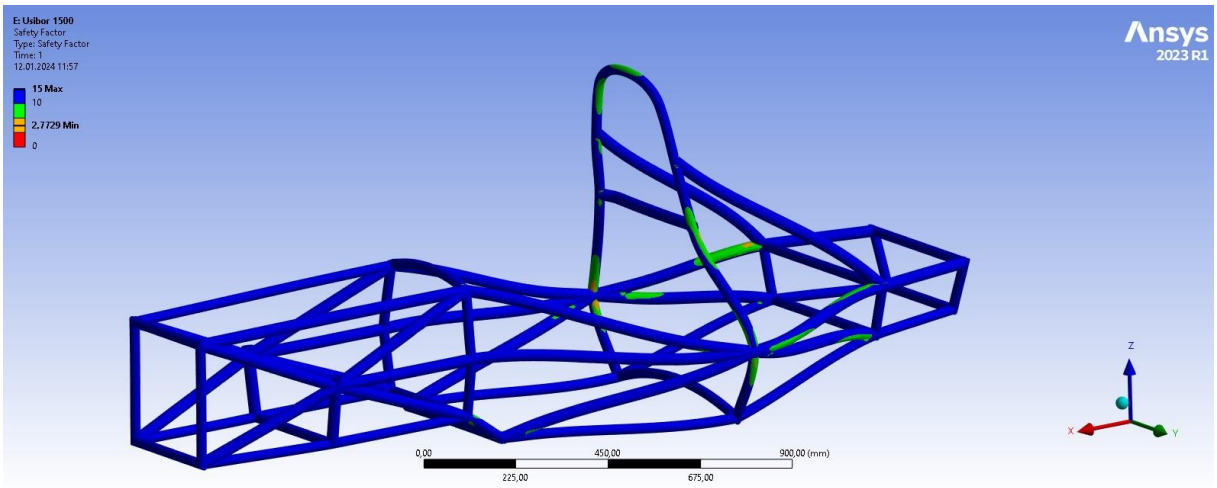


Figure 9. Safety factor of Usibor 1500 steel

The modes used in FEM software are based on natural frequencies. One of the most important conditions for visible differences in the change of natural frequency is the mass of the material. When the properties of materials in Table 1 are compared, it is observed that their specific masses are quite close to each other. This makes them quite similar in their vibration characteristics. Another important property is the flexibility of the material. With this feature, they have very close values with each other.There was one more factor in our analysis made through the FEM program. The fixed support boundary conditions determined for the design directly affect the frequency values obtained. Since the same boundary conditions were preferred in the analysis process of each material, no difference was obtained in this respect. The resulting frequency and deformation values are given in Table 3.

Table 3. Modal analysis results

	AISI 4130	S355	Usibor 1500
Mod 1 (Hz)	101.45	102	99.857
Total deformation (mm)	12.268	12.31	12.232
Mod 2 (Hz)	151.71	152.98	150
Total deformation (mm)	12.464	12.631	12.545
Mod 3 (Hz)	166.94	168.15	164.35
Total deformation (mm)	20.212	20.247	20.222
Mod 4 (Hz)	191.23	192.52	188.37
Total deformation (mm)	11.013	11.039	10.949
Mod 5 (Hz)	203.07	204.16	199.96
Total deformation (mm)	11.292	11.209	11.049
Mod 6 (Hz)	207.26	208.03	204.15
Total deformation (mm)	26.847	26.987	26.747
Mod 7 (Hz)	212.46	213.59	209.02
Total deformation (mm)	28.488	28.536	28.286
Mod 8 (Hz)	217.02	218.22	214.12
Total deformation (mm)	24.248	24.383	24.227
Mod 9 (Hz)	245.49	246.28	241.78
Total deformation (mm)	12.945	13.019	12.934
Mod 10 (Hz)	255.81	256.46	251.96
Total deformation (mm)	20.346	20.344	20.263

The deformation images resulting from the vibration analysis are given from Figure 13 to Figure 42.

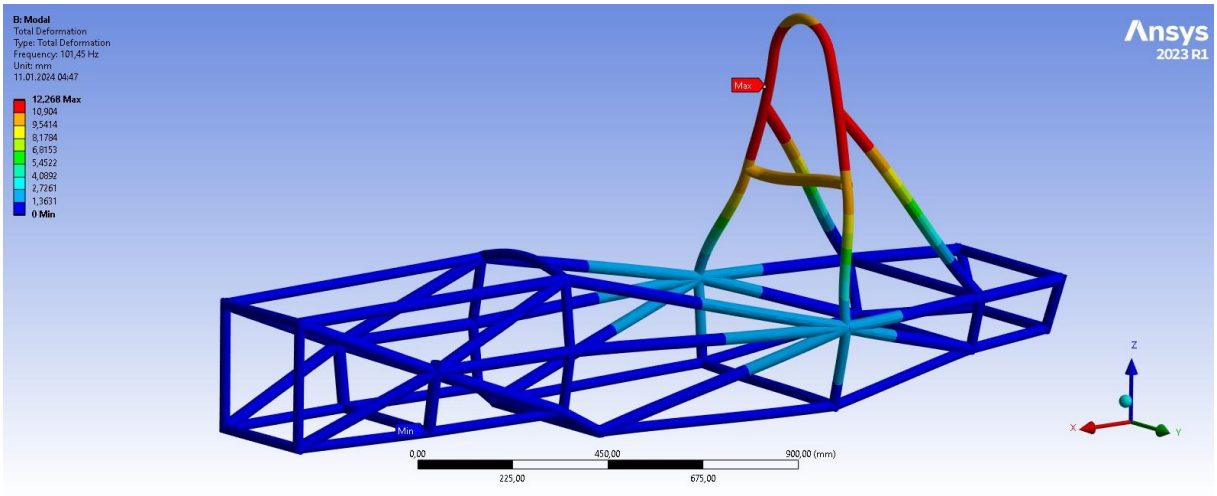


Figure 10. Mode 1 total deformation of AISI 4130 steel

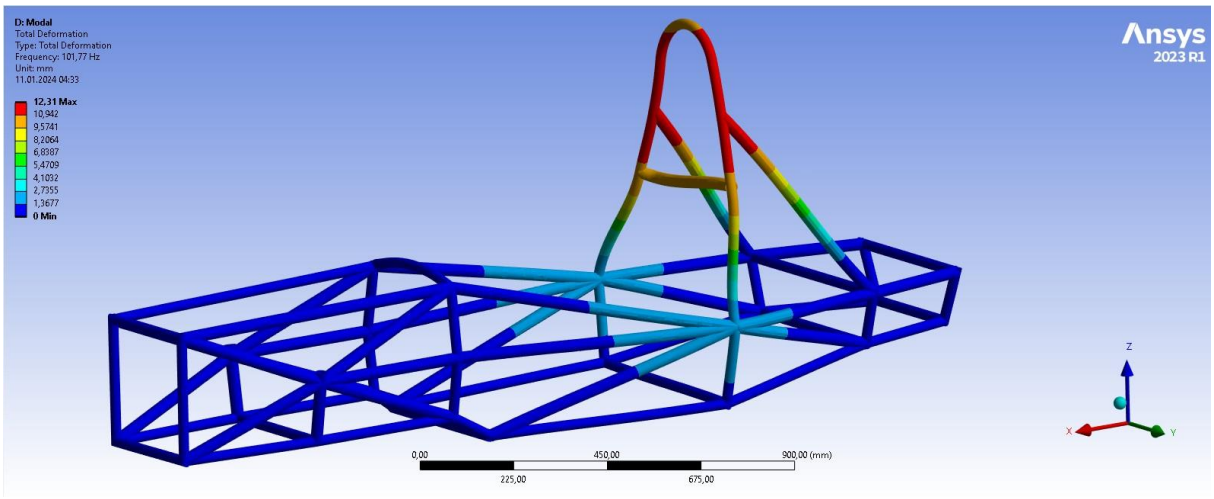


Figure 11. Mode 1 total deformation of S355 steel

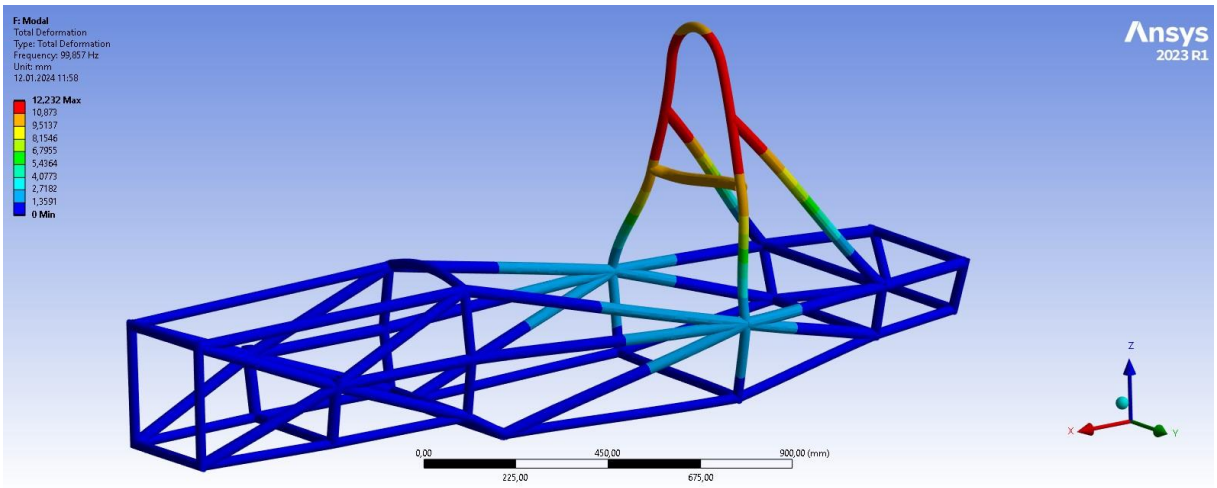


Figure 12. Mode 1 total deformation of Usibor 1500 steel

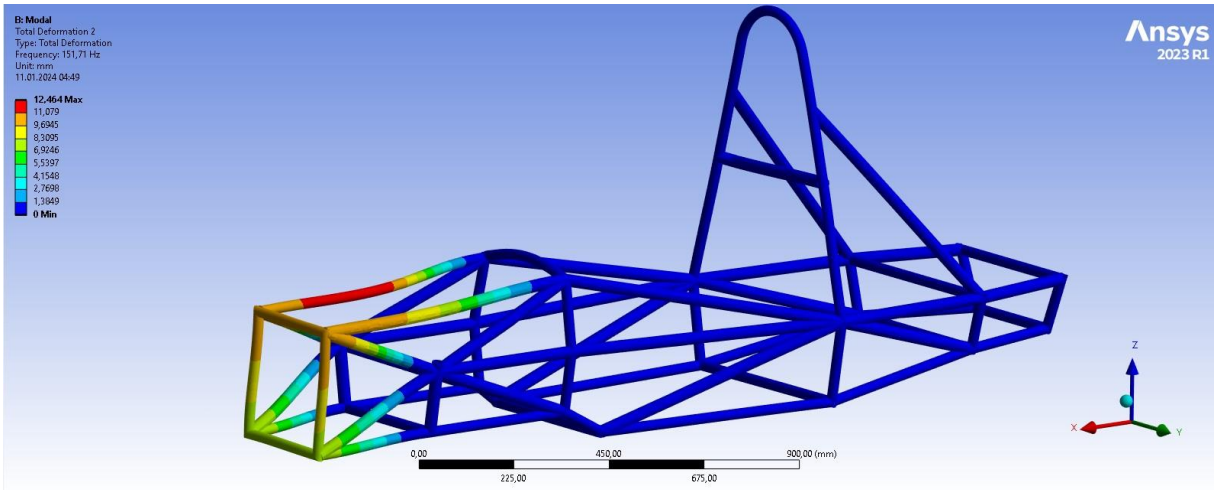


Figure 13. Mode 2 total deformation of AISI 4130 steel

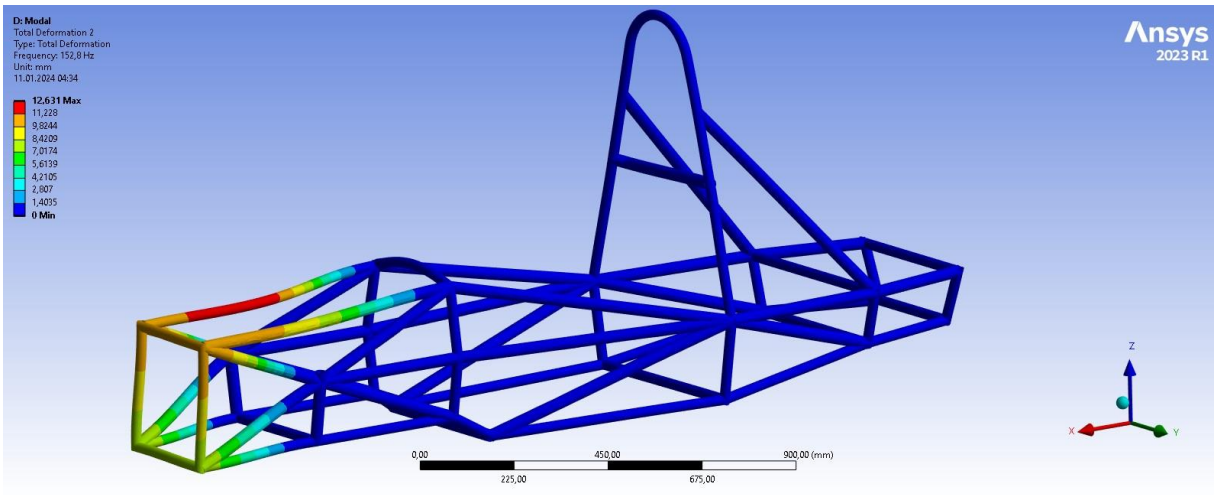


Figure 14. Mode 2 total deformation of S355 steel

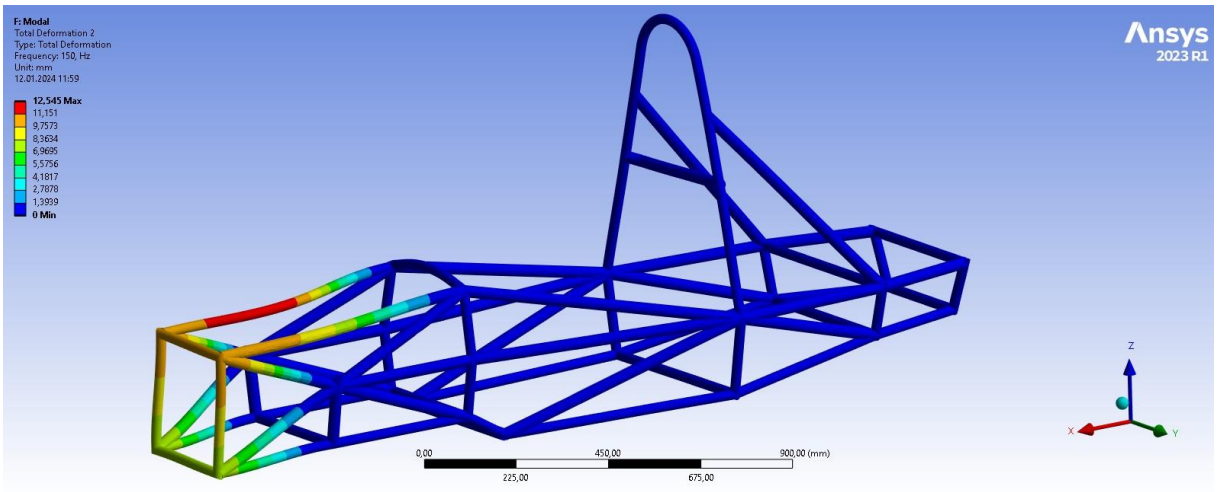


Figure 15. Mode 2 total deformation of Usibor 1500 steel

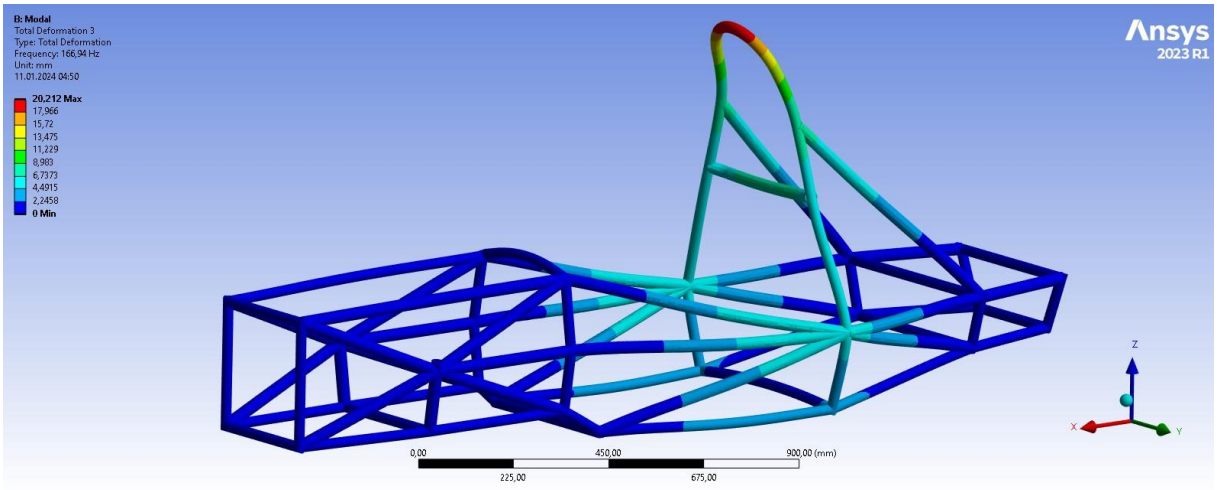


Figure 16. Mode 3 total deformation of AISI 4130 steel

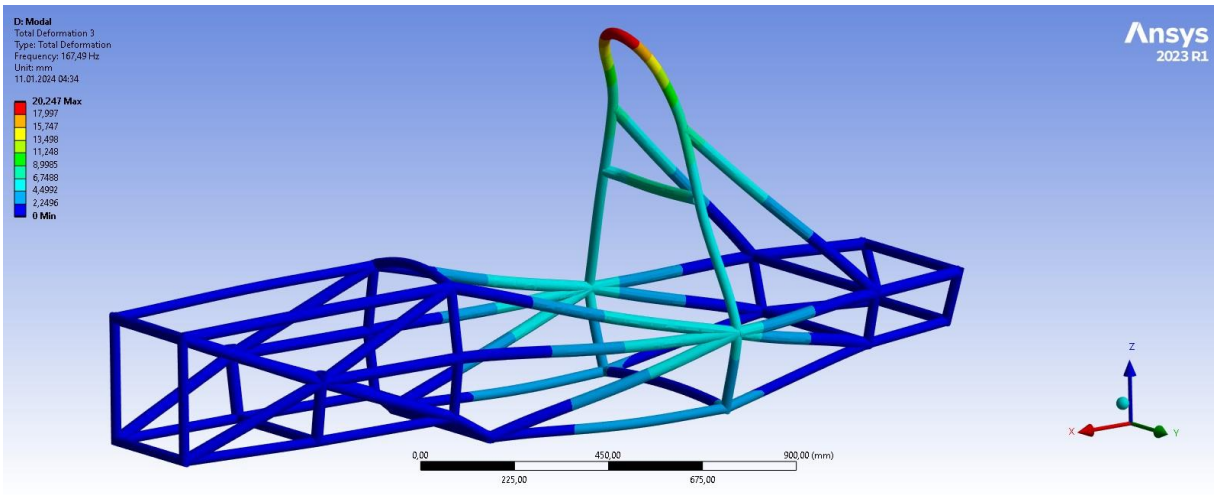


Figure 17. Mode 3 total deformation of S355 steel

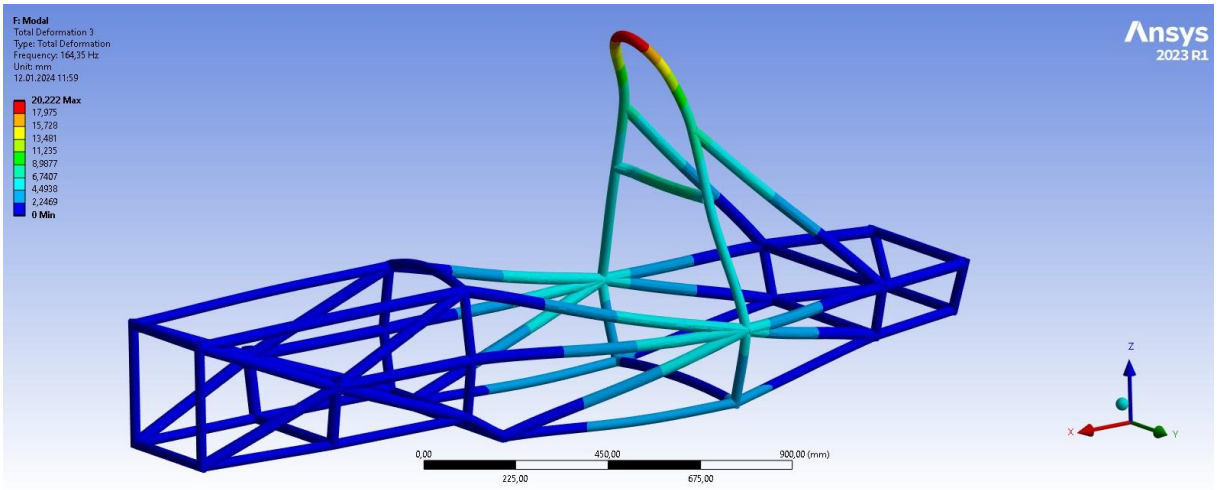


Figure 18. Mode 3 total deformation of Usibor 1500 steel

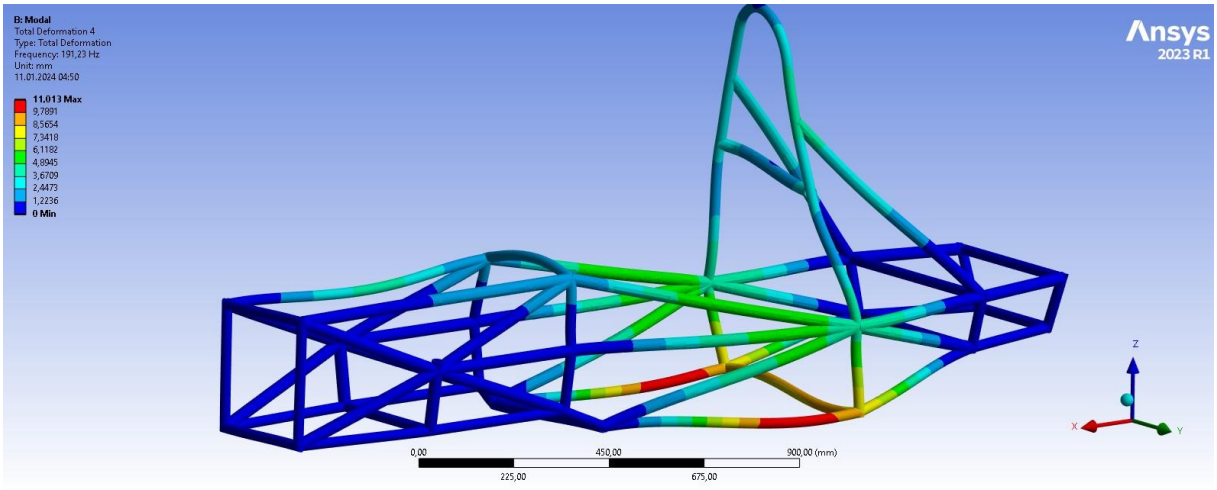


Figure 19. Mode 4 total deformation of AISI 4130 steel

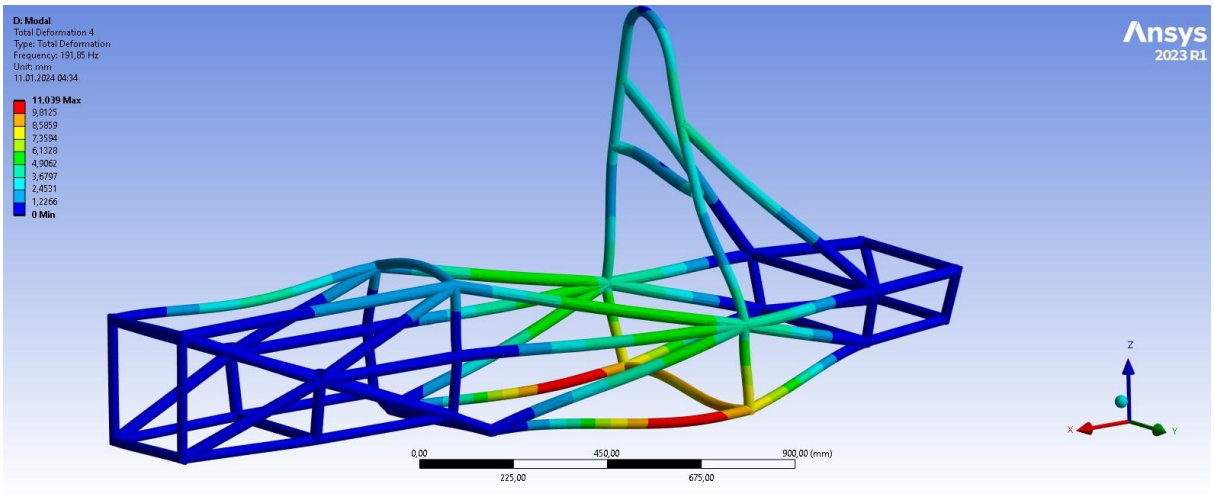


Figure 20. Mode 4 total deformation of S355 steel

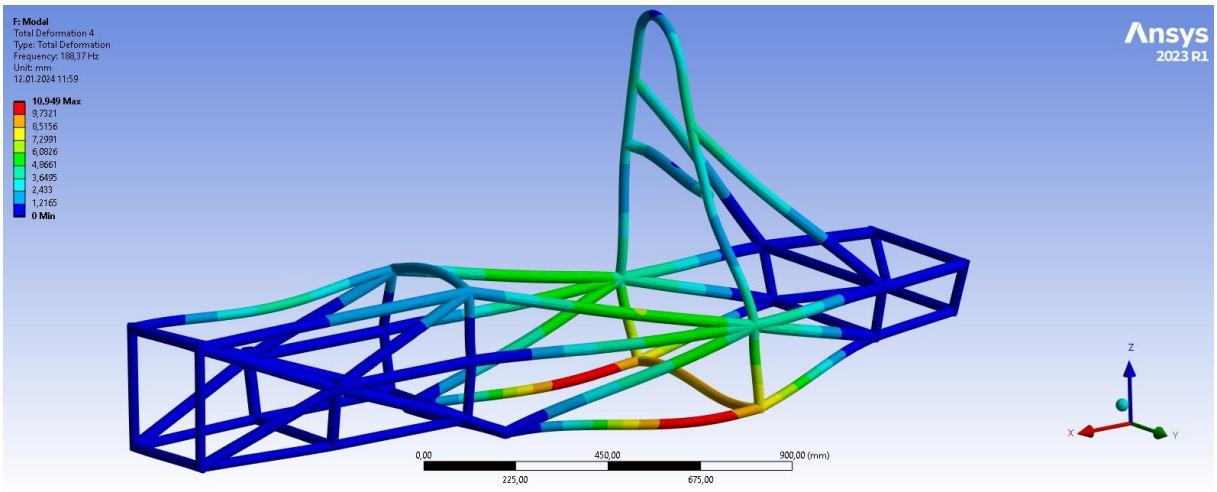


Figure 21. Mode 4 total deformation of Usibor 1500 steel

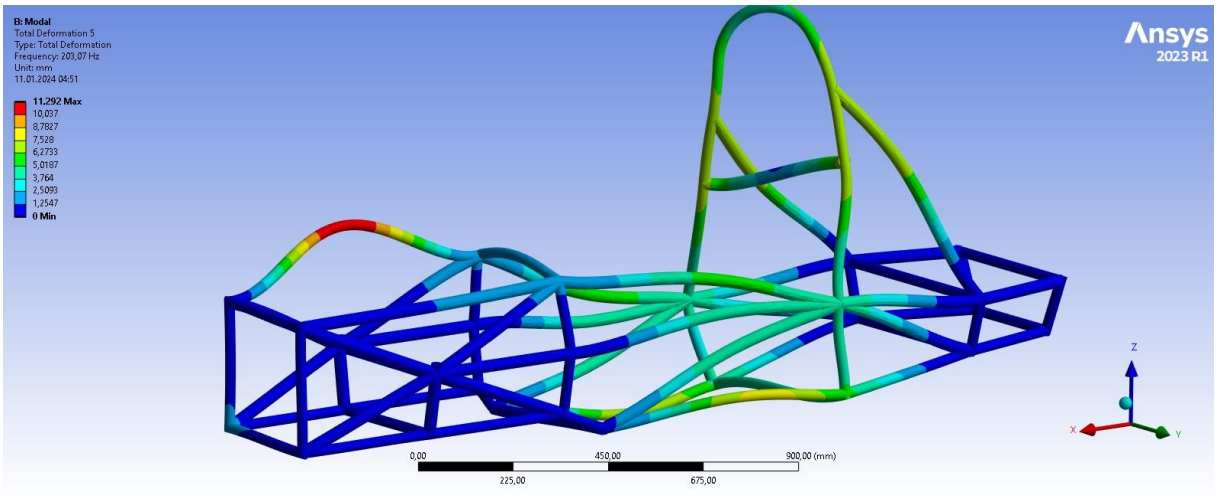


Figure 22. Mode 5 total deformation of AISI 4130 steel

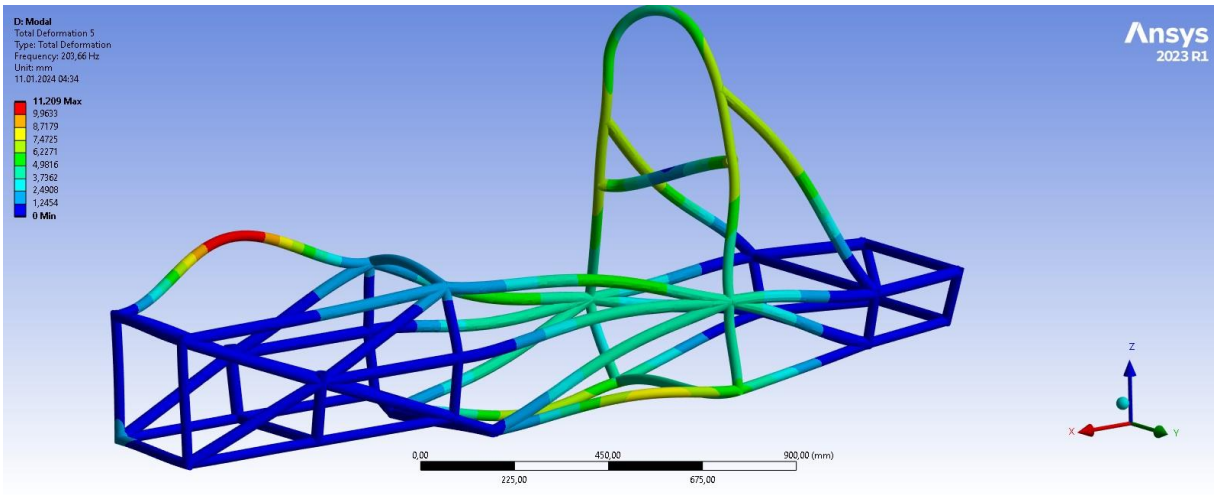


Figure 23. Mode 5 total deformation of S355 steel

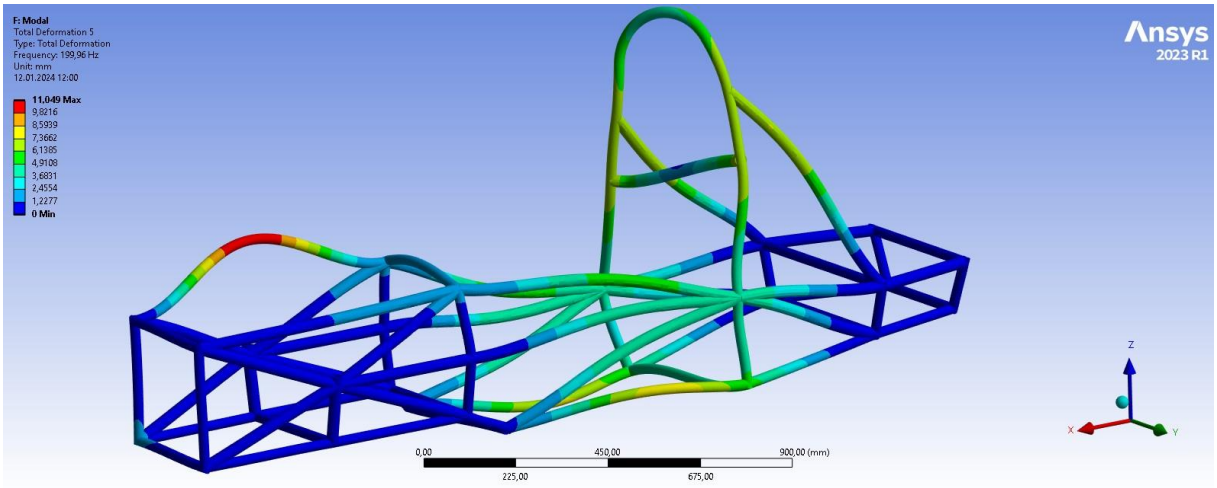


Figure 24. Mode 5 total deformation of Usibor 1500 steel

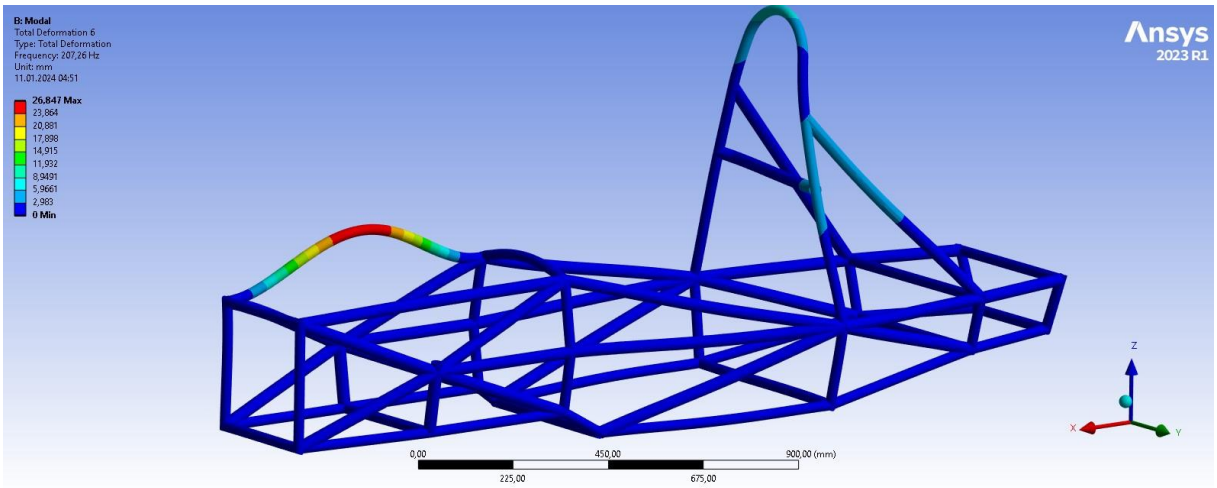


Figure 25. Mode 6 total deformation of AISI 4130 steel

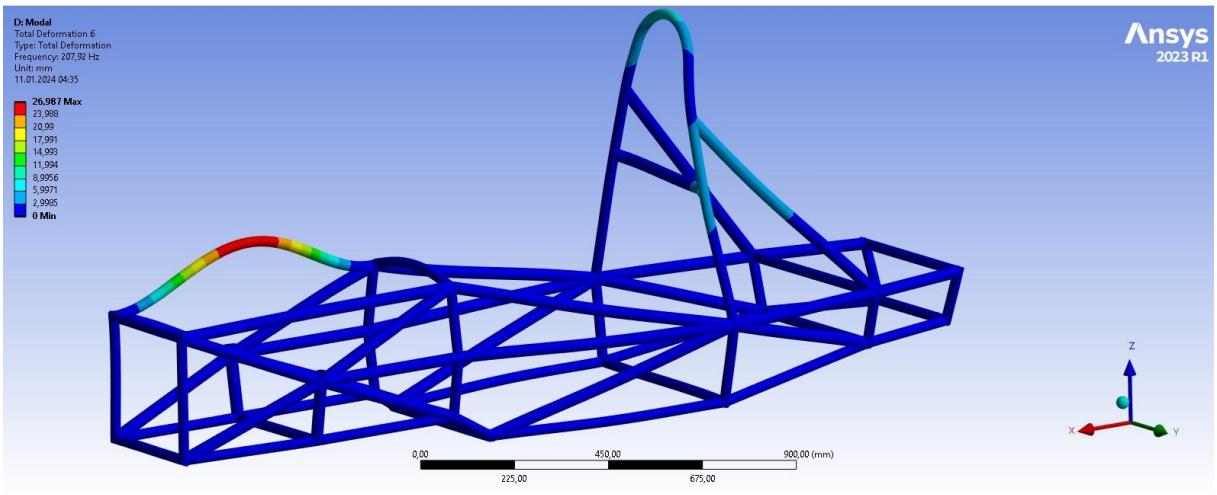


Figure 26. Mode 6 total deformation of S355 steel

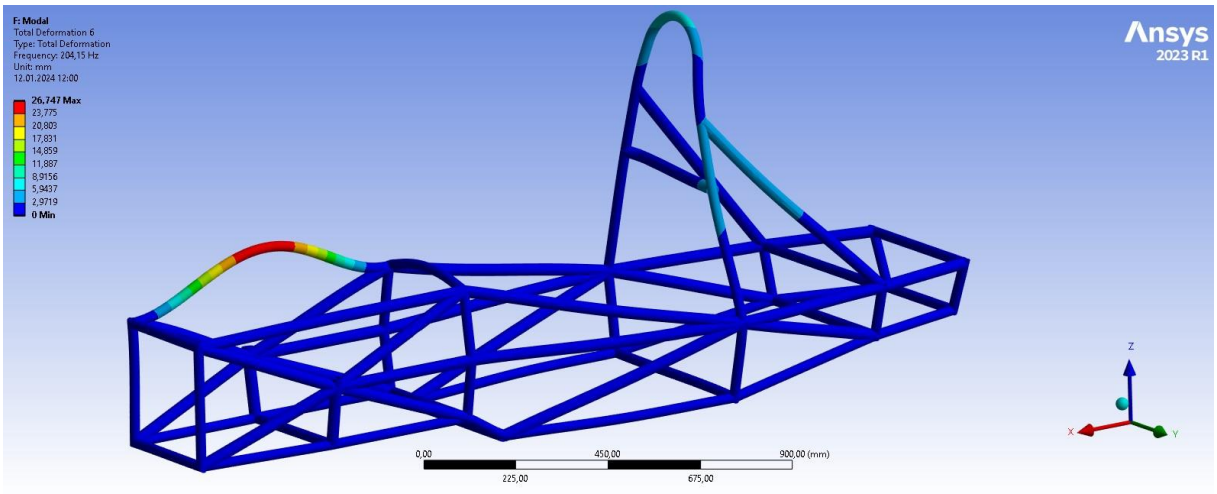


Figure 27. Mode 6 total deformation of Usibor 1500 steel

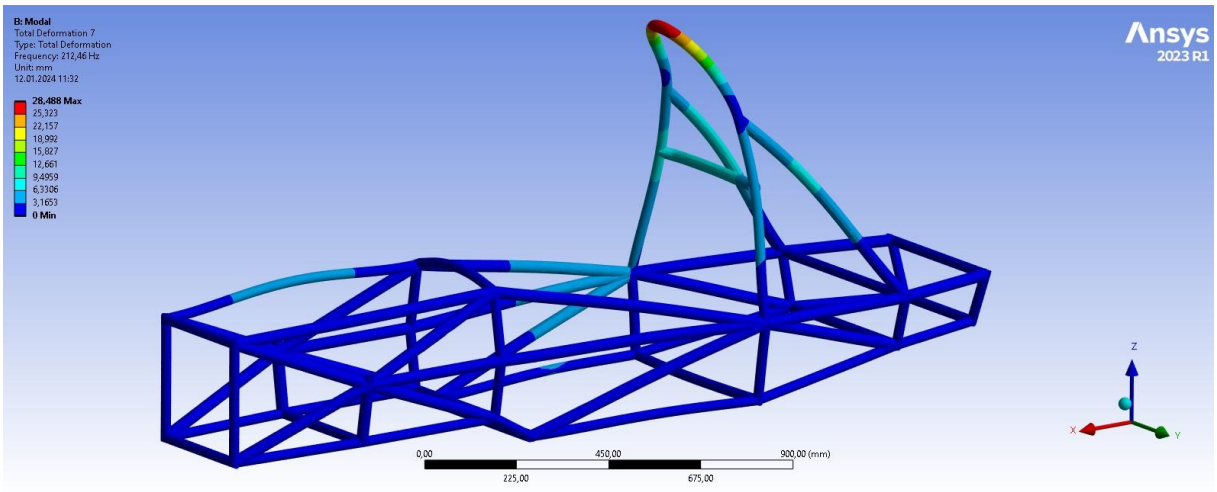


Figure 28. Mode 7 total deformation of AISI 4130 steel

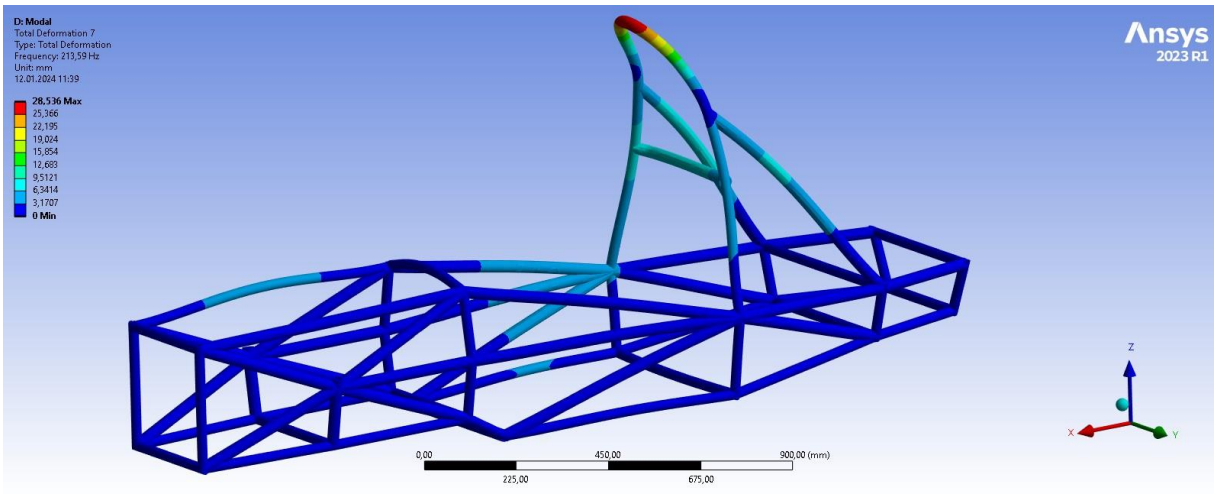


Figure 29. Mode 7 total deformation of S355 steel

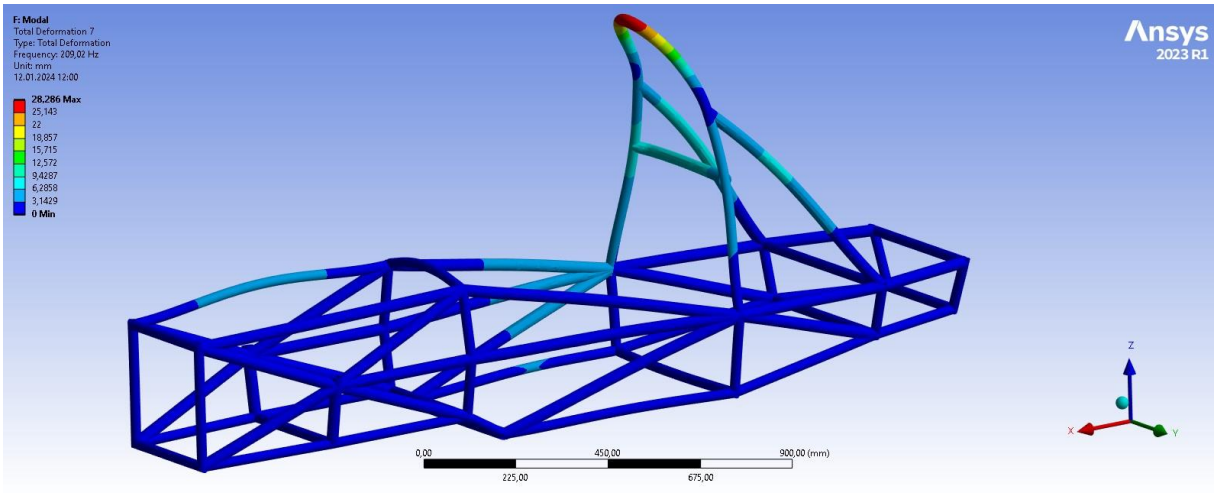


Figure 30. Mode 7 total deformation of Usibor 1500 steel

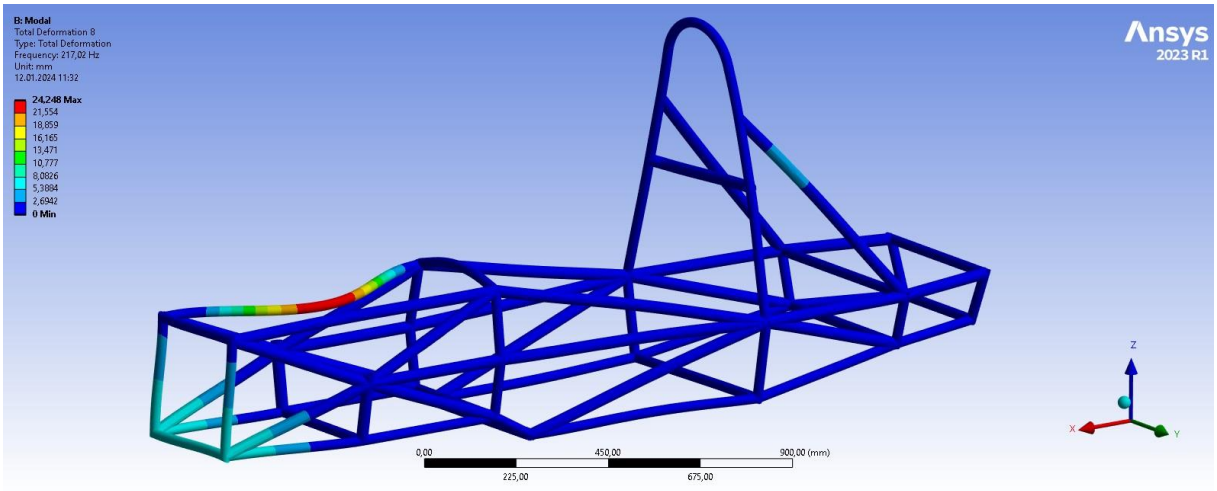


Figure 31. Mode 8 total deformation of AISI 4130 steel

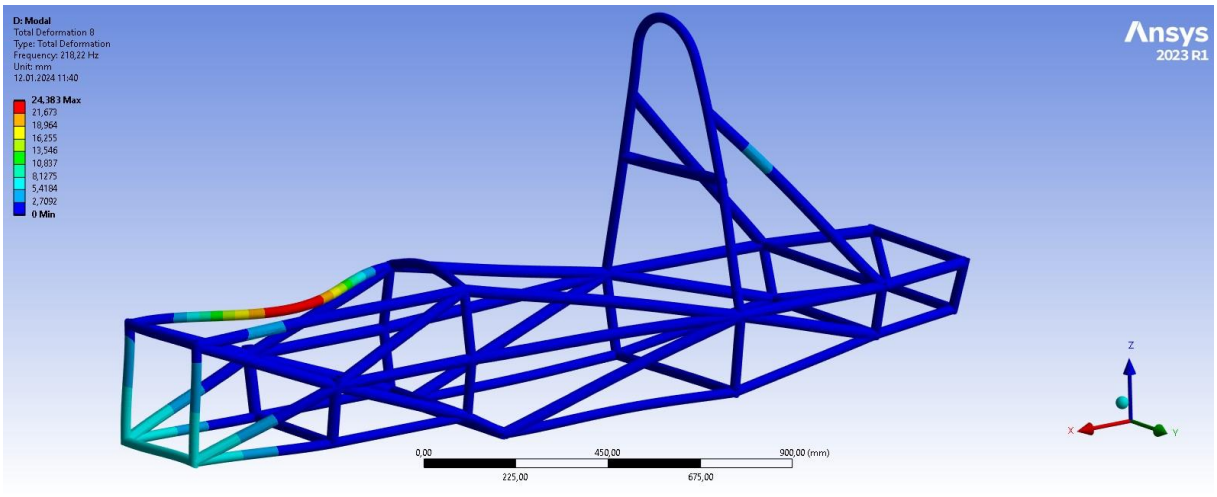


Figure 32. Mode 8 total deformation of S355 steel

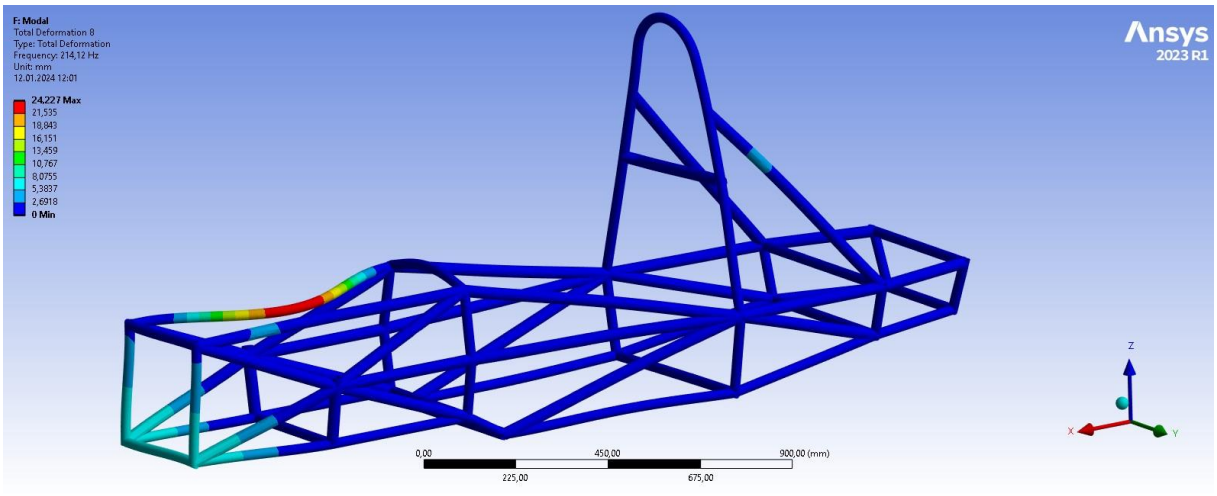


Figure 33. Mode 8 total deformation of Usibor 1500 steel

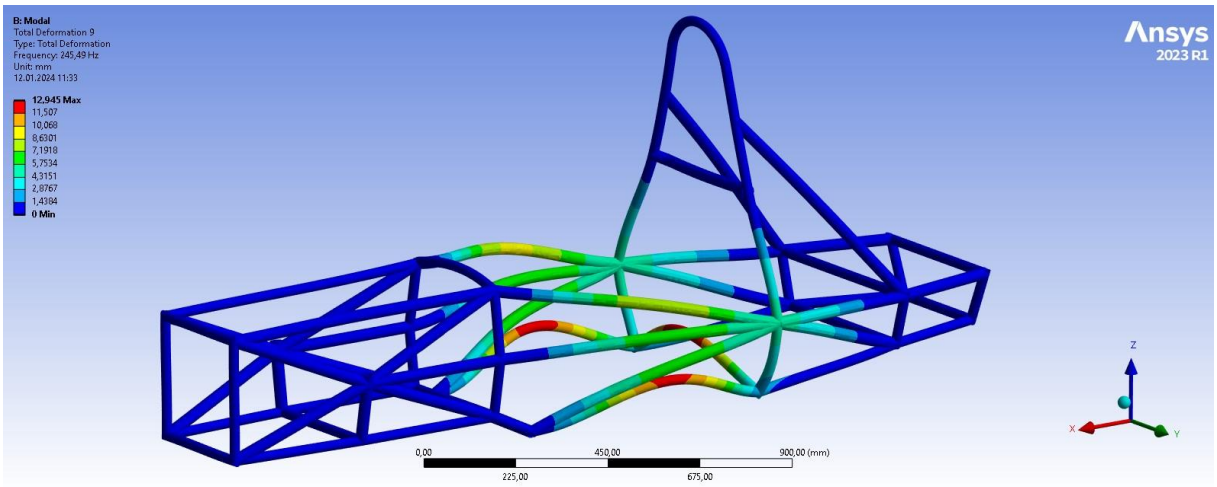


Figure 34. Mode 9 total deformation of AISI 4130 steel

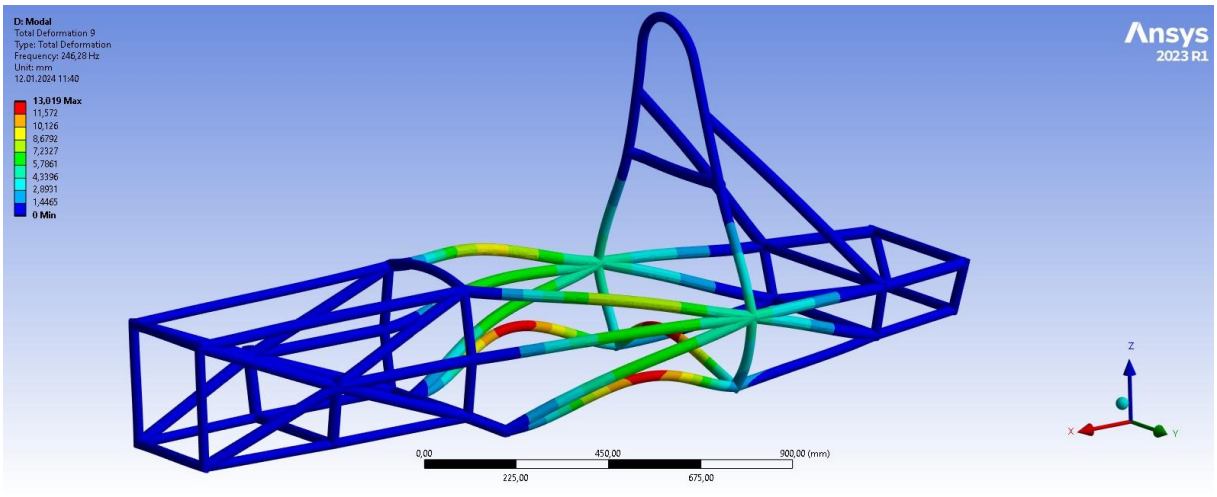


Figure 35. Mode 9 total deformation of S355 steel

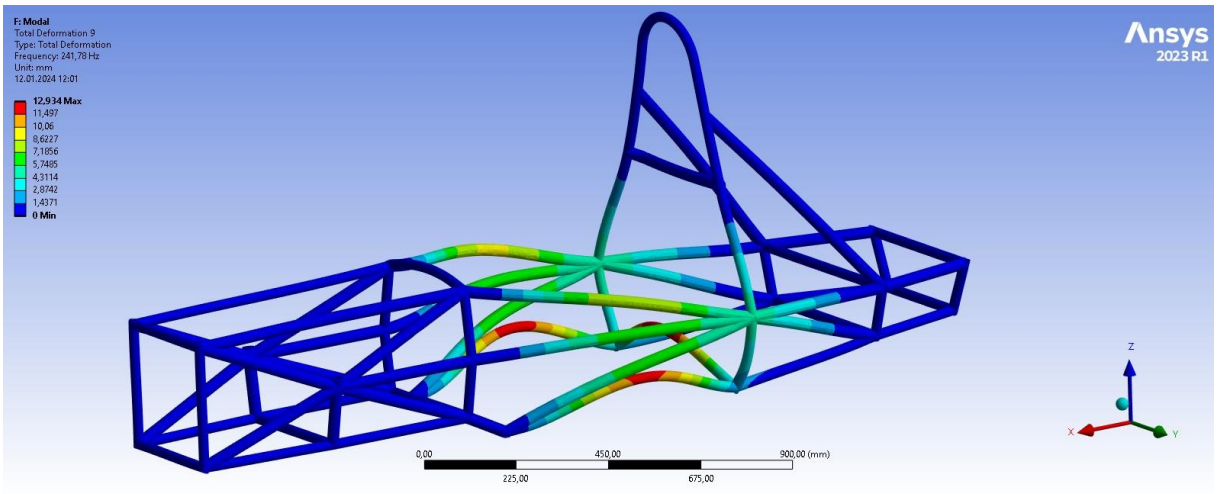


Figure 36. Mode 9 total deformation of Usibor 1500 steel

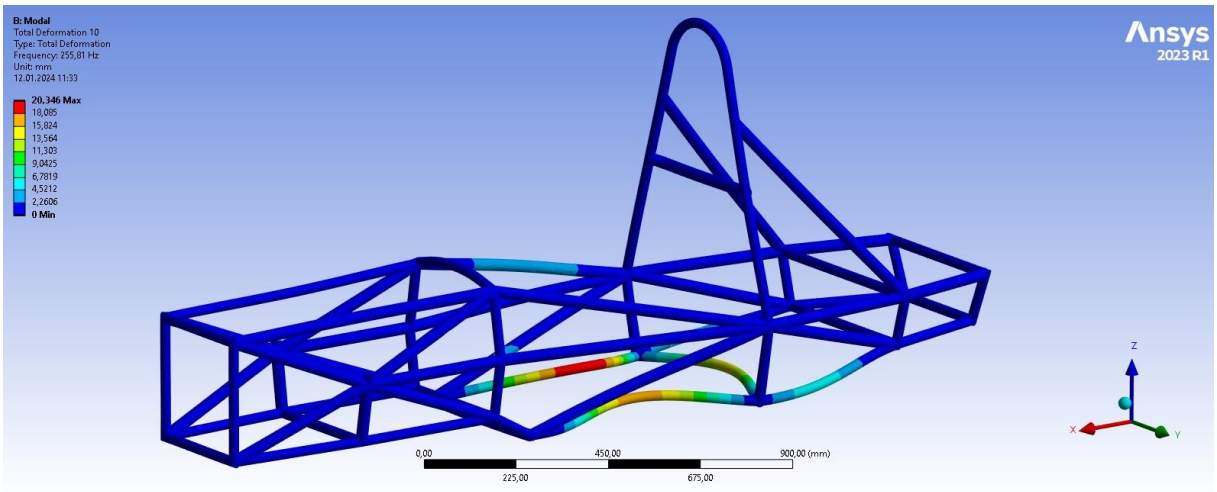


Figure 37. Mode 10 total deformation of AISI 4130 steel

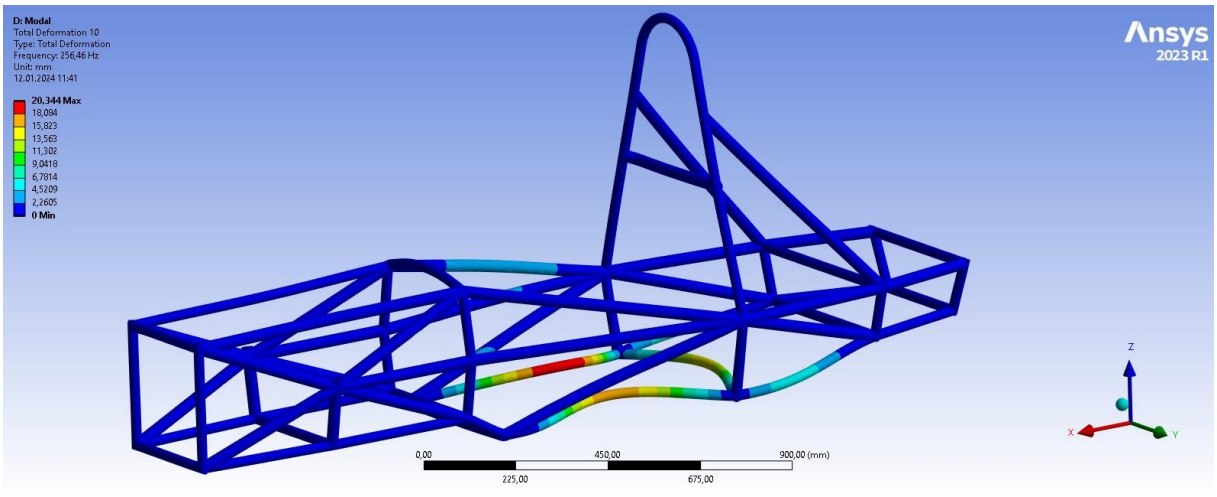


Figure 38. Mode 10 total deformation of S355 steel

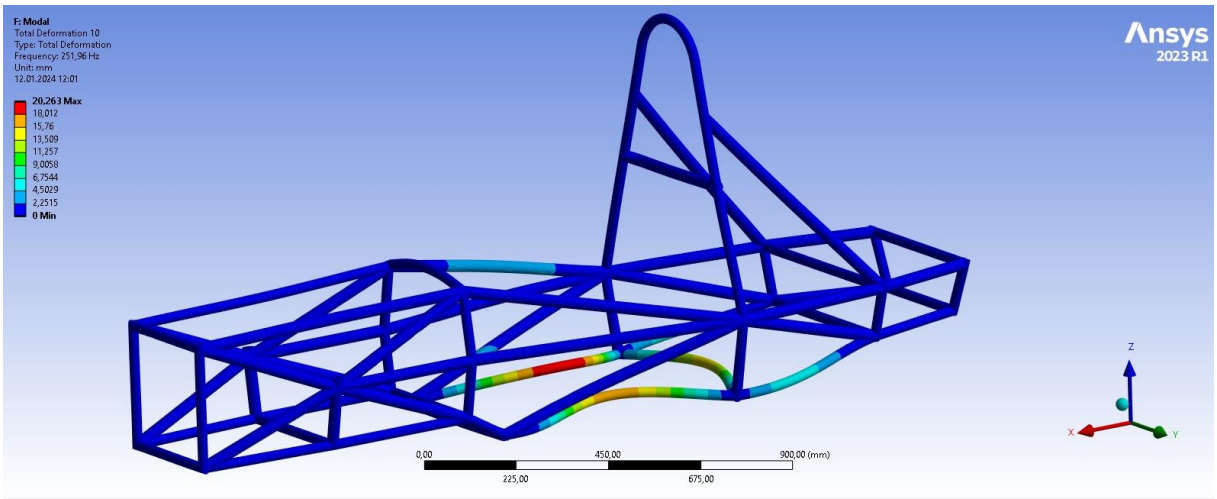


Figure 39. Mode 10 total deformation of Usibor 1500 steel

Conclusion and Recommendations

In this study, a Formula car chassis was designed, and structural analysis and vibration analysis were carried out with three diverse materials, and the properties of the design, and materials were investigated. The following results were obtained during the study;

- Design with ultra-high strength steel material has a factor of safety 2.33 times higher than AISI 4130 and 3 times higher than S355.
- When the results of the structural analysis were compared, the equivalent stresses and total deformations of all three materials were very close to each other. The highest value was observed in AISI 4130 material with 400 MPa. 396 MPa followed by ultra-high strength steel and S355 with 395 MPa.

- AISI 4130 and S355 materials had a total deformation of 2.9 mm, while 3 mm was obtained from ultra-high strength steel.
- When the modal analysis results are compared, the lowest frequency values are obtained from ultra-high strength steel.

In subsequent analysis studies, weight reduction can be achieved by applying topology in the design of the chassis, and the cost can be reduced along with the topology with appropriate material combinations.

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BİR OPTİMİZASYON ÇALIŞMASI: KAMYON ŞASESİNDE FARKLI MALZEME KULLANIMININ İNCELENMESİ

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Özet
Ağır ticari araç şasileri, düzenli olarak geliştirilen askeri projelerde, taşımacılıkta, beton pompalarında ve benzeri sektörlerde sıklıkla kullanılan bir şasi türüdür. Bu şasi tiplerinin farklı sektörlerde tercih edilmesi, dayanıklılığın yanı sıra hafiflik ve maliyet gibi parametreleri de ön plana çıkarmaktadır. Bu çalışmada ağır ticari araç şasi tasarımında topoloji yöntemi kullanılarak şasi ağırlığının azaltılmasına yönelik tasarım değişiklikleri yapılmıştır. Tasarım için CATIA V5 R21 tasarım programı kullanıldı. Analizlerde ANSYS Workbench R23 sonlu elemanlar analiz programı kullanıldı. Şasi analizinde St-37 (yapısal çelik), Usibor 1500 (UHSS) ve S690QL çeliği olmak üzere üç farklı malzeme kullanıldı. Bu çelik gruplarının seçilmesinin nedeni, farklı şekil ve dayanımlardaki çelik gruplarının topoloji optimizasyonu yoluyla karşılaştırılmasının incelenmesiydi. Analizler sonucunda üç farklı çelik grubu toplam deformasyon, eşdeğer gerilme değeri, güvenlik faktörü ve maliyet açısından karşılaştırıldı. Çalışma sonuçları, optimize edilen parçaların ağırlığının %37,84 oranında azaldığını gösterdi. Ayrıca elde edilen veriler çelik gruplarındaki güvenlik faktörü değerlerinin 1.04 ila 1.07 kat daha iyi olduğunu yansıtmaktadır. Tasarımda topoloji optimizasyonu ile malzeme maliyetlerinin yaklaşık 1.61 kat azaldığı, şasinin bazı noktalarındaki gerilim değişimlerinin belirli noktalardan farklı bölgelere dağıtılmasıyla kritik nokta sayısının azaldığı tespit edilmiştir.
Anahtar Kelimeler: Sonlu elemanlar metodu, Optimizasyon, Ultra yüksek mukavemetli çelik, Yapısal çelik, S690QL

AN OPTIMIZATION STUDY: EXAMINING DIFFERENT MATERIALS USAGE IN THE TRUCK CHASSIS

Abstract
Heavy commercial vehicle chassis is a chassis type that is frequently used in regularly developed military projects, transportation, concrete pumps, and similar sectors. The preference of these chassis types in different sectors highlights parameters such as lightness and cost, as well as durability. In this study, design changes were made in the heavy commercial vehicle chassis design by using the topology method to reduce chassis weight. CATIA V5 R21 design program was used for the design. ANSYS Workbench R23 finite element analysis program was used for analyses. Three different materials were used in the chassis analysis, namely St-37 (structural steel), Usibor 1500 (UHSS), and S690QL steel. The reason for choosing these steel groups was to examine the comparison of steel groups in different shapes and strengths through topology optimization. As a result of the analyses, three different steel groups were compared in terms of total deformation, equivalent stress value, safety factor, and cost. The study results showed that the weight of the optimized parts was reduced by 37.84%. In addition, the data obtained reflects that the safety factor values in steel groups are 1.04 to 1.07 times better. It has been determined that material costs are reduced by approximately 1.61 times with topology optimization, and the number of critical points is reduced by distributing the stress changes at some points of the chassis from certain points to different regions in the design.
Keywords: Finite element method, Optimization, Ultra-high strength steel, Structural steel, S690QL

Introduction

Vehicle chassis are one of the fundamental building blocks of the automotive industry and have a major impact on the durability, safety, and performance of the vehicle. With technological developments and advances in material science and engineering, chassis designs have also undergone significant changes. After ensuring that the design is safe for humans, material selection becomes one of the most important points, as well as costs such as manufacturability, part cost, labor cost, transportation cost, and transportation permitting. At this point, optimum design, accurate material analysis, and selectable potential material cost feasibilities are indispensable for the vehicle to be produced. These parameters enable optimizing the appropriate storage units to increase the loading amount of the passenger truck charger and designing suitable storage units with stress analysis, taking into account the stress distribution factor for different cross-sections under different loads. They decided to profile the most appropriate stress value of the parts to be produced with the finite parameter's method (Kengkongan et al., 2020). In the Veleso et al. study,a deformation analysis of the longitudinal beam of a prototype vehicle was carried out. During the durability analysis, deformations at the junction points of the buffer of the vehicle solutions were detected. Cracks appear in the beam and continue to grow. Stress analysis was carried out using the finite element method. The resulting result was supported by a new design. The resulting cracks were removed (Veloso et al., 2009).There are methods that include techniques for the design of automotive components. In particular, topology, tonometry, and size ranges are monitored in conjunction with FEM (Finite Element Method) analysis and for guidance to ensure optimal hardware configuration. This work combined design elements of high-performance vehicle components with a central engine at the rear (Cavazzuti et al., 2011).Optimum results were achieved by replacing steel with a potential metal matrix composite lightweight Graphite Al GA 7–230 MMC material in a heavy-duty TATA 1612 truck chassis (ladder type frame). Analysis shows about 70% weight reduction in power dissipation and overall good direct maintenance of the system (Agarwal & Mthembu, 2022). It is a study conducted to reveal the potential of design and analysis in some applications. Following the improving experience in the Mille Chili Laboratory, studies were carried out to reduce weight in automotive chassis design applications (Cavazzuti & Splendi, 2011).In these studies, analyses were carried out to find the structural, material, and modal deformation rate, optimum durability, total deformations occurring at different frequencies, etc. It has been searched what is the best material to match the required values of the truck chassis. The modeling and analysis of the Ashok Leyland 2516 model truck was carried out using

programs such as SOLIDWORKS 2016 and ANSYS 14.0. Comparing all the stresses, strains, and deformations of the relevant materials, it turned out that among the three materials (Structural steel, AISI4340, Carbon fiber) is the most optimum for modeling a chassis (Rastogi & Singh, 2019). It is a study based on the isolation of automotive conditions with fatigue, highest shear stress, equivalent stress, and maximum load and durability limitations. The numerical analysis method was used to reduce the weight. This situation was modeled with the help of computers. The chassis is modeled after the PRO-E. FEA was performed on frameworks modeled with ANSYS Workbench (Vijaykumar & Patel, n.d.). Topology optimizations of the truck chassis were made within this enclosure. Analyzes were carried out with the loads that this vehicle can lift. ANSYS Workbench program was used to perform these analyses. The deformation and stress values of the chassis change. When the optimized model was compared with the first designed model, approximately 14% mass structure was decreased without exceeding the desired stress values (Doğru, 2019). These features focus on performing stress analysis of heavy-duty truck vehicles. Stress analysis is one of the most important points in the ongoing analysis of the critical point with the highest stress in estimating the fatigue distribution and life of materials. The analysis was made of a truck model using the software called ABAQUS, the finite parameters method. The length of the model is 12.35 m and the width is 2.45 m. The chassis material is ASTM Low Alloy Steel A 710 C (Grade 3) with a yield limit of 552 MPa and a tensile strength of 620 MPa. As a result, a change in the critical voltage point occurs at the points where the poles are in contact. The stress magnitude of the critical point is 386.9 MPa. This critical point was where the stresses in the crack formation began because fatigue was where the highest stress began (Abd Rahman et al., 2008). In this study, unlike the literature, topology optimization was applied to examine the structural characteristics of three different materials such as deformation, equivalent stress, and safety factor, as well as their effects on cost and chassis weight.

Materials and Methods

When materials such as automotive wax, steel, alloy, and composite are generally desired to be lightened according to the condition of the part or the condition in which it will break the cost, durability, parts, and lightness must be taken into consideration and the necessary elements must be selected. It is essential to choose the right material for the critical parts that will be used continuously under static, dynamic and these loads on the vehicles. While the availability of components such as parts is very important, the price of the selected material and the performance provided are equally important. The fact that a material is very good may increase

its selection ability, but the material must meet the desired loads, with optimum durability and at optimum cost. In addition to this issue, it is also very important whether the selected material is manufacturable or not. When the material to be used in a leak has poor weldability, poor bending conditions, low resistance to abrasion, and similar features, it is not desirable to use it in weak places. In truck bodies, the heat level is the most used metal and steel group. The steels used for the truck markets modeled in this study are St-37 (Structural Steel), Usibor 1500 (UHSS),and S690QL metals.

Table 1 Material Properties(Kumlu et al., 2023; Steel number, 2024)

Material	Density (kg/m^3)	Elastic module (GPa)	Poisson ratio	Tensile strength (MPa)	Tensile ultimate strength (MPa)
St-37	7850	200	0,3	250	460
Usibor 1500	7860	205	0,29	1100	1500
S690QL	7860	210	0,29	770	810

In this study, numerical analysis was performed using computer-aided drawing program (CAD) and finite element method (FEM). The chassis designed with Catia V5 R21 was transferred to Ansys Workbench for static analysis. After examining the total deformation stress value and safety factor of the chassis, whose resistance to static loads was examined, lightened modeling of the parts coded mba_1001, mba_1003.1, mba_1003.2, mba_1003.3, mba_1004 and mba_1005 was carried out with topology optimization. Based on the results obtained, a lightened version of the chassis was modeled. Then, static loads were examined again. The process in which the static loads of the chassis in the initial state were examined was called Case 1, and the process in which the lightened model was examined was called Case 2.The ladder type truck chassis, which is frequently used among truck chassis models, was created in the CATIA V5 R21 modeling program using U-type profiles suitable for the truck model, as shown in Figures 1 to 7. Surface modeling, sheet metal bending, solid modeling, and assembly modules were used in the design.

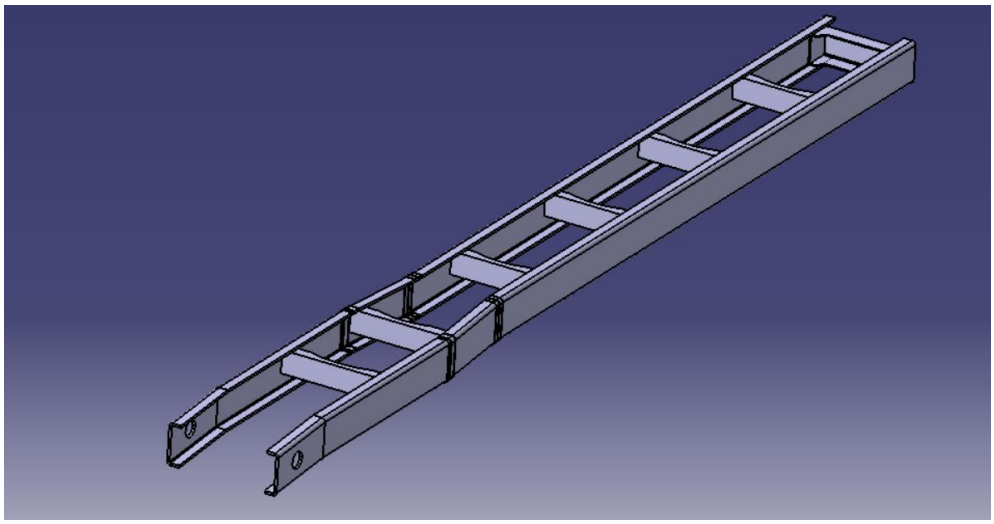


Figure 40. Case 1 model display in different views

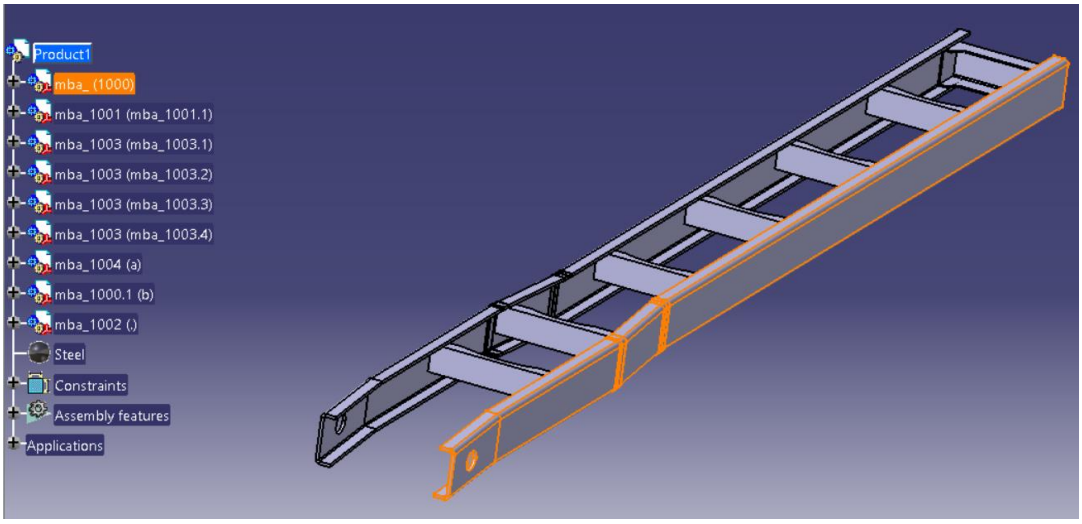


Figure 41. mba_1000 code carrier

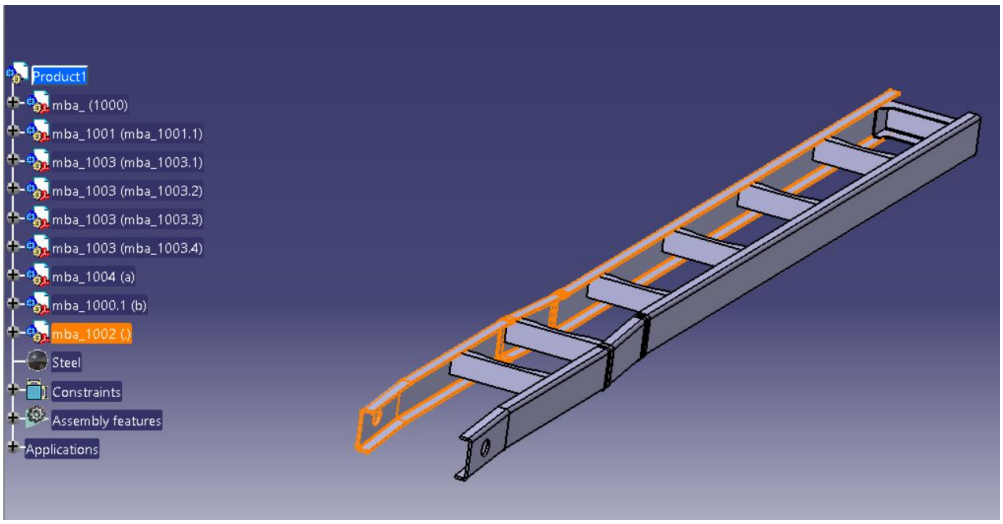


Figure 42. mba_1002 code carrier

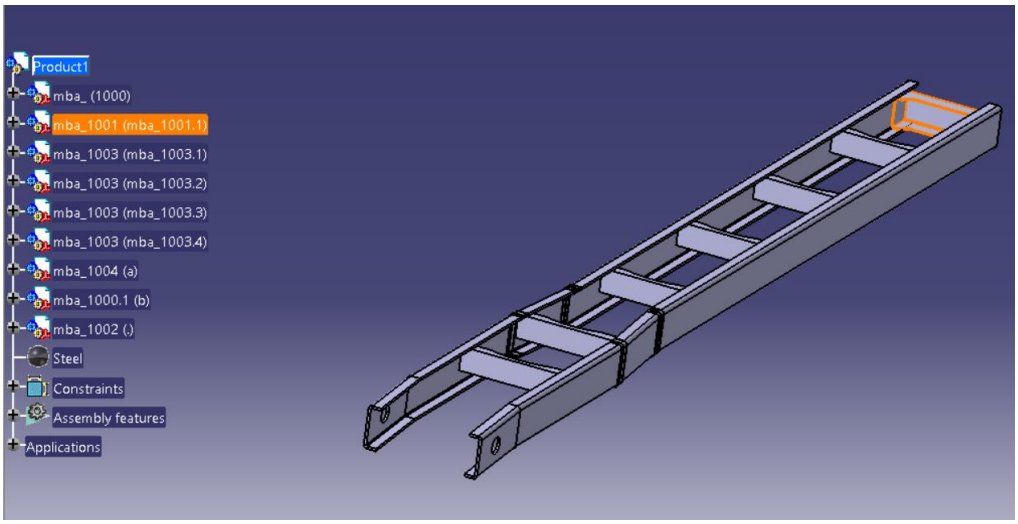


Figure 43. mba_1001 code carrier

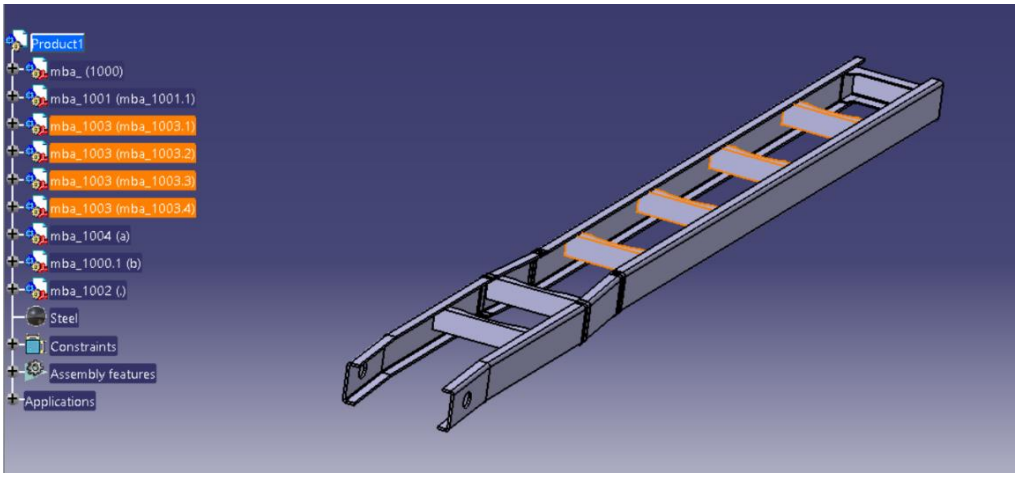


Figure 44. mba_1003 code carriers

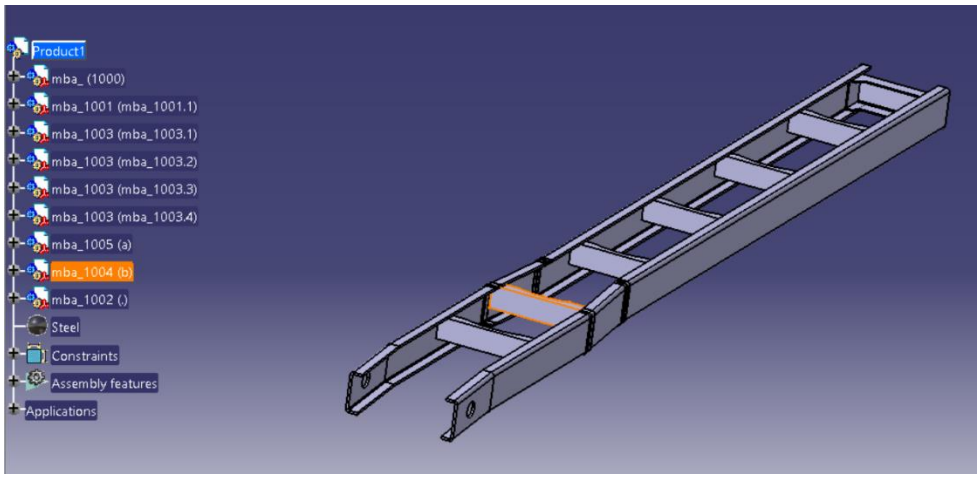


Figure 45. mba_1004 code carrier

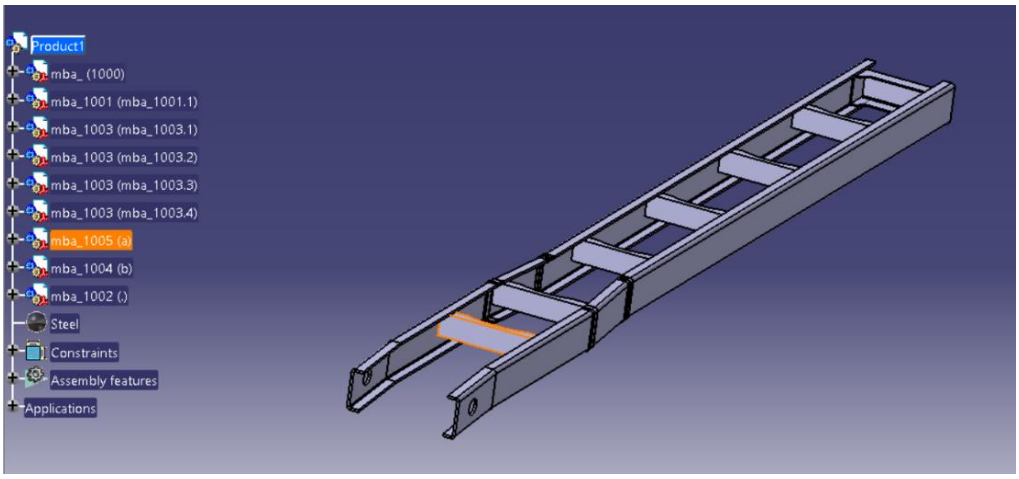


Figure 46. mba_1005 code carrier

The wall thickness of the main carriers of the model to be used in the first analysis was determined as 20 mm as in Figure 8. Figure 9 indicates the Case 1 mba_1001 thickness.

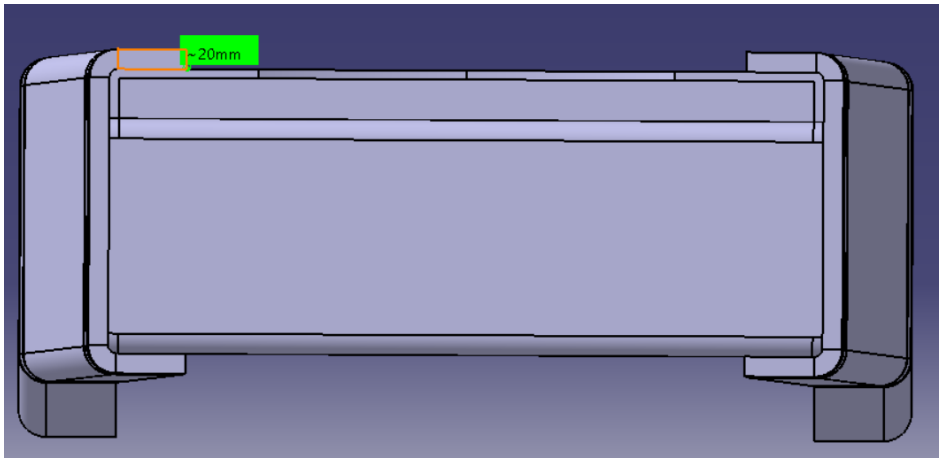


Figure 47. Case 1 mba_1000 and mba_1002 wall thicknesses

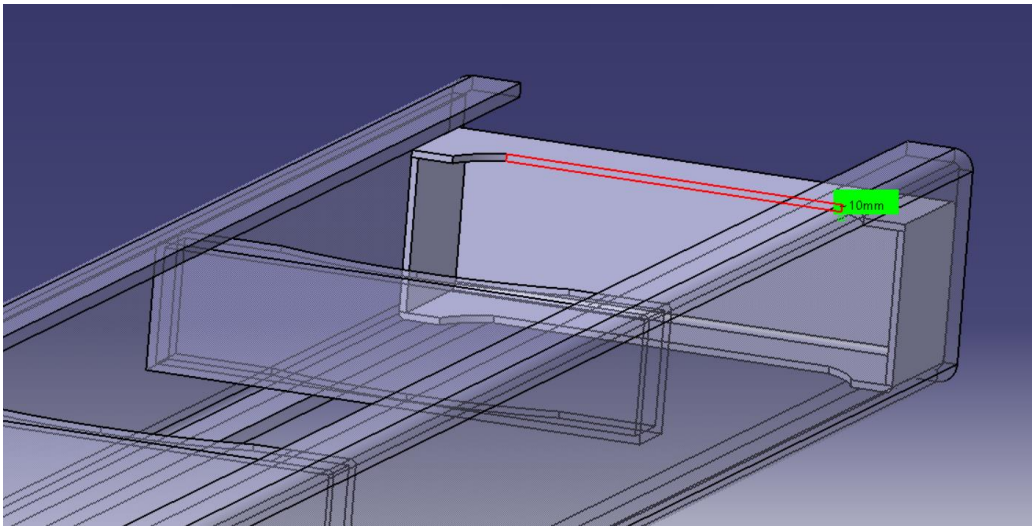


Figure 48. Case 1 mba_1001 thickness

The thickness of mba_1003, mba_1004, and mba_1005 carriers was chosen as 10 mm, as in mba_1001. Case 2 mba_1000 and mba1002 wall thickness was halved and determined as 10 mm. Figure 10 and Figure 11 indicate the general view of the model designed for Case 2 of the two models. Figure 10 and Figure 11 display the Case 2 mba_1000 and mba1002 wall thickness and Case 2 mba_1001 thickness.

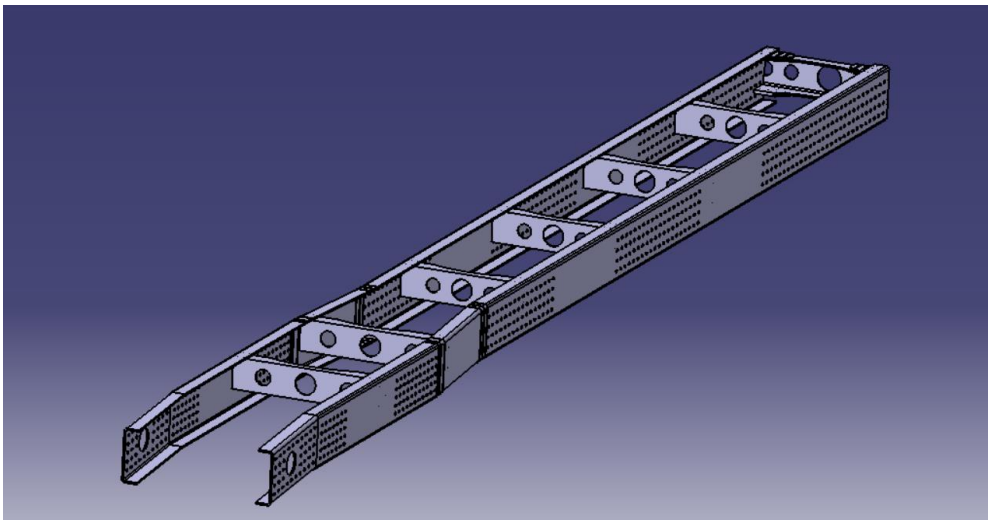


Figure 49. General view of the model designed for Case 2: first

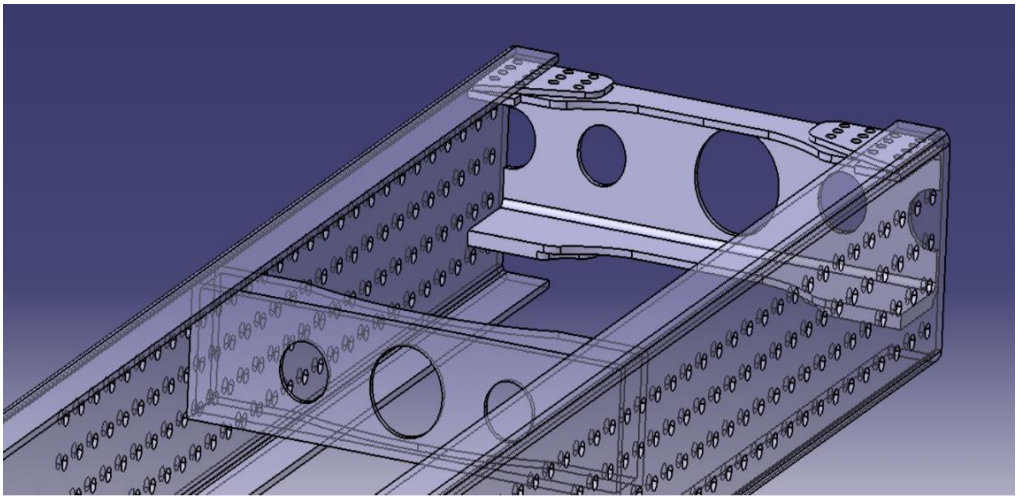


Figure 50. General view of the model designed for Case 2: second

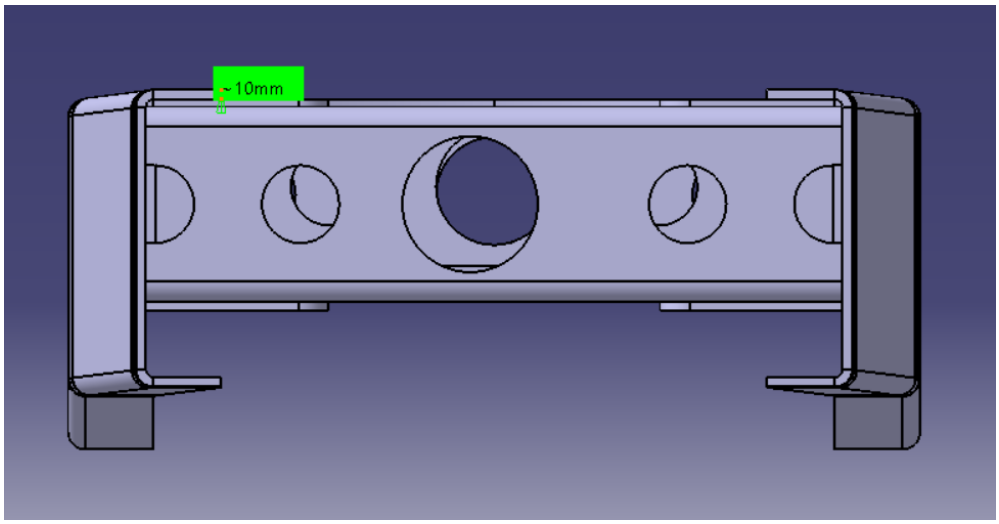


Figure 51. Case 2 mba_1000 and mba1002 wall thickness

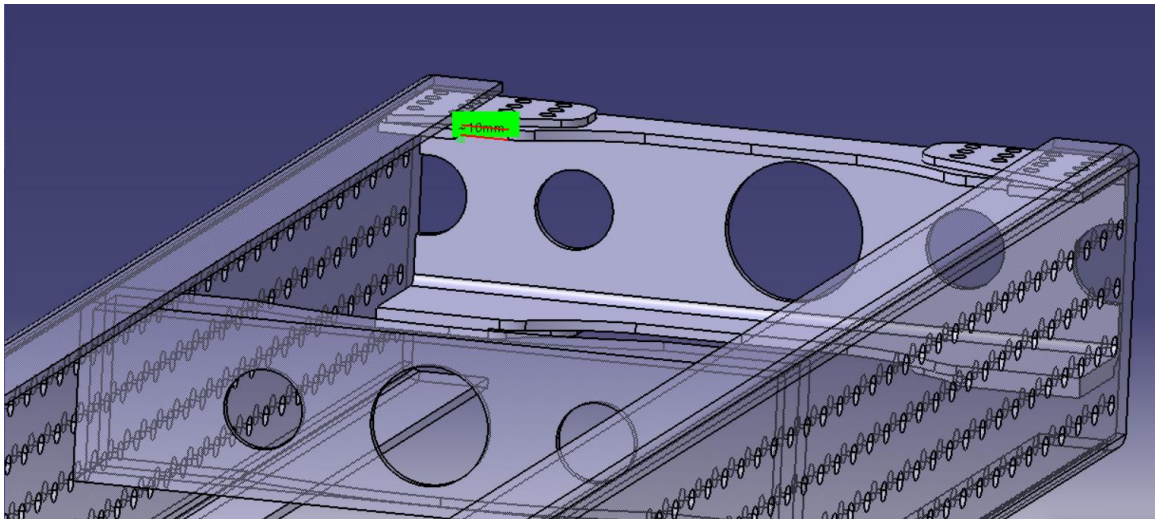


Figure 52. Case 2 mba_1001 thickness

The thickness of mba_1003, mba_1004, and mba_1005 carriers was selected as 10 mm, as in mba_1001. However, because of the results of topology optimization, circular discharges were made at points where the effect of the loads was low. The Case 1 chassis designed in Catia V5 R21 was converted to STEP format and transferred to Ansys Workbench 2023 R1. The methods followed in the analysis are respectively, the meshing process, determination of fix points, application of loads,and results. During the mesh creation process, after the mesh was updated, patch independent was applied to the lateral carriers. Then, body sizing was applied to parts mba_1000 and mba_1002. As a result, 829,278 node points and 448,198 element numbers were obtained. The maximum value of element quality was found to be 0.99999 and the average mean value was 0.69239. The maximum skewness value was found to be 0.99853 and the average value was 0.40746. The same procedures were applied for Case 1 and Case 2 and

approximately the same values were obtained. Fix points are determined as the points where the wheels of the vehicle are connected as in Figure 14.

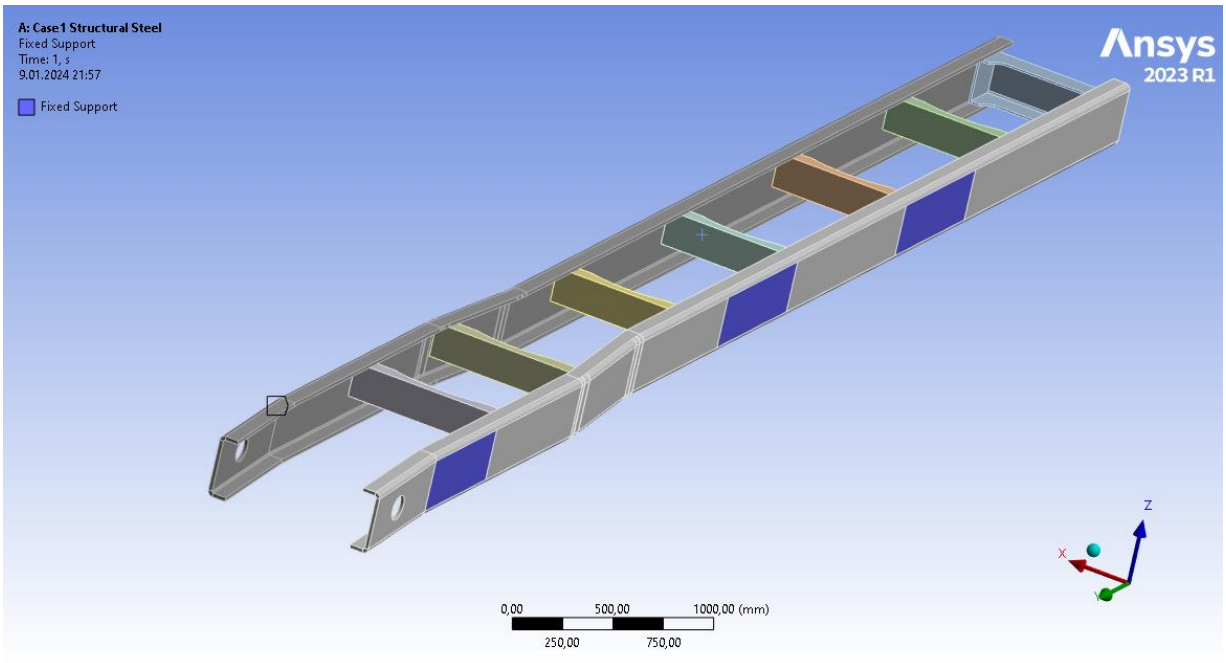


Figure 53. Fixed support region

The applied loads were examined in two groups: loads on the front axle and loads on the rear axle as in Figures 15 and 16. A load of 70,000 N was applied, corresponding to a load on the front axle of 7,000 kg. The load on the rear axle was 180,000 N, corresponding to 18,000 kg.

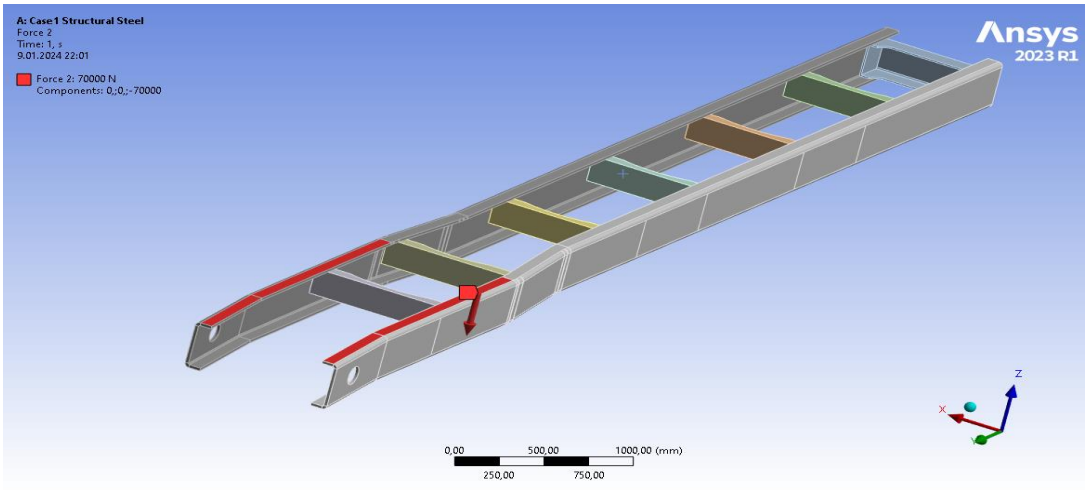


Figure 54. Case 1 front axle load

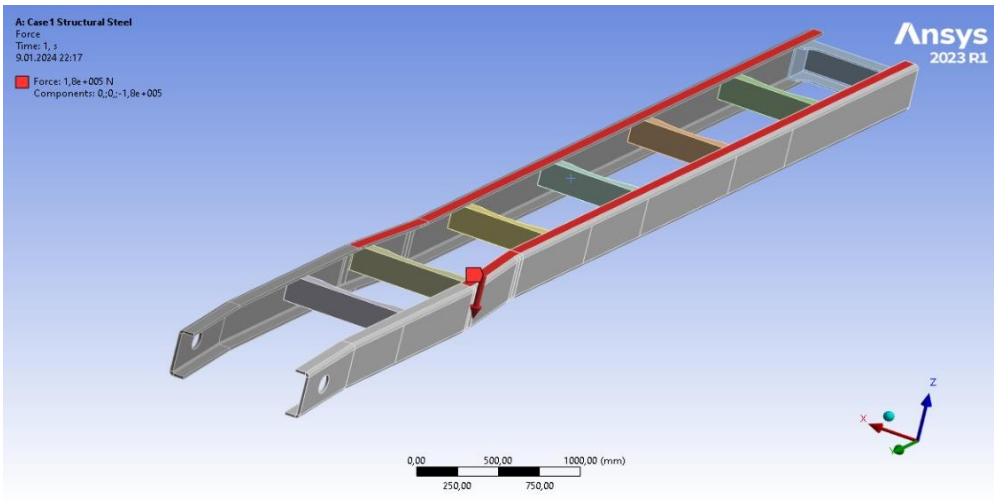


Figure 55. Case 1 load

The same processes applied in Case 1 were carried out in Case 2 as shown in Figures 17 and 18. The applied loads are the same as in Case 2, as in Figures 19 and 20.

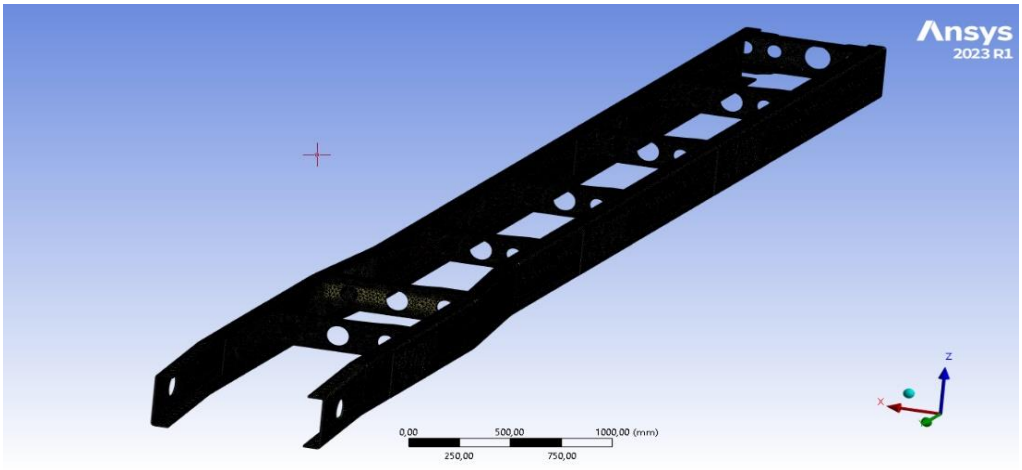


Figure 56. Case 2 mesh structure

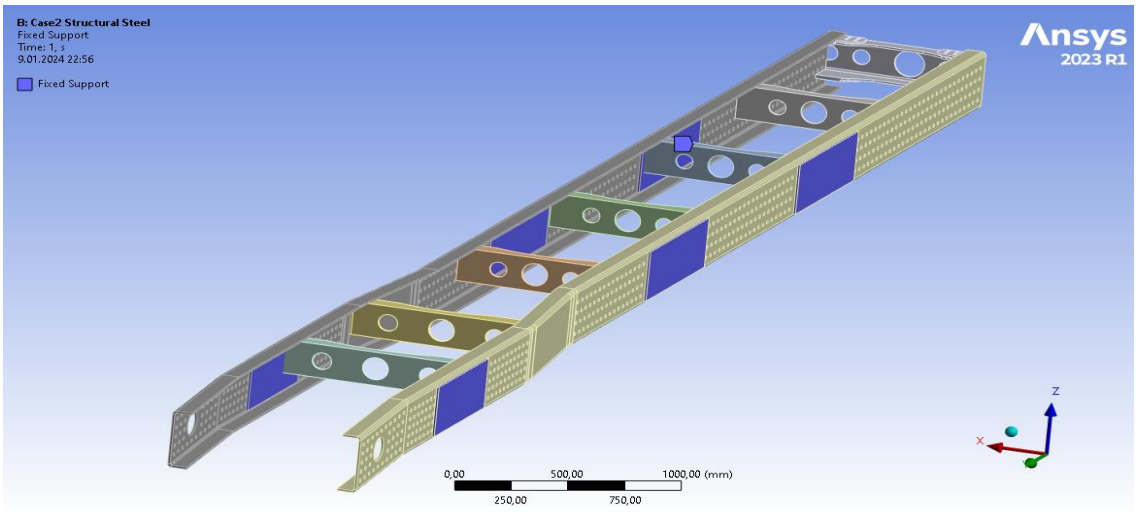


Figure 57. Case 2 fix points

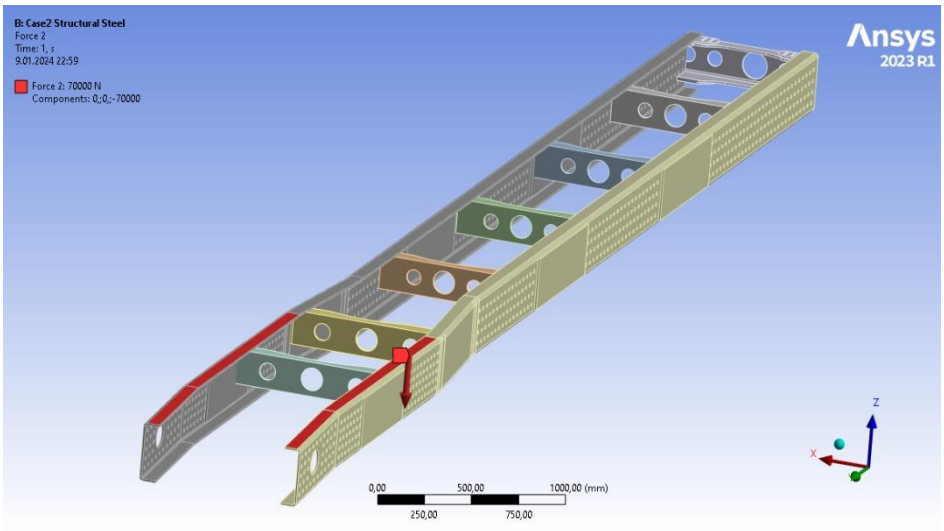


Figure 58. Case 2 front axle load

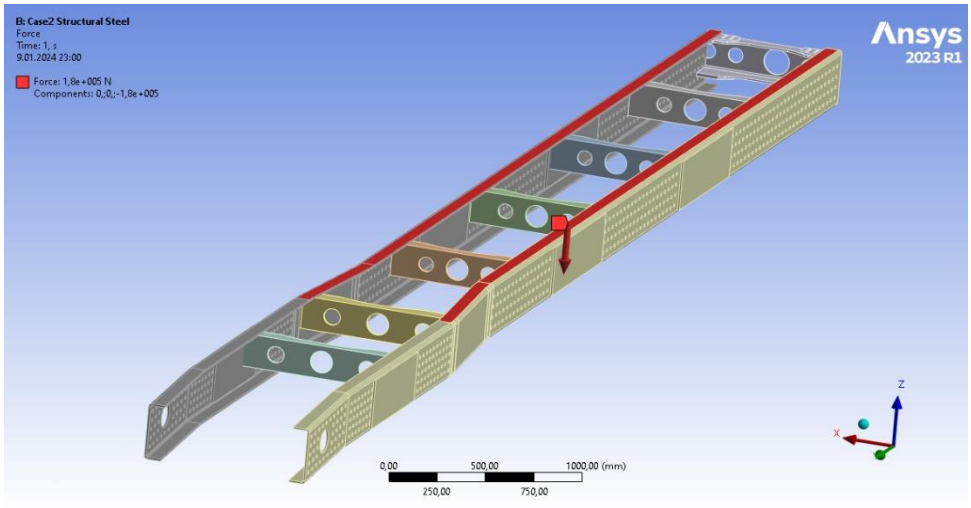


Figure 59. Case 2 rear axle load

Topology optimization of the mba_1001 part involves first analyzing the part as a STEP file with the Ansys Workbench Static Analysis module and then analyzing it with the Topology Optimization module. The process then continued with the topology optimization of the part coded mba_1003.1. Since the parts mba_1003.1, mba_1003.2, mba_1003.3, mba_1004, and mba_1005 are very similar to each other geometrically, a similar process was followed in the design of the parts after the final analysis and the designs were completed. Patch independence was used when creating the mesh structure. The maximum value of element quality was found to be 0.99999 and the average mean value was 0.78402. The maximum skewness value was found to be 0.69709 and the average value was 0.29512. Figure 21 shows the mba_1001 topology optimization overview

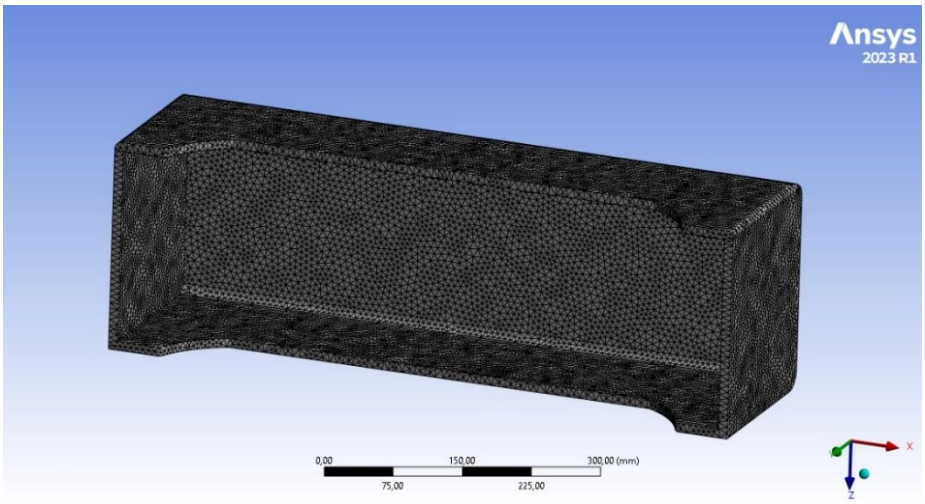


Figure 60. mba_1001 topology optimization overview

Since the mba_1001 part is welded to the chassis, the fix points are determined as corners as in Figure 22.

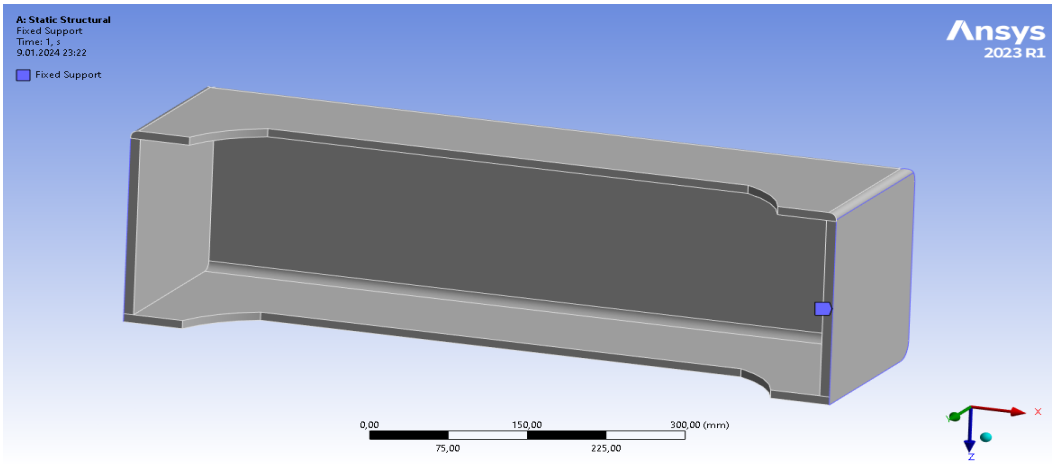


Figure 61. mba_1001 topology optimization fixed points

Since the applied loads were perpendicular to the chassis, the forces came to the side surfaces of the part, and since the loads were divided, it was determined as 44,000 N as in Figure 23.

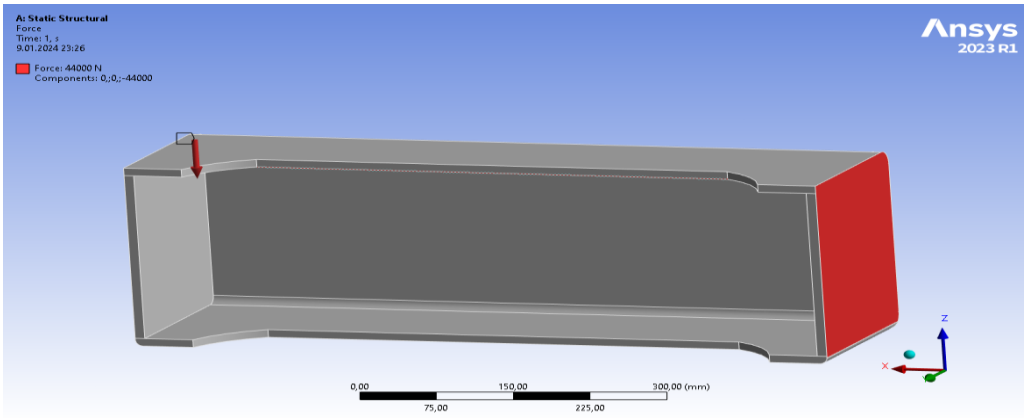


Figure 62. Applied loads

The process continued as in the mba_1001 topology optimization. Patch independence was used when creating the mesh structure as in Figure 24. The maximum value of element quality was found to be 0.99999 and the average mean value was 0.70754. The maximum Skewness value was found to be 0.65139 and the average value was 0.39737. Figure 25 and Figure 26 represent the mba_1003 topology optimization fixed points and applied forces.

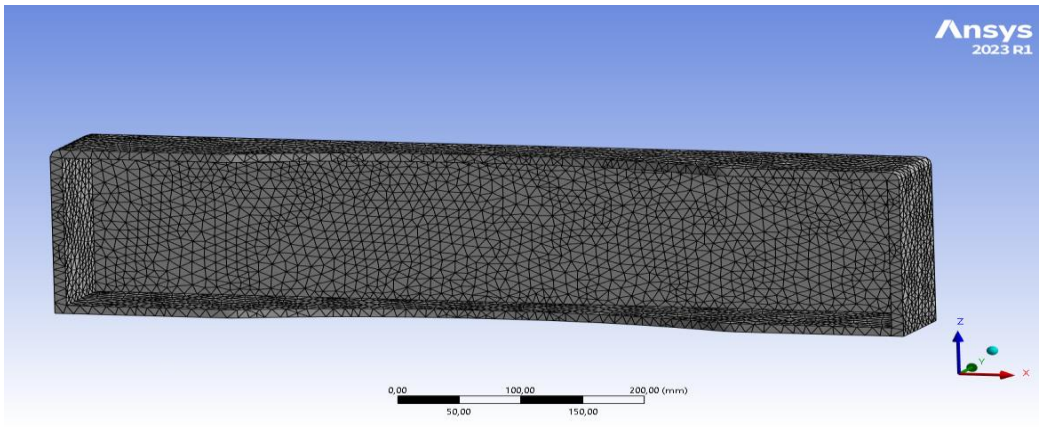


Figure 63. mba_1003 topology optimization general mesh structure

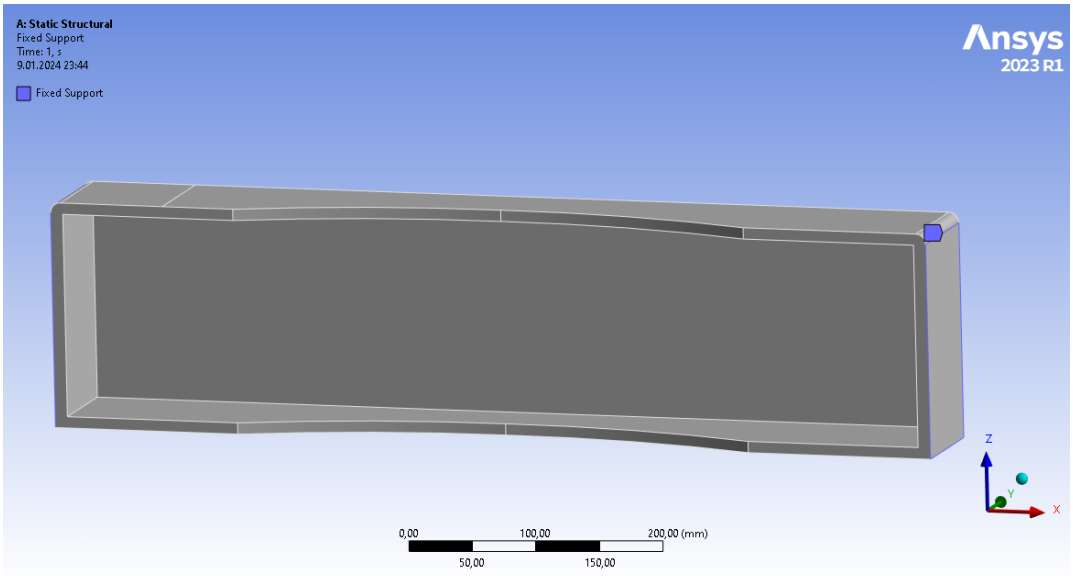


Figure 64. mba_1003 topology optimization fixed points

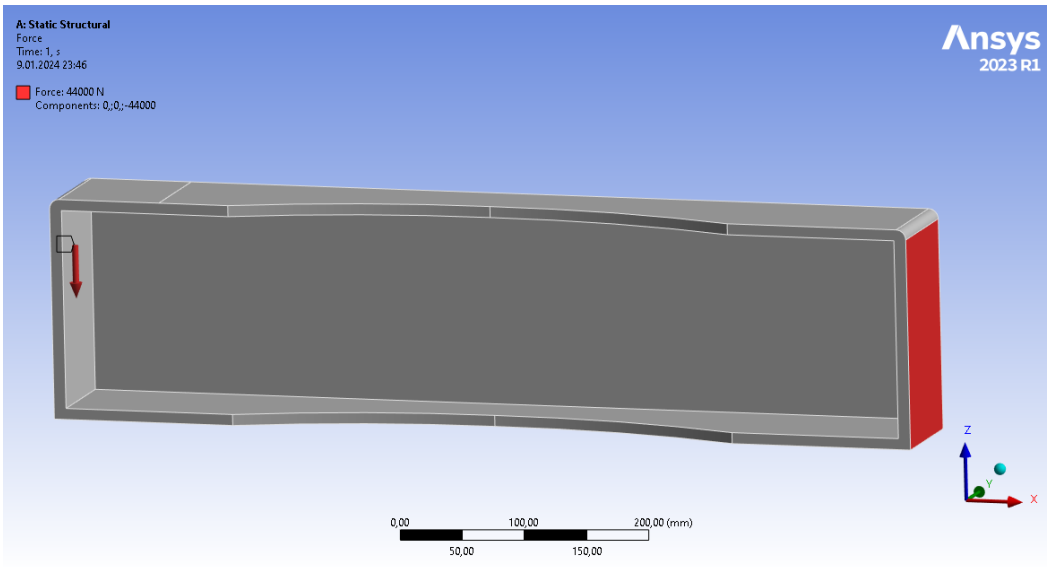


Figure 65. mba_1003 topology optimization applied forces

Findings and Discussion

While Figures 27 to 29 indicates the St-37 material case 1 analysis results, Figures 30 to 32 displays Usibor 1500 material case 1 analysis data. Figures 33 to 35 represent S690QL material case 1 analysis outcomes

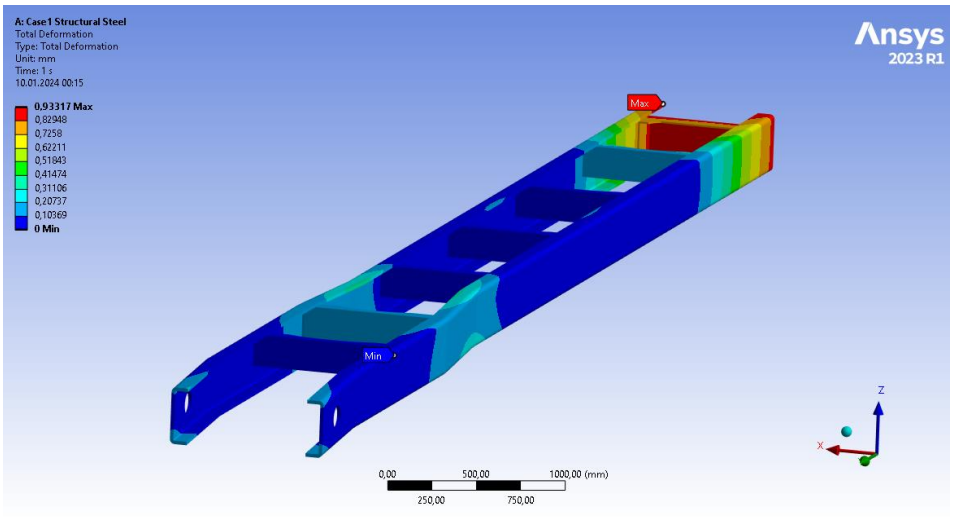


Figure 66. Case 1 St- 37 total deformation

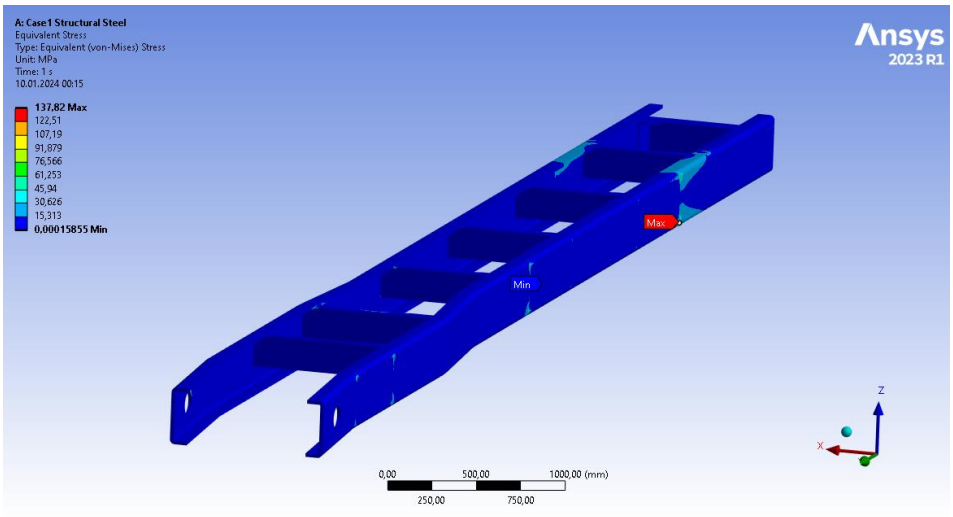


Figure 67. Case 1 St- 37 stress value

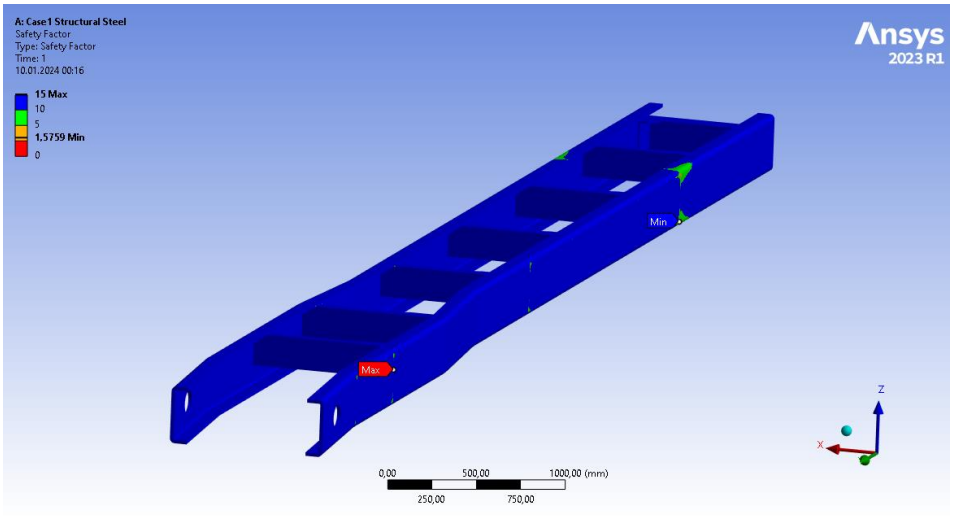


Figure 68. Case 1 St- 37 safety factor

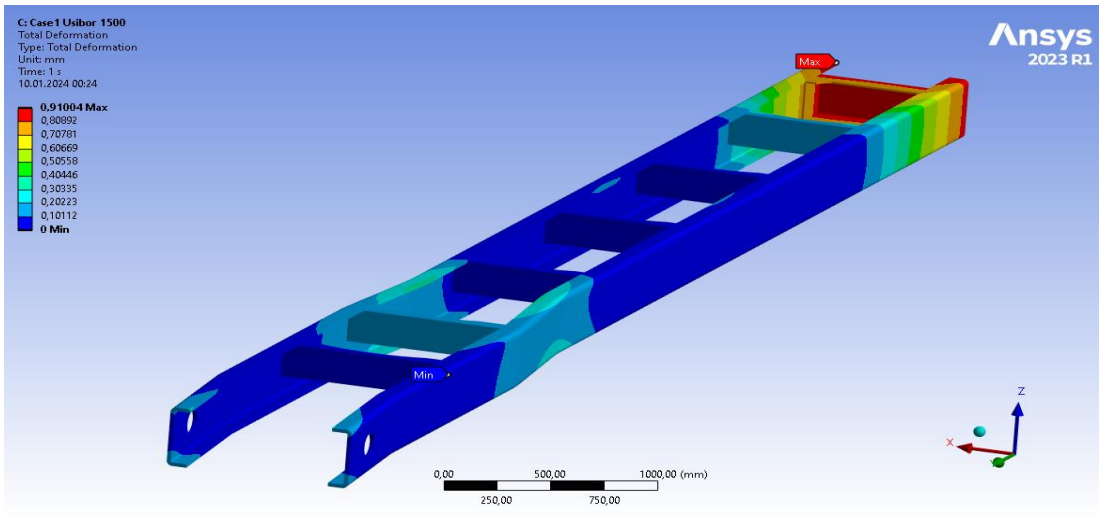


Figure 69. Case 1 Usibor 1500 total deformation

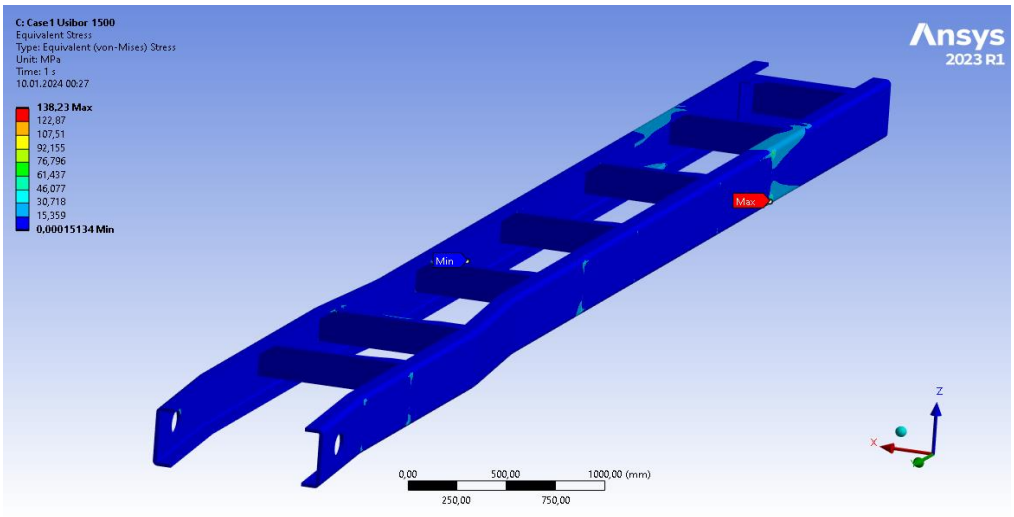


Figure 70. Case 1 Usibor 1500 stress value

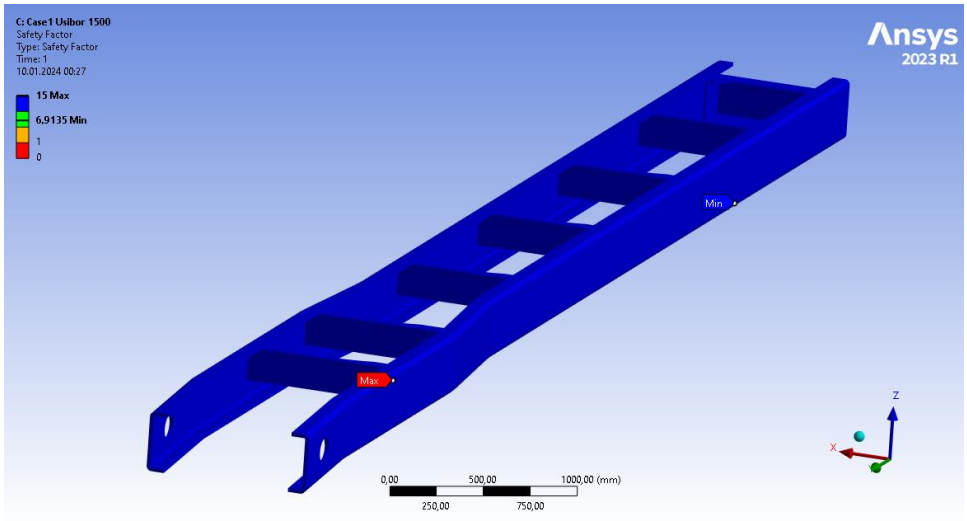


Figure 71. Case 1 Usibor 1500 safety factor

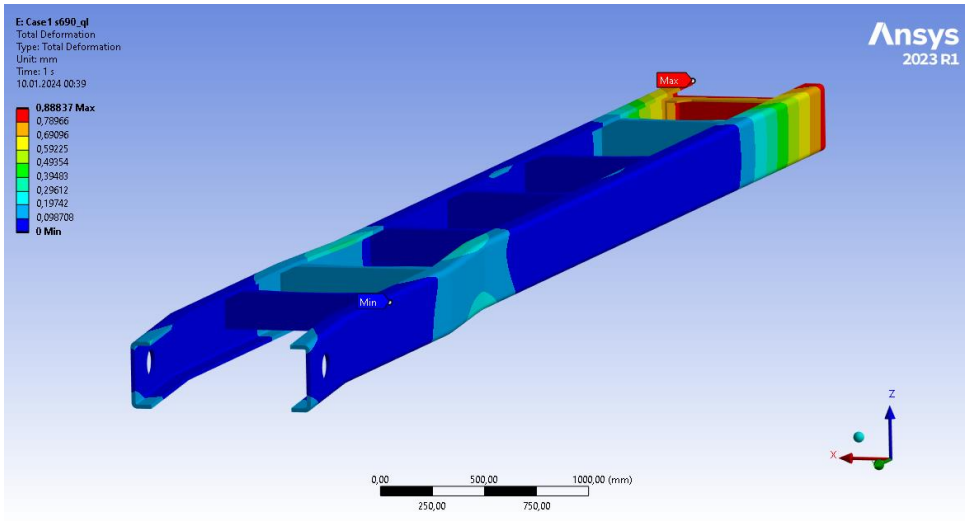


Figure 72. Case 1 S690QL total deformation

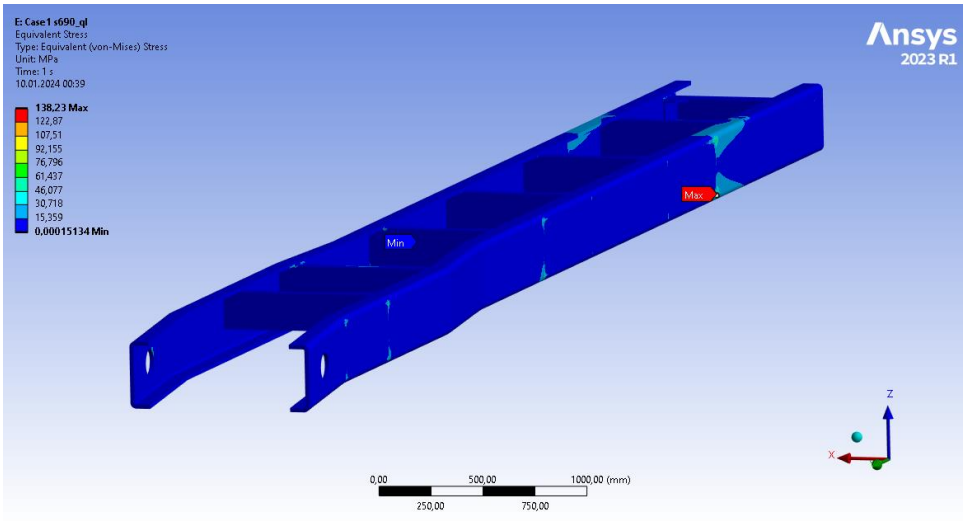


Figure 73. Case1 S690QL stress value

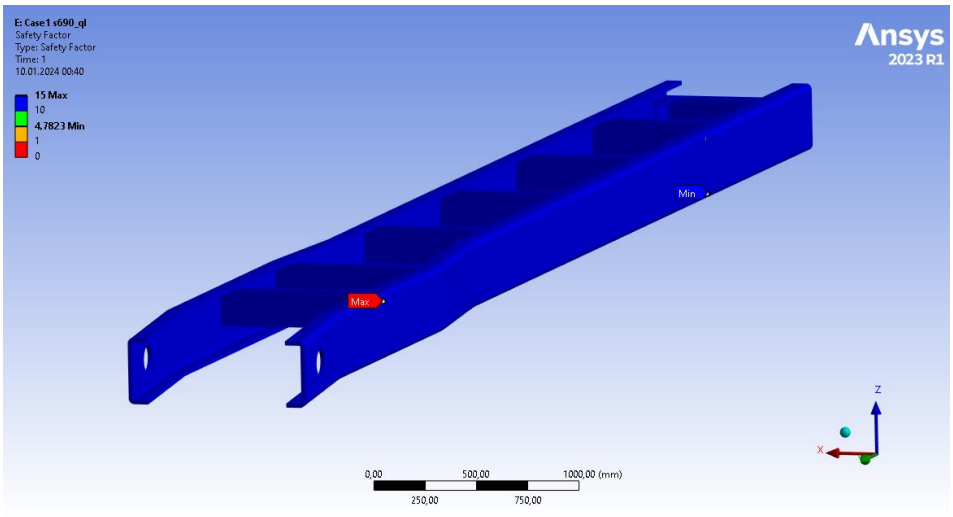


Figure 74. Case 1 S690QL safety factor

While Figures 36 to 38 show the St-37 material case 2 analysis results, Figures 39 to 41 displays Usibor 1500 material case 2 analysis data. Figures 42 to 44 indicate S690QL material case 2 analysis outcomes.

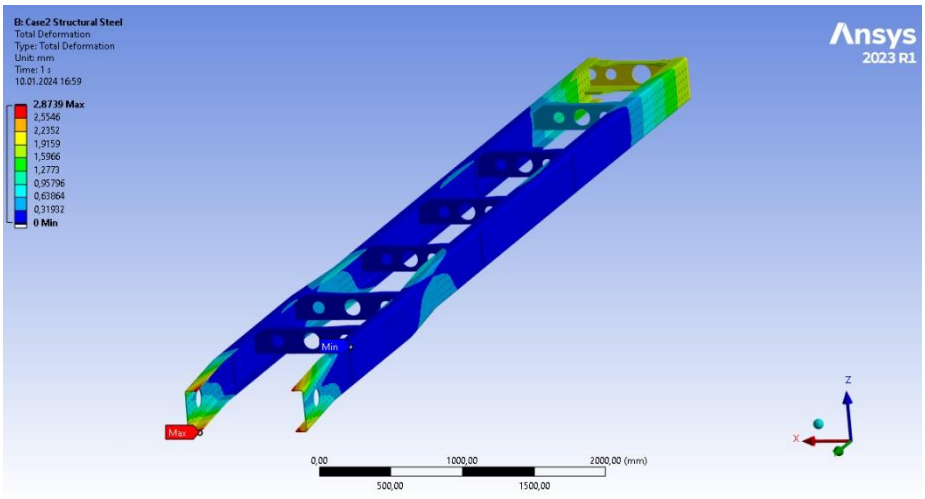


Figure 75. Case 2 St- 37 total deformation

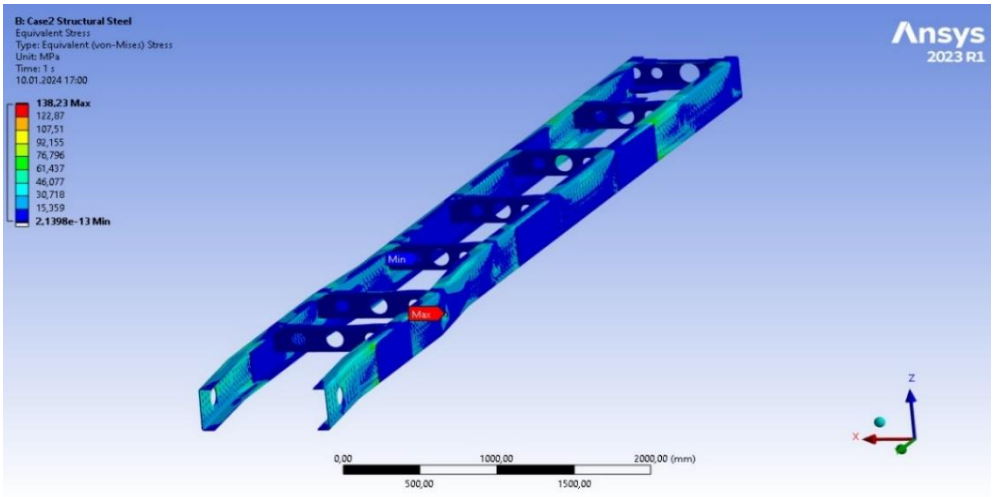


Figure 76. Case 2 St- 37 stress value

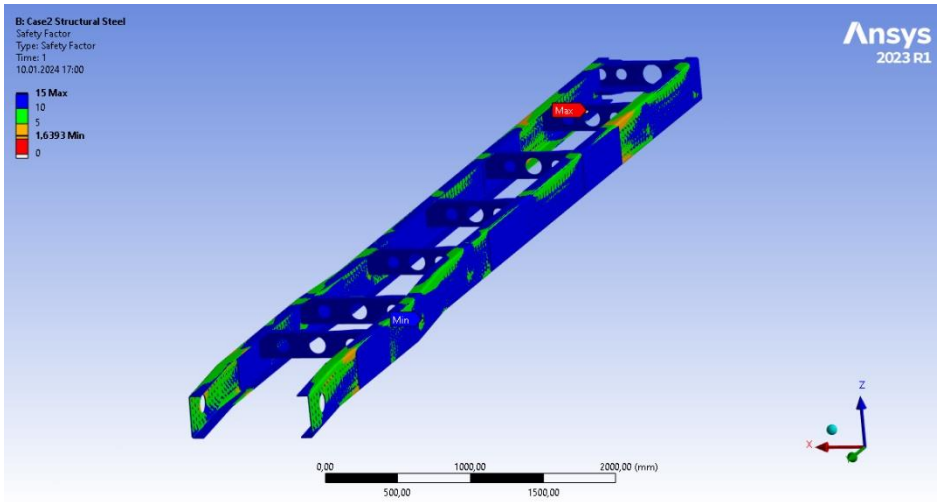


Figure 77. Case 2 St- 37 safety factor

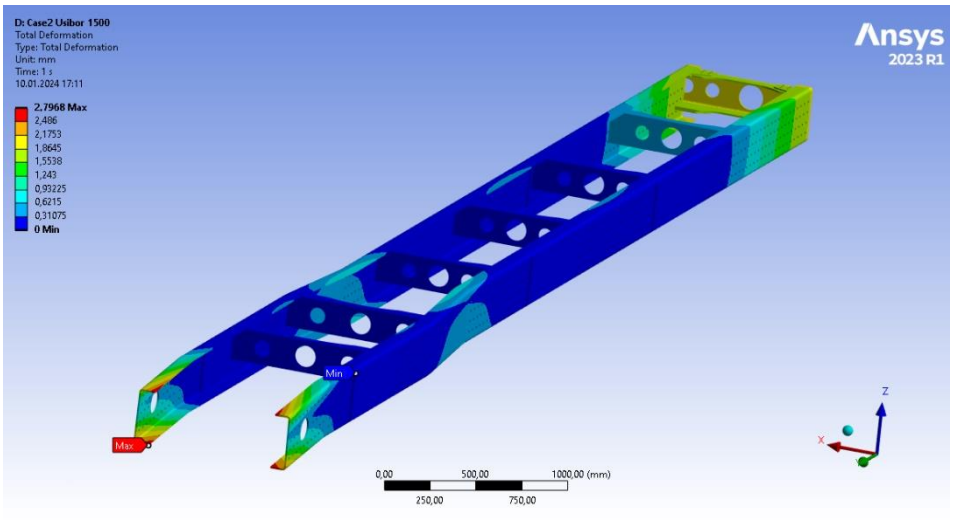


Figure 78. Case 2 Usibor 1500 total deformation

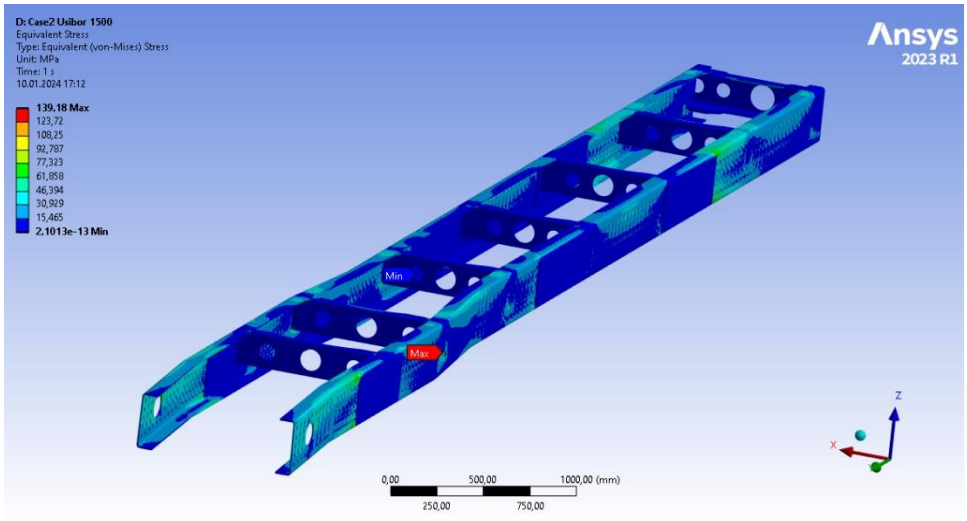


Figure 79. Case 2 Usibor 1500 stress value

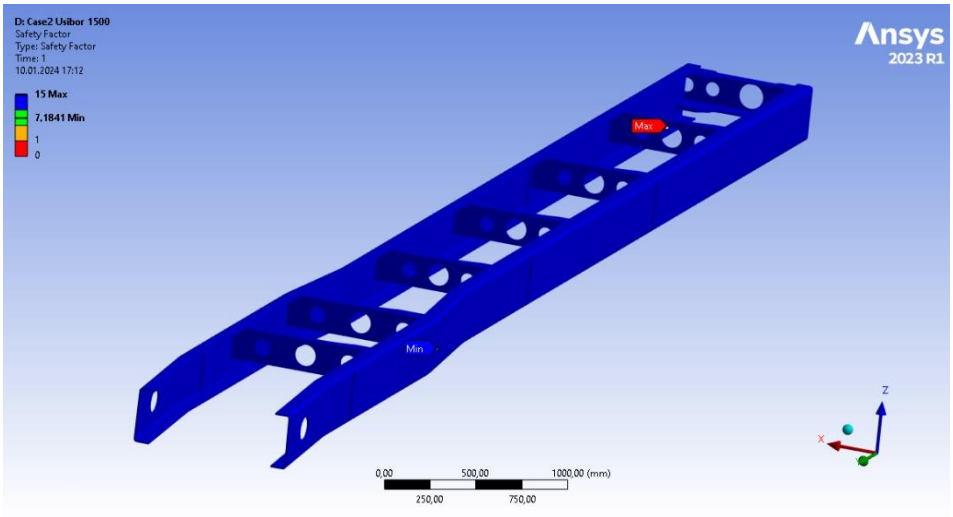


Figure 80. Case 2 Usibor 1500 safety factor

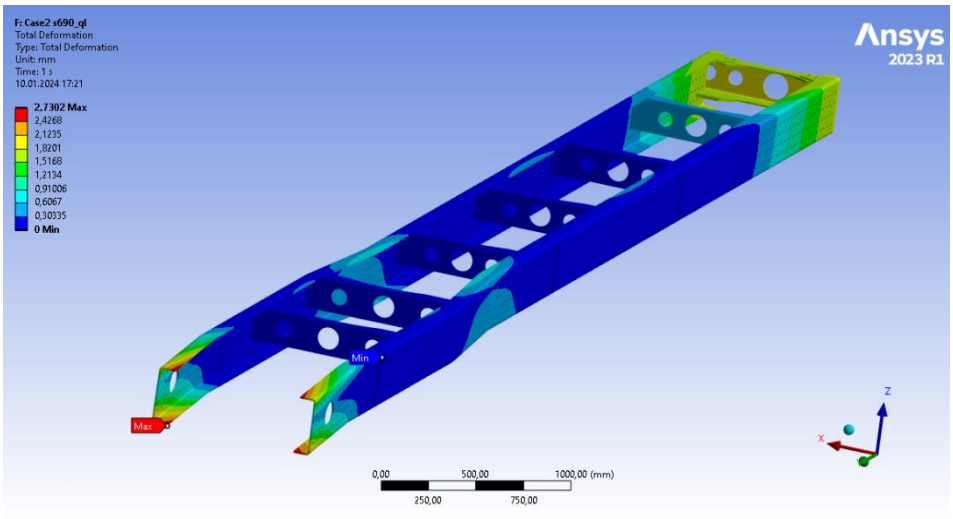


Figure 81. Case 2 S690QL total deformation

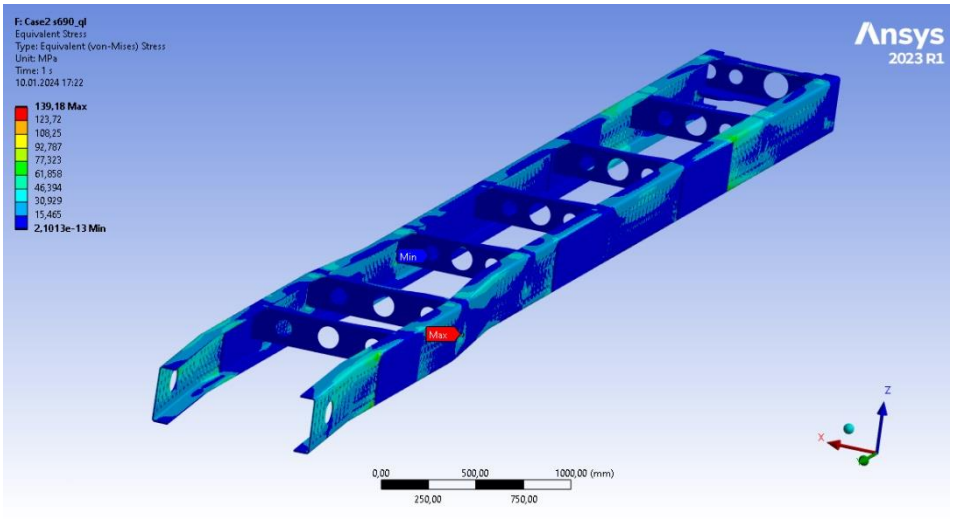


Figure 82. Case 2 S690QL stress value

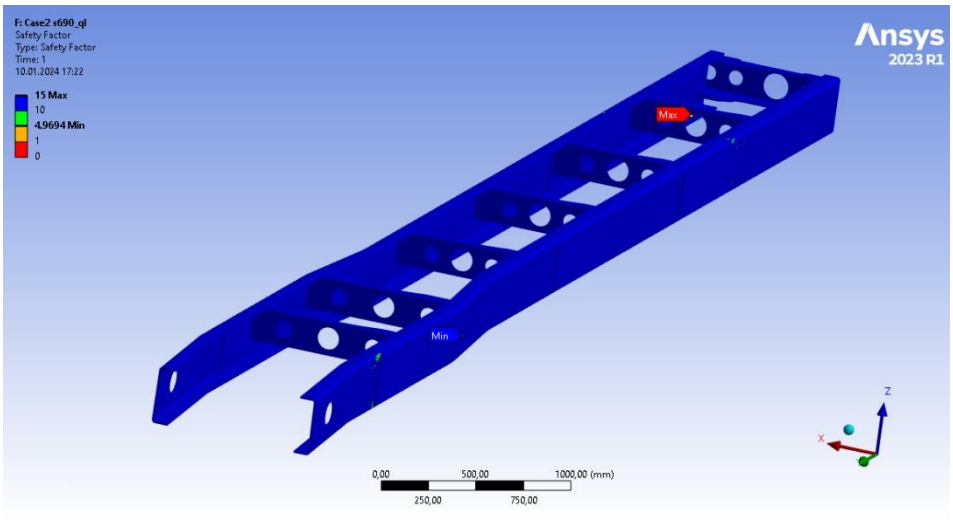


Figure 83. Case 2 S690QL safety factor

A new design was made as a result of the geometry resulting from topology optimization. mba_1001 static analysis safety factor was seen in Figure 45. Figure 46 displays mba_1001 topology density view.

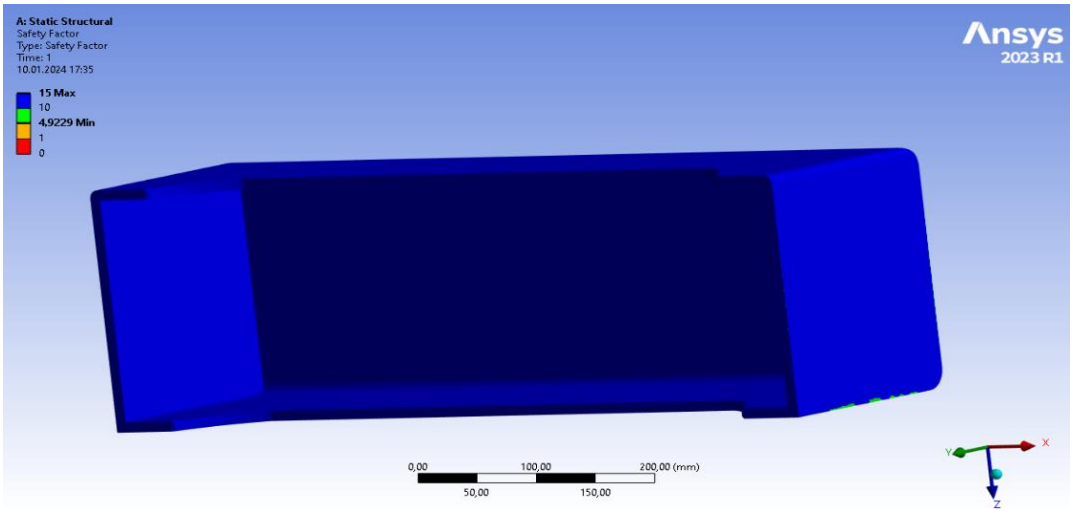


Figure 84. mba_1001 static analysis safety factor

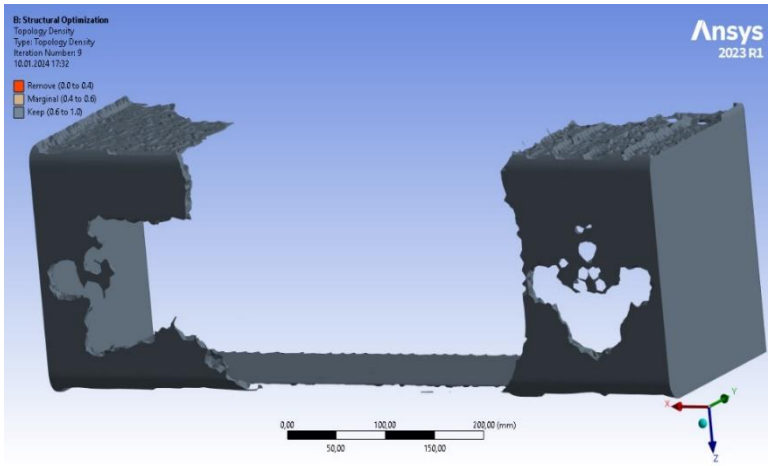


Figure 85. mba_1001 topology density

As a result of topology optimization, mba_1003 and the remaining lateral carriers were subjected to similar mitigation processes. Also, Figure 47 indicates the mba_1003 static analysis safety factor. mba_1003 topology density is shown in Figure 48 and Figure 49 represents the mba_1003 new designs as a result of topology optimization.

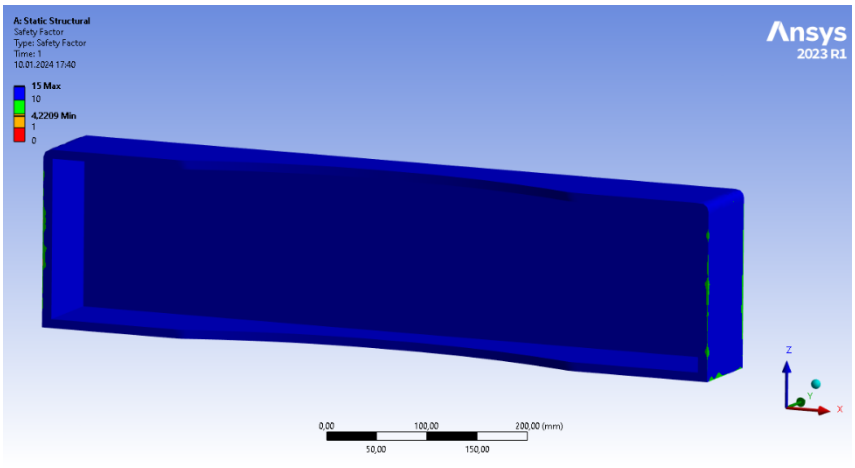


Figure 86. mba_1003 static analysis safety factor

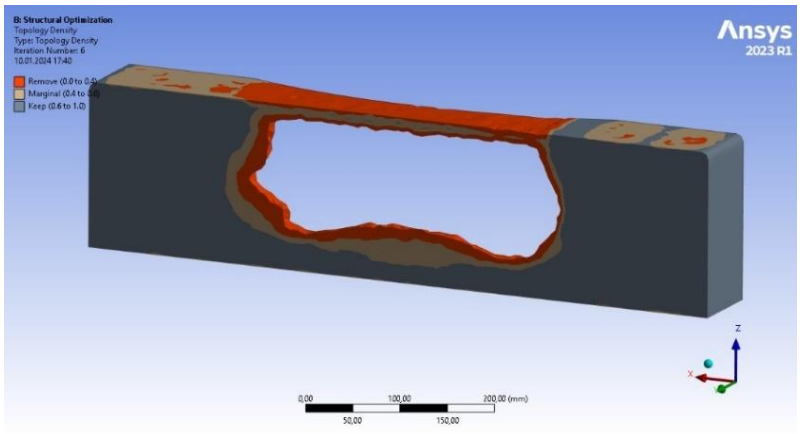


Figure 87. mba_1003 topology density

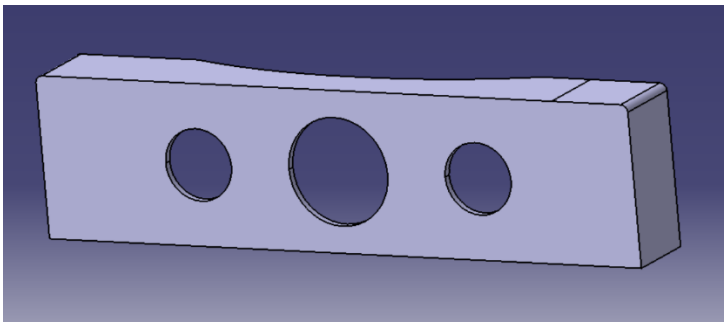


Figure 88. mba_1003 new design as a result of topology optimization

Table 2 indicates the analysis results of Case 1 and Case 2 for three material design. In terms of total deformations in case 1, St-37 material has a deformation value that is 2.54% higher than the design with Usibor 1500 material and 5.04% higher than the design with S690QL material. The lowest value in terms of equivalent stresses in case 1 belongs to the design with St-37 material, with 132.82 MPa. In terms of safety factor in case 1, the design with Usibor 1500 material has the highest value with 6.9135, reaching 4.39 times higher than St-37 and 1.44 times

higher than S690QL. In Case 2, the lowest deformation was found in S690QL, the lowest equivalent stress in St-37, and the highest safety factor in Usibor 1500 material.

Table 2. Case 1 and Case 2 results

Case 1	**St-37**	**Usibor 1500**	**S690QL**
Total Deformation (mm)	0.93317	0.91004	0.88837
Equivalent Stress (MPa)	132.82	138.23	138.23
Safety Factor	1.5759	6.9135	4.7823
Case 2	**St-37**	**Usibor 1500**	**S690QL**
Total Deformation (mm)	2.8739	2.7968	2.7302
Equivalent Stress (MPa)	138.23	139.18	139.18
Safety Factor	1.69393	7.1841	4.9694

The weight results of chassis in case 1 and case 2 are given in Table 3. When looking at case 1 and case 2, a 37.84% decrease in the weight of all three materials was observed in case 2 compared to case 1. Costs per kg are given as $150.01 for St-37, $379.66 for Usibor 1500,and $120 for S690QL. Average prices of materials are obtained from metal suppliers (Kumlu et al., 2023). When the cost prices were examined, it was calculated that a 37.84% decrease resulted in a cost reduction of approximately 0.62 times.

Table 3. Case 1 and Case 2 weight distributions

Case 1	**St-37**	**Usibor 1500**	**S690QL**
Weights (kg)	1429	1430.8	1430.8
Case 2	**St-37**	**Usibor 1500**	**S690QL**
Weights (kg)	888.25	889.38	889.38

Conclusion and Recommendations

In this study, the chassis of the heavy truck model was modeled and its reactions to static loads were examined. It was examined in two cases: Case 1 and Case 2. In Case 1, after examining the total deformation, stress, and safety factor of the main model, the topology optimization of the two lateral carrier elements and their designs that could work optimally with the loads were examined. In Case 2, the resistance of the new and lighter model to static loads was examined. Then, the weights and cost feasibility of the St-37, Usibor 1500, and S690QL steels used in these designs were carried out. The results of this study are as follows.

- In Case 1, the lowest total deformation was obtained in S690QL steel and the highest total deformation was obtained in St- 37 steel.

- In Case 1, the lowest stress value was obtained in St- 37 steel, while equal stress values were determined in Usibor 1500 and S690QL steel.
- In Case 1, the highest safety factor was obtained in Usibor 1500, while the lowest was determined in St-37 steel.
- In Case 1 and Case 2, the stress values were very close to each other, although the geometry has been changed and alleviated. The reason for this is the improvements in the places where deformation and stress values were lowest in the light of topology optimization and static analysis of the chassis designed in Case 2.
- The safety factor values of the chassis developed in Case 2 increased by 1.1 times to case 1, although it was lighter.
- In the stress view observed in Case 1, the stress accumulated only on the front and rear of the chassis, while in the stress view in Case 2, it was determined that this situation spread to almost every part of the chassis, just as desired.
- In Case 2, chassis weights were reduced 1.61 times in comparison with Case 1.

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SİRKADİYEN RİTİMDE BESLENMENİN ROLÜ

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ÖZET
Uyku, insan yaşamında beslenme kadar önemli fizyolojik bir gereksinimdir. Vücudumuzun yeni bir güne hazırlandığı dönem olarak tanımlanmaktadır.Beslenme ise insan hayatında birçok faktöre etki etmekte ve birçok faktörden de etkilenmektedir. Uyku süresi ve kalitesi de bu faktörlerdendir. Fiziksel ve ruhsal olarak dinlenme, hücrelerin tamiri, hafıza fonksiyonlarının düzenlenerek öğrenmenin sağlanması için uyku kilit bir rol oynamaktadır. Uyku gereksinmesi yaşa, cinsiyete, fiziksel aktivite düzeyine ,bireyin beslenme tarzına, çevresel koşullara, bireyin sağlık durumuna göre değişmektedir.Canlı varlıkların fizyolojisinde 24 saate dayalı gün içerisinde değişebilen günlük bir ritim söz konusudur ve bu "sirkadiyen ritim" olarak ifade edilmektedir.Işık, sıcaklık, melatonin, jetlag, vardiyalı çalışma ve beslenme sirkadiyen ritmi etkileyen faktörlerdendir.Yapılan çalışmalar sirkadiyen ritim, beslenme ve uykunun birbirlerini etkilediklerini göstermektedir.Bu faktörler kişinin iş performansını, günlük performansını ve konsantrasyon seviyesini etkileyerek yaşam kalitesi üzerinde etkili olmaktadır.Vardiyalı çalışma hem uyku hem de beslenme düzeninde değişikliklere neden olarak farklı sorunları ortaya çıkarmaktadır.Uyku zamanındaki değişimler yanlış besin seçimine neden olmakta bu da birçok kronik hastalığı beraberinde getirmektedir.Uykuyu etkileyen besinler;süt,yağlı balıklar,çay,kahve ve meyveler olarak belirtilmektedir.Makro besin ögeleri dışında bazı mikro besin ögelerinin de bu döngüyü etkileyebileceği belirtilmektedir.Yapılan çalışmalar daha çok B grubu vitaminleri ve magnezyum üzerinde durmaktadır.B grubu vitaminlerden B_6, B_{12} ve niasinle ilgili çalışmalar mevcuttur.Uyku süresinin beslenmeye yönelik etkilerinin mekanizması netleşmiş değildir.Bu ilişkinin daha iyi anlaşılabilmesi için farklı popülasyonlar ve çalışma saatleri ile daha fazla çalışmaya ihtiyaç olduğu bildirilmektedir.Bu çalışma sirkadiyen ritimde beslenmenin rolünü araştırma amacıyla yapılmıştır.
Anahtar Kelimeler: sirkadiyen ritim,beslenme,uyku süresi,uyku kalitesi,vardiyalı çalışma

THE ROLE OF NUTRITION IN CIRCADIAN RHYTHM

ABSTRACT
Sleep is a physiological need as important as nutrition in human life. It is defined as the period when our body prepares for a new day. Nutrition affects many factors in human life and is affected by many factors. Sleep duration and quality are also among these factors. Sleep plays a key role in resting physically and spiritually, repairing cells, regulating memory functions and ensuring learning. The need for sleep varies according to age, gender, physical activity level, individual's nutrition style, environmental conditions, and the individual's health status. In the physiology of living beings, there is a daily rhythm that can change during the day based on 24 hours, and this is referred to as "circadian rhythm". Light, temperature , melatonin, jetlag, shift work and nutrition are among the factors that affect the circadian rhythm. Studies show that circadian rhythm, nutrition and sleep affect each other. These factors have an impact on the quality of life by affecting the person's work performance, daily performance and concentration level. Shift work affects both sleep and sleep. It causes different problems by causing changes in the diet. Changes in sleep time cause wrong food selection, which brings about many chronic diseases. Foods that affect sleep are stated as milk, fatty fish, tea, coffee and fruits. Apart from macro nutrients, some micronutrients It is stated that elements of sleep may also affect this cycle. Studies mostly focus on B group vitamins and magnesium. There are studies on B group vitamins B_6, B_{12} and niacin. The mechanism of the nutritional effects of sleep duration is not clear. Different populations and studies are used to better understand this relationship. It is reported that more work is needed with hours.This study was conducted to investigate the role of nutrition in circadian rhythm.
Keywords: circadian rhythm, nutrition, sleep duration, sleep quality,shift work

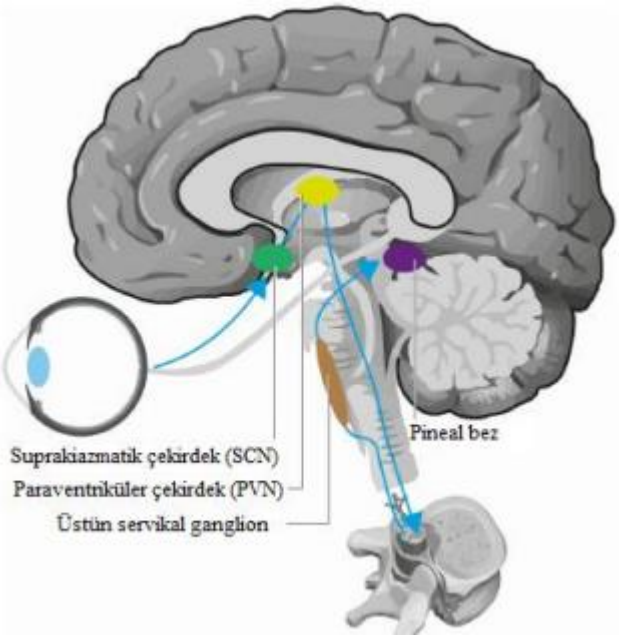
GİRİŞ

Uyku insan yaşamında beslenme ve nefes alma kadar önemli fizyolojik bir gereksinimdir. Vücudumuzun yeni bir güne hazırlandığı dönem olarak ifade edilmektedir (Karasu ve ark.,2021). Beslenme insan hayatında birçok faktöre etki etmekte ve birçok faktörden de etkilenmektedir.Uyku süresi ve kalitesi bu faktörlerdendir. Fiziksel ve ruhsal dinlenme, hücrelerin tamiri, hafıza fonksiyonlarının düzenlenerek öğrenmenin sağlanması için uyku kilit bir rol oynamaktadır (Gumz,2016). Uykunun evreleri ve bu evrelerin sürelerini etkileyen faktörler bulunmaktadır. Evrelerden ilki hızlı olmayan göz hareketi (Non-rapid eye movement, NREM) ve ikincisi ise hızlı göz hareketi (Rapid eye movement, REM) olarak isimlendirilmektedir. Toplam uykunun % 20-30'unu REM uykusu oluşturmaktadır. REM döneminin önemli özelliklerinden biri rüyaların uykunun bu evresinde görülmesidir. NREM dönemi kendi içinde 4 evreden oluşmaktadır. 1. ve 2. evre yüzeysel uyku; 3. ve 4. evre ise derin uyku olarak ifade edilmektedir.Yaş,cinsiyet,beslenme vb. faktörlerle birlikte uyku süresi ve kalitesi de değişmektedir. Uyku süresi ve kalitesi uyku testleriyle hatta gelişen teknolojiyle beraber üretilen cihazlarla da ölçülebilmektedir. Bunun sonucu olarak uyku kalitesi ve süresi ile ilgili çalışmalar hız kazanmıştır. Yetişkinlere oranla çocuk ve yaşlıların 3.evre NREM uyku süreleri daha fazla olduğu belirtilmektedir (Harding ve ark.,2019). 20 yaş ve üzeri 688 yetişkin bireyde yapılan bir çalışmaya göre kadınların Pittsburgh Uyku Kalite İndeksi (PUKİ) puanının erkeklerinkine göre istatistiksel olarak daha yüksek olduğu bulunmuştur($p=0.002$) (Akova&Koçoğlu,2018). Adölesanlar üzerinde yapılan bir çalışmada adölesanların %54,7'sinin kötü uyku kalitesine sahip olduğu , % 9'unun aşırı uykululuk halinden şikayetçi oldukları sosyal-ailevi problem varlığı, daha önce geçirilmiş uyku bozukluğu ve iştah değişikliği uyku kalitesindeki azalmanın temel belirleyici nedenleri olarak saptanmıştır (Şenol ve ark.,2015). Yapılan bir çalışmaya göre kötü uyku kalitesinin beslenme, sigara-alkol kullanımı, fiziksel aktivite ve stres yönetimi gibi davranışları etkilediği bildirilmiştir (Hui ve ark.,2015). Canlı varlıkların fizyolojisinde 24 saate dayalı gün içerisinde değişebilen günlük bir ritim söz konusudur ve bu "sirkadiyen ritim" olarak ifade edilmektedir. Işık, sıcaklık, melatonin, jetlag, vardiyalı çalışma ve beslenme sirkadiyen ritmi etkileyen faktörlerdendir (Sözlü&Şanlıer,2017). Bu çalışma da sirkadiyen ritimde beslenmenin rolünü araştırmak amacıyla yapılmıştır.

SİRKADİYEN RİTİM ve UYKU FİZYOLOJİSİ

Sirkadiyen,"circa"(yaklaşık) ve "dies"(gün) kelimelerinin birleştirilmesiyle oluşturulmuştur. "Yaklaşık bir gün" anlamına gelmektedir.Canlı varlıkların fizyolojisinde 24 saate dayalı gün

içerisinde değişebilen günlük bir ritim söz konusudur bu döngü de "sirkadiyen ritim" olarak ifade edilmektedir (Poggiogalle ve ark.,2018). Sirkadiyen ritim 2 kısımdan oluşmaktadır: 1) Hipotalamusta yer alan suprakiazmatik çekirdekteki (SCN) ana saat-merkezi saat2) Dokularda bulunan periferik saat (pankreas, karaciğer, gastrointestinal sistem, adipoz doku ve iskelet kası vb.) (Glaus ve ark.,2019).Sirkadiyen ritim büyüme faktörlerini,immün fonksiyonları,gen ekspresyonunu, doku büyümesini ve kan basıncı dengesini içeren bir dögüdür (Loef ve ark.,2018). Sağlıklı kişilerde sirkadiyen ritmin kontrolü genler, hormonlar gibi endojen; ışık, çalışma düzeni , beslenme gibi ekzojen faktörler aracılığıyla sağlanmaktadır (Kandeger ve ark.,2019). Sirkadiyen ritmi etkileyen faktörler;ışık,sıcaklık,melatonin,jetlag,vardiyalı çalışma ve beslenmedir (Chattu ve ark.,2019). Uyku ve uyanıklık döngüsü beyin sapı, spinal kord ve serebral kortekste yer alan Retiküler aktivasyon sistemi (RAS) tarafından düzenlenmektedir.Aktive ve inhibe olarak uyku ve uyanıklık döngüsü düzenlenmektedir (Algın ve ark.,2016). Karanlık,sessiz ortam,gözlerin kapalı olması ve kişinin rahat pozisyonda uyku modunda olması RAS'ın(Retiküler aktivasyon sistemi) uyarılmasını azaltmakta ve uykuya geçişi sağlamaktadır. Melatonin ve seretonin uykuya geçişte görev almaktadır ve suprakiazmatik çekirdeğin (SCN) aktivasyonuna bağlı olarak salgılanmaktadır (Şekil1). Yapay ışık parlak olduğunda melatonin sentezi baskılanabilmektedir. Sıcak ortamda artış gösterdiği belirtilmektedir. Karanlığın başlaması ile fotoreseptörler hipotalamustaki suprakiazmatik çekirdeği uyarmaktadır. Uyarılmayla hücre içine alınan triptofandan melatonin sentezlenmektedir. Melatonin salınımı özellikle gece 23:00-05:00 arasında pik yapmaktadır. Gündüz saatlerindeki düzeyi gece saatlerine göre daha azdır.Melatonin düzeyleri gece 3-10 kat artarak 50-200 pg/dL düzeyine ulaşabilmektedir (Özçelik ve ark.,2013).



Şekil 1. Sirkadiyen bilginin sinyal yoluyla iletimi (Wahl ve ark.,2019).

* SCN: Suprakiazmatik çekirdek; PVN: Paraventriküler çekirdek

Serum melatonin düzeyleri yaşa göre değişmektedir.Yeni doğanda kan melatonin düzeyi düşüktür. Melatonin anne sütüne de geçmektedir. Anne sütü ile beslenen bebeklerin diğer yollarla beslenenlere göre sirkadiyen organizasyonlarının daha çabuk geliştiği bildirilmektedir (Kervezee ve ark.,2018). İnsomnia gibi uyku bozukluklarında, 1 g/gün olarak L-triptofan kullanımının etkili olduğu ifade edilmektedir.15 insomnia hastası üzerinde yapılan bir çalışmaya göre hastalara verilen 1 g'lık triptofan takviyesinin uykuya geçiş sürelerinde azalma gözlemlenmiştir (Keskin & Tamam, 2018). Brezilya'da sabit gece vardiyasında (12 saat, 19:00 - 07:00 arası) çalışan 36 aşırı kilolu kadın hemşire üzerinde yapılan bir çalışmada gece vardiyasından sonra uykuya dalma ile en yakın öğün arasındaki zaman aralığının izin günüdeki uykuya dalma ile en yakın öğün arasındaki zaman aralığından daha kısa olduğu gözlemlenmiştir (Garrido ve ark.,2021). Gece vardiyasında çalışan hemşirelerde yapılan başka bir çalışmada da hipertrigliseridemi de dahil olmak üzere metabolik sendrom tanısı için risk faktörlerinin gündüz çalışanlarına göre daha yüksek prevalansta olduğu bulunmuştur (Hollanda ve ark.,2018). Başka bir çalışmada da benzer veriler bulunmuştur. 20 yaşından büyük yetişkinlerde yapılan bu çalışmada uyku süresindeki azalma ile kardiyometabolik riskin yüksek olması arasında bir ilişki olduğu gözlemlenmiştir (Kanagasabai ve ark.,2017). Gece vardiyasında çalışmak, kadınların 24 saatlik leptin seviyelerinde %7'lik bir düşüşe ve "uyanık dönemi"ndeki ghrelin seviyelerinde %8'lik bir artışa neden olurken, erkeklerin leptin seviyelerinde %11 oranında artışa neden olduğu bildirilmiştir (Quian ve ark.,2019). Uyku

gereksinmesi yaşa, cinsiyete, fiziksel aktivite düzeyine ,bireyin beslenme tarzına, çevresel koşullara, bireyin sağlık durumuna ve kişisel özelliklerine göre değişmektedir. Ulusal Uyku Kuruluşu'nun (The National Sleep Foundation) yayınladığı son rapordaki yaş gruplarına göre gerekli uyku süreleri için belirtilen değerler aşağıdaki gibidir (The National Sleep Foundation,2015).

- Yeni doğan (0-3 ay): 14-17 saat/gün
- Toddler (1-2 yaş): 11-14 saat/gün
- Okul öncesi çocuklar (3-5 yaş): 10-13 saat/gün
- Okul çağındaki çocuklar (6-13 yaş): 9-11 saat/gün
- Gençler (14-17): 8-10 saat/gün
- Yetişkinler (18-64): 7-9 saat/gün
- Yaşlı (65+): 7-8 saat/gün

Türkiye'de Erişkin Toplumda Ulusal Uyku Epidemiyolojisi Çalışmasına (TAPES,2010) göre, kişilerin %47,6'sının 7 saat ve daha az uyuduğu;uyku kalitesi kötü olanların oranının kadınlarda %26,3, erkeklerde %17 olduğu bulunmuştur (Demir,2010).

SİRKADİYEN RİTİM VE BESLENME İLİŞKİSİ

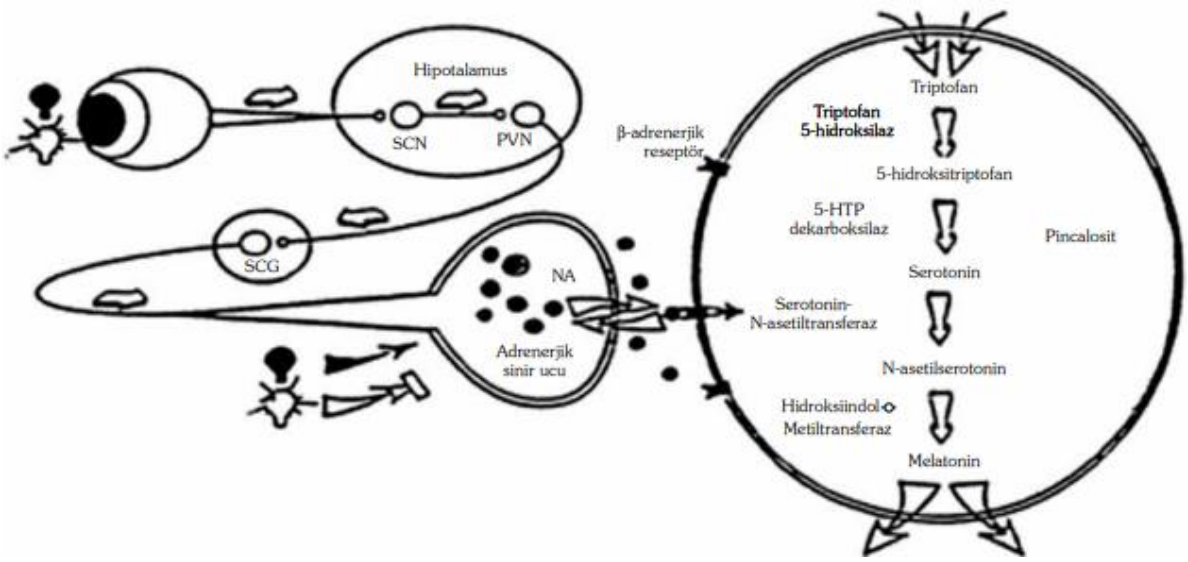
Makro Besin Ögelerinin Sirkadiyen Ritim Üzerine Etkisi

Uykuyu etkileyen besinler süt,yağlı balıklar,kahve ve meyve olarak ifade edilmektedir. Çay, kahve gibi kafeinli içecekleri tüketicilerin uykulu olma halinden kurtulmak için tüketmesine rağmen kafeinin sirkadiyen ritim üzerindeki etkilerinin mekanizması henüz netleşmiş değildir. Bazı hayvan çalışmalarında kafeinli içecek tüketiminin uyanıklık süresini uzatabildiği bildirilirken bazılarında ise sirkadiyen ritim dengesini bozabildiği belirtilmiştir (Liu ve ark.,2019). Yapılan bir hayvan çalışmasında yüksek yağlı bir diyetle beslenen ratların aydınlık ortamdaki ağırlık artışının karanlık ortamdakine oranla daha fazla olduğu gözlemlenmiştir. Sürekli olarak ışığa maruz bırakıldığında sirkadiyen ritimlerinin kötüleşmesiyle birlikte fiziksel aktivitelerinde azalma ve vücut ağırlıklarında artma gözlenmiştir (Kessler ve ark.,2019). Kök bitkiler, koyu yeşil yapraklı sebzeler gibi besin gruplarında melatonine ve seratonine rastlandığı belirtilmektedir. Besinlerle alınan seratonin ile ilgili kesin kanıtlar olmamakla birlikte son zamanlarda yapılan çalışmalar uyku-uyanıklık döngüsünde önemli rolü olan melatoninin supleman olarak verilmesinin uykuya dalma ve uyku halinin sürdürülmesinde yararlı olabileceğini göstermektedir (Southwell ve ark.,2016). Karbonhidrat metabolizmasının düzenlenmesi SCN(Suprakiazmatik çekirdek) ile kontrol edilmektedir. Makro besin ögelerinin uyku üzerindeki etkilerini gözlemlemek için dört farklı grup üzerinde yapılan bir çalışmaya

göre ilk gruba yüksek karbonhidratlı(%56 karbonhidrat, %22 protein, %22 yağ) 2.gruba yüksek proteinli(%56 protein, %22 karbonhidrat, %22 yağ),3.gruba yüksek yağlı (%56 yağ, %22 karbonhidrat, %22 protein)kontrol grubuna ise % 50 karbonhidrat % 35 yağ %15 protein içeren bir diyet verilmiştir. Diyetler 4 gün boyunca tükettirilmiştir. 4 gün boyunca uyku ölçer kullanılarak izlenmiştir. Yüksek proteinli diyet uygulanan grupta kontrol grubuna göre uyanma sayısının azaldığı gözlemlenmiştir.Ayrıca yüksek karbonhidratlı diyet tüketenlerde kontrol grubuna kıyasla uyku başlangıcındaki gecikmenin azaldığı bildirilmiştir (St-Onge ve ark.,2016). 1 ay boyunca yatmadan önce 2 kivi tüketen uyku bozukluğu olan yetişkinlerde uyku verimliliğinin önemli ölçüde arttığı bildirilmiştir.Kivinin uyku üzerindeki etkileri yüksek antioksidan kapasitesine,folat ve seratonin içeriğine bağlamaktadır.A ve E vitamini önemli antioksidanlardır ve kivide bol miktarda bulunmaktadır.Bu antioksidan vitaminler serbest radikallerin oluşumunu egellemektedir (Lin ve ark.,2011).

Mikro Besin Ögelerinin Sirkadiyen Ritim Üzerine Etkisi

Makro besin ögeleri dışında bazı mikro besin ögelerinin de uyku-uyanıklık döngüsünü etkileyebileceği belirtilmektedir. Yapılan çalışmalar daha çok B grubu vitaminleri ve magnezyum üzerinde durmaktadır. B grubu vitaminlerden B_6, B_{12} ve niasinle ilgili çalışmalar mevcuttur.Triptofan uyku üzerinde etkili olduğu bilinen serotonin ve melotoninin öncü maddesidir (Şekil 2). Niasin triptofandan sentezlenebilen bir vitamindir. B_6 vitamini triptofandan melatonin sentezini gerçekleştiren tepkimede 5-HTP dekarboksilaz (5-Hidroksitriptofan dekarboksilaz) enziminin koenzimi olarak görev aldığından bu vitamini daha çok içeren et,tavuk,balık,kurubaklagil,yağlı tohum ve yeşil sebzeler gibi besinlerin bu mekanizma üzerinde etkili olabileceği düşünülmektedir (Akıncı ve ark.,2016;Silber &Schmitt,2010).



Şekil 2. Pineal bezde ışık etkisiyle triptofandan melatonin sentezi (Atasoy & Erbaş, 2017).

* SCN: Suprakiazmatik çekirdek; PVN: Paraventriküler çekirdek;

*SCG: Süperior servikal ganglion; NA: Noradrenalin; HTP: Hidroksitriptofan.

Kandaki magnezyum seviyesinin uyku üzerine etki ettiği düşünülmektedir. Fakat bu konu üzerine yapılan çalışmalar daha çok ratlar üzerinde yapılmış olduğundan klinik kanıtlar sınırlıdır. Magnezyumun melatonin sentezinde görevli bir enzim olan serotonin N-asetiltransferaz aktivitesini stimüle ederek melatonin sentezini arttırarak gösterdiği düşünülmektedir (Roskoden ve ark.,2017). Omega 3 ve D vitamini içeren yağlı balıklar bu besin ögelerinin seratonini düzenlemesi nedeniyle uyku ile ilişkilendirilmektedir.Sınırlı güneş ışığına maruz kalan mahkumların yağlı balık tüketimlerinin uyku üzerine etkisini inceleyen bir çalışmaya göre mahkumlar 2 gruba ayrılmıştır bir gruba günlük 300 g somon,kontrol grubuna ise aynı miktarda kırmızı et verilmiştir. Kontrol grubunda uykuya dalma süresinde artış gözlemlenmiştir ancak hem kontrol grubunda hem de müdahale grubunda uyku veriminin azaldığı gözlemlenmiştir (Hansen ve ark.,2014).

SONUÇ VE ÖNERİLER

Yapılan çalışmalar sirkadiyen ritim, beslenme ve uykunun birbirlerini etkilediklerini göstermektedir.Bu faktörler kişinin iş performansını, günlük performansını ve konsantrasyon seviyesini etkileyerek yaşam kalitesi üzerinde etkili olmaktadır.Vardiyalı çalışma şekli hem uyku hem de beslenme düzeninde değişikliklere neden olarak farklı sorunlara sebep olabilmektedir.Uyku zamanındaki değişimler yanlış besin seçimine neden olmakta bu da birçok kronik hastalığı beraberinde getirmektedir. Vardiyalı çalışan işçilerde sindirim problemleri görülebildiği için posa içeriği yüksek besinler,taze sebze ve meyveler, beyaz ekmek yerine tam

buğday ekmeği ya da esmer ekmek, pirinç yerine bulgur tercih edilmelidir. Mesai başlamadan önce tüketilen öğünün proteinden (et,süt,balık,süt ürünleri ve yumurta vb.), esansiyel yağlardan (fındık,badem,ceviz vb.) ve kompleks karbonhidratlardan (tam buğday ekmek,yulaf,kepekli ekmek,bulgur vb.) zengin içeriğe sahip olması, gece boyunca kan şekerinin dengeli ve zihinsel fonksiyonların aktif olmasına katkı sağlayabileceği düşünülmektedir.Basit karbonhidratlar kan şekerinde düzensizliklere neden olabileceğinden kompleks karbonhidratlar tercih edilmelidir.Uykuyu etkileyen besinler;süt,yağlı balıklar,çay,kahve ve meyveler olarak belirtilmektedir.Makro besin ögeleri dışında bazı mikro besin ögelerinin de bu döngüyü etkileyebileceği belirtilmektedir.Yapılan çalışmalar daha çok B grubu vitaminleri ve magnezyum üzerinde durmaktadır.B grubu vitaminlerden B_6, B_{12} ve niasinle ilgili çalışmalar mevcuttur.Uyku süresinin beslenmeye yönelik etkilerinin mekanizması henüz netleşmiş değildir.Bu ilişkinin daha iyi anlaşılabilmesi için farklı popülasyonlar ve çalışma saatleri ile daha fazla çalışmaya ihtiyaç olduğu bildirilmektedir.

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SOSYAL MEDYA ÜZERİNDEN AFET DURUMLARINDA YARDIM ÇAĞRILARINA İLİŞKİN İNTERNET KULLANICILARININ GÜVEN VE YARDIM NİYETİ: BİR ANKET ARAŞTIRMASI

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ÖZET
Afetler, doğal veya insani kökenli olayların sonucunda ortaya çıkan büyük çaplı felaketlerdir. Bu olaylar genellikle insanların hayatını, sağlığını, mülkünü ve çevreyi ciddi şekilde etkiler. Doğal afetler arasında depremler, seller, fırtınalar, tsunamiler, volkanik patlamalar ve kuraklık gibi bir dizi olay yer alırken, insani kaynaklı afetler arasında ise savaşlar, terör saldırıları, endüstriyel kazalar ve salgın hastalıklar örnek gösterilebilir. Afetler genellikle ani ve beklenmedik bir şekilde ortaya çıkarlar ve toplumlar hazırlıksız yakalandığında büyük zararlar verebilirler. Bu çalışma, sosyal medya üzerinden afet durumlarında yapılan yardım çağrılarına ilişkin internet kullanıcılarının güven ve yardım niyeti üzerine bir anket araştırmasıdır. Araştırma, 2023 yılında Türkiye'de gerçekleşen Kahramanmaraş ve Hatay merkezli depremleri baz alarak, katılımcılardan afet durumlarında sosyal medyadan yapılan yardım çağrılarına karşı güven düzeylerini, tutumlarını ve yardım niyetlerini değerlendirmek amacıyla Likert ölçeği kullanılarak gerçekleştirilmiştir. Bu araştırmaya, farklı demografik özelliklere sahip 129 gönüllü katılımcı çevrimiçi anket yoluyla katılmıştır. Katılımcıların anket yönetimiyle toplanan veriler, betimsel istatistik temelli yöntem kullanılarak analiz edilmiştir. Araştırmanın bulguları, akademik çevrelere ek olarak sivil toplum kuruluşlarına ve afet konularında politika yapıcılarına önemli bilgiler sunmaktadır. Özellikle, sosyal medyanın afet yardımı ve iletişimi için nasıl daha etkin bir şekilde kullanılabileceği konusunda önemli ipuçları sağlamaktadır. Bu araştırmanın bulguları, afetlerin yönetimi ve toplumsal dayanıklılığın artırılması için stratejik adımların belirlenmesine katkı sağlayabilir.
Anahtar Kelimeler: Afet, Deprem, Yardımlaşma, Sosyal Medya, İnternet

TRUST AND HELP INTENTION OF INTERNET USERS REGARDING HELP CALLS IN DISASTER SITUATIONS VIA SOCIAL MEDIA: A SURVEY RESEARCH

ABSTRACT
Disasters are large-scale catastrophes that occur as a result of natural or man-made events. These events often have serious effects on people's lives, health, property, and the environment. While natural disasters include earthquakes, floods, storms, tsunamis, volcanic eruptions, and droughts, examples of man-made disasters include wars, terrorist attacks, industrial accidents, and epidemics. Disasters typically occur suddenly and unexpectedly, causing significant harm when communities are unprepared. This study is a survey research on the trust and intention to help of internet users regarding aid calls made during disaster situations via social media. The research, based on the earthquakes centered in Kahramanmaraş and Hatay in Turkey in 2023, was conducted using a Likert scale to assess participants' levels of trust, attitudes, and intentions to help in response to aid calls made through social media during disasters. A total of 129 voluntary participants with diverse demographic characteristics took part in the online survey. The data collected through the survey were analyzed using descriptive statistics-based methods. The findings of the research provide important insights not only to academic circles but also to civil society organizations and policymakers in disaster-related matters. Particularly, they offer significant clues on how social media can be more effectively utilized for disaster relief and communication. The findings of this research could contribute to identifying strategic steps for disaster management and enhancing societal resilience.
Keywords: Disaster, Earthquake, Solidarity, Social Media, Internet

GİRİŞ

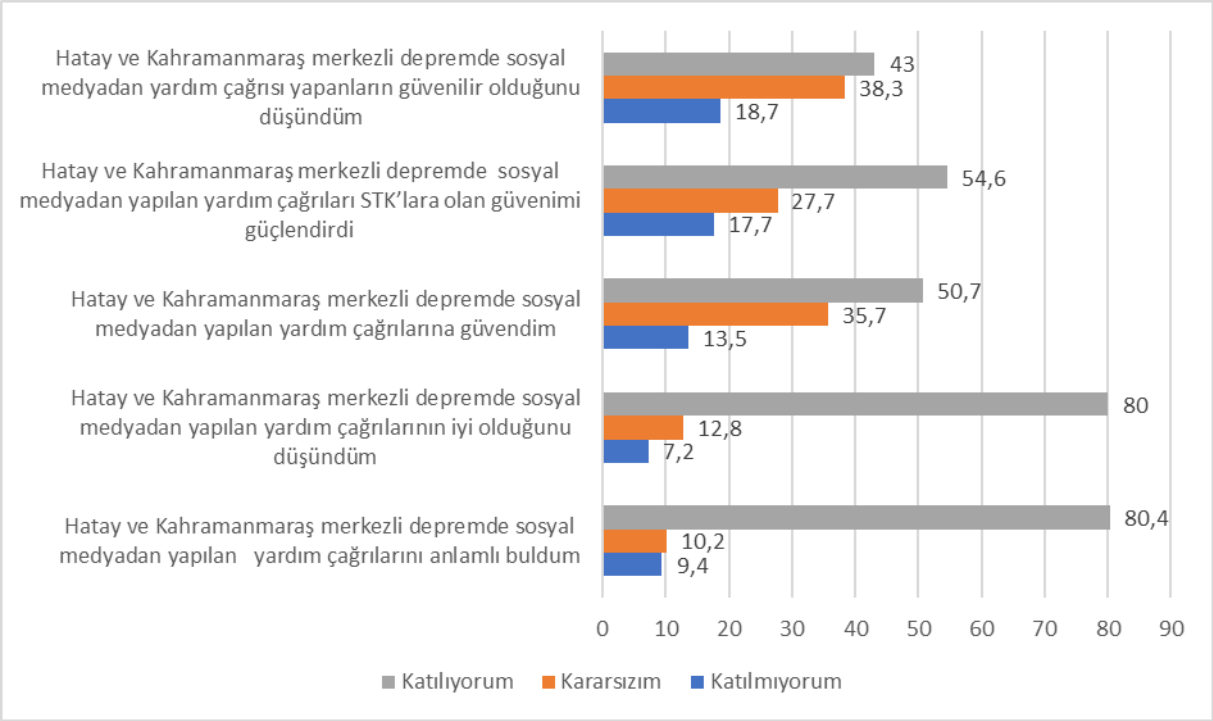
Afetler, tarihin her döneminde insanoğlunun karşılaştığı ve doğal veya insani sebeplerden kaynaklanan, çevre, toplum ve ekonomi üzerinde ciddi etkileri olan olaylardır (Çamur, 2023). Depremler, sel felaketleri, yangınlar, kasırgalar, tsunamiler gibi doğal afetlerin yanı sıra, savaşlar, terör saldırıları, salgın hastalıklar gibi insani kaynaklı afetler de yaşamı derinden etkileyebilir (Büyükbaş & Ormanoğlu, 2013; Ceren, 2021). Afetler, milyonlarca insanın evini, geçim kaynağını, sağlığını ve hatta yaşamını kaybetmesine neden olabilir. Bu nedenle, afetlerin etkilerini en aza indirmek ve etkilenen insanlara yardım etmek için hızlı ve etkili müdahaleler gerekmektedir.Sosyal medya, modern iletişim araçları arasında önemli bir yer tutmaktadır. Facebook, Twitter, Instagram gibi platformlar, milyonlarca insanın bir araya gelmesini sağlayarak geniş kitlelere ulaşma gücüne sahiptir. Ayrıca, sosyal medya üzerinden yapılan paylaşımların anlık ve hızlı bir şekilde yayılma özelliği, önemli olayların insanlara daha hızlı duyurulmasını sağlamaktadır. Özellikle afet durumlarında, sosyal medya platformları güncel bilgilerin ve acil yardım çağrılarının hızla yayılmasına yardımcı olabilir (Yan & Pedraza-Martinez, 2019; Muniz-Rodriguez et al., 2020; Mavrodieva & Shaw, 2021). Bu da toplumun afetlere daha hızlı ve etkili bir şekilde yanıt vermesini sağlayabilir. Ayrıca, sosyal medya, afet bölgelerindeki insanların güvende olduklarını sevdikleriyle paylaşmalarını ve yardım taleplerini iletmelerini sağlayarak, yardımın koordinasyonunu kolaylaştırabilir Bu çalışma, sosyal medya aracılığıyla yapılan yardım çağrılarının afet durumlarında nasıl etkili bir araç haline geldiğini ve toplumun bu çağrılara nasıl yanıt verdiğini incelemektedir. Özellikle, Kahramanmaraş ve Hatay'da 2023 yılında yaşanan deprem olaylarına odaklanarak, internet kullanıcılarının güven düzeyi ve yardım niyeti üzerindeki etkileri araştırmayı amaçlamaktadır. Bu çalışma, afetlerin yönetimi ve yardım faaliyetlerinin koordinasyonu açısından sosyal medyanın rolünü anlamamıza ve toplumun afetlere daha iyi hazırlanmasına katkı sağlayacaktır. Ayrıca, bu çalışma, sosyal medyanın afet yönetimi ve yardım koordinasyonunda nasıl kullanılabileceği konusunda daha fazla araştırmaya olanak sağlayabilir.

METOT

Bu çalışma, internet kullanıcılarının afet durumlarında sosyal medya üzerinden yapılan yardım çağrılarına verdiği yanıtları, güven ve tutumlarını detaylı bir şekilde incelemektedir. Özellikle, araştırma 2023'te Türkiye'nin Kahramanmaraş ve Hatay şehirlerinde meydana gelen deprem olaylarına odaklanmaktadır. Araştırma, katılımcıların bu tür çağrılarla ilgili güven seviyelerini, tutumlarını ve niyetlerini ölçmek için Likert ölçeğini kullanmaktadır. Verileri toplamak için, sosyal bilimlerde geniş kabul gören bir araştırma tekniği olan anket yöntemi kullanılmıştır. 132

kişilik bir örneklem grubundan elde edilen veriler, katılımcıların yanıtlarının sistematik olarak değerlendirilmesine olanak sağlayacak şekilde yapılandırılmış bir anket formunda toplanmıştır. Anket çevrimiçi kanallar aracılığıyla uygulanmış ve katılım tamamen gönüllülük esasına dayanmıştır. Analiz sonuçlarına göre, katılımcıların ortalama yaşı 30'dur; katılımcıların %44'ü erkek, %56'sı ise kadındır. Bu demografik profil, sosyal medya üzerinden afet yardımına yönelik tutumların ve niyetlerin çeşitliliğini anlamak için önemli bir içgörü sağlamaktadır.

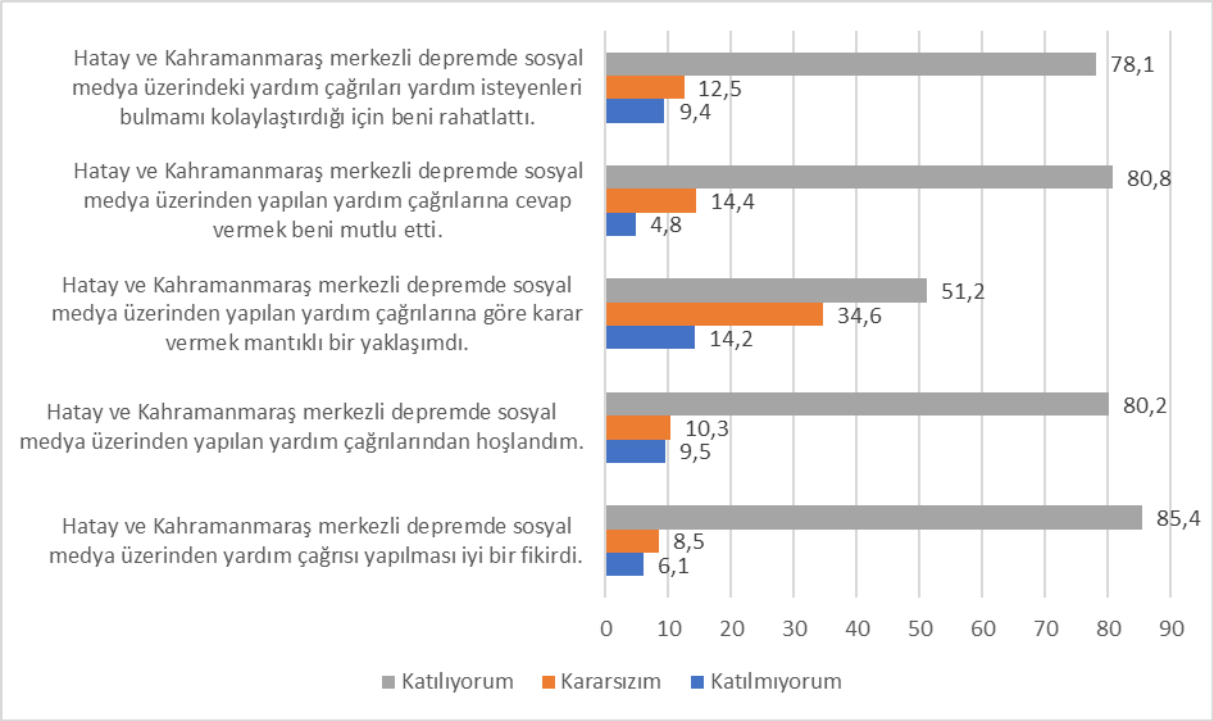
BULGULAR



Resim 1. Sosyal Medya Üzerinden Afet Durumlarında Yapılan Yardım Çağrılarına İlişkin İnternet Kullanıcılarının Güveni

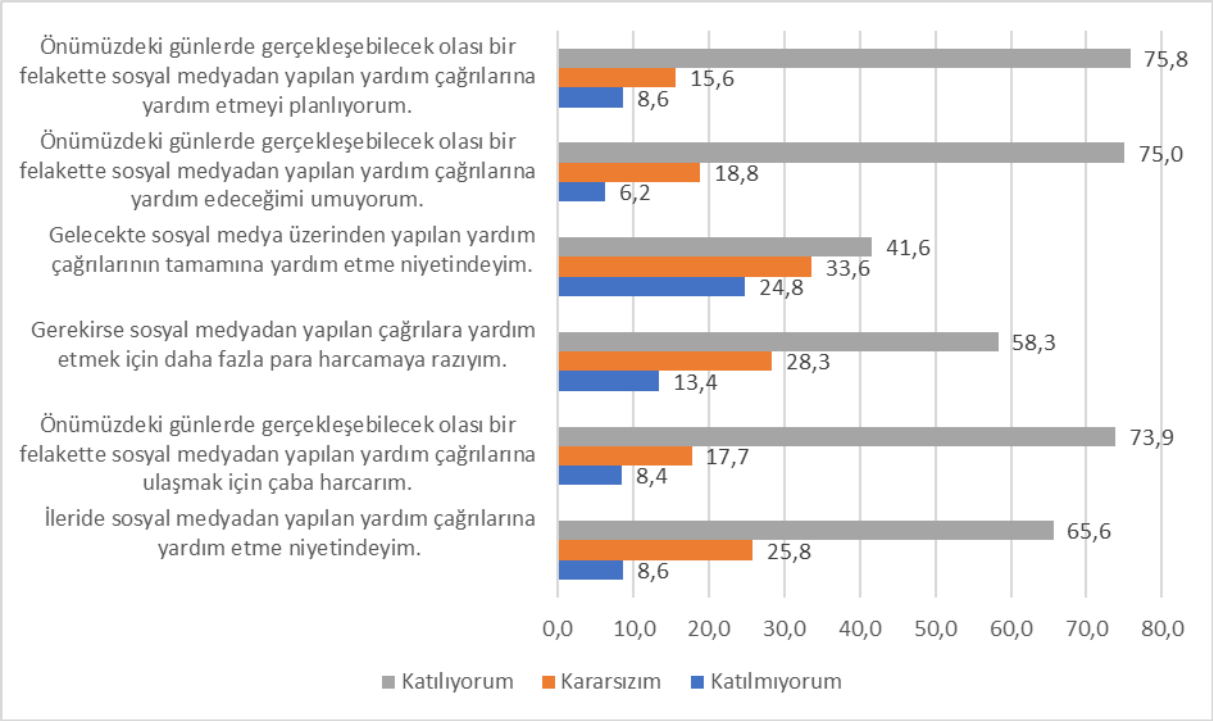
Katılımcıların, Hatay ve Kahramanmaraş merkezli depremde sosyal medya üzerinden yapılan yardım çağrılarına ilişkin güvenlerini belirlemek için beş farklı ifade incelenmiştir (Resim 1). Bu ifadeler, katılımcıların olumsuz, kararsız veya olumlu yaklaşımlarını yansıtmaktadır. Katılımcıların, sosyal medya üzerinden yapılan yardım çağrılarına ilişkin güven ifadelerini değerlendiren bulgulara göre, genel olarak olumlu bir eğilim gözlemlenmektedir. Katılımcıların %80.4'ü, bu çağrıları anlamlı bulduklarını ifade ederken, %80'i de bu çağrıların iyi olduğunu düşündüklerini belirtmiştir. Ayrıca, %50.7'si bu çağrılara güvendiklerini vurgularken, %54.6'sı da bu çağrıların sosyal yardım kuruluşlarına olan güvenlerini güçlendirdiğini ifade etmektedir. Ancak, bazı katılımcılar güvenilirlik konusunda kararsız veya olumsuz bir tutum sergilemektedir. Bu bulgular, sosyal medya aracılığıyla yapılan yardım çağrılarının toplumda

genellikle güvenilirlik algısını artırdığını ve yardım etme isteğini güçlendirdiğini göstermektedir.



Resim 2. Sosyal Medya Üzerinden Afet Durumlarında Yapılan Yardım Çağrılarına İlişkin İnternet Kullanıcılarının Tutumu

Katılımcıların, Hatay ve Kahramanmaraş merkezli depremde sosyal medya üzerinden yapılan yardım çağrılarına yönelik tutumlarını belirlemek için beş farklı ifade incelenmiştir (Resim 2). Bulgular çoğunlukla tutum açısından olumlu bir eğilim göstermektedir. Katılımcıların %85.4'ü, bu depremlerde sosyal medya üzerinden yardım çağrısı yapılmasının iyi bir fikir olduğunu düşünmektedir. Ayrıca, %80.2'si bu çağrılardan hoşlanmıştır ve %80.8'i bu çağrılara cevap vermekten mutluluk duymuştur. Katılımcıların %51.2'si, sosyal medya üzerinden yapılan yardım çağrılarına göre karar vermenin mantıklı bir yaklaşım olduğunu belirtirken, %78.1'i de bu çağrıların yardım isteyenleri bulmayı kolaylaştırdığı için rahatladığını ifade etmektedir. Ancak, bazı katılımcılar kararsız veya olumsuz bir tutum sergilemektedir. Bu bulgular, sosyal medya aracılığıyla yapılan yardım çağrılarının toplumda genellikle olumlu bir algıya sahip olduğunu ve yardım etme isteğini artırdığını göstermektedir.



Resim 3. Sosyal Medya Üzerinden Afet Durumlarında Yapılan Yardım Çağrılarına İlişkin İnternet Kullanıcılarının Yardım Niyeti

Katılımcıların, sosyal medya üzerinden yapılan yardım çağrılarına ilişkin yardım niyetini belirlemek için altı farklı ifade kullanılmıştır. Katılımcıların büyük çoğunluğu (%75.8), sosyal medyadan yapılan yardım çağrılarına katılmayı planlamaktadır. Yine, büyük bir çoğunluk (%75.0), bu çağrılara yardım etmeyi umut etmektedir. Yaklaşık yarısı (%41.6), gelecekteki sosyal medya üzerinden yapılan yardım çağrılarının tamamına yardım etmeyi planlamaktadır. Başka iki önemli bulguda, yardım etmek için daha fazla para harcamaya istekli olanların (%58.3) ve felaket durumlarında sosyal medyadan yapılan yardım çağrılarına ulaşmak için çaba harcamaya istekli olanların (%73.9) çoğunluk oluşturduğu görülmektedir. Gelecekteki sosyal medya üzerinden yapılan yardım çağrılarına yardım etme niyetini değerlendiren ifadeye göre, katılımcıların çoğunluğu (%65.6), bu tür çağrılara yardım etme niyetindedir. Bu bulgular, katılımcıların gelecekte sosyal medya aracılığıyla yapılan yardım çağrılarına olumlu bir yaklaşım sergilediğini göstermektedir. Sonuç olarak, incelenen ifadelerin genelinde katılımcılar sosyal medya üzerinden yapılan yardım çağrılarına olumlu bir tavır sergilemektedir. Ancak, bazı durumlarda kararsızlık ve olumsuz tutumlar da gözlemlenmektedir. Bu bulgular, sosyal medyanın yardım çağrılarının yayılması ve toplumun bu çağrılara nasıl yanıt vereceği konusunda karmaşık bir rol oynadığını göstermektedir. Bu nedenle, sosyal medya aracılığıyla

yapılan yardım çağrılarının etkili bir şekilde yönetilmesi ve toplumun bu çağrılara güven duyması önemlidir.

SONUÇ VE ÖNERİLER

Bu araştırma, internet kullanıcılarının afet durumlarında sosyal medya üzerinden yapılan yardım çağrılarına yanıt verme eğilimlerini, güven ve tutumlarını derinlemesine incelemiştir. Bulgular, genel olarak, katılımcıların sosyal medya aracılığıyla yapılan yardım çağrılarına olumlu bir tavır sergilediğini göstermektedir. Ancak, bazı durumlarda kararsızlık ve olumsuz tutumlar da gözlemlenmiştir. Özellikle, güven, tutumlar ve yardım niyeti üzerine yapılan analizler, sosyal medyanın yardım çağrılarının yayılması ve toplumun bu çağrılara nasıl yanıt vereceği konusunda karmaşık bir rol oynadığını göstermektedir.

Bu bulgular ışığında, afet durumlarında sosyal medya aracılığıyla yapılan yardım çağrılarının etkili bir şekilde yönetilmesi ve toplumun bu çağrılara güven duyması önemlidir. Bu bağlamda, şu önerilerde bulunulabilir:

1. Sosyal medya platformlarında, yardım çağrılarının güvenilirliğini artırmak için şeffaflık ve doğruluk ilkelerine daha fazla vurgu yapılmalıdır.
2. Toplumun yardım etme niyetini güçlendirmek için, sosyal medya üzerinden yapılan yardım çağrılarının olumlu sonuçları ve etkileri hakkında daha fazla bilgi ve farkındalık oluşturulmalıdır.
3. Afet durumlarında, sosyal medya platformlarına daha hızlı ve etkili bir şekilde erişim sağlanması için acil iletişim ve koordinasyon planları oluşturulmalıdır.
4. Katılımcıların kararsızlık ve olumsuz tutumlarını azaltmak için, sosyal medya üzerinden yapılan yardım çağrılarının içeriği ve sunumu üzerinde daha fazla çalışma yapılmalıdır.
5. Sosyal medya üzerinden yapılan yardım çağrılarının etkinliğini artırmak için, bu çağrıların içeriği ve görsel unsurları profesyonel bir şekilde hazırlanmalı ve hedef kitleye uygun olarak tasarlanmalıdır.
6. Toplumun afet durumlarına hazırlıklı olmasını teşvik etmek için, sosyal medya platformlarından afet öncesi ve sonrası önlemler hakkında düzenli hatırlatıcı ve bilgilendirici içerikler paylaşılabilir.
7. Toplumu bilinçlendirmek ve eğitmek amacıyla, sosyal medya üzerinden afet hazırlığı ve acil durum müdahale konularında düzenli eğitim ve bilgilendirme kampanyaları düzenlenmelidir.

Bu önerilerin uygulanması, sosyal medya aracılığıyla yapılan yardım çağrılarının etkinliğini artırabilir ve afet durumlarında toplumun dayanışma ve yardımlaşma potansiyelini maksimize edebilir.

BİLGİ NOTU

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SOSYAL MEDYANIN AFET YARDIMLAŞMASI VE KRİZ İLETİŞİMİNDEKİ ROLÜ: BİR LİTERATÜR DERLEMESİ

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ÖZET
Afet, doğal veya insan kaynaklı felaketlerin neden olduğu olağanüstü durumları ifade eder. Bu tür olaylar, depremler, sel, yangınlar, kasırgalar, salgın hastalıklar gibi çeşitli şekillerde ortaya çıkabilir ve toplumların acil müdahaleye ihtiyaç duyduğu kriz durumlarına yol açabilirler. Tarihte pek çok afet durumu yaşanmış ve bu durumlar genellikle can kaybı ve maddi kayıplarla sonuçlanmıştır. Bu nedenle, afetlerin etkilerini azaltmak ve toplumların direncini artırmak için sürekli olarak önlemler alınmalıdır. Bu çalışma, afet kavramının tanımıyla başlayarak, literatürdeki bilgi ve araştırmaların derlemesini sunmaktadır. Afetlerin etkilerini azaltma ve mücadele etme stratejileri üzerine yoğunlaşan bu çalışma, insanların afetlerle başa çıkma yeteneklerini artırmaya yönelik çeşitli yaklaşımları incelemekte ve bu alanda yapılan çalışmaların önemini vurgulamaktadır. Özellikle sosyal medyanın, afet yardımlaşması ve kriz iletişimi süreçlerindeki rolünü anlamak, günümüz iletişim ortamının dinamiklerini göz önünde bulundurmak açısından son derece önemlidir. Sosyal medya, çağdaş iletişim araçları arasında önemli bir yer tutmaktadır ve afet yardımlaşması süreçlerinde giderek artan bir rol oynamaktadır. İnsanlar, afet anlarında sosyal medya platformlarını kullanarak yardım talep edebilir, yardım sağlayabilir, kaynakları paylaşabilir ve bilgi alışverişinde bulunabilirler. Bu çalışma, sosyal medyanın afet yardımlaşması ve kriz iletişimi süreçlerindeki etkilerini detaylı bir şekilde analiz etmekte ve literatürdeki mevcut bulguları değerlendirmektedir. Sonuç olarak, sosyal medyanın afet yardımlaşması ve kriz iletişimi üzerindeki etkisi giderek artmaktadır ve bu etkinin daha da anlaşılması ve yönetilmesi önemlidir. Bu çalışma, afetlerin yönetimi ve toplumların afetlere hazırlıklı olma süreçlerine katkıda bulunmayı amaçlamaktadır.
Anahtar Kelimeler: Afet, Deprem, Yardımlaşma, Sosyal Medya, İnternet, Literatür Taraması

THE ROLE OF SOCIAL MEDIA IN DISASTER RELIEF AND CRISIS COMMUNICATION: A LITERATURE REVIEW

ABSTRACT
Disaster refers to extraordinary situations caused by natural or human-induced catastrophes. Such events can manifest in various forms such as earthquakes, floods, fires, hurricanes, and epidemics, leading to crisis situations requiring urgent intervention by societies. Throughout history, numerous disaster situations have occurred, often resulting in loss of life and property. Therefore, continual measures need to be taken to mitigate the impacts of disasters and enhance societal resilience. Commencing with the definition of the disaster concept, this study presents a compilation of knowledge and research from the literature. Focusing on strategies for reducing and combating the effects of disasters, this study examines various approaches aimed at enhancing people's ability to cope with disasters and emphasizes the significance of research conducted in this field. Understanding the role of social media in disaster relief and crisis communication processes is particularly crucial, considering the dynamics of contemporary communication environments. Social media holds a significant position among modern communication tools and increasingly plays a role in disaster relief processes. People can use social media platforms during disasters to request assistance, provide aid, share resources, and exchange information. This study extensively analyzes the impact of social media on disaster relief and crisis communication processes and evaluates the existing findings in the literature. Ultimately, the influence of social media on disaster relief and crisis communication is growing, underscoring the importance of further understanding and managing this influence. This study aims to contribute to disaster management and societal preparedness processes for disasters.
Keywords: Disaster, Earthquake, Disaster Relief, Social Media, Internet, Literature Review

GİRİŞ

Dünya üzerinde bilinen tarihteki geçmişten günümüze kadar birçok doğal veya insan yapımı afet meydana gelmiştir ve bu afetlerin sonucunda birçok maddi kayıplar ve can kayıpları olduğu kayıtlarla sabittir. İnsan, doğası gereği komün içerisinde yaşayan ve hayatta kalan bir canlı olduğundan ötürü, bu gibi afet durumlarında birbirleri ile iletişim kurmak amacıyla çeşitli yöntemler geliştirmiştir. Tarihe bakıldığında kimi zaman duman gibi görsel araçlarla, kimi zaman doğadaki canlıları kullanarak insanlar bu iletişimi afet zamanlarında dahi canlı tutmayı başarmıştır. Modern zamana geldiğimizde ise teknolojinin gelişimi ile iletişim telefon, tablet, bilgisayar gibi son teknoloji cihazlar ile sağlanmaktadır. Bu teknolojiler beraberinde farklı şekillerde iletişim kurulabilecek birbirinden çeşitli platformları zaman içerisinde hayatımıza sokmuştur. Afet anlarında ise geçiş zamana ve çalışmalara bakıldığında görülmüştür ki toplumlar afet anlarında istedikleri yardımlar, birbirlerine yardım etmek ve kendi aralarındaki koordinasyonu sağlayabilmek için bu platformları yoğun bir şekilde kullanmaktadır. Örneğin, 6 Şubat ve 7 Şubat 2023 Tarihinde Türkiye'nin Kahramanmaraş ili Pazarcık ve Elbistan ilçelerinde meydana gelen ve Hatay, Gaziantep ve Adıyaman gibi çevresindeki illeri etkileyen depremler esnasında Twitter ve Instagram platformlarında "#Deprem, #HatayDeprem, #DepremYardım, #KahramanmaraşDeprem, #KahramanmaraşYardım, #DepremAcil..." hashtagleri vasıtasıyla milyonlarca mesaj paylaşılmış ve insanlar iletişimlerini bu platformlar vasıtasıyla kurmaya çalışmıştır. Bu bağlamdan hareketle, farklı sosyal medya platformlarının afet koordinasyonuna ve yönetimine etkisi ve bu esnada oynadıkları roller birçok araştırma tarafından konu edilmiştir (Yıldırım, 2023; Doğuç, 2022; Kumar vd., 2019; Sreelakshmi vd., 2022; Çanakçı vd., 2022). Bu araştırmada, literatürde bulunan 32 farklı kaynak detaylı ve sistematik bir şekilde incelenmiş olup, literatürde katkı sağlanabilecek alanlar, çelişen noktalar ve dikkat çekilmesi gereken alanlar sonraki bölümlerde açıklanmıştır. Araştırmanın bulguları ve sonuç kısmında literatürle ve yapılacak araştırmalarla ilgili öneriler sıralanmış olup açıklanmıştır. Ayrıca, bu çalışma, sosyal medyanın afet yönetimi ve yardım koordinasyonunda nasıl kullanılabileceği konusunda daha fazla araştırmaya olanak sağlayabilir.

METOT

Bu araştırmadaki temel hedef, literatürde bulunan ve sosyal medyanın afet yardımları ve kriz iletişimindeki rolünü konu alan araştırmaları sistematik bir şekilde inceleyerek katkıda bulunulabilecek alanları belirlemek, yapılan araştırmalar içerisindeki ilişkiyi ortaya koyarak literatüre bu konu hakkında katkı sağlamak ve gelecek araştırmalara yardımcı kaynak oluşturmaktır. Araştırmada, son dört yıla ait olan özellikle afet yardımlaşmasını, kriz iletişimini

ve koordinasyonu konu alan 32 ulusal ve uluslararası kaynak sistematik bir şekilde incelenmiş ve belirli kaynaklar arasında karşılaştırmalar ve açıklamalar yapılarak detaylara yer verilmiştir. İncelenen araştırmalar, alt parçalara bölünerek sınıflandırılmış, eleştirel olarak gözden geçirilmiş, temel çıkarımlara ve yorumlara sonuç kısmında yer verilmiştir. Ayrıca literatür genelinde yapılan öneriler sonuç ve öneriler alanında ayrıca belirtilmiştir. Ayrıca, bu çalışma, sosyal medyanın afet yönetimi ve yardım koordinasyonunda nasıl kullanılabileceği konusunda daha fazla araştırmaya olanak sağlayabilir.

BULGULAR

Çalışmanın ilk adımı olarak sosyal medyanın afet iletişimindeki rolüne odaklanılmış ve bu kapsamdaki çalışmalar incelenmiştir. Yapılan araştırmalar göstermiştir ki, sosyal medya platformları afet sırasında ve sonrasında yoğun bir şekilde toplum kitleleri tarafından etkin bir şekilde kullanılmaktadır. Bu kullanım, kimi zaman afet durumundaki yardım ihtiyacına ve dayanışmaya odaklanmış, kimi zaman ise haber, bilgi ve duyuru paylaşımı için sivil toplum kuruluşlarınca ve resmi makamlarca yapılmıştır (Argın, 2023). Ayrıca sosyal medyada yayınlanan bu mesajlar duygu ve düşünceleri ifade etmek amacıyla yayınlanabildiği gibi belirli zamanlarda bilgilendirme amacıyla da servis edilmektedir (Doğuç, 2022, Kumar vd., 2019). Bu amaçlarla sosyal medyada yayınlanan öğeler metinsel içerikler barındırabildiği gibi görsel veyahut işitsel içeriklerden de meydana gelmektedir. Araştırmaların büyük bir kısmı ise metinsel öğeleri kullanmaktadır. Bunun temel sebebinin, metinsel içeriklerin kolay depolanması ve güncel teknolojik imkanlar (Makine öğrenmesi, dil modelleri, doğal dil işleme uygulamaları vb.) sayesinde hızlıca incelenebilmesi olduğu düşünülmektedir. Ayrıca X(Twitter) platformu, afetler sırasında ve sonrasında, koordinasyon ve yardım içerikli gönderileri paylaşmak amacıyla en çok kullanılan sosyal medya platformudur (Dwarakanath vd., 2021). Ek olarak, X (Twitter) kullanımı üzerine bir araştırma gerçekleştiren Adba Analytics, Pazarcık ve Elbistan'da gerçekleşen depremler esnasında en çok kullanılan sosyal medya uygulamasının X(Twitter) olduğunu belirtmiştir (Yıldırım, 2023). Afetler sırasında gerçekleşen sosyal medya paylaşımlarının amaçlarından bazıları bilgi edinmek, bilgi vermek, duygu ve düşünceleri paylaşmak, organizasyonu sağlamak olmaktadır. Bu esnada kullanıcılar veya kurumlar farklı rollere bürünmekle birlikte bu roller vasıtasıyla kullanıcıları farklı şekillerde etkileyebilmektedir. Afet sırasında yapılan sosyal medya paylaşımları vasıtasıyla dört ana kullanıcı grubu tanımlanmıştır. Bunlar; (1) inovatif kullanıcılar (Faydalı olanlar), (2) reaktif kullanıcılar (etkilenen insanları yönlendirebilenler), (3) duyarlı kullanıcılar (tepki gösterenler), (4) proaktif kullanıcılar (kuruluşlar) (Dwarakanath vd., 2021). Sosyal medya

platformlarının anlık bir paylaşım kaynağı olarak, bilgi paylaşmak, kriz iletişimini yönetmek ve afet yardımlarının koordinasyonlarını sağlamak amacıyla kullanabileceği bir çok kaynakta açıkça belirtilmiş ve konu edinilmiştir. Sosyal medya, afet iletişiminde geleneksel medya araçlarının ötesinde alternatif ve interaktif bir araç olarak çalışmalarda tanımlanmış ve incelenmiştir (Ata, 2023).Sosyal medya üzerinden yayınlanan içerikler üzerinde, platform idarecileri tarafından birçok filtre uygulanmakta ve suç teşkil edici içerikler engellenmektedir. Fakat, yapılan paylaşımların doğruluğunu kontrol eden bir mekanizma günümüzde bulunmamaktadır. Bu durum yayınlanan gönderilerin manipülasyona ve yanlış yönlendirmelere açık olmasını da beraberinde getirmektedir. Bilgi güvenliği üzerine duyulan bu endişelerin yanında, yaşça büyük bireylerin geleneksel medyayı sosyal medyaya nazaran afet sırasında daha fazla tercih ettiği görülmüştür. Bu kriterler dikkate alındığında sosyal medyanın afet iletişimi ve koordinasyonunda kullanılabilmesi için bilgilerin teyit edilmesi gerekmektedir (Yıldırım, 2023). Fakat yapılan araştırmalar göstermiştir ki, yayınlanan içerikler toplumsal farkındalığı artırmış ve bilinçlenmeyi sağlamıştır (Ata, 2023).

Yapılan çalışmalarda, sosyal medya iletişiminin kişiler, kurumlar ve afet personeli için bilgilendirme amacıyla etkin bir rol oynadığı ve kitlelere erişimi kolaylaştırdığına yer verilmiştir. Bunun bir örneği olarak bazı araştırmalarda gerçekleşen afetler sonrasında yardım ve koordinasyon ekiplerinde görev almış kişilerin görüşlerine yer verilmiştir (Ekşi vd., 2014).

SONUÇ VE ÖNERİLER

Bu çalışma, sosyal medyanın afet yardımlaşması ve koordinasyonu üzerindeki etkisini araştıran, ayrıca afetler üzerinde sosyal medya iletişiminin etkisini konu alan birçok literatür kaynağını detaylı ve sistematik şekilde incelemiştir. İncelenen araştırmalarda, sosyal medya kullanımının afet iletişimi vasıtasıyla kullanımının günden güne arttığını, afet yardımları ve kriz iletişimindeki rolünün ve gelişen teknolojiyle beraber etkisinin yoğunlaştığını, etkisinin ise göreceli ve değişken olduğunu ortaya koymuştur. Literatürde yer alan kaynaklarda afet iletişiminde sosyal medya kullanımının manipülasyona ve yanlış yönlendirmelere açık olduğu ve bununla ilgili çalışmaların artması gerektiği gözlemlenmiştir. Ayrıca birçok kaynak bu olguyu araştırma kısıtlarına da dahil etmiş ve dikkat edilmesi gereken bir unsur olarak belgelemiştir. Fakat geleneksel kitle iletişim araçlarının yanında öneminin ve etkisinin özellikle genç bireyler özelinde gitgide arttığından kaynaklarda sıkça bahsedilmiştir.Yapılan incelemelerin büyük bir kısmında veri kaynağı olarak sosyal medya araçlarında yer alan etkileşimler kullanılmaktadır. Fakat bu etkileşimler genelde afet esnasına ve yakın tarihlere ait olup bireylerin psikolojik veya duygusal çıkarımları hakkında güncel durumlarını yansıtmadığı

düşünülmektedir ki yine yapılan medya incelemelerinde afet sonrasında uzunca bir süre afet ve yapılan yardımlar hususunda bilgiler sosyal medyada farklı kullanıcılar tarafından servis edilmiştir. Bu vasıtayla, anket, mülakat vb. metotların yaygınlaştırılarak hem afetlere yakın tarihlerde hem sonrasında sosyal medya kullanımının kullanıcılar üzerindeki etkisini araştıran çalışmaların artırılması gerektiği düşünülmektedir.Ayrıca, yapılan incelemelerde kaynaklarda bilgi kirliliğinin ve manipülatif paylaşımların önemine ve olumsuz etkisine dikkat çekilmiştir. Bu hususta sosyal medya kullanıcılarının bu olumsuz etkilere sahip olan paylaşımlara karşı nasıl ve ne şekilde bilinçlendirilebileceği ve bu paylaşımların engellenebileceği hakkında yapılan araştırmaların literatürde artması gerektiği düşünülmektedir. Sosyal medyanın kullanıcıları bilinçlendirme ve koordinasyon sorunlarını ortadan kaldırmasına yardımcı olması hususunda yapılabilecek çalışmaları konu alan araştırmaların literatürde eksikliği göze çarpmıştır.

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ENDÜSTRİ MÜHENDİSLİĞİNDE YALIN ÜRETİM ÇALIŞMASI – OTOMOTİV TEDARİKÇİ FİRMASI BAŞVURUSU

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Özet
Yalın üretim, yapısında gereksiz unsur bulundurmayan, hata, maliyet, stok, fire ve müşteri memnuniyetsizliği gibi sebeplerin en aza indirildiği üretim sistemidir. Yalın üretimin genel felsefesinde sıfır hatalı, tam zamanında, küçük partiler halinde, yüksek çeşitlilikte üretim yapılması öngörülür. Yalın üretim uzun zaman alan ve çaba gerektiren bir süreç işidir. Üretime özgün nitelik kazandırır ve eldeki imkânla ile mümkün olan maksimum çıktı elde edilir. İşletmeler, teknolojinin çok hızlı bir şekilde geliştiği bu günlerde büyüyen pazarda rakipleri ile mücadele edebilmek için elindeki kaynakları en iyi biçimde kullanmak durumundalardır. Bu çalışmada, bir otomotiv yan sanayii firmasında üretimin israflarından arındırılmasını içeren montaj hattı iyileştirme çalışması gerçekleştirilmiştir. Bunun amaçla yalın üretim sistemi ve yalın üretim sistemlerinden biri olan WCM (World Class Manufacturing) sistematiğinden yararlanılmıştır. Ayrıca, World Class Manufacturing (WCM) ve Workplace Organization (WO) aktiviteleri ile katma değer oluşturmayan süreçler elimine edilmeye çalışılarak montaj hattı iyileştirme problemine farklı bir bakış açısı sağlanarak aynı zamanda yerleşim düzeni iyileştirilmesi sağlanmıştır. İyileştirme çalışmasının sonucunda verimlilik artışı da sağlanmıştır. Çalışmanın planlama aşamasında kayıpların analizi, kayıpların önceliklendirilmesi, kayıpların ayrıştırılması, öncelikli kayıp alanlarının belirlenmesi ele alınmıştır. Uygulama aşamasında ise yalın üretimin vazgeçilmezi olan Muri (aşırı yük), Mura (düzensizlik) ve Muda (atık) analizleri ve iyileştirmeleri yapılmıştır. Çalışmada ayrıca zaman etüdünden ve hareket etüdünden de faydalanılmıştır. Uygulama sonucunda hat denge kaybı yüzdesi azaltılarak çalışan sayısında düşüş sağlanmıştır. Ayrıca genel olarak üretim sisteminde % 5 gibi bir iyileşme elde edilmiştir.
Anahtar Kelimeler: Yalın üretim, WCM, Montaj Hattı İyileştirme

LEAN MANUFACTURING STUDY IN INDUSTRIAL ENGINEERING – AUTOMOTIVE SUPPLIER COMPANY APPLICATION

Abstract
Lean production is a production system that does not contain unnecessary elements in its structure, in which errors, costs, stock, wastage, and customer dissatisfaction are minimized. The general philosophy of lean production envisages zero-defect, just-in-time, small-batch, high-variety production. Lean manufacturing is a process that takes a long time and requires effort. It gives a unique quality to the production, and the maximum possible output is achieved with the available resources. These days, when technology is developing rapidly, businesses have to make the best use of their resources to compete with their competitors in the growing market. In this study, an assembly line improvement study was carried out in an automotive supplier company, which included eliminating production waste. For this purpose, the lean production system and World Class Manufacturing (WCM) systematics, one of the lean production systems were used. In addition, with WCM and Workplace Organization (WO) activities, processes that do not create added value were tried to be eliminated, providing a different perspective on the assembly line improvement problem and, at the same time, improving the layout. As a result of the improvement in work, productivity increased. During the study's planning phase, analysis of losses, prioritization of losses, separation of losses, and determining priority loss areas were discussed. During the implementation phase, Muri (overload), Mura (disorder), and Muda (waste), which are indispensable for lean production, were analyzed and improved. Time and motion studies were also used. As a result of the application, the percentage of line balance loss was reduced, and the number of employees decreased. In addition, an overall improvement of 5% was achieved in the production system.
Keywords: Lean manufacturing, WCM, Assembly Line Improvement

Introduction

In the automotive industry, as in other industrial organizations, product diversity and customer demands constantly change and increase. To be long-lasting and run a profitable process, businesses must use these values effectively and efficiently and produce final products or services with lean production by reducing waste. For this reason, companies operating in the automotive industry have to meet customer expectations to maintain their existence in their market and compete with other competitors. At the same time, it is necessary to use resources such as energy, labor, and raw materials effectively and efficiently in a globalized world. Improving existing processes, efficient use of the workforce, ensuring and maintaining the working environment, and maintaining the health and safety of employees also increase productivity conditions.The study aims to examine the production process, reduce cycle time, eliminate movements that do not create added value, and improve layout using a lean production system and WCM tools, one of the lean production systems, in an automotive supplier company. In this way, it is aimed to increase productivity. In addition, it is aimed to bring a different perspective to line balancing studies with WCM. This study proposes balancing studies for a line producing mixed-model products. Analyzing the current situation in the business aims to reduce the cycle times and number of operators of mixed model assembly lines. Solutions developed to eliminate activities that do not create added value have been proposed during balancing. As a result of the study, minimum cycle time and minimum number of operators were obtained.

2. Production and Production Systems

Production includes activities to increase the number and benefits of production and services to meet living things' needs. Production consists of three stages: inputs, processes, and outputs. Products and services are the outputs of the production process. To carry out production, the concepts of raw materials, labor force, capital, and information found in nature, which we call inputs, must be brought together.

2.1. Production Systems

Types of production systems are examined under five main headings according to customer demands, production quantities, and product features. Types of production systems are;

Project type production: Project type production is manufacturing a product that has not been produced before according to customer wishes. (Kanat, 2016)

Workshop-type production: In workshop-type production, products are produced at the time and in the quantity requested by the customer. The production cost is very high. One of the advantages of this type of production is that it is more flexible since it is not serial.

Batch-type production: In batch-type production, products are produced at certain times to meet customer orders in variable quantities. The most crucial point is that production planning correctly meets the customer's needs. (Kanat, 2016)

Mass production: In mass production, all workforce, machinery, and equipment on the production line work in a coordinated manner to produce one or similar products. The most significant disadvantage of mass production is that the slightest problem in the production line slows down or pauses production. (Kanat, 2016)

Just-in-time production: Just-in-time production (JIT) is the whole of production activities carried out to produce the right products in the desired quantity at the right time. In this way, production quality is ensured by preventing inefficiency and waste.

Waste and loss are not only faulty production but all activities that have no added value but create costs. The seven basic wastes are unnecessary production, waiting time, unnecessary transportation, unnecessary processing, excess stock, unnecessary movement, and defective product (Woehrle and Abou-Shady, 2010)

2.2. Lean Manufacturing

Lean production is a system that aims to improve product and production processes in line with customer demands, eliminate waste and losses, reduce labor, costs, scrap, and stock, and also ensure and manage supplier and customer relations. The primary purpose of lean production is to optimize the cycle time and produce with zero errors, zero inventory, and lower costs. The basic principle is to make a wide variety of products with fewer production lots just in time. It also aims to eliminate activities that do not create added value in line with customer demands.In the 1800s, the concept of production began to be considered as a process. One of those who contributed to the emergence of the idea of process in these years was Eli Whitney. Eli Whitney implemented and maintained the production system through short-cycle processes in weapons production.In the 1900s, Frederick Taylor created the concept of standard business. Frank Gilbreth introduced work and motion study and the idea of process mapping.In the 1910s, Henry Ford implemented and developed the flow production system. He made the flow system by taking an example from the slaughterhouse belt system.The foundations of the lean production system were laid in the 1950s under the leadership of Eiji Toyoda and Taichi Ohno. Inspired by Toyota Ford's flow system, they adopted and implemented the lean production

system to maintain their market presence and adapt to changing demands.Concepts and techniques such as visual factory, 5S, kaizen, pull system, line balancing, and SMED have been developed with the Toyota production system. The most crucial goal of the Toyota production system is just-in-time production when the customer wants it and without stock. (Kılıç, 2016)

Lean Manufacturing Principles

The main principle of the lean production idea is to separate the concepts of value and waste and transfer the value-free waste to the customer. These principles are Value, Value Stream, Flow, Towing, and Perfection.

Value

Value can only be defined by the end customer and has meaning only when expressed in terms of a specific product that meets customer needs at a particular price at a specific time. The customer creates the value for the producer. Therefore, value should be tailored to the customer. (https://lean.org.tr/yalin-dusuncenin-ilkeleri/, 2019) Processing, Control, Transportation, Waiting, and Stock create value.

Value Stream

Value stream is the second step of lean manufacturing principles. These are all the steps that create and do not create value in the process from the beginning of the raw material to the customer. Three activities create and do not create value during production. Activities for which the customer accepts the cost while creating the product are value-added activities (VAA). Semi-value-added activities (SVAA) do not create added value but are necessary to produce the customer's desired product. (Fastening the screw, fixing the part, etc.) Non-value-added activities (NVAA) are activities the customer does not consider necessary for the product he wants. (https://lean.org.tr/yalin-dusuncenin-ilkeleri/, 2019)

Stream

Lean production flow uses a single flow system to eliminate waste and losses. Henry Ford successfully implemented the flow throughout the process until the finished product was produced by arranging all the machines in the production line in a particular order. (https://lean.org.tr/yalin-dusuncenin-ilkeleri/, 2019)

Pull

Pull means pulling the product as needed by the customer rather than pushing it into another process without the customer's request. Pulling begins with the customer's demand, and then production starts as each process demands from the previous one. (https://lean.org.tr/yalin-dusuncenin-ilkeleri/, 2019)

The pull system ensures the production rate is the same as the customer demand rate. Thanks to the pull system, the requested products are produced in the requested quantity and quantity.

Table 1. Comparison of push and pull strategies (Arıcı 2017)

Push System	**Pull System**
The forecast of future demand guides production.	Production is driven by current demand.
Changes in demand cause excess and dead stock.	Changes in demand can be transferred from the following process to the previous one.
Safety stocks are created for possible errors.	There is no need for safety stock as errors are prevented before they occur.
Information flow between processes is fast.	Information flow between processes is slow.

Perfection

Businesses must create the idea of excellence along with workforce and cost reduction by defining their values correctly, creating value flows, ensuring a continuous flow with steps that create added value, and ensuring the value flow of end customers starting from the first operation. Additionally, excellence requires direct communication with the customer. (Kanat, 2016)

2.3. Lean Manufacturing Tools

2.3.1. Total productive maintenance

It eliminates and improves these losses by identifying losses and waste with the teams formed by employees at all levels. After serial mass production, operators who are qualified in maintenance and can repair their machines are generally preferred. However, with mass production and automation, the need for operators to repair the machines was eliminated. The need for maintenance management also emerged here. For this reason, the Japan Planned Maintenance Institute was established. (Bingöl, 2012)

2.3.2. 5S

These are words whose initial letters start with S in Japanese, called 5S. Table:2 shows these five steps. Its purpose is to organize the work area and environment and ensure continuity. 5S is a systematic approach that organizes and standardizes the work environment.

Table 2. 5S steps (Arıcı, 2017)

Japanese	English	Meaning
Seiri	Sort	It refers to the distinction between what is needed and what is not needed for production and eliminating unnecessary things.
Seiton	Set in Order	It refers to preparing an orderly working environment to easily access your needs.
Seiso	Shine	It refers to cleaning the working environment.
Seiketsu	Standardize	Creating order means maintaining order and cleanliness.
Shitsuke	Sustain	It means ensuring continuity.

2.3.3. Kanban and pull system

Kanban can be defined as the definition card of the product in Japanese. The Kanban card contains all the information about the product. Kanban is an integral part of the pull system. It ensures the flow of information between operations and retrieves parts from the previous operation. The pull system is applied for continuous production without stock and interruption. In the pull system, any product not requested from the next operation is not manufactured in the previous operation. In this way, no stock is kept between operations. This system is used together with Kanban. The pull system is the most essential part of the Just-in-time production (JIT) system. (Yılmaz, 2010)

2.3.4. Poka – Yoke

Poka - Yoke error prevention systems contain the Japanese words Poka and Yoke. Poka means to reduce or eliminate. It is a lean production tool that prevents the occurrence and repetition of errors in the production process and envisages continuous improvement. The primary purpose of Poka-Yoke is to make quality-oriented improvements that will prevent the production of errors and defective parts and products. (Yılmaz, 2010)

2.3.5. Jidoka

Jidoka means autonomy. It also includes machines and manual operations. Jidoka detects abnormal situations during production and stops production when necessary. (Yılmaz, 2010)

2.3.6. SMED

The time between the product produced in the previous production lot and the first quality product in the next production lot is called setup. The setup is divided into two. These;

- Internal Setup: These are the operations performed when production is stopped.
- External setup refers to all the preparations made after the line without stopping production.

2.3.7. Kaizen

It consists of the Japanese words "KAI" and "ZEN". The meaning of Kai is change, and the sense of Zen is improvement. In other words, kaizen can be called temporary improvement. Kaizen aims to improve the process by making small changes. (Güneş et al., 1999)

2.3.8. Heijunka

Heijunka (Sequential Production) is called average. Heijunka is the sequential production of products in terms of type and volume on the production line. The purpose of Heijunka production is to increase efficiency by reducing or eliminating fluctuations in demand through sequential production. In this way, customer satisfaction is ensured. (Yılmaz, 2010)

2.3.9. Value Stream Mapping

Value Stream Mapping (VSM) is an activity that shows the process and flow from supplier to customer. VSM aims to make improvements to implement lean production. It is also to eliminate NVAA.

2.4. World-Class Manufacturing (WCM)

The lean production system was developed together with the Toyota production system. WCM (World Class Manufacturing) aims to continuously improve by bringing new approaches to the lean production system. WCM is an integrated model that covers all production processes and enables continuous improvement and development of quality, efficiency, safety, and delivery. WCM encompasses all processes and focuses on the most significant loss. (Tepekule, 2015) WCM consists of 20 pillars, ten administrative and ten technical pillars.

Table 3. Administrative and Technical Pillar

Administrative Pillar	Technical Pillars
Management's Determination	Occupational Safety (SA)
Clarity of Goals and KPIs	Cost Spread (CD)
WCM Roadmap	Focused Improvement (FI)
Allocation of Highly Qualified Employees for Model Areas	Autonomous Activities (Workplace Organization/Autonomous Maintenance) (WO/AM)
Organization's Commitment	Professional Maintenance (PM)
Competency of the Organization in Improvements	Quality Control (QC)
Time and Budget	Logistics (Log)
Propagation Level	Early Product/Equipment Management (EPM/EEM)
Level of Detail	Employee Development (PD)
Employee Motivation	Environment and Energy (EN/NRG)

Pillars are scored between 1 and 5 points and evaluated out of 100. (Koçak et al., 2011) The distribution of costs, one of the ten technical units in the structure of WCM, focuses on reporting losses. Workplace organization includes improving workstations in the workplace; Occupational safety works to ensure the safety of the working environment in the facility. (Murino, 2014) "Production system: Workplace organization is structured on quality, maintenance, and logistics. "If we look at the general structure of the system, the aim is zero waste, zero error, zero malfunction, zero stock, and zero work accidents." (Bozağaç, 2018) Autonomous Maintenance and Workplace Organization pillars form the Autonomous Activities Pillars. WO (Workplace Organization) pillar activities are generally implemented in assembly lines. In workplace organization, other pillars aim for 0 errors in quality, 0 failures in professional maintenance and autonomous maintenance, 0 stocks in logistics, and most importantly, 0 accidents in occupational safety.

2.5. Assembly Lines And Assembly Line Balancing

Assembly is the process of combining multiple similar or different parts to create the product. The parts required for the assembly process may be semi-finished products or components.

Semi-finished parts are parts that are subjected to varying processes before being subjected to assembly. (Yıldız, 2015)Assembly line systems consist of two or more lined workstations that exchange information and products between each other. Products are transported between workstations within a determined cycle time, the necessary operations on the product are carried out respectively, and the finished product is obtained at the end of the line. (Yıldız, 2015)Assembly line balancing is the assignment of work to be done to workstations according to the optimum cycle time, priority relationships, capacity, and time constraints. "The most fundamental problem encountered in assembly lines is the balanced assignment of tasks to be completed to the workstations, considering one or more objectives, under certain constraints related to the production system and the product. This problem is called the assembly line balancing problem." (Altunay et al., 2017)For assembly line balancing efforts, priority relationships must be established. To proceed with an operation, all necessary work must be completed beforehand. This situation is called the priority constraint. Each operation must be assigned strictly to any operation. While operations can be assigned to only one station, assigning more than one operation to a station is possible. This situation is called an assignment constraint. Another constraint is cycle time. No operation or station time can be greater than the cycle time.Sometimes, an operation may require skilled labor and must be done only with certain operators. Such constraints are called operator constraints. (Yıldız, 2015) The objectives of assembly lines are capacity, profit, cycle time, and cost. The aim is to maximize capacity and profit on assembly lines and minimize costs and cycle times. Costs are classified as labor, preparation, inventory, and investment costs.

3. Materials and Methods

The application was made for the automotive supplier, a Turkish capital company that produces parts for the leading automotive industries. The company has applied the WCM production methodology since 2010. This study will include lean production system elements and applications regarding assembly line balancing. 5S, JIT (Just in Time Production), Kanban and pulling system, Poka-Yoke, Jidoka, Kaizen, Heijunka and WCM tools. The differences between the current and past situations and the gains achieved will be shown.

This study covers improvement works in the assembly department. The studies will be explained in the PDCA cycle.

The following processes in the planning phase will be discussed:

1. Analysis of losses, prioritization of losses, selection of loss area and facility

2. Separating the losses in the selected area, determining the priority loss areas, and choosing the priority improvement area

3. Selecting the improvement topic and determining the goals

4. Selecting team members

The following processes will be addressed during the implementation phase:

5. Muri analysis and improvements

6. Mura analysis and improvements

7. Muda analysis and improvements

The following process will be discussed during the control phase:

8. Checking the results

In the precaution phase, the following process will be addressed:

9. Standardization and Controls

Planning Phase

In the planning section, the functions of all processes are defined, and information about process flow, number of employees, and cycle time is obtained.

Table 4. Losses occurring in the entire production line

NVAA losses	Poor quality losses	Shortstops
Line density/balance losses	Direct material shortage losses	Losses due to computing
Borrowed labor losses	Human resources losses	Quality losses
Order change losses	Malfunction losses	Lack of energy losses
Loss of control	Project, new product commissioning losses	Setup/mold change losses

These losses are found in the C matrix used in the WCM – CD (Cost Deployment) pillar. All losses are given in Table 4. The first three losses are NVAA, line density balance, and setup losses. The most significant proportion belongs to NVAA losses, and it was chosen as the line balancing problem to reduce and eliminate these losses.

Table 5. Current situation loss analysis

Loses	Number of Loses
NVAA	120
Line Fill Balance Losses	65
Setup / Mold Change Losses	43
Losses Due to Order Change	25
Loss of Control	15
Direct Material Shortage Losses	12
Malfunction Losses	8
Other	20

Afterward, the line with the highest NVAA losses was examined, and as a result of the analysis, it was observed that the highest loss was in the 4th line. In this way, the area to be improved and line balanced was determined as line 4. Line 5 was chosen as the dissemination area.

Table 6. NVAA-line balance losses by line

Lines	Number of loses
4th line	40
5th line	20
3rd line	17
2nd line	15
1st line	6

VAA-SVAA-NVAA analyses were performed on the selected lines. 4th and 5th line operations are;

- Back skeleton preparation
- Preparation of seat frame
- Seat back hooking
- Seat back dressing (1st operation)
- Seat back dressing (2nd operation)
- Seat and back joining
- Ironing – Bagging

Pareto shows the VAA-SVAA-NVAA distribution in Chart 3.

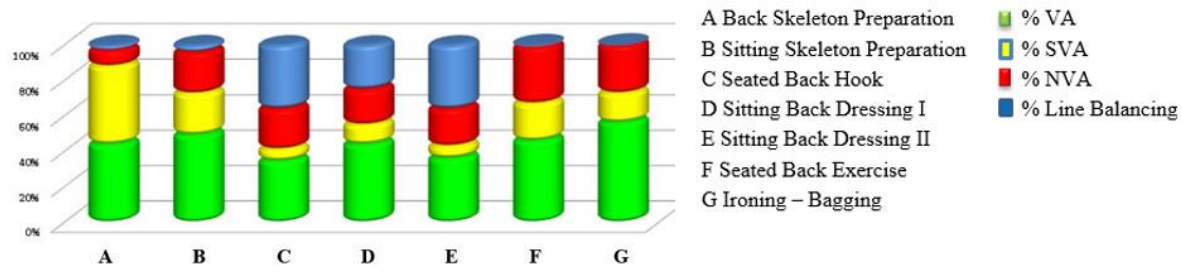
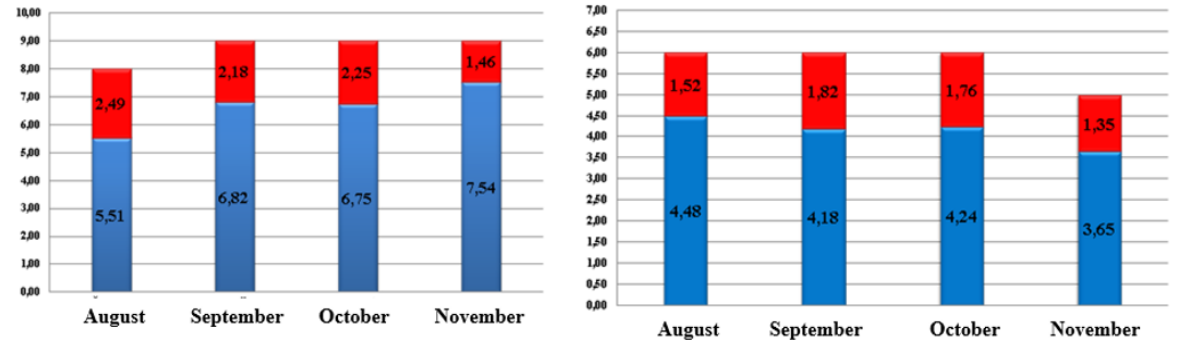


Figure 1. 4th line VA – SVA – NVA - Line Balance Paereto

The monthly labor requirement and line balance loss on the 4th and 5th lines are shown in the figure below.



4th line workforce and line balance loss distribution on a monthly basis

5th line workforce and line balance loss distribution on a monthly basis

blue bar: labor need, red bar: loss of line balance

Figure 2. The labor requirement and line balance loss on the 4th and 5th Lines

The NVAAs resulting from the analysis on the line are as follows (Table 6);

Table 7. Current status of NVAA percentage distributions

Loses	Percentage
Difficult Placement Loss	0 %
Loss of Walking	11 %
Loss of Reaching Pickup and Placement	3 %
Equipment/Material Preparation	22 %
Periodic Transactions	6 %
Loss of Sitting and Standing	0 %
Loss of Retrieving Handfuls from Mixed	0 %
Visual Control	0 %
Temporary Insertion Loss (part fixing)	25 %
Equipment Pickup/Dropoff	9 %
Bending Squatting Loss	0 %
Intermediate Transitions	13 %
Picking and Placing Heavy or Large Parts	11 %

The goal is to reduce NVAAs and line balance losses, thus reducing cycle time and the number of operators. Other goals are:

Table 8. MURİ, MURA, MUDA targets and solutions

	CAUSE	SOLUTION	Target
MURI	Difficult and unusual work	Ergonomic works	To improve the points where the current ergonomics score is 15, and the vertical body movements are 3 points.
MURA	Irregular movements	Standard operation definitions	Improvement of irregular operations.
MUDA	Works that do not create added value	Analysis and reduction	Improvement in NVAAs.

According to these analyses, a working team was established with team members with various competencies.

3.2. Application

During the application phase, Muri, Mura, and Muda analyses and improvements will be mentioned.

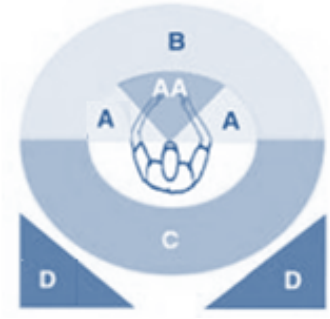
Every activity was examined, and human and machine movements were analyzed for a time study. It was videotaped using the camera technique in 3 shifts of 30 vehicles. The steps of the operation, whose video was recorded, were extracted, and the NVAA steps were examined by following the steps. As a result of the online analysis, NVAA/VAA distributions were determined. The list of VAA, SVAA, and NVAA is given in Table 9. The operation cycle time variation of each operator was determined. Duration changes were chosen based on analyzing the video footage taken for each shift.

Table 9. VAA, SVAA and NVAA list

Value Added Activities (VAA)	**Semi Value Added Activities (SVAA)**	**Non-Value Added Activities (NVAA)**		
Assembly	Getting Parts	Pull	Choose	Walk
Bending	Positioning	Press	Carry	Transport
Join	Getting Parts	Pick up	Separate	Standby
Assembly	Positioning	Download	Take	Inversion
Bending		Stacking	Open	Rotation
Join		Change	Dry	Trial for positioning
Assembly		Call	Organize	Trial for screwing
Bending		Count	Connect	Try to disassemble and open
Join		Organise	Look	Trying to place
Assembly		Measure	Delay	Try to wire
Bending		Weigh	Stop	Fix
Join		Transfer	Putting it in place	Peak
		Repackaging	Send	Leaving the pieces lying around
		Passing from hand to hand	Put in its place	Collect
		Re-stack	Push	

Muri Analysis and Muri Improvements

First of all, a Muri analysis of the 4th line was performed. Improvements have been made to create working environments with high added value and ergonomic comfort so that the operator can work in Golden Zone / Strike Zone areas (Golden Zone is a method used to pick up materials on the horizontal plane without difficulty). Maximum efficiency has been tried to be achieved with the least possible movement.



AA → All materials are accessible without leaving the assembly point.

A → Materials are within three times the distance of the installation point. The operator can reach at the elbows and use both arms to pick up the materials.

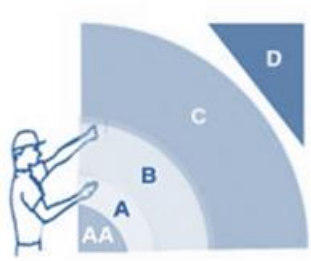
B → To reach the materials, raising the hands above shoulder level is necessary.

C → To reach the materials, arms must be extended, or auxiliary devices such as steps must be used.

D → The materials are outside the operator's reach and can only be accessed by special vehicles.

Figure 3. Golden zone schematic representation

A Strike Zone is a method used for the operator to pick up materials in the vertical plane without difficulty.



AA → All materials are at a height that can be reached without raising the hands.

A → Materials can only be reached by raising hands.

B → To reach the materials, raising the hands above shoulder level is necessary.

C → To reach the materials, arms must be extended, or auxiliary devices such as steps must be used.

D → Materials are out of the operator's reach.

Figure 4. Strike zone schematic representation

In Muri analysis, each operation is examined at three levels.

• Level 1: The ergonomic level the operator desires to work at.

• Level 2: Ergonomically acceptable but needs improvement.

• Level 3 represents the worst ergonomic situation, and improvement efforts should start here.

In Muri's analysis, operations were evaluated according to ergonomic movements in the literature.

After the current situation Muri analysis,

• There are 119 level 1 ergonomic movements (1 Point),

• There are 83 level 2 ergonomic movements (2 Points),

• It is seen that there are 40 level 3 ergonomic movements (3 points).

Muri analysis of the current situation of line 5 is as follows:

• There are 124 level 1 ergonomic movements (1 Point),

• There are 77 level 2 ergonomic movements (2 Points),

• It is seen that there are 41 level 3 ergonomic movements (3 points).

The first point that needs improvement: When the line operation is examined, the operator turns back and walks to get the assembly materials. Work has been carried out because these parts need to be improved.

Mura Analysis and Mura Improvements

Mura: It is the improvement of irregular operations. Time analyses in 3 shifts were made. The results are shown in Table 10.

Table 10. Tread preparation operation time analysis

Current Situation	Work I	Work II	Work III	Work IV	Average
Shift A	103,6 sn	133,2 sn	135,32 sn	136,42 sn	127,135 sn
Shift B	106,6 sn	130,2 sn	135,32 sn	136,42 sn	127,135 sn
Shift C	121,7 sn	145,42 sn	115,28 sn	125,84 sn	127,060 sn

The second point that needs improvement: When the way operators work is examined, although there is not much difference in terms of time, the work needs to be standardized. For this reason, it is necessary to provide training and increase visuals to ensure the standard.

Muda Analysis and Muda Improvements

Improving non-value-added activities is the reorganization and process integration of work and the application of low-cost automation.

3rd point that needs improvement: When the line operation is examined, the 5th and 4th line bagging operations are carried out separately. For this reason, there are separate operators. It is found that walking losses are high. The bagging operation should be shared, and walking losses should be reduced. The other losses are equipment and material preparation losses. For this reason, material preparation needs to be improved.

4. Findings And Discussion

The kitting method ensures that the components of each product made on the assembly line arrive at the same time and in the specified quantity as that product. The assembly materials are placed before the operator (golden zone), and body rotation and walking are eliminated. This way, while the correct products are fed to the line, the operator will not have time to search for parts, which will be eliminated in NVAA.

Muri analysis after the fourth line improvements is as follows:

• There are 135 level 1 ergonomic movements (1 Point),

• There are 76 level 2 ergonomic movements (2 Points),

• It is seen that there are 31 level 3 ergonomic movements (3 points).

Muri analysis after the fifth line improvements is as follows:

Muri analysis results after improvement;

• There are 142 level 1 ergonomic movements (1 Point),

• There are 67 level 2 ergonomic movements (2 Points),

• It is seen that there are 33 level 3 ergonomic movements (3 points).

The work distribution between shifts differed, and the 2nd operator slowed down the line during the backing operation. By regulating work distribution, the deviation between shifts was prevented.

Table 12. Tread preparation operation time analysis after improvement

After Improvement	Work 1	Work 2	Work 3	Work 4	Average
Shift A	103,6 sn	133,2 sn	135,32 sn	136,42 sn	127,135 sn
Shift B	106,6 sn	130,2 sn	135,32 sn	136,42 sn	127,135 sn
Shift C	103,6 sn	133,2 sn	135,32 sn	136,42 sn	127,135 sn

Since the fourth-line and fifth-line bagging operations were carried out in separate places, each line had an individual operator. By switching to the new line layout, the operations were combined by giving the fourth-line bagging and first-line bagging operations to the same operator. By preventing the operators from turning their backs and picking up materials, the materials were taken to the golden zone, resulting in a 5% improvement in NVAAs.

5. Conclusion and Recommendations

The automotive supplier company examined the production process, reduced cycle time, eliminated movements that do not create added value, and improved layout using a lean production system and WCM (World Class Manufacturing) tools as one of the lean production systems that were discussed. Thus, it is aimed to increase productivity. Balancing exercises have been proposed for assembly lines. As a result of the studies, line balance loss on the fourth line decreased from 29% to 9%; Line balance loss on the fifth line decreased from 36% to 9%. A 5% improvement was achieved in NVAAs. The process detected irregularities by analyzing NVAA losses in the assembly lines, and time and operator savings were achieved by combining existing line flows. MURI applications have been made to improve the operator's ergonomic movements. With all these studies, the Lean production system was implemented with the WCM tool.

As a result, all employees within the company should be taught this systematically and expected to contribute through the suggestion system. As in this study, improvements can be made by performing loss analyses on assembly lines by applying a systematic approach to systems where balance losses may occur.

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ZAMAN SERİSİ VERİLERİNİN ANALİZİ VE TALEP TAHMİN DOĞRULUĞUNUN ARTIRILMASI: CAM İMALAT ENDÜSTRİSİNDE ARIMA MODELLEMESİ KULLANILAN BİR VAKA ÇALIŞMASI

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Özet
Talep tahmini, çeşitli sektörlerde karar vermenin kritik bir yönüdür; envanter yönetimini, üretim planlamasını, genel operasyonel verimliliği ve kaynak tahsisini etkileyerek stratejik karar almayı kolaylaştırır. Doğru tahmin, kuruluşların operasyonlarını optimize etmelerine, maliyetleri azaltmalarına ve müşteri taleplerini verimli bir şekilde karşılamalarına olanak tanır. Zaman serisi analizi, ekonomi, finans ve çevre bilimi gibi çeşitli alanlarda temel kalıplara ve eğilimlere dair içgörüler sunarak önemli bir rol oynamaktadır. Talep tahmin yöntemlerinde zaman serilerine sıklıkla rastlanmaktadır. Karmaşık zamansal bağımlılıkları yakalamadaki esnekliği ve etkinliğiyle bilinen Otoregresif Entegre Hareketli Ortalama (ARIMA) modelleri, zaman içinde gelişen olayların tahmin edilmesinde ve anlaşılmasında yaygın olarak kullanılmaktadır. Bu çalışma, cam endüstrisi için zaman serisi verilerinin analizinde ARIMA modellemesinin uygulanmasını araştırmayı ve ARIMA modellemesini uygulayarak talep tahmin doğruluğunu arttırmayı amaçlamaktadır. Bu çalışmada ARIMA modelinin zaman serisi verileri üzerindeki uygunluğunu ve performansını değerlendirmek amacıyla çeşitli analizler yapılmıştır. Sonuçlar, ARIMA modelinin etkinliğini değerlendirmeye ve zaman serisi verilerindeki eğilimler ve mevsimsellik gibi önemli özellikleri yakalamak için kullanılan bir dizi istatistiksel teste ve göstergeye dayanmaktadır. Bu çalışma, on dört farklı potansiyel model (iki farklı eğitim ve test dönemine dayanan yedi farklı yöntem) arasından en iyi sonuçlara sahip ARIMA modellerinin sonuçlarını incelemekte ve özellikle modeller arasında yer alan en iyi sonuçları sergileyen "Rastgele Aramalı En İyi ARIMA Modeli (son 2 yıllık eğitim verileri)" üzerine odaklanmaktadır. Durağanlık testleri, teşhis testleri, artık analizleri, hata analizleri ve istatistiksel değerlendirmeler, "Rastgele Aramalı En İyi ARIMA Modeli (son 2 yıllık eğitim verileri)"nin etkinliğini ve zaman serisi verilerindeki yapıları modelleme konusundaki başarılı yeteneğini göstermektedir. Bu yetenek, yüksek talep tahmini doğruluk oranıyla başarısını kanıtlamıştır.
Anahtar Kelimeler: Otoregresif Entegre Hareketli Ortalama (ARIMA), Zaman Serisi Analizi, Model Seçimi, Parametre Tahmini, Cam Endüstrisi

AN ANALYSIS OF TIME SERIES DATA AND ENHANCING DEMAND FORECASTING ACCURACY: A CASE STUDY USING ARIMA MODELING IN GLASS PRODUCTION INDUSTRY

Abstract
Demand forecasting is a critical aspect of decision-making in various industries; it influences inventory management, production planning, overall operational efficiency, and resource allocation, facilitating strategic decision-making. Accurate forecasting enables organizations to optimize their operations, reduce costs, and efficiently meet customer demands. Time series analysis plays a significant role in various fields such as economics, finance, and environmental science by providing insights into fundamental patterns and trends. Time series are frequently encountered in demand forecasting methods. Known for their flexibility and effectiveness in capturing complex temporal dependencies, Autoregressive Integrated Moving Average (ARIMA) models are widely used in predicting and understanding evolving events over time. This study aims to investigate the application of ARIMA modeling in the analysis of time series data for the glass industry and to enhance demand forecasting accuracy by implementing ARIMA modeling. In this study, analyses were conducted to assess the suitability and performance of the ARIMA model on time series data. The results are based on a series of statistical tests and indicators used to evaluate the effectiveness of the ARIMA model and capture important features such as trends and seasonality in time series data. This study examines the best ARIMA results among fourteen different potential models (seven different methods based on two different training and testing periods), particularly focusing on the "Best ARIMA Model with Random Search (last 2 years of training data)" which exhibits the best fit among the models. Stationarity tests, diagnostic tests, residual analysis, error analysis, and statistical assessments demonstrate the effectiveness of the "Best ARIMA Model with Random Search (last 2 years of training data)" and its successful ability to model structures in time series data. This capability has proven its success with its high demand forecast accuracy rate.
Keywords: Autoregressive Integrated Moving Average (ARIMA), Time Series Analysis, Model Selection, Parameter Estimation, Glass Industry

Introduction

With the increasing pace of consumption, many companies from different sectors are placing significant emphasis on supply chain management. Supply chain management encompasses various crucial aspects, from meeting demands and timely production to maintaining the right product in the right quantity in stock, effectively utilizing assets, and ensuring customer satisfaction, all contributing to the company's reputation. Decision-making in supply chain management often revolves around demand forecasting to balance inventory and service levels. A reliable demand forecasting system, which is the foundation of these principles, is the most important factor in enabling accurate production and inventory planning and making correct investment decisions for future periods. Precise demand forecasting is vital for maintaining optimal inventory levels and achieving service level objectives (Stephen et al., 2017). Inaccurate demand forecasting can lead to issues like stockouts or surplus inventory, which can diminish company profitability and customer satisfaction (Sodero & Rabinovich, 2017). In other words, demand forecasting is a critical aspect of supply chain management, impacting operational efficiency and strategic decision-making. In the complex landscape of forecasting, understanding its importance, benefits, and challenges becomes essential. Despite the critical nature of sales forecasts, they are considered intricate due to significant variations in consumer preferences (Allenby et al.,1996; Choi et al., 2014). Uncertainties in forecasts, stemming from model, parameter, and data uncertainties, present challenges within the process (Petropoulos et al., 2018). The uncertainties in demand significantly impact supply chain performance, influencing production planning, inventory management, and transportation logistics (Tosarkani & Amin, 2018). Effectively managing uncertainties within supply chains is vital, with demand forecasting emerging as a fundamental strategy (Boulaksil, 2016; Tang, 2006). Employing a robust demand forecasting system will naturally improve the accuracy of demand predictions and the efficacy of these processes.Accurate predictions facilitate efficient production scheduling, reduced downtime, optimal resource allocation, and overall improvements in supply chain efficiency. Demand forecasting holds particular importance in industries with extended production and research and development lead times, ensuring precise planning for production and sales (Arslankaya & Oz, 2018; Danese & Kalchschmidt, 2011). Timely and precise responses to customer needs, enabled by robust forecasting methods, enhance customer experiences, loyalty, and competitive advantage within the market. Accurate demand forecasting has the potential to boost the efficiency and resilience of production processes, including relevant supply chains. Aligning resources with actual requirements can

lead to reduced inventory levels and waste (Acar & Gardner, 2012; Ma S, 2016). Oliva and Watson (2009) underscore the favorable effects of a robust demand forecasting procedure, illustrating instances of inventory turnovers doubling and substantial drops in inventory quantities. Clarke (2006) underscores the financial impacts of successful demand forecasting, noting a 25% reduction in inventory days at Coca-Cola Inc. Conversely, an imprecise prediction may result in negative consequences like surplus inventory, inadequate production resources, elevated labor expenses, and harm to reputation (Gao et al., 2017). In the literature, there are studies on demand forecasting in nearly every sector from past to present, with efforts aimed at enhancing this capability. In summary, effective demand forecasting management is essential for efficiently organizing and overseeing processes (Merkuryeva et al., 2019). A reliable demand forecasting system will improve the accuracy of demand forecasts and enhance the performance of these processes.Temporal data frequently appears in demand forecasting. Typically, temporal data is divided into two main categories: the first, widely recognized one is time series data, and the second includes data associated with different time points (Minaei-Bidgoli & Lajevardi, 2008; Ricardo & Sheng, 2002). Time series data consists of a series of observations arranged in chronological order (Tak-chung, 2011). Time series analysis serves as a crucial tool across diverse domains, notably in finance, economics, and meteorology, facilitating the prediction of future values or examination of historical trends. In the realm of time series modeling and prediction, significant progress has been made with the Box-Jenkins ARIMA technique (Vishwajith, 2016). An important objective is to emphasize the consistency and alteration of values over time, along with pinpointing trends within these sequences. In contrast to conventional econometrics, the focus of time series analysis is not on establishing correlations between variables, but rather on exploring the "dynamics" of a variable. This entails employing linear models such as auto-regressive (AR) and moving average (MA) (often abbreviated as AR and MA) (Box-Jenkins, 1976), along with conditional heteroscedasticity models, specifically ARCH (Auto-Regressive Conditional Heteroskedasticity) (Engel, 1982), to model time series data. At present, ARIMA stands out as one of the most frequently utilized models in time series analysis. It's known for its simplicity, relying solely on endogenous variables without the need for external ones (Titus et al., 2021). In an ARIMA model, "p" represents the number of autoregressive terms, "d" signifies the degree of differencing the data, and "q" denotes the degree of the moving average process. In this framework, the future value of a variable is considered a linear function of previous observations and random errors (Huang et al., 2020). Autoregressive Integrated Moving Average (ARIMA) model, providing a robust

framework for modeling and forecasting time series data, offers advantages in capturing both short and long-term dependencies. Advanced time series analysis techniques like ARIMA modeling can combine complex mathematical models to capture the underlying structure of the data, addressing trends, seasonal variations, and random fluctuations to forecast future values. In the study by Uddin et al. (2020), ARIMA models have demonstrated their superiority not only in conventional sales data but also in trend analysis; moreover, Kurawarwala and Matsuo (1998) and Miller and Williams (2003) models have demonstrated the success of forecasting seasonality. Additionally, successful results in both trend and seasonality relationships have been expressed in the study by Hyndman (2004). Widely used in the analysis and modeling of such data, the ARIMA model is successfully applied across various domains such as sales forecasting, financial data analysis, industrial production forecasting, and demand forecasting. Also, in the manufacturing sector, the ARIMA model is commonly used in areas like sales forecasting, inventory management, demand forecasting, and production planning. For instance, in the energy domain, Ozturk and Ozturk (2018) employed the ARIMA model to forecast energy consumption in Turkey. In another study from the economics/finance sector, Godfred (2013) utilized ARIMA in the forecasting model for the relationship between per capita GDP growth and energy consumption. In the agricultural sector, which is vastly different from these topics, Sahu (2006) successfully used ARIMA modeling techniques to predict the production of potatoes, mustard, and wheat, Rahman et al. (2013) used ARIMA modeling techniques for lentil production, and Vishwajith et al. (2016) used ARIMA modeling techniques for sugarcane production. In a study conducted by Qin (2021) for the tourism sector, the results indicate that the model can accurately forecast the dynamic trend.Stationarity is an important criterion in ARIMA models. At this point, conducting stationarity tests and adjusting the model accordingly to fit this structure is crucial. In their study, Vishwajith et al. (2022), took first-order differences to make the dataset stationary and successfully used the ARIMA model in agricultural forecasting systems. Additionally, whether the errors in the ARIMA time series are correlated or not and normally distributed are also important criteria for model fit. In their study, Kumar and Anand (2014) demonstrated the absence of correlation among errors and normal distribution, thereby selecting an appropriate ARIMA model within certain confidence intervals.The performance of ARIMA models can be interpreted using information criteria. Dritsaki et al., (2021) attempted to find the most suitable model for forecasting petroleum consumption in Greece's energy sector using the Maximum Likelihood approach with the ARIMA method. AIC, SC, Sigma SQ, and AjR2 information criteria were used to evaluate and

find the most suitable model. In addition to information criteria, error metrics such as MSE and MAPE are also important for interpreting the adequacy and performance of the model. Ghosh (2020) used SBC, AIC, standard error, and maximum likelihood criteria to select the ARIMA model used for forecasting demand in food production. When real values compared to the selected model, it has shown feasible and successful results. Similarly, in a study led by Rahmanian et al. (2020), eleven different ARIMA models were analyzed for a disease within the healthcare sector. Eventually, the most suitable model, determined by the lowest Akaike Information Criterion (AIC) and Bayesian Information Criterion (BIC) values, was selected, and its predictive precision was evaluated through the mean absolute percentage error (MAPE). Similarly, Ariyo et al. (2014) tested the performance of the model based on the low standard error value BIC (Bayesian Information Criterion) and showed that the model can compete well. In short, ARIMA is widely applied in various sectors due to its ease of implementation and effectiveness. A brief literature review of ARIMA models applied in different sectors is shown in Table 1. The applicability and performance criteria of these models are important both in terms of literature review and interpreting the results of this study. In other words, studies have emphasized the importance of accurate demand forecasting in optimizing supply chain management and increasing operational efficiency and have highlighted the potential benefits of utilizing ARIMA modeling to improve forecast accuracy. Similarly, the effectiveness of ARIMA models has been demonstrated across various fields, including manufacturing, agriculture, finance, economics, and meteorology. It offers a flexible approach to modeling data by considering time series features such as stationarity, autocorrelation, and seasonality. Due to their flexibility, simplicity, and ability to adapt to complex temporal patterns, ARIMA models have been widely adopted.

Table 1: Literature Review for ARIMA

Authors	Publication Year	Working Area	Technique
Vishwajith et al.	2022	Agriculture - Urad Production	The Autoregressive Integrated Moving Average (ARIMA) and Generalized Autoregressive Conditional Heteroskedasticity (GARCH) Model
Dritsaki et al.	2021	Energy - Oil Consumption	Autoregressive Integrated Moving Average (ARIMA) (Box-Jenkins Methodology)
Qin	2021	Tourism - The Number of Domestic Tourists in Hunan	Autoregressive Integrated Moving Average (ARIMA)
Ghosh	2020	Production - In a Food Company	Autoregressive Integrated Moving Average (ARIMA) (Box-Jenkins Methodology)
Uddin et al.	2020	Production - Bangladesh's Milk Production	Autoregressive Integrated Moving Average (ARIMA) Model and Compares It with the Trend Analysis Model (TAM) in MS Excel
Mishra et al.	2020	Production - Milk Production in India	Autoregressive Integrated Moving Average (ARIMA)
Madlul et al.	2020	Agriculture - Wheat Production in Iraq	Autoregressive Integrated Moving Average (ARIMA)
Rahmanian et al.	2020	Health - The Temporal Patterns of VLH in Ardabil Province, Iran	Eleven potential Autoregressive Integrated Moving Average (ARIMA) models
Zou	2020	Economy/Finance - Estimate the Gross Domestic Product (GDP) of Ji'an City	Autoregressive Integrated Moving Average (ARIMA)
Gopinath & Kavithamani	2019	Agriculture- Sugarcane Production in India	Autoregressive Integrated Moving Average with Exogenous Variable or Inputs Model (ARIMAX)
Ozturk & Ozturk	2018	Energy - Energy Consumption in Turkey	Autoregressive Integrated Moving Average (ARIMA)
Mehrmolaei & Keyvanpour	2016	Different Application Areas	Autoregressive Integrated Moving Average (ARIMA)
Shen & Shen	2016	Economy/Finance - Stock Index	Autoregressive Integrated Moving Average (ARIMA)
Kumar & Anand	2014	Agriculture - Sugarcane Production in India	Autoregressive Integrated Moving Average (ARIMA) (Box-Jenkins Methodology)
Ariyo et al.	2014	Economy/Finance - Stock Pric	Autoregressive Integrated Moving Average (ARIMA)
Rahman et al.	2013	Agriculture - Lentil Production in Bangladesh	Autoregressive Integrated Moving Average (ARIMA)
Contreras et al.	2003	Energy - Electricity Prices	Autoregressive Integrated Moving Average (ARIMA)

As in other sectors, the demand forecasting system is important in the glass industry. In the literature, there are many studies applying various methods for mentioned reasons. It is desired to carry out a study similar to these studies in the glass industry in order to benefit from precise demand forecasting system. The aim is to apply statistical analyses to develop the demand forecasting method and test the performance impact of the new method used. Through statistical analyses, the proposed system's outputs will be interpreted, compared with real data, and the accuracy of demand forecasting will be calculated. Actual sales for the past years are used for these products for forecasting. The new system to be developed in this study will aim to analyze the presence/absence of seasonality and other influencing factors more effectively through statistical time series methods, leading to better predictions.

This study examines the suitability and results of ARIMA models generated from actual sales data for specific time series data pertaining to products 421 and 423 of a company operating in the glass manufacturing sector, aiming to capture the dynamics of the dataset. The data used in this study constitutes approximately 25 percent of all sales. This study evaluates the quality of the model and focuses on the top five models in terms of suitability and results among fourteen different models, as well as the best-performing model among those models.

Materials and Methods

The methodology section summarizes the process of applying ARIMA modeling for demand forecasting on the monthly sales data of two different products, Product 421 and Product 423, which constitute the dataset used in the study. The study was carried out in Python by following the steps outlined in Figure 1 below.In this study, analysis was conducted on the time series data of two different products: Product 421 and Product 423. Additionally, detailed analyses were performed on the top five results that yielded the best ARIMA forecasts among fourteen models with two different training sets, where seven different approaches were applied. These analyses were based on parameter estimations, diagnostic statistics, and goodness-of-fit measures, focusing on the ability to accurately forecast future demand and capture underlying patterns in the data. Furthermore, a detailed analysis was conducted on the best-performing model, "Best ARIMA Model with Random Search (last 2 years of training data)". The analysis focuses on a specific dataset and encompasses various steps of the ARIMA modeling process, including model identification, parameter estimation, and diagnostic checking. To assess the adequacy of the model, various statistical tests were applied, including unit root tests (ADF (Augmented Dickey-Fuller) and KPSS (Kwiatkowski-Phillips-Schmidt-Shin)), normality tests (Shapiro-Wilk and Jarque-Bera), autocorrelation tests (Durbin-Watson and Ljung-Box), error term analysis, information criteria (AIC and BIC), and homoskedasticity tests. Model identification requires determining appropriate orders of autoregressive (AR) and moving average (MA) components as well as the degree of differencing required for stationarity. Parameter estimates of the model were obtained using the maximum likelihood method. Additionally, the predictive performance of the model was measured by statistically evaluating the differences between predicted and actual values. Model performance metrics (Mean Absolute Error, Mean Squared Error, Root Mean Squared Error) were computed. Diagnostic checking involves assessing the adequacy of the fitted model through various statistical tests (residual analysis, goodness-of-fit tests, and prediction evaluation metrics) and diagnostic plots.

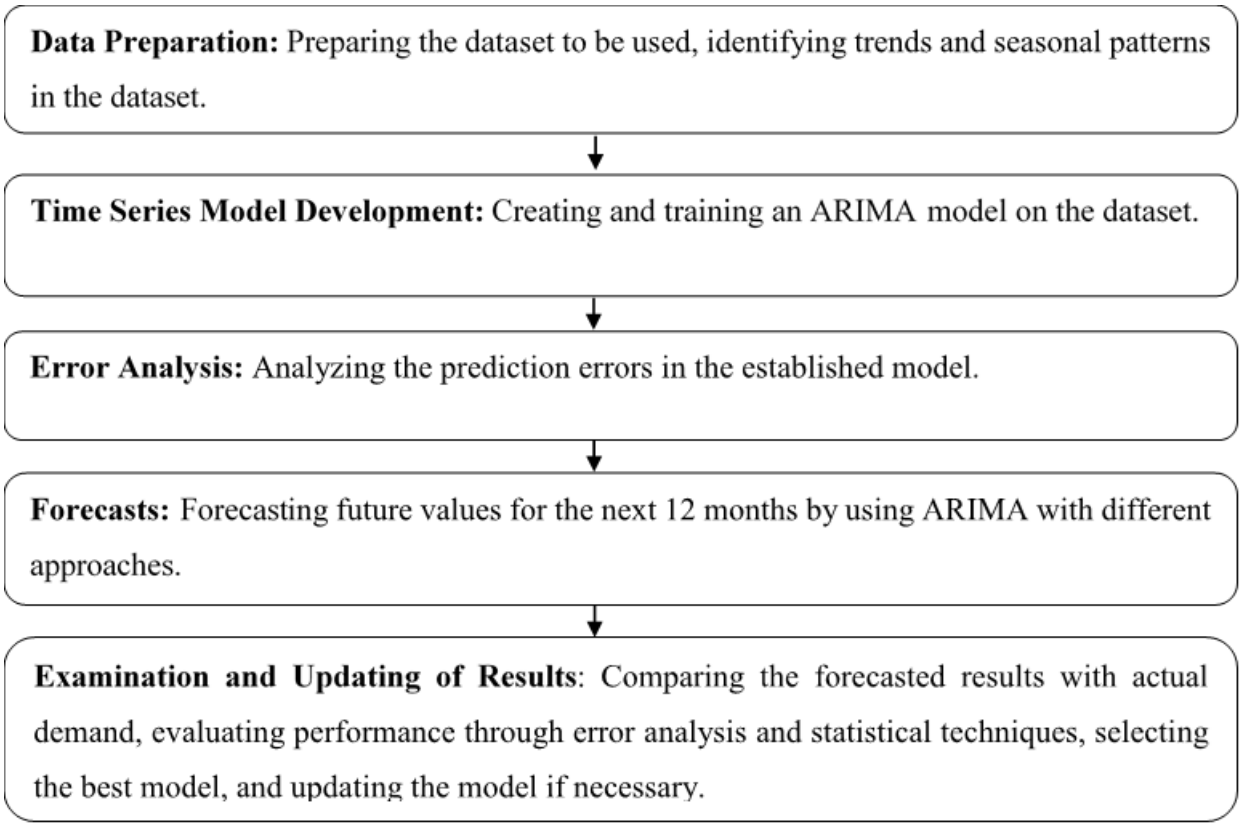


Figure 1: Framework of Forecasting Model

Findings and Discussion

This section presents the findings of the ARIMA modeling analysis, including selected model specifications, parameter estimates, diagnostic test results, and forecast accuracy measurements.In this study, the best ARIMA model was tested with fourteen different models, in other words, ARIMA model was tested with seven different approaches and two different training data sets of 2 years or 3 years. These seven approaches are as follows, respectively: "Best ARIMA Model with Exhaustive Search", "Best ARIMA Model with Stepwise Search", "Best ARIMA Model with BIC", "Best ARIMA Model with Grid Search", "Best ARIMA Model with Random Search", "Best ARIMA Model with Optuna function for Hyperparameter Optimization" and "Best ARIMA Model with Cross-Validation". These seven approaches offer different strategies for determining and optimizing ARIMA models. Exhaustive Search attempts to find the best ARIMA model by trying all possible parameter combinations, while Stepwise Search aims to achieve good results by searching parameters incrementally, reducing computational cost. Bayesian Information Criterion (BIC) balances model complexity and fit by using it for model selection. Grid Search conducts a systematic search by trying all

combinations on a parameter grid, while Random Search explores a wide range of possibilities by trying randomly selected parameter combinations. Effective parameter search is conducted using hyperparameter optimization tools like Optuna, and Cross-Validation evaluates the generalization ability of the model by dividing the dataset into different parts. These methods offer a broad range of approaches for addressing various aspects and complexities of ARIMA models. These approaches are often used to achieve the best results. Therefore, these seven approaches were preferred. They were evaluated according to diagnostic test results, stationarity results, information criteria and error metrics, as mentioned in the methodology section. These results are shared in Appendix 1 shared in the appendix. "Best ARIMA Model with BIC", "Best ARIMA Model with Grid Search" and "Best ARIMA Model with Optuna function for Hyperparameter Optimization" approaches were eliminated because they did not meet the normality assumption. In other results, they were excluded from the top five models because they had high error metrics.Normality and autocorrelation tests (Diagnostic tests) results of the five best-performing ARIMA models are given in Table 2.If the results of all five ARIMA models are compared and ranked, the model that provides the best results is "Best ARIMA Model with Random Search (last 2 years of training data)". The Shapiro-Wilk test is used to determine whether a dataset follows a normal distribution. The test result is considered to fit a normal distribution if the p-value is greater than 0.05 at a 95% confidence level. Similarly, the Jarque-Bera test calculates a test statistic using skewness and kurtosis coefficients to determine whether the dataset has a symmetric and normal distribution. The p-values of both the Shapiro-Wilk Test Statistic and Jarque-Bera Test Statistic are the highest. As the p-values are high for both Product 421 and Product 423, they are considered to exhibit a normal distribution. The Durbin-Watson test is used to determine whether there is autocorrelation (serial dependence) in the error terms of regression analysis. This statistic takes a value between 0 and 4. Values close to 2 indicate no autocorrelation, values approaching 0 indicate positive autocorrelation, and values approaching 4 indicate negative autocorrelation. The Durbin-Watson Statistic values are approximately 1.84 and 1.70, which are quite close to 2, indicating a strong independence indicator in the model. The absence of autocorrelation indicates that the errors in the model are random and there is no specific pattern among past values. The absence of autocorrelation means that the ARIMA model can make more reliable predictions because the model does not misinterpret structural features from past values or falsely indicate their presence where they do not exist. These tests were performed on residuals generated during the model's training.

Table 2: Diagnostic tests results of the five best-performing ARIMA models

Product	Test	Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Best ARIMA Model with Stepwise Search (last 3 years of training data)	Best ARIMA with Random Search (last 2 years of training data)	Best ARIMA with Random Search (last 3 years of training data)	Best ARIMA Model with Cross-Validation (last 3 years of training data)
Product 421	Shapiro-Wilk Test Statistic	T.S. 0,955 P.V. 0,149	T.S. 0,955 P.V. 0,149	T.S. 0,972 P.V. 0,720	T.S. 0,964 P.V. 0,286	T.S. 0,966 P.V. 0,324
Product 423	Shapiro-Wilk Test Statistic	T.S. 0,973 P.V. 0,511	T.S. 0,973 P.V. 0,511	T.S. 0,973 P.V. 0,749	T.S. 0,973 P.V. 0,506	T.S. 0,964 P.V. 0,282
Product 421	Jarque-Bera Test Statistic	T.S. 1,573 P.V. 0,456	T.S. 1,573 P.V. 0,456	T.S. 1,014 P.V. 0,602	T.S. 1,153 P.V. 0,562	T.S. 0,217 P.V. 0,897
Product 423	Jarque-Bera Test Statistic	T.S. 1,046 P.V. 0,593	T.S. 1,046 P.V. 0,593	T.S. 0,512 P.V. 0,774	T.S. 0,745 P.V. 0,689	T.S. 0,685 P.V. 0,710
Product 421	Durbin-Watson Statistic	1,727	1,727	1,843	1,862	1,908
Product 423	Durbin-Watson Statistic	1,757	1,757	1,696	1,857	1,798

(T.S.=Test Statistic; P.V=P-Value)

During residual analysis, residuals close to a normal distribution are desired. A normal distribution indicates that the residuals are symmetrically distributed around the mean with few outliers in the tails. Residuals that do not follow a normal distribution can question the accuracy of the model and lead to incorrect results. Autocorrelation is a type of dependency observed among residuals. In other words, there is a relationship between residuals, which can affect the reliability of the regression model. The absence of autocorrelation indicates that the residuals are independent of each other, and the regression model is reliable. This indicates that the model's predictions are reliable and the errors in the model are randomly distributed. Confirmation of these results can be observed using the Q-Q plot of the residuals of the best model in Figure 2 below.

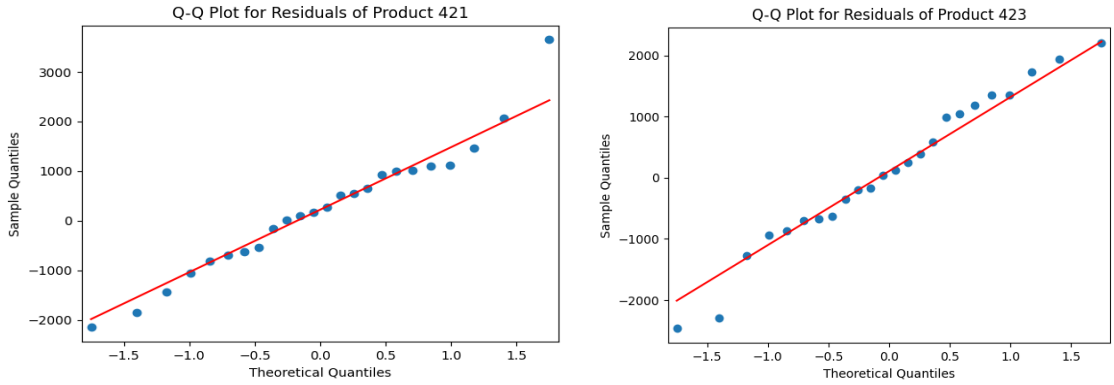


Figure 2: Q-Q Plot for Residuals of Products

In conclusion, it can be considered that this model has the most statistically reliable results. However, also in the other four results, both statistically in terms of normality and autocorrelation, they are suitable.Stationarity test results of the five best-performing ARIMA models are given in Table 3. Determining whether a time series is stationary is important for modeling and forecasting processes. The ADF Test (Augmented Dickey-Fuller Test) tests for the presence of a unit root in a time series, which determines whether the series is stationary. The KPSS Test (Kwiatkowski-Phillips-Schmidt-Shin Test) is a statistical test that evaluates the stationarity property of time series, like the ADF test. However, the KPSS test tests for the absence of a unit root. Generally, if the ADF test statistic is negative and the p-value is small, or if the KPSS test statistic is positive and the p-value is small, the time series is considered stationary. The Seasonal Decomposition test decomposes a time series into seasonal, trend, and irregular components. The results of Seasonal Decomposition help examine seasonality or trends in the time series. These tests are performed on the training data.In the results of the "Best ARIMA Model with Random Search (last 2 years of training data)", the ADF Test Statistic values are positive, and the p-values are above 0.05 significance level, indicating that the series is non-stationary. KPSS Test Statistic values are above the 0.05 significance level, and the p-values are high. Looking at the results of Seasonal Decomposition, it is observed that the residual series show low variability. In the 'Other models,' the ADF Test Statistic value is negative, and the p-value is small for Product 421 and Product 423, and the KPSS Test Statistic values are high. This indicates that both products are stationary. The ARIMA model can also handle non-stationary components. Techniques like differencing can be used to make the series stationary, and then the ARIMA model can be applied. In this case, the ARIMA model can successfully model the non-stationary components of the time series. In Table 3, despite the time series being stationary for other models, there appears to be more fluctuation between the predicted values and the actual values. In this scenario, the ability of the ARIMA model to make accurate forecasts may be limited. In conclusion, the results of the "Best ARIMA Model with Random Search (last 2 years of training data)" indicate signs for a more suitable ARIMA model. This is because in this table, it is observed that the time series is non-stationary, and the seasonal component shows lower variability. This provides a more suitable basis for implementing the ARIMA model.

Table 3: Stationarity test results of the five best-performing ARIMA models

Best ARIMA Model with Random Search (last 2 years of training data)		Other Models	
Product 421 ADF Test Statistic	**Product 421 ADF p-value**	**Product 421 ADF Test Statistic**	**Product 421 ADF p-value**
3,49	1,00	-2,90	0,05
Product 423 ADF Test Statistic	**Product 423 ADF p-value**	**Product 423 ADF Test Statistic**	**Product 423 ADF p-value**
-2,32	0,16	-2,99	0,04
Product 421 KPSS Test Statistic	**Product 421 KPSS p-value**	**Product 421 KPSS Test Statistic**	**Product 421 KPSS p-value**
0,58	0,02	0,64	0,02
Product 423 KPSS Test Statistic	**Product 423 KPSS p-value**	**Product 423 KPSS Test Statistic**	**Product 423 KPSS p-value**
0,51	0,04	0,52	0,04
resid	**resid**	**resid**	**resid**
163,88	388,70	-692,93	810,90
163,88	388,70	-503,31	-326,43
163,88	388,70	-485,26	-794,14
163,88	388,70	211,07	68,21
163,88	388,70	14,11	-104,48
163,88	388,70	2.217,67	673,59
163,88	388,70	649,44	-304,50
163,88	388,70	45,84	319,07
163,88	388,70	-266,43	574,50
163,88	388,70	-1.866,01	-1.577,06
163,88	388,70	-1.698,20	-1.050,89
163,88	388,70	527,67	-749,06
		702,94	-627,23
		513,32	510,11
		495,28	977,82
		-201,06	115,46
		-4,10	288,15
		-2.207,66	-489,91
		-639,43	488,17
		-35,83	-135,39
		276,44	-390,83
		1.876,03	1.760,73
		1.708,22	1.234,57
		-517,66	932,73

Ljung-Box test results of the five best-performing ARIMA models are given in Appendix 2. The Ljung-Box test is a statistical test used to assess the autocorrelation of a time series. It is typically used to evaluate the adequacy of a model in time series analysis. The Ljung-Box test calculates an autocorrelation function for a series of observations and then tests whether there is autocorrelation at a specific point in this function (usually after several lagged time steps). If the test statistic is small and the p-value is high, the time series is considered good in terms of autocorrelation, meaning it fits the ARIMA model better. This test is calculated with the residuals of the model on the training set. The Ljung-Box Test Statistic values for the "Best ARIMA Model with Random Search (last 2 years of training data)" are generally lower compared to other models. Similarly, the p-values are generally higher compared to other models. This model indicates lower autocorrelation and better fit models. It shows that the "Best ARIMA Model with Random Search (last 3 years of training data)" generally exhibits the lowest performance. For Product421 and For Product423, the Ljung-Box test statistic generally increases, but since the p-values are greater than 0.05 significance level, it suggests that the autocorrelation is not statistically significant. Thus, it indicates a random relationship between observations in the time series.

The ARIMA parameters results for five different models are shared in Table 4 below.

Table 4: ARIMA parameters of the five best-performing ARIMA models

Product	Parameters	Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Best ARIMA Model with Stepwise Search (last 3 years of training data)	Best ARIMA Model with Random Search (last 2 years of training data)	Best ARIMA Model with Random Search (last 3 years of training data)	Best ARIMA Model with Cross-Validation (last 3 years of training data)
Product 421	ARIMA Parameters	(2, 1, 2)	(2, 1, 2)	(4, 0, 4)	(5, 0, 3)	(5, 0, 2)
Product 421	AR Parameters	[-0.51555812 0.35350876]	[-0.51555812 0.35350876]	[-0.64483174 0.73897944 0.96115473 - 0.05531922]	[-0.02497575 1.11778098 0.51649679 -0.6044744 -0.0431728]	[0.7204771 0.298185 -0.08905459 -0.22549604 0.20688114]
Product 421	MA Parameters	[0.23209802 -0.76726738]	[0.23209802 -0.76726738]	[1.93873552 0.68499495 - 0.99838455 -0.74464382]	[0.7654891 -0.76484248 - 0.96702857]	[-0.13194657 -0.38633029]
Product 423	ARIMA Parameters	(2, 1, 2)	(2, 1, 2)	(4, 0, 4)	(5, 0, 3)	(5, 0, 2)
Product 423	AR Parameters	[-0.43207713 0.46478641]	[-0.43207713 0.46478641]	[0.07764193 0.44434274 0.11041136 0.10703708]	[1.42987003 0.35321218 -1.2629968 0.27699306 0.14796985]	[0.39771381 0.84980071 - 0.32386968 -0.08378672 0.03444544]
Product 423	MA Parameters	[0.15593209 -0.84404275]	[0.15593209 -0.84404275]	[0.68272528 0.48863288 0.177861 -0.62692715]	[-0.87500147 -0.90970576 0.96513812]	[0.17824941 -0.80658275]

ARIMA Parameters are the parameters that define the ARIMA model. These parameters allow the ARIMA model to be fitted to time series data and predict future values. Autoregressive (AR) terms predict the value at the current time step using a linear combination of past time steps. Moving Average (MA) terms predict the value at the current time step using a linear combination of past errors. These parameters have been calculated based on the 2022 Forecast Data. In the "Best ARIMA Model with Random Search (last 2 years of training data)" model, a more complex structure has been used for the ARIMA model. It may have achieved better fit with higher-order AR and MA terms. However, it's important to consider that this more complex model may also involve more overfitting. In the "Best ARIMA Model with Exhaustive Search (last 3 years of training data)" and "Best ARIMA Model with Stepwise Search (last 3 years of training data)" models, a simpler ARIMA structure has been used. They contain fewer parameters and may carry less risk of overfitting. However, due to their lower flexibility, they may not fit the data perfectly. This ranking may indicate that more complex models perform better according to ARIMA parameters, but it's important to consider the risk of overfitting. While more complex models can often fit more data, unnecessary complexity can reduce the reliability of predictions. Therefore, adopting a balanced approach is important when selecting the most appropriate model.The ARIMA parameters and statistical evaluation results for five different models are shared in Appendix 3. This table provides detailed information on the estimated coefficients of the AR (autoregressive) and MA (moving average) terms of the ARIMA model, their standard errors, and z-test values, probabilities of the true value at 95% confidence interval, measurements of autocorrelation at the first lag time step, skewness and kurtosis measurements of the time series, results of the heteroskedasticity test, and skewness measurement of the time series. These tables are used to assess the adequacy of an ARIMA model, the reliability of estimated coefficients, and the statistical properties of the time series. This information is obtained using the 2022 Forecast Data. It is necessary to interpret in detail

the parameters and fits of the ARIMA models presented in the tables. The parameters of the "Best ARIMA Model with Random Search (last 2 years of training data)" model are statistically significant ($p<0.05$). Box test results indicate no autocorrelation in the model, meaning the error terms of the model are independent. The Jarque-Bera test indicates that the error terms follow a normal distribution, which indicates that the error terms of the model meet the assumption of normal distribution. The high Prob(H) value suggests that the homoscedasticity assumption is acceptable. In other words, signs of heteroskedasticity are weak, meaning the error terms are homoscedastic. Therefore, this model is more robust and reliable compared to others. The first four autoregressive (AR) terms are statistically significant ($p<0.05$). These terms have positive and large coefficients, indicating that past values play an important role in predicting future values. The last four moving average (MA) terms are statistically significant ($p<0.05$). These terms have negative and large coefficients, indicating that past values of errors in the model need to be corrected with a predetermined weight. The error variance of the model(sigma2) is quite small, indicating a good fit to the data. In conclusion, the parameters of the "Best ARIMA Model with Random Search (last 2 years of training data)" are the most significant and consistent, indicating that the model is more reliable compared to others. In other models, some parameters are statistically insignificant, and the overall performance of the model is weaker. In the "Best ARIMA Model with Cross-Validation (last 3 years of training data)" model, many coefficients are statistically insignificant, reducing the predictive power of the model. Ljung-Box and Jarque-Bera test results may indicate that the model is not appropriate. Signs of heteroskedasticity are observed. Therefore, this model exhibits the weakest performance compared to others.AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion) information criteria test results of the five best-performing ARIMA models are given in Table 5.

Table 5: Information criteria test results of the five best-performing ARIMA models

Product	Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Best ARIMA Model with Stepwise Search (last 3 years of training data)	Best ARIMA Model with Random Search (last 2 years of training data)	Best ARIMA Model with Random Search (last 3 years of training data)	Best ARIMA Model with Cross-Validation (last 3 years of training data)
Product 421	AIC 613,04 BIC 620,81	AIC 613,04 BIC 620,81	AIC 476,44 BIC 488,22	AIC 633,74 BIC 649,57	AIC 634,25 BIC 648,50
Product 423	AIC 614,12 BIC 621,90	AIC 614,12 BIC 621,90	AIC 426,82 BIC 438,60	AIC 636,84 BIC 652,67	AIC 635,55 BIC 649,80

AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion) are information criteria used in statistical model selection and decision-making processes, aiding in comparing

different models and selecting the best model. Smaller values indicate better model fit and generalization ability. AIC penalizes model complexity less, whereas BIC penalizes greater model complexity. These information criteria have been calculated based on the 2022 Forecast Data. When evaluating AIC and BIC values, the model that provides the best results is the "Best ARIMA Model with Random Search (last 2 years of training data)" . Its values are lower compared to other models, indicating better fit than others. Although the values of other models are not significantly higher, they are close to each other.

The performance of the five best-performing ARIMA models according to error metrics is shown in Table 6 below.

Table 6: Error metrics of the five best-performing ARIMA models

Product	Metric	Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Best ARIMA Model with Stepwise Search (last 3 years of training data)	Best ARIMA Model with Random Search (last 2 years of training data)	Best ARIMA Model with Random Search (last 3 years of training data)	Best ARIMA Model with Cross-Validation (last 3 years of training data)
Product 421	Mean Absolute Error	904	904	918	1.773	1.237
Product 423	Mean Absolute Error	991	991	1.129	1.302	1.386
Product 421	Mean Squared Error	1.120.071	1.120.071	1.021.159	4.646.444	2.343.719
Product 423	Mean Squared Error	1.537.188	1.537.188	1.900.309	2.414.567	2.672.109
Product 421	Root Mean Squared Error	1.058	1.058	1.011	2.156	1.531
Product 423	Root Mean Squared Error	1.240	1.240	1.379	1.554	1.635

Terms like Mean Absolute Error (MAE), Mean Squared Error (MSE), and Root Mean Squared Error (RMSE) are criteria used to evaluate the performance of prediction models such as regression analysis. These metrics determine how well the model matches the actual values or how much it deviates. Generally, all three metrics assess the prediction performance of a model but are structured differently. While MAE and RMSE measure the magnitude of errors, RMSE provides a value compatible with the original scale. MSE provides value by using the squares of errors, thus giving more weight to larger errors. Error metrics are used to evaluate how close a model's predictions are to the actual values. The lower these metrics, the better the model's performance. These error metrics have been calculated considering the 2022 Forecast Data and Actual Data. In terms of error metrics, it can be noted that the models "Best ARIMA Model with Exhaustive Search (last 3 years of training data)" demonstrate the best performance, with the "Best ARIMA Model with Random Search (last 2 years of training data)" model also showing very close values. Similarly, looking at the average error performances, it can be said that the best model is the "Best ARIMA Model with Random Search (last 2 years of training data)". The above results indicate that the "Best ARIMA Model with Random Search (last 3 years of training data)" and "Best ARIMA Model with Cross-Validation (last 3 years of training data)" models exhibit lower performance. Additionally, considering the outputs of AIC (Akaike Information Criterion) and BIC (Bayesian Information Criterion), it can conclude that the most

appropriate and best-performing model is the "Best ARIMA Model with Random Search (last 2 years of training data)" model.

Overall, interpreting the results, the "Best ARIMA Model with Random Search (last 2 years of training data)" indicates:

- Data Normality: Both Shapiro-Wilk and Jarque-Bera tests indicate statistical proximity to normal distribution.
- Absence of Autocorrelation: Durbin-Watson statistics for both products close to 2 (indicating independence). Ljung-Box tests, indicating no significant difference in autocorrelation among these models.
- Time Series Stationarity: Unit root tests confirm the statistical significance of the model and stationarity of the series.
- Low AIC and BIC Values: Low AIC and BIC values indicate a better fit to the data.
- ARIMA Parameters (4, 0, 4) (A more complex model): The model parameters are statistically significant.
- Heteroskedasticity Results: There is no significant evidence indicating heteroskedasticity for both products.
- Low Mean Absolute Error and Mean Squared Error: Low error values imply better prediction capability.

These findings indicate that "Best ARIMA Model with Random Search (last 2 years of training data)" is an effective model and a reliable tool for forecasting future values. In line with the explanations mentioned above, visual analyzes were also examined as follows Figure 3.

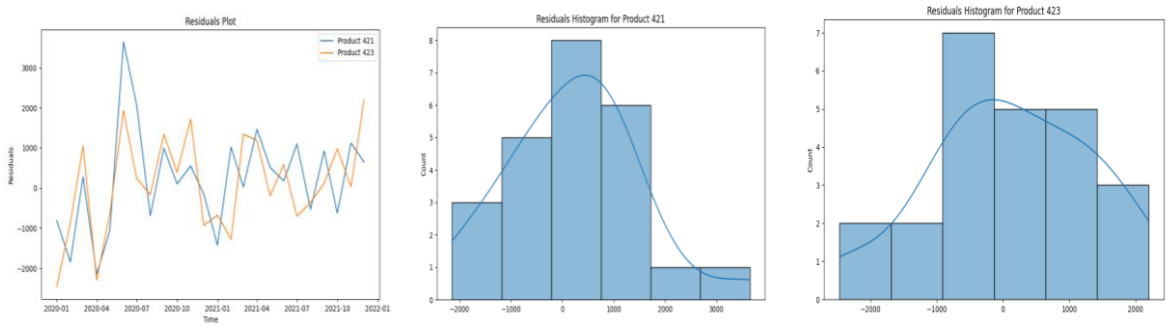


Figure 3: Residuals Plot and Residuals Histogram

Supported by graphs and tables, the results demonstrate that the data are consistent with a normal distribution. The "Residual Histogram for Products" and "Residuals Plot" visuals were applied to the training dataset. The purpose of these visuals is to evaluate how well the ARIMA model fits the training dataset. Therefore, analyzing these visuals is important to determine how

well the ARIMA model fits the training dataset and how reliable the predictions are. This Histogram Plot helps visually assess how accurate the model predictions are and how homogeneously distributed the residuals are. The residuals are symmetrically distributed around a certain center, it indicates that the best model is well-calibrated, and the predictions are close to the actual values. In the Residuals Plot graph, the residual values represent the differences between the model predictions and the actual values. This indicates how successful the model is for each time point or observation unit. The residual values are close to zero and homogeneously distributed, it indicates that the best model is well-calibrated, and the predictions are close to the actual values. The residuals are symmetrically distributed around a certain center and show no significant pattern over time, it seems that the best model is successful. The convergence of residuals to a normal distribution in the training set can enhance the model's ability to make accurate and reliable predictions.These results can be considered when deciding which model to use. Overall, it has been noted that in the top five models, the data exhibited normal distribution and no autocorrelation. Prediction performance was evaluated using various metrics such as AIC and BIC criteria.Indicatively, the selected "Best ARIMA Model with Random Search (last 2 years of training data)" model has shown a fairly satisfactory level of accuracy. With 1-MAD (Mean Absolute Deviation) /MEAN(Sales), the demand forecast accuracy of the relevant item is calculated. In addition, annual demand forecast accuracy was calculated based on the weighted average by sales too. Demand forecast accuracy calculations are shared in detail in Table 7 below.

Table 7: Forecast Accuracy Calculation Table

Product	Country	Month	Accuracy	Weighted Accuracy by Sales
421	45	1.01.2022	97%	9%
421	45	1.02.2022	91%	7%
421	45	1.03.2022	92%	7%
421	45	1.04.2022	94%	8%
421	45	1.05.2022	83%	8%
421	45	1.06.2022	89%	9%
421	45	1.07.2022	80%	5%
421	45	1.08.2022	87%	7%
421	45	1.09.2022	85%	8%
421	45	1.10.2022	87%	8%
421	45	1.11.2022	87%	7%
421	45	1.12.2022	97%	7%
TOTAL Product 421			89%	89%
423	45	1.01.2022	82%	7%
423	45	1.02.2022	97%	9%
423	45	1.03.2022	85%	7%
423	45	1.04.2022	86%	7%
423	45	1.05.2022	95%	8%
423	45	1.06.2022	78%	8%
423	45	1.07.2022	41%	2%
423	45	1.08.2022	100%	7%
423	45	1.09.2022	87%	7%
423	45	1.10.2022	68%	7%
423	45	1.11.2022	75%	7%
423	45	1.12.2022	86%	5%
TOTAL Product 423			82%	83%
TOTAL			85%	86%

The results show an accuracy rate of 85% on a monthly average and 86% on a weighted average. While the accuracy rate of Product 421 appears to be 89%, the accuracy rate of Product 423 is 83%. In general, when look at the products month by month, almost all prediction rates are over 85%. All of the accuracy rates are classified as 85-100%, 80-85%, 75-80% and other by products and their percentages are shown in Figure 4 below.

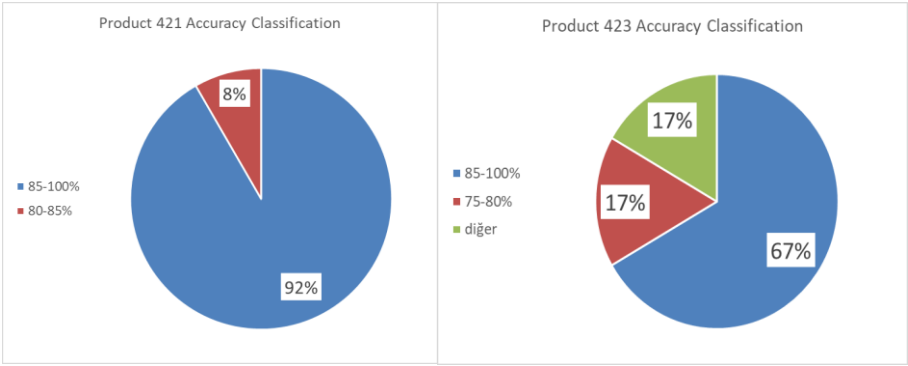


Figure 4: Classification Percentages of Forecast Accuracy

Generally, when the biases are examined, it does not appear to be a biased distribution to one side. It shows normal distribution in terms of a positive and negative bias. In general, having a normal bias distribution and high demand forecasts indicates that the selected ARIMA model can be applied successfully.In conclusion, this study highlights the importance of ARIMA modeling in improving demand forecasting accuracy and optimizing supply chain management. The findings demonstrate that the ARIMA (4, 0, 4) model adequately represents the underlying structure of time series data. Significant autoregressive and moving average components imply the presence of both short-term and long-term dependencies in the data. The model's ability to capture these dependencies accurately makes it valuable for predicting future observations and understanding the underlying processes driving the data. It serves as a useful tool for future research and decision-making in relevant domains.

Conclusion and Recommendations

As a result, this study underscores the importance of advanced time series analysis techniques such as ARIMA modeling in improving demand forecasting accuracy. The significance of demand forecasting accuracy in increasing operational efficiency and customer satisfaction emphasizes the importance of utilizing advanced modeling techniques like ARIMA. The results demonstrate the effectiveness of ARIMA models in capturing complex temporal dependencies and enhancing prediction performance in real-world applications. Companies can improve their decision-making processes, optimize resource allocation, and enhance overall operational efficiency by selecting the appropriate ARIMA model. Organizations can make more informed

decisions, streamline their operations, and gain a competitive advantage in today's dynamic business environment by leveraging ARIMA modeling.This study evaluates the forecasts made by a company operating in the glass manufacturing sector using an ARIMA model based on actual shipment data. Additionally, this study provides a comprehensive analysis to assess the suitability and prediction performance of ARIMA models. Based on the data presented above, "Best ARIMA Model with Random Search (last 2 years of training data)" is selected and the effectiveness of the model has been evaluated for products 421 and 423. Results from normality tests, autocorrelation tests, heteroskedasticity tests, and time series stationarity tests demonstrate that the ARIMA model is applied correctly and provides reliable forecasts. The results indicate that the model captures important features in the time series data, such as trend and seasonality, effectively.This study demonstrates the effectiveness of ARIMA models in forecasting time series data for specific products. In the future, this analysis can be expanded with a larger dataset and the use of different modeling techniques. Future research directions may include exploring the application of other advanced time series analysis techniques, such as exponential smoothing methods or machine learning algorithms, to further enhance demand forecasting accuracy. Additionally, research efforts could focus on integrating external factors.

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Appendices

Appendix 1

Product	Test	Best ARIMA Model with Exhaustive Search (last 2 years of training data)	Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Best ARIMA Model with Stepwise Search (last 3 years of training data)	Best ARIMA Model with Stepwise Search (last 2 years of training data)	Best ARIMA Model with BIC (last 2 years of training data)	Best ARIMA Model with BIC (last 3 years of training data)	Best ARIMA Model with Grid Search (last 2 years of training data)
Product 421	Shapiro-Wilk Test Statistic (p-value)	0.0139	0.1485	0.1485	0.0008	0.0055	0.0283	0.0079
Product 423	Shapiro-Wilk Test Statistic (p-value)	0.9059	0.5107	0.5107	0.5215	0.8587	0.4654	0.8319
Product 421	Jarque-Bera Test Statistic (p-value)	0.0013	0.4555	0.4555	7,34E+00	0.0231	0.0128	0.0668
Product 423	Jarque-Bera Test Statistic (p-value)	0.7498	0.5929	0.5929	0.6519	0.7562	0.5395	0.7204
Product 421	Durbin-Watson Statistic	1.65	1.73	1.73	1.66	2.20	1.96	2.35
Product 423	Durbin-Watson Statistic	1.65	1.73	1.73	1.71	1.96	1.91	2.01
Product 421	MAE	882	904	904	1.030	2.298	1.764	1.771
Product 423	MAE	1.219	991	991	1.483	3.379	2.787	3.038
Product 421	MSE	1.187.478	1.120.071	1.120.071	1.304.626	7.374.601	4.725.541	4.734.804
Product 423	MSE	2.734.322	1.537.188	1.537.188	3.474.748	14.078.909	9.826.051	11.759.032
Product 421	RMSE	1.090	1.058	1.058	1.142	2.716	2.174	2.176
Product 423	RMSE	1.654	1.240	1.240	1.864	3.752	3.135	3.429
Product 421	AIC	402	613	613	400	388	602	386
Product 423	AIC	401	614	614	400	388	603	391
Product 421	BIC	408	621	621	403	392	610	392
Product 423	BIC	408	622	622	402	391	610	397

Product	Test	Best ARIMA Model with Grid Search (last 3 years of training data)	Best ARIMA Model with Random Search (last 2 years of training data)	Best ARIMA Model with Random Search (last 3 years of training data)	Best ARIMA Model with Optuna function for Hyperparameter Optimization (last 2 years of training data)	Best ARIMA Model with Optuna function for Hyperparameter Optimization (last 3 years of training data)	Best ARIMA Model with Cross-Validation (last 2 years of training data)	Best ARIMA Model with Cross-Validation (last 3 years of training data)
Product 421	Shapiro-Wilk Test Statistic (p-value)	0.0283	0.7198	0.2860	0.0064	0.0283	0.0005	0.3241
Product 423	Shapiro-Wilk Test Statistic (p-value)	0.4654	0.7495	0.5060	0.7917	0.4654	0.3790	0.2820
Product 421	Jarque-Bera Test Statistic (p-value)	0.0128	0.6022	0.5619	0.0593	0.0128	0.00001	0.8973
Product 423	Jarque-Bera Test Statistic (p-value)	0.5395	0.7743	0.6891	0.7490	0.5395	0.6269	0.7100
Product 421	Durbin-Watson Statistic	1.96	1.84	1.86	2.28	1.96	1.61	1.91
Product 423	Durbin-Watson Statistic	1.91	1.70	1.86	2.10	1.91	1.77	1.80
Product 421	MAE	1.764	918	1.773	2.096	1.764	932	1.237
Product 423	MAE	2.787	1.129	1.302	3.662	2.787	1.059	1.386
Product 421	MSE	4.725.541	1.021.159	4.646.444	6.341.411	4.725.541	1.063.127	2.343.719
Product 423	MSE	9.826.051	1.900.309	2.414.567	16.076.467	9.826.051	2.023.110	2.672.109
Product 421	RMSE	2.174	1.011	2.156	2.518	2.174	1.031	1.531
Product 423	RMSE	3.135	1.379	1.554	4.010	3.135	1.422	1.635
Product 421	AIC	602	476	634	386	602	403	634
Product 423	AIC	603	427	637	391	603	405	636
Product 421	BIC	610	488	650	394	610	409	648
Product 423	BIC	610	439	653	398	610	411	650

Appendix 1: Results of the all potential ARIMA models

Appendix 2

Models	Product	Ljung-Box Test Statistic	p-value
Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Product 421	[0.0766025872396713, 0.17791506914332114, 0.18163309538207054, 1.2240307733246647, 1.2589932722135604, 1.5992032675757941, 1.7980056622083822, 2.1987767520787243, 2.3074231905337355, 3.3865200108929825, 3.3960353972495776, 4.098007788456944, 7.134505672098589, 9.164148666290117, 9.567436146706148, 10.080151928459369, 15.150320374502263, 15.151015682466257, 15.252762871315644, 15.252831950636818]	[0.7819553942462005, 0.9148844237084862, 0.9804984226034583, 0.8741264820019989, 0.9390941322549198, 0.9526346660063888, 0.97017010637142, 0.9743033230920705, 0.9856222055013403, 0.9708117341224711, 0.9843898193377323, 0.9816021725926742, 0.8950874184323214, 0.8203935794162281, 0.8460318334812578, 0.8624091841555265, 0.5846550901319341, 0.6515729901888321, 0.706402634223831, 0.761762296453775]
Best ARIMA Model with Exhaustive Search (last 3 years of training data)	Product 423	[0.042797530928843884, 0.05447064726988678, 0.3440355796398312, 0.754371089899602, 1.5128058201964927, 1.5256239886811775, 1.526673773868777, 1.7717545628334157, 2.6739494410395035, 2.678915521439227, 3.475143989054098, 5.273948110676029, 5.7724797730892 16, 6.997126337647562, 7.923680222201235, 9.833026147404464, 9.837951977063021, 12.536695269281696, 13.148928505319464, 13.266881631803432]	[0.8361069804887369, 0.9731322135677708, 0.9515445319856444, 0.9444584462649099, 0.9115873119506355, 0.9577743110547591, 0.9813718205272913, 0.9872274625875131, 0.975833693590734, 0.9880041796753329, 0.9828420366358065, 0.9481973335734415, 0.9540426803631481, 0.9348226234387453, 0.9268059590467971, 0.8752013276114314, 0.9102678101030013, 0.8183285911363739, 0.8308604482614229, 0.8656418636079349]
Best ARIMA Model with Stepwise Search (last 3 years of training data)	Product 421	[0.0766025872396713, 0.17791506914332114, 0.18163309538207054, 1.2240307733246647, 1.2589932722135604, 1.5992032675757941, 1.7980056622083822, 2.1987767520787243, 2.3074231905337355, 3.3865200108929825, 3.3960353972495776, 4.098007788456944, 7.134505672098589, 9.164148666290117, 9.567436146706148, 10.080151928459369, 15.150320374502263, 15.151015682466257, 15.252762871315644, 15.252831950636818]	[0.7819553942462005, 0.9148844237084862, 0.9804984226034583, 0.8741264820019989, 0.9390941322549198, 0.9526346660063888, 0.97017010637142, 0.9743033230920705, 0.9856222055013403, 0.9708117341224711, 0.9843898193377323, 0.9816021725926742, 0.8950874184323214, 0.8203935794162281, 0.8460318334812578, 0.8624091841555265, 0.5846550901319341, 0.6515729901888321, 0.706402634223831, 0.761762296453775]
Best ARIMA Model with Stepwise Search (last 3 years of training data)	Product 423	[0.042797530928843884, 0.05447064726988678, 0.3440355796398312, 0.754371089899602, 1.5128058201964927, 1.5256239886811775, 1.526673773868777, 1.7717545628334157, 2.6739494410395035, 2.678915521439227, 3.475143989054098, 5.273948110676029, 5.7724797730892 16, 6.997126337647562, 7.923680222201235, 9.833026147404464, 9.837951977063021, 12.536695269281696, 13.148928505319464, 13.266881631803432]	[0.8361069804887369, 0.9731322135677708, 0.9515445319856444, 0.9444584462649099, 0.9115873119506355, 0.9577743110547591, 0.9813718205272913, 0.9872274625875131, 0.975833693590734, 0.9880041796753329, 0.9828420366358065, 0.9481973335734415, 0.9540426803631481, 0.9348226234387453, 0.9268059590467971, 0.8752013276114314, 0.9102678101030013, 0.8183285911363739, 0.8308604482614229, 0.8656418636079349]
Best ARIMA Model with Random Search (last 2 years of training data)	Product 421	[0.029181782286942112, 0.49004681181368903, 0.6025046660098121, 1.5777066791794514, 2.001727594567679, 3.691326316701255, 3.7245702902028945, 3.9713118615493537, 4.702003169378091, 5.126283657388474, 5.149362320285965, 5.153583329496728, 5.168689291407585, 5.615794296743418 5, 5.956182511729807, 5.99967059094157, 6.1377173505366045, 6.786237421638774, 7.786066124023327, 7.786739437287962]	[0.8643599860923168, 0.7826862185467547, 0.8958587486394242, 0.8127932413895674, 0.8489059386807984, 0.7183647406602427, 0.8108985553940411, 0.8597024792447822, 0.8594734749972954, 0.8825839610923711, 0.9237176517895014, 0.9526513102915425, 0.971289412277743, 0.9752665167321233, 0.9804743976800009, 0.9880990540347782, 0.992211519626264, 0.9918085010115398, 0.9886970115642801, 0.9931872422112058]
Best ARIMA Model with Random Search (last 2 years of training data)	Product 423	[0.003559768135618569, 0.5136888635727109, 0.9251520165549063, 1.0167281542278808, 2.1003441110148042, 2.17998639724689, 2.270052876819796, 2.354123472459889, 2.8206504024327494, 3.5576678781447915, 3.8270313457547864, 3.8728820229965604, 5.899665959503953, 7.528761612361275, 8.037117856893314, 8.214607754873658, 8.357486086344089, 9.93760458389942, 9.979057518031988, 14.512496767240012]	[0.9524234097358634, 0.7734885346357627, 0.8193541950062594, 0.9072489354952138, 0.8350935676434926, 0.9024232383646145, 0.9433954670765214, 0.9681865875037186, 0.9709829414418016, 0.9651039176260654, 0.9747061683518616, 0.9856224222969749, 0.9497283608722366, 0.9124054155563965, 0.9222859743481768, 0.9422189704258941, 0.9582936879092298, 0.9339238438277759, 0.9534605097071934, 0.8035903839881869]
Best ARIMA Model with Random Search (last 3 years of training data)	Product 421	[0.00056270100805 15173, 0.03549548666306233, 0.08881457844380494, 0.09897453294871557, 0.30181273417111293, 0.33088087382466697, 0.5825817924635458, 1.6610150940739634, 1.7832539150861693, 1.7980547769812396, 2.0475214206237125, 2.4370654680309323, 2.456804995871468, 3.2509175190231776, 3.9352454057557478, 3.935916274529964, 4.137791750392956, 4.162709189223383, 4.370837923505239, 4.501419939570445]	[0.9810749001326133, 0.9824088202799872, 0.9931450689277359, 0.9988151632597003, 0.9976088545010291, 0.9993330223489204, 0.9990844226642434, 0.9897008179693703, 0.9944499127064551, 0.9976666695238982, 0.9983218187713445, 0.9983805875342608, 0.9992904627205343, 0.9985402066674068, 0.9979416914227985, 0.9990090848565174, 0.9993507232689716, 0.9996835590636227, 0.9997905456362154, 0.999878890338432]
Best ARIMA Model with Random Search (last 3 years of training data)	Product 423	[0.04915573597307727, 0.07648086965792554, 0.08082290094910463, 0.09872386578981177, 0.12243910817510845, 0.30106134961456565, 0.9563757820962255, 2.0133048778024745, 2.636317918698022, 3.0186089285312008, 3.1269860706110886, 3.29633341372057, 5.045958461072966, 7.2774022496696755, 7.345049716078644, 8.039954335183301, 8.727793546316386, 9.796908453317277, 9.866618439152704, 11.367436415258 51]	[0.8245389218451582, 0.9624814989943775, 0.9940349440430338, 0.9988210591006793, 0.9997328868411839, 0.9994919822871816, 0.995501895906621, 0.9806012441371768, 0.9769898708021316, 0.9809827331736655, 0.9889389243963745, 0.9930656242300858, 0.9741674394309567, 0.9234883347309651, 0.9473581777427273, 0.9476680159770718, 0.9484162828666725, 0.9383336616685483, 0.9561595969611001, 0.936131566321255]
Best ARIMA Model with Cross-Validation (last 3 years of training data)	Product 421	[0.03680605701324126, 0.21861607393086332, 0.21899476394135148, 0.2192265394200208, 0.30638979875184635, 0.6457243897548571, 0.7260952326830398, 1.8744628289081644, 1.9617675165706698, 2.4958308547601518, 3.220746406575291, 4.5516100595614 34, 4.5521451823021 77, 5.701434957674592, 6.876193568527947, 6.913209497615053, 7.099733476454889, 7.263499780663752, 7.689130985841718, 7.9188644798911465]	[0.8478604501697 64, 0.8964542339211783, 0.9744661658481927, 0.9944139396226135, 0.997521180718685, 0.995588345904892, 0.9981271001250632, 0.9846215069296179, 0.9920578554951675, 0.9909363359704483, 0.9874750195731128, 0.9713069698533404, 0.9837766769266612, 0.9734648996242025, 0.9609945818111182, 0.974897859344601, 0.9822202230567398, 0.9877097311422638, 0.9895346845547427, 0.992391054581521]
Best ARIMA Model with Cross-Validation (last 3 years of training data)	Product 423	[0.009573228140090042, 0.01299832639010664, 0.014750614715180297, 0.0979204788326705, 0.09845265327932433, 0.3008958095358642, 0.7666027521171082, 1.5997170517499715, 2.2341840090874516, 2.52800606795544, 2.5503861690637 16, 2.9206063898636243, 5.497363941610099, 6.964479886889791, 7.22452361215273, 8.062470159444704, 8.77624508891054, 9.540674597736604, 9.83638553683588, 12.253707617054884]	[0.9220570615638103, 0.9935219106871493, 0.999525634645235, 0.9988398594425347, 0.9998438036886 92, 0.9994927885890958, 0.9977700332624372, 0.9909255656500333, 0.9871999380475694, 0.9904612888602653, 0.9954352817963331, 0.9960790512674526, 0.9625530808310192, 0.9360724905053869, 0.9511171551102242, 0.9469848157308076, 0.9470208948737856, 0.9458723862028875, 0.9568669348992348, 0.9070667469182861]

Appendix 2: Ljung-Box Test Statistic results of the five best-performing ARIMA models

Appendix 3

Best ARIMA Model with Exhaustive Search (last 3 years of training data)

standard_errors_421							standard_errors_423						
	coef	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**		**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
ar.L1	-0.5156	0.391	-1.318	0.188	-1.282	0.251	ar.L1	-0.4321	0.350	-1.236	0.216	-1.117	0.253
ar.L2	0.3535	0.457	0.774	0.439	-0.542	1.249	ar.L2	0.4648	0.327	1.421	0.155	-0.176	1.106
ma.L1	0.2321	0.352	0.660	0.509	-0.457	0.921	ma.L1	0.1559	0.341	0.457	0.647	-0.512	0.824
ma.L2	-0.7673	0.344	-2.234	0.026	-1.441	-0.094	ma.L2	-0.8440	0.349	-2.421	0.015	-1.527	-0.161
sigma2	1.691e+06	2.22e-07	7.63e+12	0.000	1.69e+06	1.69e+06	sigma2	1.741e+06	2.86e-07	6.08e+12	0.000	1.74e+06	1.74e+06

standard_errors_423				standard_errors_423_ma			
Ljung-Box (L1) (Q):	**0.35**	**Jarque-Bera (JB):**	**1.74**	**Ljung-Box (L1) (Q):**	**0.32**	**Jarque-Bera (JB):**	**0.97**
Prob(Q):	0.56	Prob(JB):	0.42	Prob(Q):	0.57	Prob(JB):	0.61
Heteroskedasticity (H):	0.35	Skew:	0.12	Heteroskedasticity (H):	0.65	Skew:	-0.37
Prob(H) (two-sided):	0.08	Kurtosis:	4.06	Prob(H) (two-sided):	0.46	Kurtosis:	2.67

Best ARIMA Model with Stepwise Search (last 3 years of training data)

standard_errors_421							standard_errors_423						
	coef	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**		**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
ar.L1	-0.5156	0.391	-1.318	0.188	-1.282	0.251	ar.L1	-0.4321	0.350	-1.236	0.216	-1.117	0.253
ar.L2	0.3535	0.457	0.774	0.439	-0.542	1.249	ar.L2	0.4648	0.327	1.421	0.155	-0.176	1.106
ma.L1	0.2321	0.352	0.660	0.509	-0.457	0.921	ma.L1	0.1559	0.341	0.457	0.647	-0.512	0.824
ma.L2	-0.7673	0.344	-2.234	0.026	-1.441	-0.094	ma.L2	-0.8440	0.349	-2.421	0.015	-1.527	-0.161
sigma2	1.691e+06	2.22e-07	7.63e+12	0.000	1.69e+06	1.69e+06	sigma2	1.741e+06	2.86e-07	6.08e+12	0.000	1.74e+06	1.74e+06

standard_errors_423				standard_errors_423_ma			
Ljung-Box (L1) (Q):	**0.35**	**Jarque-Bera (JB):**	**1.74**	**Ljung-Box (L1) (Q):**	**0.32**	**Jarque-Bera (JB):**	**0.97**
Prob(Q):	0.56	Prob(JB):	0.42	Prob(Q):	0.57	Prob(JB):	0.61
Heteroskedasticity (H):	0.35	Skew:	0.12	Heteroskedasticity (H):	0.65	Skew:	-0.37
Prob(H) (two-sided):	0.08	Kurtosis:	4.06	Prob(H) (two-sided):	0.46	Kurtosis:	2.67

Best ARIMA Model with Random Search (last 2 years of training data)

standard_errors_421							standard_errors_423						
	coef	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**		**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
const	6423.2528	0.001	8.19e+06	0.000	6423.251	6423.254	const	5143.5377	1469.481	3.500	0.000	2263.408	8023.667
ar.L1	-0.6448	0.125	-5.146	0.000	-0.890	-0.399	ar.L1	0.0776	1.486	0.052	0.958	-2.835	2.991
ar.L2	0.7390	0.084	8.752	0.000	0.573	0.904	ar.L2	0.4443	0.499	0.891	0.373	-0.533	1.421
ar.L3	0.9612	0.084	11.432	0.000	0.796	1.126	ar.L3	0.1104	0.391	0.282	0.778	-0.657	0.877
ar.L4	-0.0553	0.125	-0.444	0.657	-0.299	0.189	ar.L4	0.1070	0.725	0.148	0.883	-1.315	1.529
ma.L1	1.9387	34.734	0.056	0.955	-66.138	70.016	ma.L1	0.6827	69.359	0.010	0.992	-135.259	136.624
ma.L2	0.6850	61.054	0.011	0.991	-118.979	120.349	ma.L2	0.4886	110.040	0.004	0.996	-215.185	216.163
ma.L3	-0.9984	25.836	-0.039	0.969	-51.635	49.638	ma.L3	0.1779	44.217	0.004	0.997	-86.486	86.842
ma.L4	-0.7446	0.073	-10.220	0.000	-0.887	-0.602	ma.L4	-0.6269	0.928	-0.676	0.499	-2.446	1.192
sigma2	1.909e+05	0.000	1.63e+09	0.000	1.91e+05	1.91e+05	sigma2	1.016e+06	8.47e-05	1.2e+10	0.000	1.02e+06	1.02e+06

standard_errors_423				standard_errors_423_ma			
Ljung-Box (L1) (Q):	**0.29**	**Jarque-Bera (JB):**	**0.28**	**Ljung-Box (L1) (Q):**	**0.04**	**Jarque-Bera (JB):**	**0.67**
Prob(Q):	0.59	Prob(JB):	0.87	Prob(Q):	0.84	Prob(JB):	0.72
Heteroskedasticity (H):	0.42	Skew:	0.19	Heteroskedasticity (H):	0.65	Skew:	0.07
Prob(H) (two-sided):	0.25	Kurtosis:	2.64	Prob(H) (two-sided):	0.56	Kurtosis:	2.19

Best ARIMA Model with Random Search (last 3 years of training data)

standard_errors_421							standard_errors_423						
	coef	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**		**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
const	6140.7813	1153.558	5.323	0.000	3879.848	8401.714	const	4972.6656	1250.490	3.977	0.000	2521.751	7423.580
ar.L1	-0.0250	1.023	-0.024	0.981	-2.031	1.981	ar.L1	1.4299	0.659	2.169	0.030	0.138	2.722
ar.L2	1.1178	0.638	1.753	0.080	-0.132	2.368	ar.L2	0.3532	0.760	0.465	0.642	-1.136	1.842
ar.L3	0.5165	0.467	1.106	0.269	-0.399	1.432	ar.L3	-1.2630	0.538	-2.350	0.019	-2.317	-0.209
ar.L4	-0.6045	0.485	-1.246	0.213	-1.555	0.346	ar.L4	0.2770	0.569	0.487	0.626	-0.838	1.392
ar.L5	-0.0432	0.481	-0.090	0.928	-0.986	0.900	ar.L5	0.1480	0.277	0.534	0.593	-0.395	0.691
ma.L1	0.7655	2.062	0.371	0.710	-3.276	4.807	ma.L1	-0.8750	1.797	-0.487	0.626	-4.398	2.648
ma.L2	-0.7648	2.431	-0.315	0.753	-5.529	3.999	ma.L2	-0.9097	1.600	-0.569	0.570	-4.045	2.226
ma.L3	-0.9670	0.783	-1.234	0.217	-2.503	0.569	ma.L3	0.9651	0.761	1.268	0.205	-0.526	2.457
sigma2	1.565e+06	0.028	5.6e+07	0.000	1.57e+06	1.57e+06	sigma2	1.777e+06	0.001	1.67e+09	0.000	1.78e+06	1.78e+06

standard_errors_423				standard_errors_423_ma			
Ljung-Box (L1) (Q):	**0.00**	**Jarque-Bera (JB):**	**1.49**	**Ljung-Box (L1) (Q):**	**0.04**	**Jarque-Bera (JB):**	**0.45**
Prob(Q):	0.99	Prob(JB):	0.48	Prob(Q):	0.85	Prob(JB):	0.80
Heteroskedasticity (H):	0.60	Skew:	0.27	Heteroskedasticity (H):	1.12	Skew:	-0.26
Prob(H) (two-sided):	0.38	Kurtosis:	3.84	Prob(H) (two-sided):	0.85	Kurtosis:	2.84

Best ARIMA Model with Cross-Validation (last 3 years of training data)

standard_errors_421							standard_errors_423						
	coef	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**		**coef**	**std err**	**z**	**P>|z|**	**[0.025**	**0.975]**
const	6144.5129	1394.316	4.407	0.000	3411.703	8877.323	const	4975.6047	922.784	5.392	0.000	3166.981	6784.228
ar.L1	0.7205	0.878	0.821	0.412	-1.000	2.441	ar.L1	0.3977	2.163	0.184	0.854	-3.842	4.638
ar.L2	0.2982	0.624	0.478	0.633	-0.924	1.521	ar.L2	0.8498	0.825	1.029	0.303	-0.768	2.468
ar.L3	-0.0891	0.594	-0.150	0.881	-1.253	1.074	ar.L3	-0.3239	1.018	-0.318	0.750	-2.319	1.672
ar.L4	-0.2255	0.234	-0.964	0.335	-0.684	0.233	ar.L4	-0.0838	0.386	-0.217	0.828	-0.840	0.673
ar.L5	0.2069	0.235	0.880	0.379	-0.254	0.668	ar.L5	0.0344	0.308	0.112	0.911	-0.569	0.638
ma.L1	-0.1319	0.820	-0.161	0.872	-1.740	1.476	ma.L1	0.1782	2.413	0.074	0.941	-4.551	4.907
ma.L2	-0.3863	0.751	-0.514	0.607	-1.859	1.086	ma.L2	-0.8066	2.156	-0.374	0.708	-5.033	3.420
sigma2	1.548e+06	4.43e+05	3.495	0.000	6.8e+05	2.42e+06	sigma2	1.619e+06	1.66e+06	0.976	0.329	-1.63e+06	4.87e+06

standard_errors_423				standard_errors_423_ma			
Ljung-Box (L1) (Q):	**0.06**	**Jarque-Bera (JB):**	**0.41**	**Ljung-Box (L1) (Q):**	**0.01**	**Jarque-Bera (JB):**	**0.45**
Prob(Q):	0.81	Prob(JB):	0.81	Prob(Q):	0.94	Prob(JB):	0.80
Heteroskedasticity (H):	0.62	Skew:	0.20	Heteroskedasticity (H):	1.18	Skew:	-0.27
Prob(H) (two-sided):	0.41	Kurtosis:	3.35	Prob(H) (two-sided):	0.78	Kurtosis:	2.92

Appendix 3: The ARIMA parameters and statistical evaluation results of the five best-performing ARIMA models

CAM ELYAF TAKVİYELİ PLASTİK KOMPOZİT DELMEDE TAGUCHI OPTİMİZASYONU YOLUYLA DELAMİNASYON FAKTÖRÜNÜN MİNİMİZE EDİLMESİ

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Özet
Hafif, dayanıklı ve yüksek performanslı malzemeler, modern mühendislik uygulamalarında rekabetçilik açısından vazgeçilmezdir. Cam elyafı ile güçlendirilmiş polimer bazlı bir malzeme olan Cam Elyaf Takviyeli Plastikler (GFRP), havacılık, rüzgar enerjisi, savunma ve denizcilik endüstrileri gibi kritik sektörlerde hayati bir rol oynamaktadır. GFRP ile ilgili zorluklar, heterojen ve anizotropik doğasında yatmaktadır; bu da işlemede zorluklara ve delaminasyon, çıkıntılar, elyaf kırılmaları, matris yayılması ve yırtılma gibi potansiyel hasarlara yol açmaktadır. Bu çalışma, delme işlemi sırasında GFRP'de meydana gelen delaminasyon etkisinin araştırılmasına odaklanmakta ve en uygun parametreleri belirlemeyi amaçlamaktadır. Taguchi yöntemi kullanılarak delme sırasında giriş ve çıkış noktalarındaki delaminasyon faktörünü optimize edecek bir yaklaşım geliştirilmiştir. Taguchi yöntemi, birden fazla parametrenin etkilerini minimum sayıda deneyle değerlendirerek, zamandan tasarruf ederek ve en iyi sonuçları sağlayarak süreç tasarımı optimizasyonunu kolaylaştırır. Deneylerde 6 mm Yüksek Hız Çeliği (HSS) kullanılmış ve farklı seviyelerde kesme hızı ilerleme hızı gibi delme parametrelerini içermektedir. Performans değerlendirmesi için Taguchi yöntemiyle birlikte bir L9 tasarımı kullanan analiz, ilerleme hızının çıkış bölgesindeki delaminasyonun %81,86'sına hakim olduğunu ortaya koyuyor. Bu da delme işlemi sırasında delaminasyon oluşumunda ilerleme hızının ne kadar etkili olduğunu göstermektedir.
Anahtar Kelimeler: Cam elyaf takviyeli plastik, GFRP, Taguchi yöntemi, Savunma Sanayi, Delaminasyon, Delme.

MINIMIZING DELAMINATION FACTOR IN GLASS FIBER REINFORCED PLASTIC COMPOSITE DRILLING THROUGH TAGUCHI OPTIMIZATION

Abstract
Lightweight, durable, and high-performance materials are essential in modern engineering applications for competitiveness. Glass Fiber Reinforced Plastics (GFRP), a polymer-based material reinforced with fiberglass, plays a vital role in critical sectors like aviation, wind power, defense, and maritime industries. The challenges with GFRP lie in their heterogeneous and anisotropic nature, leading to difficulties in processing and potential damages such as delamination, protrusions, fiber breakages, matrix spreading, and tearing. This study focuses on investigating delamination in GFRP during the drilling process and aims to determine optimal parameters. Using the Taguchi method, an approach is developed to optimize the delamination factor at entry and exit points during drilling. The Taguchi method streamlines process design optimization by assessing the effects of multiple parameters with a minimized number of experiments, saving time and providing optimal results. The experiments use 6mm High-Speed Steel (HSS) and include drilling parameters such as cutting speed feed rate at different levels. Using an L9 design in combination with the Taguchi method for performance evaluation, the analysis reveals that the feed rate dominates 81.86% of the delamination in the exit zone. This shows how effective the feed rate is in the formation of delamination during the drilling process.
Keywords: Glass Fiber Reinforced Plastic, GFRP, Taguchi method, Defense Industry, Delamination, Drilling.

Introduction

In recent years, the use of GFRP composite materials in the industries (i.e., automobile, ship, chemistry, aerospace) has increased due to their significant advantage over other materials, i.e., high specific stiffness and strength, superior corrosion resistance, lightweight and low thermal conductivity (Davim et al., 2004, Palanikumar et al., 2007). As GFRP composite materials are becoming increasingly popular, there is a growing emphasis on producing and fabricating them better, cheaper, and faster. Composite materials are subjected to many processes for the production and final product. Due to the intensive use of GFRP materials in many areas, a secondary process such as turning, milling, and drilling is required (Geng et al., 2019). Various non-traditional machining processes such as laser cutting, water jet cutting, ultrasonic cutting, and electro-discharge machining have also been developed to process GFRP (Jenkins & Joppa, 2009). One of the most common of these is the traditional drilling process. The life of the drilling joint in composite materials is directly affected by the quality of the holes drilled. Compared to conventional metallic materials, drilling composites pose additional challenges due to their unique nature, microscopic inhomogeneity, anisotropy, and laminate structure (Guo & Bao, 2012, Bayraktar, 2018). Defects such as fiber shrinkage, microcrack formation at the hole entry and exit surfaces, and thermal damage to the matrix phase, as well as delamination, occur during the drilling of GFRP (Işık & Ekici, 2010, Lukacs, 2023). Delamination is a surface defect caused by the separation of layered materials. The formation of delamination reduces laminate stiffness and strength against loads on the material. Therefore, delamination significantly reduces the material's resistance to load and lowers its fatigue resistance, thus accelerating the occurrence of fatigue damage. These adverse effects of delamination on the material are a major cause of part rejection in assemblies, especially in the aerospace and defense industry (Geng et al., 2019, Tsao & Hocheng, 2016). These defects pose a significant problem in terms of hole surface quality and need to be minimized for precise assembly of these materials. In order to perform the minimization process, it is necessary to perform delamination experiments on GFRP material under appropriate conditions and determine the appropriate drilling parameters. Increasing the number of experiments helps us to find the appropriate drilling parameters, but has disadvantages in terms of time and cost. More practical methods are needed to avoid excessive cost and time loss due to experiments (Adda & Bourchak, 2021). For this reason, Taguchi's experimental design methods were used in our study. With this method, instead of trying all combinations of experiments, only some of them are performed

with the help of orthogonal series and the factor levels that give the best performance can be found (Özdemir, 2023).

Materials and Methods

In the study, an HSS drill bit with a 6 mm diameter, a 30° helix angle, and a 118° point angle was used for drilling. The materials used were produced by Secant Technology Development Inc., following to ASTM standards through the Infusion Method, employing 600 gr/m^2 E-Glass Plain Weave and Vinyl ester Resin (Figure 1.). The GFRP plates, produced at a thickness of 10 mm, were precision-cut using a water jet to prepare for drilling. The drilling process was conducted without coolant, under dry air conditions. The experiment varied cutting speed and feed rate across three levels to determine their impact on the drilling process, as detailed in Table 1. This methodical approach allows for a comprehensive analysis of the drilling parameters and their effects on the material's integrity and the quality of the holes produced (Khashaba & Elhamid, 2007).

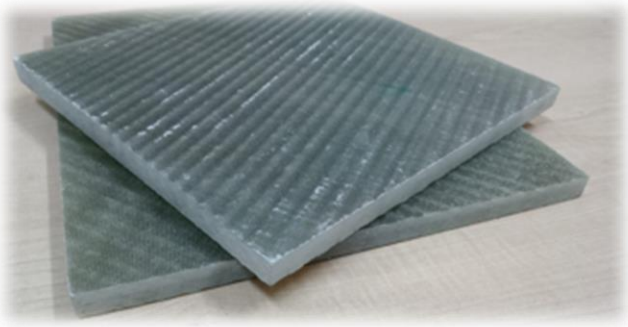


Figure 1. GFRP composite material plates

Table 1. Drilling factors and levels

Factors and levels of machining parameters					
Factors	Symbols	Units	Levels		
			1	2	3
Cutting Speed	Vc	m/min	62	422	945
Feed Rate	f	mm/min	0.10	0.18	0.24

The delamination factor, often denoted as Fd, quantifies the extent of this effect by comparing the maximum diameter of the delaminated area to the original hole diameter, as shown in Figure 2. This factor is crucial for both the inlet and outlet of the hole, as it can significantly influence the structural integrity and the assembly tolerance of the final product. The use of an optical digital microscope in examining the workpiece allows for precise observation of the delamination and any burrs that may form, providing valuable insights into the quality of the drilling process. The schematic diagram, typically shown in Figure 3, details the experimental setup, including the positioning of the optical microscope.

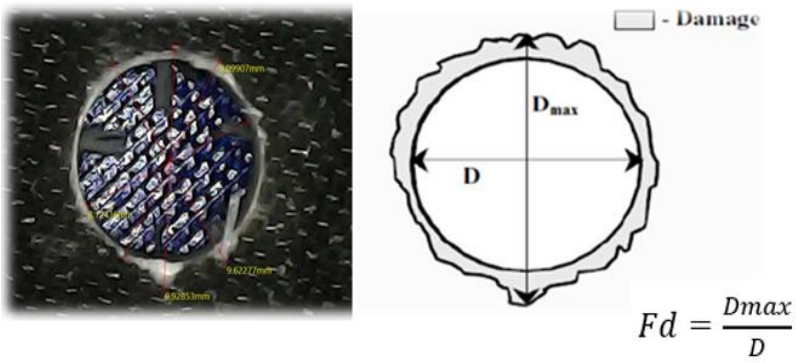


Figure 2. Demonstration of delamination on the workpiece(Shafiq, 2018)

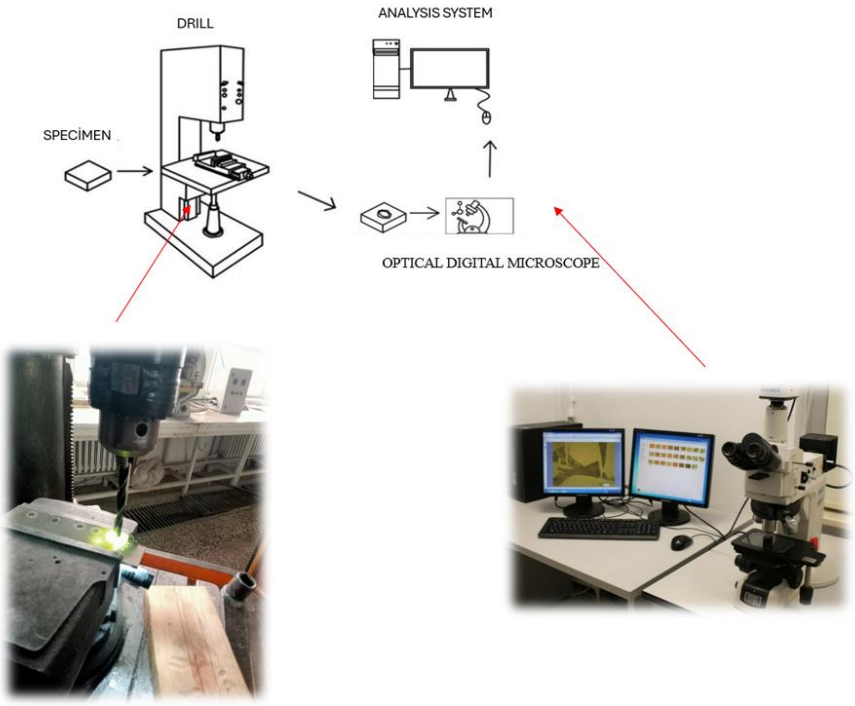


Figure 3. Experimental setup

The Taguchi method is a robust design technique that is widely used in engineering to optimize process parameters and improve quality. The "smaller is better" objective function is particularly useful in minimizing undesirable traits, such as the delamination effect in drilling processes (Eq. 1.). By focusing on the signal-to-noise ratio (S/N), the Taguchi method helps in identifying the settings that minimize variability due to noise factors (Tsao & Hocheng, 2004, 2014). The use of orthogonal arrays further streamlines the experimental process, reducing the number of trials needed to obtain reliable data (Bayraktar & Turgut, 2020, Sudhakara & Prasanthi, 2017). The optimizations were performed using the Minitab Software.

$$\eta = -10\ log10\ [\frac{1}{n}\Sigma_{i=1}^{n} y_i^2] \qquad 1$$

Results and Discussion

Taguchi's experimental design methods offer a streamlined approach to optimization in complex experiments. By utilizing an L9(3^2) orthogonal array, we can efficiently explore the effects of multiple factors on a process while minimizing the number of experiments needed. Table 2. Shows experimental results and S/N ratios.

Table 2. Experimental results and S/N ratios

Cutting Speed (m/min)	Feed Rate (mm/min)	D(in)	D(out)	SNRA1	SNRA2
62	0.1	1.218292798	1.217011825	-1.715033534	-1.705895963
62	0.18	1.205194002	1.339696975	-1.621139231	-2.540131533
62	0.24	1.178088128	1.225120833	-1.423555592	-1.763578498
422	0.1	1.15796778	1.166988748	-1.27392951	-1.341333375
422	0.18	1.251315246	1.281091282	-1.947334719	-2.151601514
422	0.24	1.258810912	1.217361928	-1.999209977	-1.708394308
945	0.1	1.142345001	1.115795939	-1.155945707	-0.95169553
945	0.18	1.203315905	1.370055722	-1.607593144	-2.734764619
945	0.24	1.187939678	1.210059509	-1.495887764	-1.656134573

The observation of burr formation or delamination is a crucial aspect of machining processes. The graphical representation as shown in Figure 4., with a feed rate of 0.24 and a cutting speed of 62, illustrates the challenges in maintaining material integrity (Mohan & Ramachandra, 2007). The side view showing elongated material with significant delamination emphasizes the need for careful control of machining parameters. Meanwhile, the entrance and exit views of the hole provide valuable insights into the effectiveness of the cutting operation, with minimal surface damage at the entrance and significant burr formation at the exit.

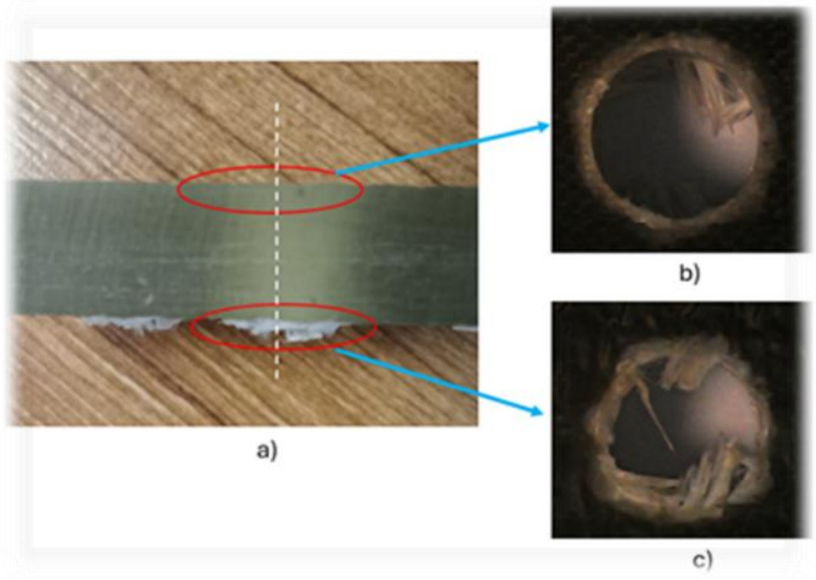


Figure 4. Delamination for a) side, b) inlet, c) outlet for 0.24 Feed Rate and 62 Cutting Speed

Figure 5. depicts main effect plots for the signal-to-noise (S/N) ratio concerning delamination, specifically at both the entrance (D(in)) and exit (D(out)) of the hole. These plots are used to analyze the influence of cutting speed and feed rate on the S/N ratio. D(in) plot indicates that as the cutting speed increases, the mean S/N ratio initially decreases sharply, then slightly increases at higher speeds. Conversely, an increase in feed rate consistently reduces the mean S/N ratio. D(out) plot shows that both increasing cutting speed and feed rate lead to a reduction in the mean S/N ratio. The results suggest that a high cutting speed combined with a low feed rate is optimal at the hole entrance to reduce D(in), while at the hole exit, the impact of cutting speed is less pronounced, yet a low feed rate remains beneficial for controlling D(out) (Khashaba, 2003).

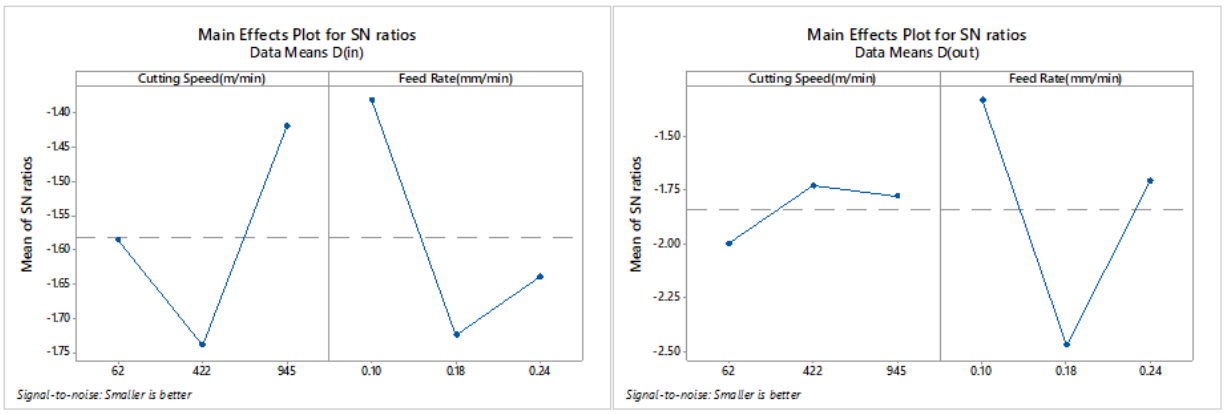


Figure 5. Delamination main effect plots for S/N ratio for the entrance D(in) and exit D(out) of the hole

The analysis of Figures 6 and 7, 3D surface plots, provides valuable insights into the machining process, particularly in understanding how delamination is influenced by varying cutting speeds and feed rates. It's clear from the first graph that optimal conditions for minimizing delamination involve a combination of high cutting speeds and low feed rates. This suggests that at higher speeds, the cutting tool can pass through the material with less resistance, thereby reducing the chances of delamination. Conversely, as the feed rate increases, even at high cutting speeds, there is a corresponding increase in delamination, indicating that the material removal rate is a critical factor in the quality of the cut. The second graph reinforces this observation, showing that delamination is not solely dependent on the cutting speed but is significantly affected by the feed rate across all levels of cutting speeds.

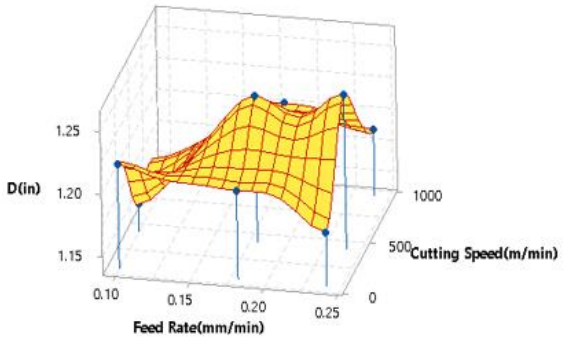


Figure 6. Surface Plot of D(in) vs Cutting Speed and Feed Rate

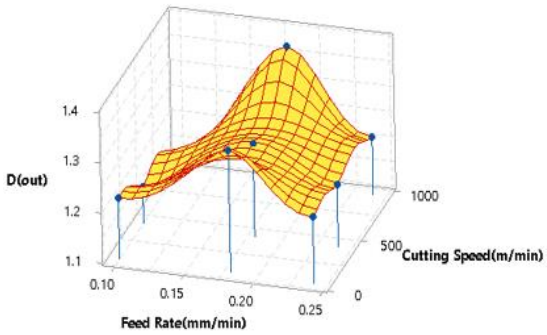


Figure 7. Surface Plot of D(out) vs Cutting Speed and Feed Rate

The Analysis of Variance (ANOVA) analysis for the response variable D(out) indicates that feed rate is a significant factor, accounting for a substantial 81.86% of the variability in D(out), with a P-value of 0.02, which is below the standard significance level of 0.05 (Table 3.) This suggests that adjustments in feed rate can lead to significant improvements in D(out). Conversely, cutting speed appears to have a minimal impact, contributing only 4.72% to the variability and possessing a P-value of 0.547, well above the significance threshold. Therefore, it is concluded that cutting speed does not significantly affect D(out). The remaining 13.41% of the variability is attributed to error, representing unexplained factors not included in the model.

Table 3. Analysis of Variance for D(out)

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Cutting Speed	2	0.002428	4.72%	0.002428	0.001214	0.7	0.547000
Feed Rate	2	0.042101	81.86%	0.042101	0.02105	12.21	0.02000
Error	4	0.006898	13.41%	0.006898	0.001724		
Total	8	0.051427	100.00%				

Regression analysis is a powerful statistical tool that allows to examine the relationship between variables as presented in Figure 8. In the case of D(out), the provided statistics indicate a strong model. Standard Error of the Estimate (S) of 0.0337857 is quite low, suggesting that the model's predictions are on average very close to the actual observed values. The Coefficient of Determination (R-Sq) value of 86.7% is particularly impressive, as it means that the majority of the variance in D(out) is captured by the model. The Adjusted R-Squared (R-Sq(adj)) value of 82.2% is also significant because it takes into account the number of predictors used, which helps to prevent overfitting the model to the data. These statistics suggest that the regression model fits the data well, with a high proportion of the variance in D(out) being explained by the model. The standard error indicates that the observed values are, on average, close to the predicted values from the model.

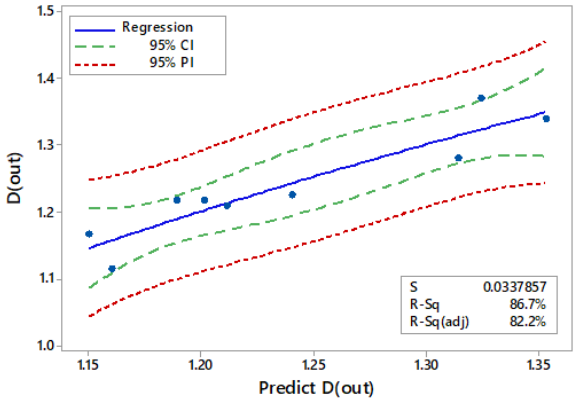


Figure 8. Regression Analysis for D(out)

Conclusion and Recommendations

The study of drilling parameters in GFRP materials is essential for industries that demand high precision and quality, such as aerospace and defence indusry. The results highlight the significance of feed rate, which is identified as the most influential parameter affecting delamination. A lower feed rate minimizes delamination at both the entry and exit points of the drill hole, which is crucial for maintaining the integrity of the material. Additionally, an increase

in cutting speed correlates with reduced delamination, suggesting that faster cutting speeds could be beneficial. However, a higher feed rate is associated with more deformation, indicating a trade-off between speed and accuracy. Damage types such as delamination, uncut fibers, and fragmentation are more prevalent at the hole exit, which suggests that the exit phase of drilling requires particular attention to prevent material degradation. Ultimately, the study underscores the importance of optimizing drilling parameters to enhance the quality and performance of GFRP components, which is vital for the efficiency and reliability of the production process in sensitive industries. Determining the most suitable parameters is not just a matter of quality, but also of ensuring the longevity and safety of the components produced.

Thanks and Information Note

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TÜRKİYE'DE SU KAYNAKLARI VE KULLANILABİLİRLİK DURUMU

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ÖZET
İnsan ihtiyaçlarını karşılayacak üretimi devam ettirebilmek için gerekli olan sonlu iş gücü ve doğal kaynaklar gibi sınırlı değişkenlerin verimli kullanımı iktisadın genel konusudur. Bu kaynaklar içinde doğal kaynakların sürdürülebilir kullanımı bugünün ve geleceğin iktisadi kavrayışının temelinde yer alır. Sonlu doğal kaynaklar içerisinde sektör ayrıt etmeksizin tüm üretim süreçlerinde değişmez bir girdi olarak yer aldığı için suyun önemi iktisadi açıdan da yaşamsaldır. Özellikle son yıllarda küresel ısınmayla gelen iklim değişikliğinin su kaynakları üzerindeki olumsuz etkisi ciddi anlamda arttığından suyun miktar ve kalite açısından kullanılabilirlik durumu büyük baskı altına girmiştir. Ayrıca su, her sektörde bir girdi olduğu için bütünleşik bir yapı ve bütünleşik bir sorun arz eder. Bu nedenle su kaynaklarının sürdürülebilir kullanımı üzerinde birçok bilim dalı araştırma yapmaktadır. Buna ek olarak kaynakların kullanımı üzerindeki yönetim yaklaşımı da değişip gelişmektedir. Türkiye su kaynakları bakımından kırılgan bir konumda olup kaynakların kullanılabilirliği üzerindeki iktisadi ve yönetişimsel çalışmalar devam etmektedir. Fakat Türkiye su kaynaklarının sürdürülebilir kullanımı açısından henüz istenen aşamaya ulaşamamıştır. Bu çalışmada Türkiye'nin su potansiyeline değinilerek bu potansiyelin kullanılabilir olan kısmı ele alınacaktır. Buna ek olarak Türkiye'nin kullanılabilir su varlığındaki değişimin sürdürülebilir olup olmadığına dair sayısal veriler üzerinden bir değerlendirilme yapılacaktır.
Anahtar Sözcükler: Döngüsel Ekonomi, Sürdürülebilirlik, Kullanılabilir Su Kaynakları, Su Yönetimi

WATER RESOURCES AND AVAILABILITY STATUS IN TURKEY

ABSTRACT
The general subject of economics is the efficient use of limited variables such as finite labor force and natural resources required to continue production to meet human needs. Among these resources, the sustainable use of natural resources is at the basis of today's and future's economic understanding. The importance of water is also vital from an economic perspective, as it is a constant input in all production processes, regardless of sector, among finite natural resources. Especially in recent years, the negative impact of climate change due to global warming on water resources has increased significantly, and the availability of water in terms of quantity and quality has come under great pressure. Moreover, since water is an input in every sector, it presents an integrated structure and an integrated problem. For this reason, many branches of science are conducting research on the sustainable use of water resources. In addition, the management approach on the use of resources is also changing and developing.Turkey is in a fragile position in terms of water resources and economic and governance studies on the availability of resources continue. However, Türkiye has not yet reached the desired stage in terms of sustainable use of water resources. In this study, Turkey's water potential will be touched upon and the usable part of this potential will be discussed. In addition, an evaluation will be made based on numerical data as to whether the change in Turkey's water availability is sustainable.
Keywords: Circular Economy, Sustainability, Available Water Resources, Water Management

GİRİŞ

Dünyada bilinen her yaşam türü için gerekli olan su, iktisadi faaliyetin devam edebilmesi için de gereklidir. Ekonomide sektör ayırt etmeksizin su bir girdi olarak kullanılmaktadır. Kullanılış amaçları ve kullanılan su türleri farklı olsa da suyun bir girdi olarak yer almadığı bir üretim süreci hemen hemen yok gibidir. Ekonominin bu ihtiyacı faaliyet gösteren birimlerin yapılarına göre farklılık gösterebilir. Bu nedenle ihtiyacın karşılanması için kullanılan kaynaklar da farklı olabilir. Fakat hangi kaynağa başvurulursa vurulsun mevcut olan suyun tamamı kullanılabilir değildir. Çevresel dengenin bozulmaması için doğada bulunan tüm su varlığının yalnızca belirli bir kısmı kullanılabilir durumdadır. Bu sınırlama fiziki ya da kalite bakımından iki farklı biçimde olabilir. Özellikle orta vadeli geçmişten günümüze kadar küresel ısınma nedeniyle süregelen iklim değişikliğinin sözü edilen sınırları daraltmaktadır. Su kaynakları artan nüfusun, bilinçsiz kullanımın ve iklim değişikliğinin yarattığı çoklu etkiyle daha ağır baskı altına girmektedir. Bu nedenle mevcut su varlığının kullanılabilir kısmı giderek azalmaktadır.Su varlığı ve diğer sonlu doğal kaynaklar üzerindeki giderek artan baskının azaltılması için ekonomi de dahil olmak üzere birçok disiplin sürdürülebilirlik kavramı üzerinde durmaktadır. Eğer gelecekte sürdürülebilir bir üretim yapısı tüm faaliyet kollarında yerleştirilemezse sonu doğal kaynakların doğal yaşamı ve insan faaliyetini destekleyemeyeceği açıktır. Bu noktada sürdürülebilirlik kavramının genel geçer bir tanımı olsa da her koşul için genel geçer bir sınırı yoktur. Farklı coğrafi yapılar ve teknolojilerdeki farklılaşmaya göre sürdürülebilirlik için yapılması gerekenler değişkenlik gösterebilir. Örneğin Almanya ve İran'ın su kaynakları rejimleri birbirinden faklıdır. Bu nedenle kayankatan yapılan çekimin sürdürülebilir bir ölçü içinde kalması için farklı oranda çekimler söz konusu olacaktır. Üretim teknolojilerindeki farklılık da sürdürülebilirlik sınırını değiştirebilir. Bu bağlamda, çalışmada ilk önce topyekûn varlığı ve bunun kullanılabilir kısmının ne olduğu ile ilgili ayrım ortaya konulacaktır. Ardından Türkiye'nin toplam su potansiyeli ve kullanılabilirlik oranına değinilecektir. Ardından Türkiye'nin kullanılabilir su varlığı verisi elde edilecektir. Daha sonra Falkenmark ve Shiklomanov endekslerinin tanımlanması yapılarak Türkiye'nin kullanılabilir su varlığının bu endeksler üzerinden yıllara göre nasıl bir değişim izlediği gösterilecektir. Elde edilen sonuçlar üzerinden Türkiye'nin kullanılabilir su kaynaklarının sürdürülebilir bir kullanım rejimine tabi olup olmadığı değerlendirilecektir.

ARAŞTIRMA VE BULGULAR

1. Su Varlığı ve Kullanılabilirlik Oranı

Dünyadaki su varlığının %96,5'i okyanuslar bünyesinde yer almaktayken %0,9'unu diğer tuzlu su kaynakları oluşturur. Dünya su varlığının ancak %2,5'i tatlı sulardan meydana gelmektedir. Bunun tatlı suları oluşturan bölümü ise %68,7 buzullar, %30,1'i yeraltı ve %1,2'si yüzey suları olmak üzere üç farklı kaynak türünde yer alır (USGS, 2019). Tuzlu sular tuzdan arındırma işlemi ile kentsel olarak kullanılabilir hale geitirlebilir ya da sanayi de doğrudan kaynaktan çekildiği haliyle soğutma suyu olarak kullanilabilir. Fakat tuzdan arındırma işlemi son derece yüksek maliyetli olup yüksek oranda tuz meydana çıkarır. Bu yöntem yalnızca küçük birimlerin tatlı su ihtiyacını gidermek için nadiren seçilir. Buna ek olarak yüksek bakım maliyetine neden olması nedeniyle soğutma suyu olarak kullanımı da maliyetlidir. Bu nedenle su kaynakları ve bunların kullanılabilirlik oranına değinilirken tatlı sular temel alınacaktır. Su kaynaklarının tamamı insan faaliyeti için kullanıma uygun değildir. Gerek yüzey suları gerek yeraltı suları olsun insan kullanımı için ancak belirli bir miktar su hacmi kaynaklardan çekilebilir. Kaynaklardan çekilebilecek su varlığına güvenli kullanım oranı ya da kullanılabilirlik oranı denir. Bu oran belirlenirken kaynaktan yapılacak çekimin su döngüsünü bozmayacak kadar suyun çekilmesi esasına dayanılır. Yani yüzey sularından yapılacak çekim sonrası buharlaşma ve yeraltına sızma sonrasında nihai kaynağa ulaşabilecek kadar su bırakılması anlamına gelir. Yeraltı sularında ise basınç dengesini bozmamak koşullardan biridir. Aksi durumda bozulan basınç dengesi nedeniyle toprakta göçükler ya da deniz suyu tecavüzü gerçekleşebilecek olumsuz sonuçlardır. Buna ek olarak her iki kaynak türü için de çekim yapılırken göz önünde bulundurulması gereken koşullardan biri de kaynağa bağlı yaşayan canlı türlerini olumsuz etkilememesidir. Azalan su varlığı ekosistem için yeterli olamayacak seviyeye inmemelidir.Kaynaktan yapılan su çekimi kaynaklar üzerindeki fiziksel baskıyı arttıracak türden bir eylemdir. Bunun yanı sıra kaynaklar kalite bakımından da baskı altına girebilir. Bu noktada kalite bakımından yoğun baskı altına girerek kirlenmiş bir su kaynağı da kullanılabilir olmaktan çıkmış olabilir. Örneğin "siyah sular" olarak sınıflandırılan insani tuvalet atığı içeren sular kalite bakımından aşırı kirlenmiş sayılır. Bu türdeki suların arıtılması bir noktaya kadar mümkün olduğu için kullanılabilirlik oranını ciddi biçimde düşürür. Siyah sular bugünün arıtma olanaklarıyla evsel kullanıma uygun hale getirilememektedir. Diğer türde kullanımlar içinse arıtma maliyetleri oldukça yüksektir.

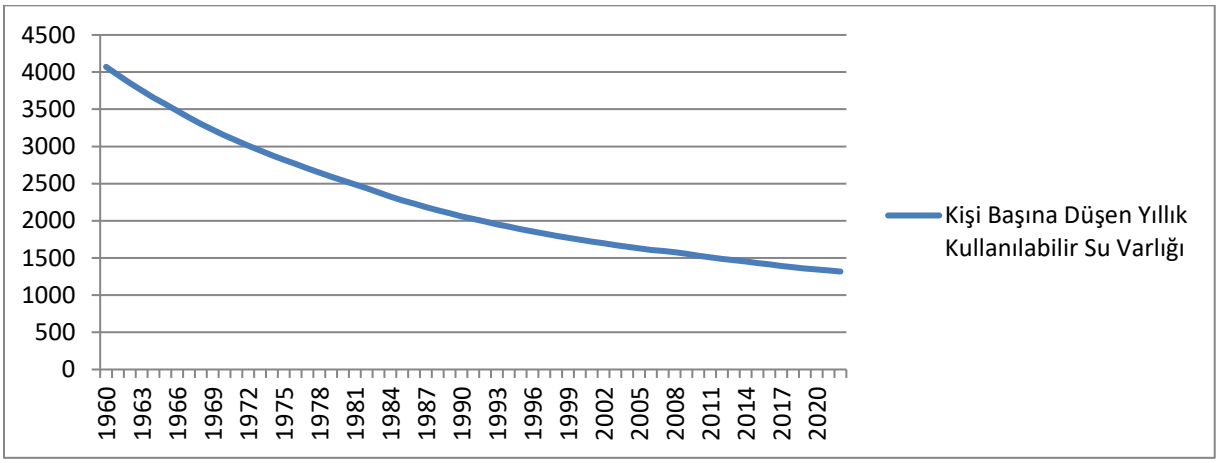
2. Türkiye'nin Su Varlığı ve Kullanılabilirlik Oranı

Türkiye'nin tatlı su kaynakları ele alınırken ilk önce brüt kaynak hesabı yapılacak olursa bunun yıllık yağışla gelen miktarı ortalama olarak 501 km^3'tür. Yüzey buharlaşması sonucu atmosfere karışan su miktarının yıllık ortalaması 274 km^3 olarak hesaplanmıştır. Bunun yıllık ortalama 41 km^3'ü yeraltı sularına karışır. Geriye kalan 186 km^3'lük su hacmi ise yüzey akışını oluşturur. Türkiye ayrıca sınır aşan sulardan gelen yaklaşık 7 km^3'lük brüt su varlığına sahiptir.

Tablo 1. Türkiye'nin Brüt ve Kullanılabilir Su Varlığı (Kalkınma Bakanlığı, 2018)

	Kaynak Türü	Hacim (km^3)
Brüt su varlığı	Yıllık Ortalama Toplam Yüzey Akışı	193
	-Yıllık ortalama yüzey akışı	186
	-Sınır aşan sulardan gelen	7
	Yeraltına Sızan Su	41
	Brüt Kayank Toplamı	234
Kullanılabilir su varlığı	Yıllık Kullanılabilir Yüzey Suyu Toplamı	98
	-Yüzey akışından gelen	95
	-Sınır aşan sulardan gelen	3
	Yıllık Kullanılabilir Yeraltı Su Hacmi	14
	Kullanılabilir Kayank Toplamı	**11**2

Yukarıda belirtildiği gibi brüt su potansiyelinin tamamı kullanılabilir durumda değildir. Buna göre Türkiye'nin sahip olduğu toplam yüzey akışının ancak 95 km^3'ü kullanılabilir durumdadır. Bu da yüzey akışının güvenli kullanım oranını %51 yapar. Sınır aşan suların ise 3 km^3'ü kullanılabilir durumdadır. Böylece yıllık toplam yüzey akışının kullanılabilir kısmı 98 km^3 olarak karşımıza çıkar. Bunun da güvenli kullanım oranı %50,7'dir. Yeraltı suları için 14 km^3 güvenli çekime uygun olup güvenli kullanım oranı ancak %34,1'dir. Bu tablo Türkiye'nin fiziksel olarak kullanılabilir su hacmini 112 km^3 olarak göstermektedir. Bu da güvenli kullanım hacminin yaklaşık %47,8 olduğunu gösterir (T.C. Kalkınma Bakanlığı, 2018).



Grafik 1 Türkiye'nin Kişi Başına Düşen Kullanılabilir Su Varlığının Yıllara Göre Değişimi (1960-2022) (Tablo 1'de yer alan veriler ve Dünya Bankası, (2022) nüfus verileri aracılığıyla üretilmiştir).Türkiye'nin kullanılabilir su varlığının yıllara göre değişimi Grafik 1'de gösterilmiştir. Buna göre 1960 yılında kişi başına düşen yıllık kullanılabilir su varlığı 4000 m^3'ün üzerindeyken bu hacim yıllar geçtikçe doğrusal bir biçimde düşerek 2022 yılına gelindiğinde yaklaşık 1300 m^3'e gerileşmiştir. Bu durumun Türkiye'nin sürekli artan nüfusunun kullanılabilir su kaynakları üzerinde ciddi baskı oluşturduğunu göstermektedir. Günümüzde Türkiye'nin kişi başına düşen yıllık kullanılabilir su varlığını iki güvenilir gösterge olan Shiklomanov ve Falkenmark göstergeleri ışığında değerlendirmek anlamlı olacaktır. Shiklomanov'a göre 1000-2000 m^3 bandında kişi başına düşen kullanılabilir su varlığı, su varlığını "çok az" olarak değerlendirmiştir (Bilen, 2008). Bu ifade yedi basamaktan oluşan göstergede "olağanüstü az"dan sonra gelen en kötü durumu betimlemek için kullanılmaktadır. Falkenmark göstergesine göre ise Türkiye'nin durumu 1700-1000 m^3 aralığına düşer. Bu da Falkenmark'a göre "su baskısının başlaması" aşaması (Abraha, v.d., 2022) olarak nitelendirilmiştir.

SONUÇ

Su kaynakları olarak Türkiye genel kanının aksine zengin bir varlığa sahip değildir. Yoğun olarak yüzey sularına bel bağlar ve yüzey suları kalite bakımından ne kadar baskı altında olduğuna dair esaslı bir veri derlemesinden yoksundur. Bu bağlamda suların kullanılabilirlik durumu üzerinde belirsizlik mevcuttur. Hacimsel su varlığında ise kullanılabilirlik durumu ölçülebilir durumdadır. Buna göre Türkiye'nin su hacminin kullanılabilir olan kısmı 112 km^3 olarak tespit edilmiştir. Fakat kullanılabilir su varlığı giderek artan nüfusla birlikte büyük baskı altına girmiştir. Mevcut kullanılabilir su hacmini geliştirilen en güvenilir göstergelerden sayılan Falkenmark ve Shiklomanov göstergeleri ışığında değerlendirdiğimizde ortaya ciddi bir tablo

çıkar. Buna göre 1300 m^3'e gerileyen Türkiye'nin kişi başına düşen kullanılabilir su varlığı su baskısı yaşayan bir ülke betimler. Mevcut hesaplamanın da Türkiye Cumhuriyeti'nin resmi nüfus kayıtları üzerinden yapıldığı hatırlanırsa bu hacmin aslında çok daha düşük bir değerde olacağını tahmin etmek güç değildir. Yoğun yasadışı göçe ve sığınmacı akınına maruz kalan Türkiye'nin hali hazırda içinde barındırdığı insan sayısı hakkında kesin verilere ulaşmak söz konusu olmadığından kesin bir çıkarım yapmak oldukça güçtür. Türkiye'nin artmakta olan doğal nüfus yapısı (TÜİK, 2013; ÇŞİDB, 2018; Dünya Bankası, 2018) ve çoğalan düzensiz nüfus yükü de hesaba katıldığında Türkiye'nin kullanılabilir su kaynakları bakımından gelecekte çok ciddi sıkıntı yaşayacağı neredeyse kesin gibidir. Buna ek olarak yıllık 112 km^3'lük kullanılabilir su varlığında küresel ısınma nedeniyle bir düşüş yaşanabileceği de unutulmamalıdır.

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KALLUS KÜLTÜRÜNÜNÜN MEYVE YETİŞTİRİCİLİĞİNDEKİ ÖNEMİ VE KULLANIM ALANLARI

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Özet
Son yıllarda biyoteknolojik çalışmalar kullanım alanı ve başarı durumu ilerleme göstermiştir. Oldukça sık kullanılan uygulamalardan biri de kallus kültürleridir. Kallus kültürlerinin birçok kullanım alanı bulunmaktadır. Elde edilen kallus dokusu farklı amaçlara hizmet edebilmektedir. Farklı bitki materyallerinden kontrollü in vitro koşullarda kallus elde edilmektedir. Kalluslar bitki türüne, hormon içeriğine ve kullanılan besin ortamlarına bağlı olarak sert, yumuşak dokulu; farklı renklerde ve özelliklerde olabilmektedir. Kallusun yapısı kullanım özelliklerini de etkilemektedir. Kallus kültürleri bitki rejenerasyonu ve somatik embriyogenesis çalışmalarında yer almaktadır. Günümüzde insan sağlığında çok önemli yer tutan sekonder bitki metabolitleri kallus kültürleri sayesinde daha hızlı ve kontrollü koşullarda elde edilebilmektedir. Bitki büyüme modellerinin oluşturulmasında önem arz etmektedir. Kallus kültürleri ıslah çalışmalarında da değerlidir. Abiyotik stres koşullarına dayanıklılık çalışmalarında kısa sürelerde sonuç alınması olanaklı kılmaktadır. Kallus topluluklarından hücre süspansiyon kültürleri oluşturularak, ıslah çalışmalarında gen aktarımı sağlanabilmektedir. Burada sunulan çalışmada kallus kültürlerinin kullanım alanlarına yönelik çalışmalardan örnekler sunulmuştur.
Anahtar Kelimeler: Kallus, hücre süspansiyon kültürü, büyümeyi düzenleyici, sekonder metabolit

THE IMPORTANCE OF CALLUS CULTURE IN FRUIT GROWING AND ITS AREAS OF USE

Abstract
In recent years, the field of use and success of biotechnological studies have progressed. One of the most frequently used applications is callus cultures. Callus cultures have many uses. The resulting callus tissue can serve different purposes. Callus is obtained from different plant materials under controlled in vitro conditions. Calli have hard or soft textures depending on the plant type, hormone content and nutrient media used; It can be in distinct colors and features. The structure of the callus also affects its usage properties. Callus cultures participate in plant regeneration and somatic embryogenesis studies. Nowadays, secondary plant metabolites, which are important for human health, they obtained faster and under controlled conditions thanks to callus cultures. It is important in creating plant growth models. Callus cultures are also valuable in breeding studies. It makes it possible to obtain results in a brief time in studies of resistance to abiotic stress conditions. By creating cell suspension cultures from callus communities, gene transfer can be achieved in breeding studies. In the study presented here, examples of studies on the usage areas of callus cultures are summarized.
Keywords: Callus, cell suspension culture, growth regulator, secondary metabolite

GİRİŞ

Günümüzde teknolojik gelişmelere paralel olarak bitki ıslahı ve yetiştiriciliği konularında da ilerlemeler kaydedilmiştir. Bitkilerde biyoteknolji uygulamaları her geçen gün daha geniş yer tutmaya başlamıştır. Kallus kültürleri in vitro uygulamalar içinde önemli bir üretim tekniğidir. Gen kaynaklarının çoğaltımı ve muhafazası, sekonder metabolitlerin üretimi, bitki ıslahı konularında geniş olanaklar sunmaktadır.

2. KALLUS KÜLTÜRLERİNİN UYGULAMA ALANLARINDAN ÖRNEKLER

2.1. Kallus Kültürlerinin Sekonder Metabolitlerin Üretiminde Kullanılması

Siraitia grosvenorii (Luo Han Guo) meyvesi mogrositler olarak bilinen sıfır kalorili doğal tatlandırıcı bileşikleri nedeniyle ticari olarak önemli bir meyvedir. Yürütülen bir çalışmada meyvelerin mezokarpından hücre kültürü oluşturularak, bu kültürlerden mogrosit üretimi için alternatif bir kaynak sağlanması amaçlanmıştır. Mezokarp kallusundan geliştirilmiş hücre biyokütlesi (FW; 184,58 g/L) ile geliştirilen hücre süspansiyonunda mogrosit V (1,76 mg/g DW) ve 11-okso-mogrosit V (0,68 mg/g DW) içeriği önemli miktarlarda ölçülmüştür. Sonuç olarak meyve mezokarpından elde edilen in vitro kültürün mogrosit üretimi için potansiyel bir kaynak olduğu gösterilmiştir (Partab et al. 2022).Diğer bir çalışmada Granny Smith elma çeşidinin meyvelerinden kallus elde edilmiş, kallus dokularından hücre süspansiyon kültürleri oluşturulmuştur. Hücre kültüründeki fenolik bileşiklerden anti-tirozinaz aktivitesini ölçerek cildin yaşlanmasına karşı etkisinin değerlendirilmesine çalışılmıştır. Hücre kültürü ekstraktlarında klorojenik asit, kafeik asit, kateşin ve kuersetinin HPLC bazlı miktar tayini yapılmıştır. Sonuç, metanolik ekstraktın 1,42 µg/mg klorojenik asit, 0,46 µg/mg kateşin, 0,12 µg/mg kafeik asit ve 0,95 µg/mg kuersetin içerdiği belirlenmiştir. Hücre kültürü ekstraktının anti-tirozinaz aktivitesi ölçülmüş ve en yüksek inhibitör aktivite 100 mg/mL ekstrakt (%55) ile ilişkilendirilmiştir (Menbari et al. 2021). Tropikal bir meyve olan Guavanın aroması birçok meyve ürününde kullanılmaktadır. Laboratuvar çalışmaları meyvedeki aromanın ikincil bir metabolit olarak in vitro doku kültürü yoluyla ekspresyonunun mümkün olduğunu göstermiştir. Guavanın kallus kültürü için bir protokol oluşturulmuş, farklı olgunluktaki meyveleri kullanılmıştır. Klimakterik döneme ulaşmadan önce alınan meyve dokularından elde edilen kallus kültürlerinde aromanın maksimum değere ulaştığı belirlenmiştir (Madhavi et al. 1992). Karaerik üzüm çeşidinin kallus kültürlerinde ultraviyole ışınlarının antosiyanin üretimine etkileri araştırılmıştır. In vitro bitkilerin yapraklarından kallus kültürleri üretilmiş, ikinci alt kültürden sonra steril kabindeki petri kaplarının kapakları açılarak 12 ve 15 günlük kallus dokuları kaynaktan 10 cm uzaklıkta 10 ve 15 dakika boyunca 254 nm UV-C ışığa maruz

bırakılmıştır. Uygulama sonrasında kallus dokuları karanlık ortamda inkübe edilmiştir. Dokularda antosiyanin üretiminin uyarılmasında UV radyasyonunun etkili olduğu belirlenmiştir. En yüksek antosiyanin (196,74 µmol g-1 FW) 10 dakika UV radyasyona maruz bırakılan 72 saatlik inkübasyonda yetiştirilen 12 günlük kalluslardan elde edilmiştir (Oğuz et al. 2020).

2.2. Kallus Kültürlerinin Bitkilerdeki Yaşamsal Olayların İncelenmesindeki Kullanımı

Çilek meyvesinin olgunlaşması sırasında renk gelişimi ve hücre duvarı yapısının gelişimini incelemek için meyve kallus kültürleri model sistem olarak kullanılmıştır. Olgunlaşmamış-yeşil, beyaz ve olgun-kırmızı çilek meyvelerinin yaprak ve kortikal dokularından elde edilen kalluslarda yüksek miktarda pektin tespit edilmiştir. Pektin miktarı meyvelerin yeşil renk aşamasından beyaz aşamasına geçişinde artmış, kırmızı meyvelerde ise parçalanmıştır. Kallus kültürlerinden alınan hücre duvarı fraksiyonları ekstensin bakımından zengin bulunmuş, ancak az miktarda pektin içerdiği ortaya konmuştur. Genel olarak elde edilen sonuçlar, meyve hücre hatlarının çilekte renk gelişiminin hormonal düzenlemesini analiz etmek için kullanılabileceğini ancak meyve yumuşamasıyla ilişkili hücre duvarı yeniden yapılanma sürecinin kallus kültürlerinde yüksek ekstensin varlığı nedeniyle maskelenebileceğini göstermiştir (Ric-Varas et al. 2020).Kırmızı renkli armutlar, bol miktardaki besinsel faydaları ve görsel olarak çarpıcı kırmızı renk tonu nedeniyle beğenilmekte ve önemli bir pazar talebi bulunmaktadır. Kallus içindeki antosiyaninler de dahil olmak üzere ikincil metabolitlerdeki değişiklikleri araştırmak için farklı şeker, MS konsantrasyonları, ışık nitelikleri ve sıcaklıklara maruz bırakılan meyve etinden kallus üretimi üzerine çalışılmıştır. Sükrozun daha fazla antosiyanini indükleyebildiği ve bununla ilgili metabolitlerin ve genlerin de sükroz ve MS konsantrasyonlarının artışına paralel olarak artığı bulunmuştur. Kırmızı-mavi ışık ve 15 °C sıcaklık koşulları altında, daha fazla antosiyanin ve ikincil metabolit üretiminin tetiklenebileceği, ayrıca antosiyaninle ilgili genlerin ekspresyonunu, fizyolojik aktivitesini artırarak düzenleyebileceği ortaya konmuştur. Çalışma ile kırmızı armutlarda antosiyanin birikimine katkı yapan faktörlerin açıklanması ve böylece renk değişiminin altında yatan mekanizmaların anlaşılması için teorik bir temel sağlanmıştır (Yao et al. 2023).

2.3. Kallus Kültürlerinin Gen Kaynaklarının Muhafazasındaki Önemi

Kallus kültürleri genetik kaynakların muhafazası, ıslah çalışmalarında yer alması bakımından da avantajlar sunmaktadır. *Malus sieversii* (Ledeb.) Roem., Orta Asya Tianshan Dağları'ndaki yabani elma ormanlarının yaklaşık %78'ini oluşturan bir genetik kaynaktır. Somatik embriyogenesis için in vitro sürgünlerin yaprak ve gövde kısımları başlangıç materyali olarak

kullanılmış, kültürlerde kompakt yapıda kallus oluşmuştur. Hormon olarak TDZ, NAA, BA kullanılmış, kallus rengi hormon içeriğine göre değişmiştir. Sarımsı renkte embriyojenik kalluslar oluşmuş, ancak somatik embriyo indüksiyonu gerçekleşmemiştir (Zhang ve diğ., 2020). Turunçgil tohumlarının meyve etinden ayrıldıktan sonra özel koşullarda saklanması gereklidir. Embriyojenik kalluslar ve kalluslardan elde edilen somatik embriyolar turunçgil genetik kaynaklarının *in vitro* koşullarda saklanmasına olanaklar sunmaktadır (Ling ve Iwamasa, 1997).

2.4. Kallus Kültürlerinden Islah Çalışmalarında ve Bitkisel Üretim Materyali Olarak Somatik Embriyogenesis Oluşturulması

Kallus kültürlerinden somatik embriyogenesis gerek bitkisel materyalin çoğaltılması gerekse ıslah çalışmalarında değer taşımaktadır. Kuş kirazında olgun zigotik embriyolarının kotiledonlarından geliştirilen adventif köklerden alınan protoplastlarla oluşturulan hücre süspansiyon kültürlerinde embriyojenik kalluslardan somatik embriyolar gelişmiştir (David ve diğ. 1992). Çin kestanesinde (*Castanea mollissima* Blume) yürütülen bir çalışmada somatik embriyogenesisin mekanizmasının tanımlanması ve somatik embriyogenesis ile ilgili genlerin ekspresyonu üzerinde çalışılmıştır (Lu ve diğ., 2017).Ceviz gençlik kısırlığı uzun bir meyve türüdür ve ıslah çalışmaları zaman alıcıdır. *J. nigra* ve *J. Regia* melezleri genellikle anormal gelişim göstermekte, melez bitkilerde canlılık oranı düşmektedir. İki türün melezlerinin olgunlaşmamış embriyolarının kotiledonlarından somatik embriyolar çoğaltılmış, bunlardan sağlıklı bitkiler elde edilerek, melezleme çalışmalarından çeşit adaylarının elde edilmesi sağlanmıştır. Bu sayede gerek materyal canlılığı korunmuş gerekse zamandan kazanılmıştır (Cornu, 1988). Diğer bir çalışmada da olgunlaşmamış embriyoların kotiledonlarından üretilen primer somatik embriyolardan sekonder embriyolar oluşturularak gen transferi çalışmalarında başarı şansı artırılmıştır (Bosela ve diğ, 2004) Somatik embriyoların elde edilmesinde önemli bir araç olan kallus kültürleri gelecekte küçük alanda çok sayıda bitki materyalinin üretimine olanak sağlayabilmesi bakımından teknik geliştirilmelidir.Golden Delicious (*Malus X domestica* Borkh)'ın olgunlaşmamış zigotik embriyolarının kotiledonlarından somatik embriyogenez yoluyla rejenerasyon sağlanmıştır. Çalışmada kallus indüksiyonu 3.7 mg/L nikotinik asit+ 1.7 mg/L tiamin klorhidrat + 10 mg/L adenin+ 20 mg/L glutamin + 20 mg/L glisin+ 6 mg/L NAA ilave edilen MS ortamında sağlanmıştır. Embriyoların gelişme aşamasında MS + 3.7 mg/L nikotinik asit + 1.7 mg/L tiamin klorhidrat + 0.5 mg/L BAP+0.05 mg/L NAA ortamı kullanılmıştır. Emriyolar hormonsuz 1/2 MS ortamında bitkiye dönüşmüştür (Paul ve diğ., 1994)Çilekte somatik embriyogenesis ile elde edilen bitkilerin üretimde kullanılma

potansiyeli önemlidir. Yapılan bir çalışmada 1.0 mg/l 2,4-D+ 0.5 mg/l BAP+Prolin eklenen MS ortamında somatik embriyolar başarı ile üretilmiş ve bitki rejenerasyonu sağlanarak, %90-95'e varan oranlarda başarı ile sera ve dış ortam koşullarına transfer edilmiştir (Biswas 2007).

Liçinin yaşlı ağaçlarından yeniden üretimde sorunlar yaşanmaktadır. Bu tür bitkilerden yeni üretim materyalinin oluşturulması için somatik embriyogenesis önemli bir avantaj sağlamaktadır. Bitkide embriyojenik kültürler yaprak eksplantlarından oluşturulmuştur. Kallus indüksiyonu ve embriyojenik kallusların oluşturulmasından sonra, süspansiyon kültüründe somatik embriyolar geliştirilmiştir. Beyaz-opak somatik embriyolar bitki rejenerasyonu için alınmıştır (Raharjo ve Litz, 2007).Turunçgillerde embriyojenik kalluslar ve kalluslardan elde edilen somatik embriyolar ıslah çalışmalarında, somatik hibridizasyon, genetik transformasyon, protoplast füzyonu ve uzun süreli muhafaza gibi pek çok çalışmada kullanılarak yeni çeşitlerin geliştirilmesinde katkı sağlamaktadır. Bu sayede *Citrus* ve *Citrus* akrabaları arasında somatik hibridizasyon gelişme göstermektedir (Ling ve Iwamasa, 1997). Calixto ve ark (2004) *Citrus sinensis* (L.) Osbeck ve *Citrus grandis* (L.) Osbeck (Hamlin+Indian Red ve hamlin+Singapura) arasında somatik hibridizasyon ile Tristeza virüsü ve P*hytophthora* hastalığına toleranslı anaçlar elde etmişlerdir. Turunçgillerdeki diğer bir çalışmada Avenido ve diğ. (2005) Şadok'ta somatik embriyoları olgunlaşmamış tohumların albedo dokularından 1mg/l BAP + 1mg/l 2,4-D ilave edilen MS ve BP ortamlarında elde etmişlerdir. Somatik embriyolar aracılığı ile çoğaltmanın virüsten ari fidan üretimi için kullanılabileceği belirtilmiştir. Guavada kalluslardan geliştirilen somatik embriyolarla çekirdeksizlik, artan raf ömrü ve solgunluk hastalığına yönelik genetiği değiştirilmiş guava oluşturulması konusundaki çalışmalarda ilerleme sağlanmıştır (Bajpai ve diğ. 2016)Meyve türlerinde somatik embriyolar sentetik tohum üretimi için kullanılmaktadır. Kapsüllenmiş somatik embriyolar, bitki germplazmının çoğaltılması, depolanması ve değişimi için geleneksel materyallere göre avantajlar sağlamaktadır. Kapsüllenmiş hurma somatik embriyolarının 5°C'de uzun süre saklanması mümkündür ve uluslararası materyal değişimi için umut verici olarak belirtilmiştir (Bekheet, 2017).

3. SONUÇ

Kallus kültürleri tek başına veya somatik embriyo aşaması ile birlikte bitkisel materyallerin ıslahı, muhafazası alanında önemini artırmaktadır. Diyet programlarında daha sık yer almaya başlayan sekonder metabolitlerin üretiminde önemli bir kaynaktır. Somatik embriyogenesis veya doğrudan organogenesis aracılığı ile bitkisel materyalin çeşitlenmesinde, yenilenmesinde kullanımı her geçen gün artmaktadır. Kallus kültürlerinin gelecekte küçük alanda çok sayıda

bitki materyalinin üretimine olanak sağlayabilmesi bakımından teknik olarak geliştirilmeye açık olduğu görülmektedir.

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EFFECT OF *FAAH rs324420* POLYMORPHISM ON THE RISC OF OPIOID USE DISORDER

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ABSTRACT
Opioid use disorder (OUD) is a complex and neurobehavioral disorder. Environmental factors as well as genetic predisposition have an effect on the development of OUD. Addictive substances can cause substance use disorder by affecting neurotransmitters in the brain's reward system. Some studies have shown that the endocannabinoid system is one of the main neural signaling pathways in OUD. Termination of anandamide (arachidonoylethanolamide) signaling in the central nervous system and peripheral tissues is mediated by fatty acid amide hydrolase *(FAAH)*. The fatty acid amide hydrolase *(FAAH)* gene, which is involved in endocannabinoid signaling, indirectly controls the effects of the dopamine receptor and dopamine release. The aim of the current study was to analyze whether the *FAAH rs324420* polymorphism is associated with OUD. For this purpose, 75 individuals with OUD according to DMS-5 criteria in AMATEM Clinic of Training and Research Hospital and 75 healthy individuals without past or current opioid use were included in this study. PCR-RFLP method was used for to genotype *FAAH rs324420* polymorphism. The allele frequencies of the *FAAH rs324420* were found 79% for wild type (C) and 21% for variant (A) in individuals with OUD. On the other hand, wild type and variant allele frequencies were 82% and 18% in healthy controls, respectively. The genotype frequencies were in accordance with Hardy Weinberg Equilibrium (HWE) ($p>0.05$). No significant association was found between *FAAH rs324420* and the susceptibility to OUD ($p>0.05$). This study indicated that *FAAH rs324420* didn't have an effect on the development of OUD in Turkish population.
Keywords: opioid use disorder, fatty acid amide hydrolase *(FAAH)*, polymorphism, PCR-RFLP.

INTRODUCTION

Substance use disorder (SUD), which is considered as a threat affecting individuals and society (Özbay et al., 2018), occurs in two ways: physical and psychological. Physical addiction is the state in which the body gets used to a new substance, and when the substance is not taken, the person experiences withdrawal symptoms and tolerance to the substance develops. The desire to continue using substances is defined as psychological addiction (Karakuş et al. 2021). Examples of substances that cause addiction in the individual are alcohol, heroin, amphetamines, marijuana, cocaine and barbuturates. Some of the addictive substances have narcotic properties and some have stimulant properties (Kılıç, 2016). Heroin, a semi-synthetic narcotic that creates a strong addiction in the individual. Heroin tolerance develops very quickly (Işık, 2013) and it shows its euphoric effect by binding to μ opioid receptors (MOR) in the brain (Liu et al., 2021, Sun et al., 2021). Opioid use disorder (OUD) is defined as a complex neurobehavioral disorder. Although environmental factors affect the development of OUD in an individual, the effect of genetic factors is approximately 40-60% (Sun et al., 2019). Neurotransmitters of the central nervous system take part in the emergence of addiction. Dopamine, in particular, has an undeniable effect on addiction (Akgür, 2021). Anadamide (arachidonoylethanolamide) is hydrolyzed by fatty acid amide hydrolase (FAAH). Therefore, FAAH provides termination of anandamide signaling in the central nervous system and peripheral tissues. Anandamide acts as a feedback mechanism controlling dopamine receptor activation and increased dopamine release (Chiang et al., 2004; Vinklerová et al., 2002; Deutsch et al., 2002). Any change in the *FAAH* gene can lead to mRNA instability, a change in transcription, or a decrease in the activity of the encoded protein (López-Moreno et al., 2012). It has been mentioned that *FAAH* plays a part in several biological processes such as the reward system and mood and emotional response of the individual (Zhang et al., 2020), pain perception, and appetite regulation. *rs324420* polymorphism is a variantion in the exon 3 of *FAAH* gene (Deutsch and Chin, 1993). This polymorphism changes proline (Pro/C-allele) to treonin (Thr/A-allele) in the Fatty Acid Amide Hydrolase (FAAH) protein (Sipe et al. 2012). Genetic polymorphisms of *FAAH* have been shown in various studies to be linked with some conditions such as substance/alcohol use disorders, obesity and eating disorders. Therefore, *FAAH* is considered as a new candidate gene for the treatment of various metabolic disorders, diseases, and SUD (Santoso and De Ridder, 2023).

STUDY FİELD: Forensic Biology

METHOD

Case Selection

75 individuals diagnosed with OUD who applied for the treatment at Ankara Training and Research Hospital-Alcohol and Substance Addiction Treatment and Training Center (AMATEM) and 75 healthy individuals were included in this study. The inclusion criteria are as follows: i) Being between the ages of 18-65, ii) Being diagnosed as OUD according to DSM-5 criteria, iii) smokers. The exclusion criteria are as follows: i) Individuals who use alcohol, ii) Not having mental retardation or mental disability, iii) Individuals with major cognitive and psychotic disorders, iv) Individuals with neurological diseases involving the central nervous system.Additionally, a form containing information about the individuals such as people's height and weight, their age, education level, occupation, marital status and sex was filled out. This study was approved by the institutional ethics committee (decision no. İ03-109-22 dated March 10, 2022).

Collection of blood samples, DNA isolation and PCR-RFLP method

Venous blood samples were taken from all individuals participating in the study in EDTA tubes. For genomic DNA isolation, the method specified by the manufacturer was applied by using QIAamp DNA Blood Mini Kit (Qiagen). The region with the single nucleotide polymorphism was amplified by the Polymerase chain reaction (PCR) method, using forward (5′TGTTGCTGGTTACCCCTCTC3′) and reverse (5′CCCAAAATGACCCAAGATGC3′) primers (Anvar et al., 2023). The PCR program used in the study is as follows: initial denaturation 1 cycle at 94ºC for 5 minutes, denaturation 35 cycles at 94ºC for 30 seconds, binding 35 cycles at 60ºC for 30 seconds, elongation 35 cycles at 72ºC for 30 seconds and final extension 1 cycle at 72ºC for 10 minutes. And PCR mixture (25 µl) was prepared as 10x buffer 2,5 µl; 1 pmol/µl forward and 1 pmol/µl reverse primers, 0,125 U/µl taq DNA polymerase, 0.4 µM dNTP, 1.25 mM $MgCl_2$. PCR products were treated with EtBr for being visible under UV light and were run on 1% agarose gel electrophoresis. PCR products were photographed with the “Syngene Gel Imaging System” (Figure 1).

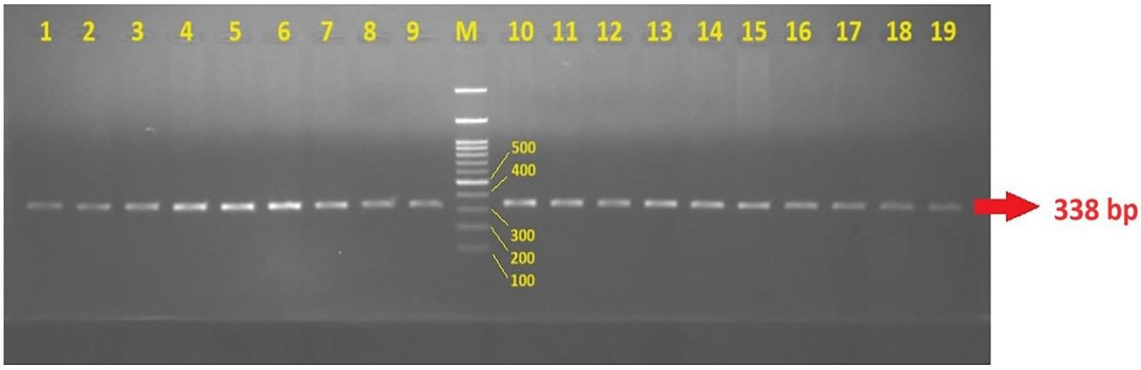


Figure 1: Agarose gel electrophoresis image of the 338 bp PCR product of the *FAAH* gene region (M: 10 bp ladder; 1-19: 338 bp PCR products).

Restriction Fragment Length Polymorphism (RFLP) technique using the *Sty1* restriction enzyme (Anvar et al., 2023) was applied to cut the amplified products. Oligonucleotides cut with restriction enzyme were run on 2% agarose gel electrophoresis. The cutting areas were photographed with the "Syngene Gel Imaging System" (Figure 2).

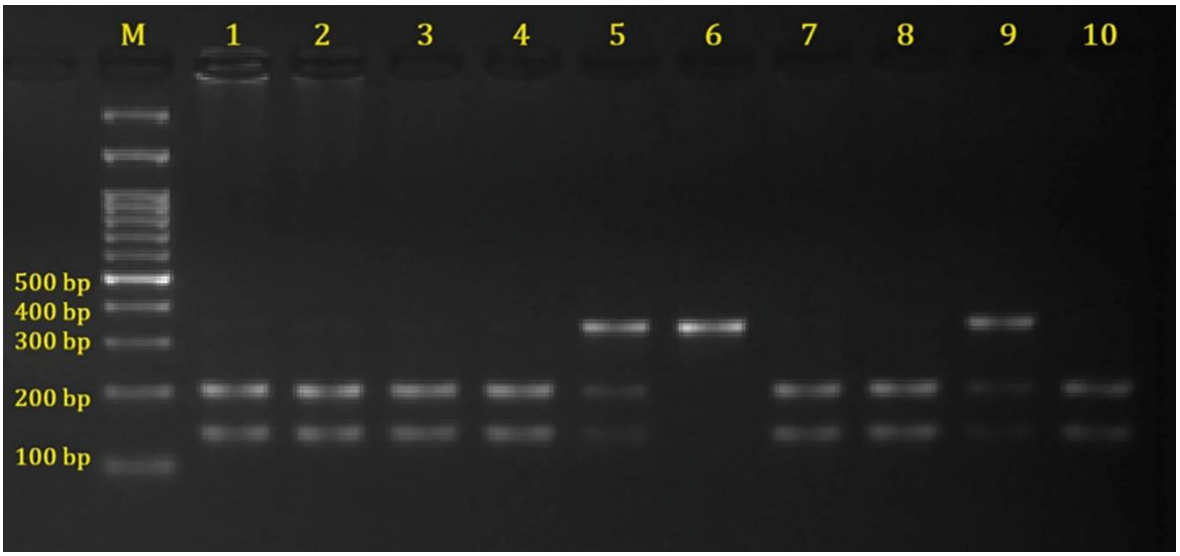


Figure 2: Agarose gel electrophoresis image of PCR products of *rs324420* polymorphism in *FAAH* gene (M: 10bp Ladder; Lanes 1-4,7,8,10: CC 200bp and 138bp; Lanes 5,9: CA 338bp, 200bp and 138bp; Lane 6: AA 338bp.)

Statistical analysis

Study results were analyzed statistically. Statistical Package for Social Sciences (SPSS, V.25, Chicago, USA) was used for statistical analyzes in this study. The priority in the analysis was to analyze whether the data were normally distributed using the Kolmogorov-Smirnov test. For quantitative variables with a statistically non-normally distributed, median (x̃) and Interquartile

Range (IQR) values are given. The $\chi 2$ (chi-square) test used to determine relationships or differences between groups in categorical variables. Hardy-Weinberg equilibrium was calculated according to the genotype and allele frequencies of the genes. When matched groups are compared with the non-parametric Mann-Whitney U test. p value of <0.05 was considered statistically significant.

RESULTS

As a result of the analysis made according to the socio-demographic characteristics of 75 individuals with OUD and 75 healthy individuals, the median age of individuals with OUD was 30 years, the median age of healthy individuals was 36 years. It was determined that the average height of individuals with OUD was 174.5 cm and the average height of healthy individuals was 177.0 cm.The average weight of individuals with OUD and healthy individuals was 70 kg and 83 kg, respectively (Table 1).

Table 1. Sociodemographic characteristics of individuals with OUD and healthy individuals.

Parameters	**Individuals with OUD (n=75)**		**Healthy Controls (n=75)**		**p-value**
Age (years)	30.0		36.0		0.004
x̃ (IQR)	(26.0-35.0)		(27.0-42.0)		
Weight (kg) mean	70.0		83.0		0.001
(min.-max.)	(62.0-76.0)		(76.0-93.0)		
Height (cm)	174.5		177.0		0.004
x̃ (IQR)	(170.0-178.0)		(173.00-180.0)		
Education	n	% frequency	n	% frequency	
Primary	17	22.7	9	12.0	
Secondary	33	44.0	15	20.0	
High School	20	26.7	38	50.7	0.01
Under-graduate	5	6.7	12	16.0	
Graduate	-	-	1	1.3	
Occupation	n	% frequency	n	% frequency	
Working	23	69.3	68	90.7	0.01
Not working	52	30.7	7	9.3	
Marital status	n	% frequency	n	% frequency	
Single	52	69.3	27	36.0	0.001
Married	16	21.3	47	62.7	
Widow/Divorced	7	9.3	1	1.3	
Sex	n	% frequency	n	% frequency	
Male	64	85.3	74	98.7	0.003
Female	11	14.7	1	1.3	

X̃:median, n: sample size, IQR: Interquartile range.

When the age, weight and height of individuals with opioid use disorder and healthy individuals were compared, a significant difference was obtained (p=0.004; p=0.001; p=0.004, respectively). Additionally, significant differences were observed between the two groups in respect to education, employment status, marital status and sex (p=0.01, p=0.01, p=0.001 and p=0.003, respectively).It is found that the most of individuals with opioid use disorder were graduated from middle and high schools (44%, 26.7% respectively) whereas the most of healthy

individuals were graduated from high schools and universities (50.7%, 16% respectively). Regarding employment status, 69.3% of individuals with OUD were working and 30.7% were not working, while 90.7% of healthy individuals were working and 9.3% were not working. Regarding marital status, 69.3% of individuals with OUD were single, 21.3% were married and 9.3% were widow/divorced, while 36% of healthy individuals were single, 62.7% were married and 1.3% were widow/divorced.

Table 2 shows the allele frequencies of *FAAH rs324420* polymorphism in individuals with OUD and healthy individuals. The allele frequencies of *FAAH rs324420* polymorphism in individuals with OUD were found 79% for wild type (C) and 21% for variant (A). On the other hand, wild type and variant allele frequencies were 82% and 18% in healthy controls, respectively. Both Individuals with OUD and healthy individuals were found to be in Hardy-Weinberg equilibrium ($p>0.05$). No significant results and association were found between *FAAH rs324420* and the susceptibility to OUD ($p>0.05$).

Table 2. Genotypes and frequencies of opioid users and healthy individuals.

***FAAH rs324420* genotypes**	**Individuals with OUD (n=75)**		**Healthy Controls (n=75)**	
	n	**%** frequency (95% CI)	**n**	**%** frequency (95% CI)
CC	48	64.0	49	65.3
CA	23	30.7	25	33.3
AA	4	5.3	1	1.3 NA*
Variant allele freq.	21%		18%	
HWE	$\chi2=0.314$; $p=0.57$		$\chi2=1.25$; $p=0.26$	

HWE: Hardy-Weinberg Equilibrium, n: sample size, CI: Confidence Interval.

*NA: Non-available due to sample size ≤5.

DISCUSSION

Studies conducted on cell lines have shown that the variant allele of *FAAH* rs324420 causes an increase in anandamide levels in the brain by changing the stability of proteins (Chiang et al., 2004; Dincheva et al., 2015). It has been reported that *FAAH* gene polymorphisms cause physical addiction in the individual by changing the reward pathways in the brain and changing the levels of the stimulatory effects of central nervous system signaling lipids (Sipe et al., 2002; Zhang et al., 2020). It has been supported by various studies that the *FAAH* rs324420

polymorphism causes addiction to substances such as alcohol, marijuana, cocaine, heroin, and nicotine (Chiang et al., 2004; Sipe et al., 2002; López-Moreno et al., 2012).In a research conducted in Caucasian populations, it was stated that the possibilty of heroin, marijuana, alcohol and methamphetamine addiction increased among substance addicts carrying the *FAAH rs324420* A allele (Filbey, 2010). In another study conducted with a Caucasian population, it was reported that participants carrying the A allele of the polymorphism exhibited increased ventral striatal activity and impulsivity in the reward-related region of the brain compared to carrying the homozygous C allele (Hariri et al., 2009). Proudnikov et al. (2010) reported that the *rs324420* polymorphism in the *FAAH* gene was not related with OUD in African-Americans, Caucasians and Hispanics (Proudnikov et al., 2010) . Our study findings supported this study. As regards to the results of our study, no relationship was found between OUD and *FAAH rs324420* polymorphism in Turkish individuals.Research conducted by Evren et al., it was stated that 88.6% of heroin users were men (Evren et al. 2002). In our study, it was also seen that 85.3% of individuals with OUD were male. Studies show that the education levels of substance addicts are low, generally below 9 years (Bulut et al., 2006; Nebioğlu et al., 2013). The findigs of our study are also compatible with these previous studies.In conclusion, this study indicated that *FAAH rs324420* didn't have an effect on the development of OUD in a Turkish population.

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AUTHOR CONTRIBUTORS

Özlem ARAT developed the study theme, carried out the genetic analyzes and prepared the article.

Dilek KAYA AKYÜZLÜ developed the theme of the study, dealt with the statistical analysis of the study and contributed to the writing of the article.

Mustafa DANIŞMAN collected venous blood samples of the individuals participating in the study and filled out the demographic data forms.

Selin ÖZKAN KOTİLOĞLU was involved in the conduct of genetic analyses.

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CEVİZ VE YER FISTIĞI BİYOKÜTLELERİNDEN KARBON BAZLI MALZEME ÜRETİMİ

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Özet
Biyokütle bazlı karbon malzemelerinin araştırılması ve geliştirilmesi, çevresel sürdürülebilirlik ve yenilenebilir enerji kaynaklarının keşfi açısından son derece önemlidir. Özellikle atık biyokütle kaynaklarının, ceviz kabuğu ve yer fıstığı kabuğu gibi doğal kaynaklardan karbon bazlı malzemelerin üretimi için potansiyeli oldukça büyüktür. Ceviz kabuğu ve yer fıstığı kabuğu gibi bitkisel atıklar, genellikle değerlendirilmeden önce çevresel sorunlara yol açabilirler. Ancak bu atık kaynakları, uygun işlemlerle karbon bazlı malzemelere dönüştürülerek çeşitli endüstriyel uygulamalarda ve çevresel iyileştirme projelerinde kullanılabilir. Karbon bazlı malzemeler, yüksek yüzey alanına sahip olmaları, mükemmel adsorpsiyon özellikleri ve termal iletkenlik gibi özelliklerinden dolayı birçok alanda potansiyel sunarlar. Bu çalışmada, ceviz kabuğu ve yer fıstığı kabuğu gibi sıkça atık olarak ortaya çıkan biyokütle kaynaklarından karbon bazlı malzemelerin üretim potansiyeli araştırılmıştır. Öncelikle kuru ceviz ve yer fıstığı kabuğu biyokütleri toplanıp, parçalanarak öğütme işlemi ardından 75 µm altı boyutlarında elendi. Boyutu küçültülüp elenen biyokütleler kül fırınında belirlenen sıcaklık ve sürede demir içerikli katalizör varlığında karbonisazyon işlemine tabi tutuldu. Karbonize edilen örnekler soğutularak toplandı. Karbonizasyon işlemi sonunda elde edilen karbon bazlı malzemelerin karakterizasyonu X-ray difraksiyonu (XRD), Fourier dönüşümlü kızılötesi spektrofotometresi (FTIR) ve Raman analizleri ile gerçekleştirildi. XRD, FTIR ve Raman analizlerinin sonuçları, lignoselülozik biyokütlenin karbonlaşma sürecinin başarıyla gerçekleştiğini ortaya koymaktadır. Bu analizler, hammaddenin yapısal değişimlerini ve karbonizasyonun ilerleyişini ayrıntılı bir şekilde göstermektedir. Bu araştırma, ceviz kabuğu ve yer fıstığı kabuğu gibi atık biyokütle kaynaklarının yeniden değerlendirilerek karbon bazlı malzemelerin üretimindeki potansiyelini ortaya koymaktadır. Bu malzemelerin üretim süreci, çevresel olarak sürdürülebilir ve ekonomik açıdan etkin bir yaklaşımı temsil ederken, aynı

zamanda çeşitli endüstriyel ihtiyaçlara da yanıt verebilmektedir. Dolayısıyla, biyokütle bazlı karbon malzemelerinin araştırılması ve geliştirilmesi, gelecekteki yeşil ve sürdürülebilir teknolojilerin geliştirilmesine önemli bir katkı sağlayacağı düşünülmektedir.
Anahtar Kelimeler: Yer fıstığı, ceviz kabuğu, biyokütle, karbon bazlı malzeme

PRODUCTION OF CARBON-BASED MATERIALS FROM WALNUT AND PEANUT BIOMASS

Abstract
The research and development of biomass-based carbon materials is extremely important for environmental sustainability and the exploration of renewable energy sources. In particular, waste biomass sources have great potential for the production of carbon-based materials from natural resources such as walnut hulls and peanut shells. Crop wastes such as walnut hulls and peanut shells can often cause environmental problems before they are utilized. However, these waste sources can be converted into carbon-based materials through appropriate processes and used in various industrial applications and environmental remediation projects. Carbon-based materials offer potential in many fields due to their high surface area, excellent adsorption properties and thermal conductivity. In this study, the potential for the production of carbon-based materials from biomass sources such as walnut shells and peanut shells was investigated. First of all, dry walnut and peanut shell biomasses were collected, crushed and sieved to a size of less than 75 μm after grinding. The reduced and sieved biomasses were subjected to carbonization process in the presence of iron-containing catalyst in a muffle furnace at the specified temperature and time. Carbonized samples were cooled and collected. The carbon-based materials obtained at the end of the carbonization process were characterized by X-ray diffraction (XRD), Fourier transform infrared spectrophotometry (FTIR) and Raman analysis. The results of XRD, FTIR and Raman analyses reveal that the carbonization process of the lignocellulosic biomass was successful. These analyses show in detail the structural changes of the feedstock and the progress of carbonization. This research demonstrates the potential of recycling waste biomass resources such as walnut shells and peanut shells for the production of carbon-based materials. The production process of these materials represents an environmentally sustainable and economically efficient approach, while at the same time responding to various industrial needs. Therefore, the research and development of biomass-based carbon materials is expected to make a significant contribution to the development of future green and sustainable technologies.
Keywords: Peanuts, walnut shells, biomass, carbon-based material

Introduction

Biomass is a renewable, abundant and cheap resource and its conversion into fuel, chemical and material precursors is of great importance to alleviate the energy crisis by reducing over-reliance on fossil resources, reduce environmental pollution and promote sustainable development (Baweja & Jeet, 2019). Recently, there is a high proportion of agricultural waste generated globally that is inefficiently used and cannot be recycled. These wastes can be considered as a viable resource that can impact environmental management. Furthermore, the utilization of biomass resources is thought to enable the use of less toxic reagents during the production phase, as well as adding value to agricultural by-products and reducing global dependence on petroleum-based feedstocks (Çavuş at al., 2022).In this study, it was aimed to investigate the potential of producing carbon-based materials from walnut shell and peanut shell, which are waste biomass sources. The obtained carbon-based materials were characterized by XRD, FTIR and Raman analysis.

Materials and Methods

Dried walnut shells were obtained from Çorum region and dried peanut shells were obtained from Osmaniye region.Dried walnut and peanut shell biomasses were collected, crushed, ground and sieved to a size of less than 75 μm. The sieved biomasses were subjected to carbonization in the presence of iron-containing catalyst in a muffle furnace at 350°C. Carbonized samples were cooled and collected. The carbonized products obtained from dry walnut and peanut shell biomasses were named CC1 and CF1, respectively.

Findings and Discussion

The synthesized samples were characterized by XRD, FTIR and RAMAN analysis. The phases of the biomasses and carbonized samples were observed by XRD patterns (Figure 1). Compared to the biomasses, the characteristic peaks of the prepared CC1 and CF1 carbonized products become more pronounced, indicating that the carbonization process only consumes impurities, but does not destroy the “core” structure of the biomasses. XRD spectra obtained from the crystal phase models of biochar (Figure 1) showed the presence of a peak indicating the formation of the intact structure of carbonaceous materials (Assirey & Altamimi, 2021). As shown in Figure 1, the XRD pattern of the prepared CC1 and CF1 exhibited a diffraction peak ($2\theta=14°$), indicating that the prepared carbon-based material has an amorphous carbon composed of aromatic carbon layers. This result clearly shows that under the process condition of carbonization and activation, it gives a carbonaceous structure composed of aromatic carbon layers (Wang, at al., 2020). After the carbonization process, it is seen that the peak at $2\theta= 16.3°$

shifted to 2θ= 14° and sharpened and also the peak between 2θ= 21.9-22° broadened and a new peak was formed around 2θ= 25°.

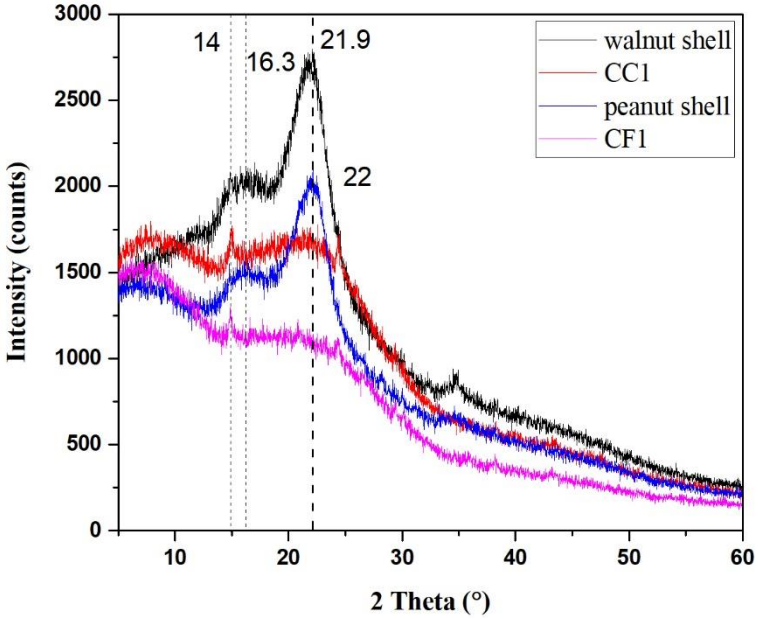


Figure 1. XRD diffractograms of biomass wastes and carbon-based materials obtained from these wastes FT-IR analysis of walnut and peanut wastes and carbon-based materials obtained from these biomasses is shown in Figure 2. It is seen that the broadband absorption peak is at 3700-3000 cm^{-1}, indicating the presence of hydroxyl group (OH). This peak was found to be broadened in CC1 and CF1 samples while it was strong and narrow in biomasses. The absorption peak observed at 2923 cm^{-1} in biomasses indicates the presence of aliphatic C-H vibration peaks originating from sp3-hybridized carbon atoms. It is observed that the intensity of this peak completely disappears in CC1 and CF1 samples (Melese at al., 2020). The bands at 1040 cm^{-1} attributed to aromatic C-O almost disappeared, while the C=C peak at 1610 cm^{-1} and the C=O peak at 1708 cm^{-1} appeared. All of these observations point to carbonization of lignocellulosic biomass (Wang at al., 2020).

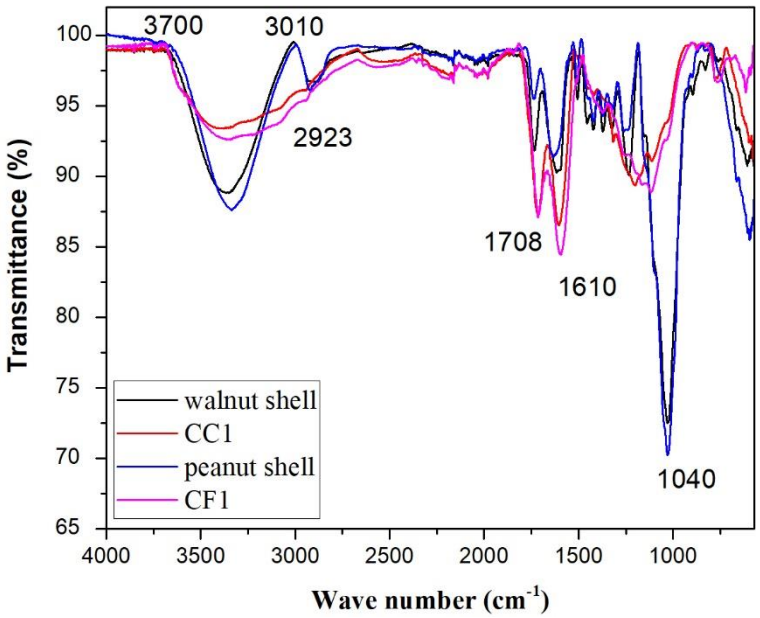


Figure 2. FT-IR spectra of biomass wastes and carbon-based materials obtained from these wastes Figure 3 shows the Raman spectra of the respective G and D bands of carbon-based materials derived from various biomass wastes. One of the leading indicators of carbon-based material formation is the characteristic peaks seen in Raman spectroscopy. Raman spectra of carbon-based materials are regularly characterized by two characteristic bands, the D-band and the G-band. The D peak is usually located around ~1350 cm^{-1} and arises due to point defects in the planar structure. This band corresponds to sp3 carbon atoms of disordered or defective carbons. The G band corresponds to the in-plane stretching vibration of sp2 hybridized C atoms in a two-dimensional hexagonal lattice and appears around ~ 1580 cm^{-1} (Li at al., 2016).

On the other hand, XRD diffractograms support the Raman analysis by showing the formation of partially turbostratic structures with assigned peaks. In our study, when all samples are evaluated within themselves, it is seen that only D and G bands belonging to carbon-based material-like structures appear.

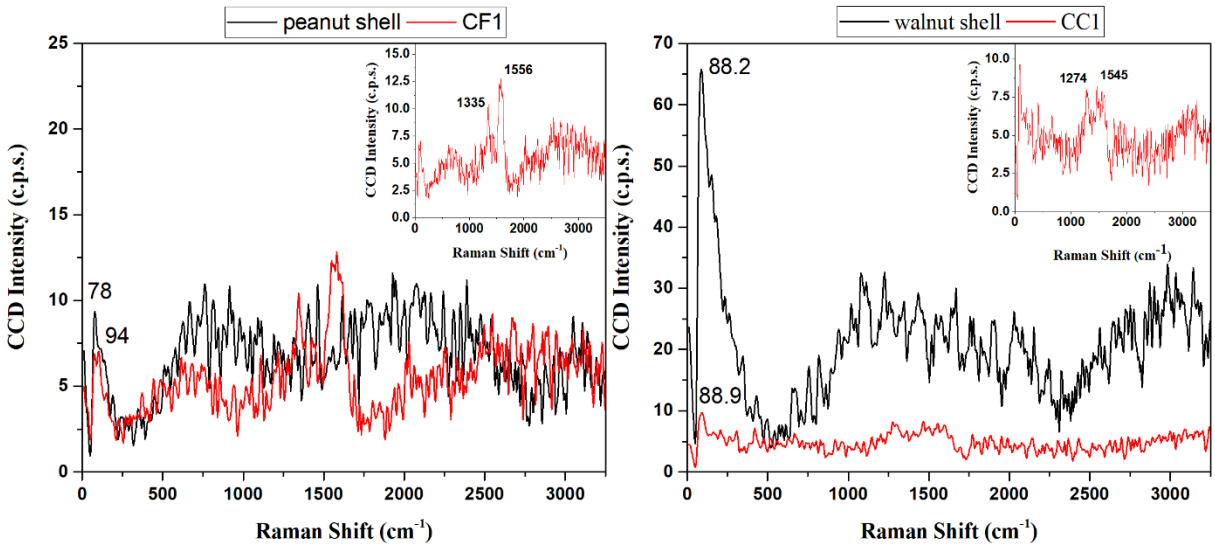


Figure 3. Raman spectra of biomass wastes and carbon-based materials obtained from these wastes

Conclusion and Recommendations

Carbon-based materials were successfully obtained from walnut shell and peanut shell biomasses. XRD diffractograms, Raman and FTIR spectra of the prepared biomasses and carbon-based materials were taken. It was determined that the carbon-based materials produced have a carbonaceous structure consisting of aromatic carbon layers. This research has demonstrated the potential of recycling waste biomass resources such as walnut shells and peanut shells for the production of carbon-based materials. The production process of these materials represents an environmentally sustainable and economically efficient approach, while at the same time responding to various industrial needs.As a result, the research and development of biomass-based carbon materials is expected to make a significant contribution to the development of future green and sustainable technologies.

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OPTIMISM IN POSITIVE PSYCHOLOGY

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Abstract
Optimism is one of the most important concepts in positive psychology. The benefits of being an optimist seem to outweigh the disadvantages by far. Most of the research supports this idea, and this is also how the general public thinks. By being an optimist, we expect good things to happen in the future, and we believe we can achieve our goals. On the contrary, if we are a pessimist, we tend to believe that things will not go our way. Consequently, we will have less motivation to act. In this article, we take a closer look at optimism in positive psychology, which is the kind of psychology that approaches the human psyche not from the aspect of psychopathology, but human thriving. Optimism is not as simple as it sometimes may sound. In this article, we examine its strong impact on well-being, life satisfaction, and even perceived pain management. But since optimism is not without any disadvantages, we also examined how some types of optimism, such as being too optimistic, can be not that good. Likewise, we talked about how some types of pessimism such as defensive pessimism can be beneficial in some cases. The most important point we find is that, the context is crucial when it comes to what kind of psychological attitude we should take, in terms of optimism or pessimism.
Keywords: optimism, positive psychology, pessimism, hope, life satisfaction

Introduction

One of the most important concepts in positive psychology is optimism (Dunn, 2017). Optimism is usually defined as having a positive outlook on life and expecting positive events in one's future. The opposite of optimism is defined as pessimism, in which a person has a negative outlook on his or her life, and expects more negative events to happen in the future. Researchers, teachers, and people in general promote optimism for well-being, happiness, and life satisfaction. After all, being an optimist feels better, and we're more motivated to take productive action when we feel better, right? By contrast, being a pessimist feels bad, and it might stop us from taking productive action because we don't even believe something good will happen in the first place. But is it really that simple? If believing in something could make it happen, it would mean that there is a real power in positive thinking (Scheier & Carver, 1993). Looking closer at these terms, optimism, and pessimism, researchers see that there are various types of them. Cousins et al. (2016) talk about the power of optimism in pediatric pain. Windschitl and Stuart (2015) talk about various types of optimism and optimism biases. Youssef and Luthans (2007) examine the impact of optimism, hope, and resilience in the workplace. Shepperd et al. (2013) talk about unrealistic optimism, and also the sub-types of it. These are just a few examples within the vast sea of research in this area.Although it is easy to say that "optimism is good, and pessimism is bad," things get complicated when we talk about, for example, "being too optimistic," or "defensive pessimism". In this article, we take a closer look at these terms, examine some of their types, and also go into detail about the benefits and disadvantages of them (Norem & Chang, 2002). And although we are talking about optimism in terms of positive psychology, we didn't confine this article to research in that field.

History of Optimism: An Overview

Peterson (2000) talks about two forms of optimism. The first one is the kind in which optimism is considered a part of human nature. The second one is optimism as an individual difference. When we look at the earlier approaches to optimism, we see that they were mostly negative. Writers from Sophocles to Nietzsche say that optimism contributes to one's suffering. They argue that it's better to face the hard facts of reality. Freud's influential writings also have this negative view of positive thinking as a main component of the subject.Around the 60s and 70s, the outlook on the subject started to change, when researchers started to find evidence that most people are not realists in a strict way, and they weren't so accurate in how they think. It was also documented by cognitive psychologists that people use many shortcuts when they process information. There were hundreds of studies that indicated people were selectively positive in

their thoughts, memory, and language (Peterson, 2000).As an example, most people use positive words more than negative words, both when speaking and writing. When they are trying to remember something freely, their positive memories come to mind sooner than the negative ones. The majority of people see themselves in a more positive light compared to others. It is accurate to say that in people's minds, all of them are "above average" (Peterson, 2000).Aaron Beck, who is mostly regarded as the father of Cognitive Behavioral Therapy (CBT), was influenced by these views at the time, and in the earlier times of his theory development, he strictly regarded people with depression as non-logical. This implied that people without depression were in fact logical. While it is true that people with depression can have a distorted view of reality, and think in ways that are not very logical, Beck didn't question the occasional positive view that the person with depression talks about in therapy. Later, Beck stopped assuming people who did not have depression were logical, and he started to consider people can have a positive bias toward their ongoing experiences and their future (Peterson, 2000).Greenwald's (1980) view on human nature was also a turning point for how optimism was regarded by psychologists. He likened human nature to a totalitarian regime. He says that the self can be viewed as an organized knowledge about one's identity and history. The self organizes the information in a biased way, by using information-control strategies just like a totalitarian regime in a country. People continuously create and revise their personal histories in their minds. And these stories are bound to be egocentric because all of us are the main characters in our stories. To some extent, all of us attribute good things to ourselves and attribute bad things to other things. We also resist changing the way we think (Peterson, 2000).

Recent Approaches to Optimism

Being optimistic about life is one of the key elements in positive psychology. Optimism as a concept has been a research subject for over 30 years. It also has roots in expectancy-value models of motivation, and in folk psychology. According to the expectancy-value models, what underlies human behavior is goal pursuit, which in itself has two elements. The first element is the value of a goal. If a goal is more important, it's more likely to be pursued. The second element is about one's confidence regarding their ability to reach that goal. If someone has little or no confidence in their ability to reach a goal, they may never take action to reach it. They might also easily give up if they face challenges. As you might expect, people who have more confidence about reaching that goal will continue pursuing it even when they face challenges (Dunn, 2017).

Optimism has many forms and the research supports that most of those forms are related to better outcomes in coping, well-being satisfaction, etc., which are measured in various contexts. Looking at this, it is easy to assume that optimism should always be preferred over pessimism. Moreover, today it is promoted that parents, researchers, educators, policy consultants, and therapists should advocate for optimism as much as possible. Consequently, the popular culture in America also supports this. As such, it is important to approach the powerful zeitgeist of positivity in a more delicate and complex manner, and not simply say "Optimism is good" and "Pessimism is bad" (Norem & Chang, 2002).When it comes to forming expectancies, people do it in countless contexts. These contexts can be specific and narrow, or they can be in very broad areas in life. Optimism usually implies confidence in those broader areas in life, rather than specific or narrow contexts. So when we look at motivation from this expectancy-value point of view, it makes sense to anticipate that optimists are usually more confident and persistent, contrary to pessimists who are usually thought to be uncertain and hesitant (Dunn, 2017).Optimism research has two main ways of measuring it. The first approach is a straightforward one in which people are directly asked about their expectancies about the future. For example, they are asked if they expect the outcomes in their life to be generally bad, or good. It is this approach that the most widely used optimism measure uses. Two tests, namely the Life Orientation Test (LOT) and the LOT-Revised (LOT-R), people are presented with statements about the future, and they report their degree of disagreement or agreement with these statements. These statements can be like "In difficult times, I never lose hope" or "I usually don't expect things to go the way I want". As you can guess, if someone shows greater agreement with positive statements and disagreement with negative statements in the measure, they are considered more optimistic. Whereas if someone agrees more with the negative elements, and disagrees with the positive ones, they are considered more pessimistic (Dunn, 2017).The second approach to measuring optimism focuses more on the past. It involves asking people to make judgments and attributions about the causes of past happenings in their lives. The main idea behind this approach is that, interpretations of the past events affect the expectation of future events. Let's say that someone believes that, in a specific area of their life, their failures are because of stable facts. If this is the case, they are likely to expect failure again in that area, in the future (Dunn, 2017).

Relationship Between Optimism and Pain

There is a lot of existing research in chronic and experimental pain contexts, and most of the research is focused on adults. It is found that, among healthy adults, optimism is related to a

low amount of self-reported pain. It is also related to habituation to the pain of cold pressor (Cousins et al., 2016). Cold pressor test is a cardiovascular test that is done by immersing the hand in an ice water container (Wood et al., 1984). Even so, health-related cognitions seems to moderate the benefits of optimism. This means that optimism might be causing the person to disengage from the stressor and use active coping mechanisms. In the studies with adults, pain catastrophizing is found to be a mediator of the relationship between pain and optimism, and this suggests that, lower experimental pain might be related to decreased pain catastrophizing. Lastly, optimism seems to soften the effects of pain on executive functions after a cold pressor test (Cousins et al., 2016).Other than pain in experimental contexts, optimism research has also been conducted on adults with chronic pain. Again, optimism has been found to be associated with less severe perceived pain and lower pain catastrophizing. It was also found to be associated with well-being, higher functioning, internal locus of pain control, and active pain coping. In older adults, research shows that optimism mediates the relationship between life satisfaction and pain (Cousins et al., 2016).

Some Critical Views on Optimism

According to Norem and Chang (2002), there are some complications to this general attitude toward optimism, as suggested by some researchers. We can look at the research on defensive pessimism, which clarifies some of these complications we would like to talk about. In summary, we can talk about these points:Since optimism and pessimism cover several concepts, it is important to keep the differences among them clear. There are several forms of optimism and pessimism, and the costs-benefits balance might differ among them. And even though there are potential costs and benefits to both pessimism and optimism, usually the merits of optimism are overemphasized, and its costs are underemphasized. Also, the context is highly important in this balance of costs and benefits and they can vastly differ if the context changes. As such, it is important to keep this in mind when conducting research and interpreting the results. It is also important to point out that optimism and positive psychology are not synonymous (Norem & Chang, 2002).When we look at the existing research, it is clear that there is an extremely lot of constructs for both optimism and pessimism. In other words, there are so many types of them. These include dispositional pessimism and optimism, pessimistic and optimistic explanatory or attributional styles, naïve optimism, optimistic illusions or biases, rational or neurotic pessimism, unrealistic optimism, realistic pessimism, strategic optimism, and defensive pessimism (Norem & Chang, 2002).

It is also worth noting that in highly individualistic cultures, most of the research on pessimism and optimism focuses on the outcomes in the individual's life, e.g. in their life satisfaction or positive affect (Norem & Chang, 2002).Defensive pessimism is a kind of pessimism in which an individual sets unrealisticallylow expectations for a situation, and reflects on all the possible outcomes of that situation.By contrast, strategic optimism refers to a strategy that is about having an optimistic view about a situation that is going to be experienced soon. It also involves avoiding extensive reflection prior to that situation and/or task (Norem & Chang, 2002).So what are the costs of optimism? One is that their optimistic attitude might get derailed.This can happen if someone in an optimist state of mind starts to calculate possible outcomes in their mind. This is said to impair their performance. But if the given situation requires a review of alternative outcomes, or getting a grasp of possible negative outcomes, a defensive pessimism might bear better outcomes (Norem & Chang, 2002).Aging is another context in which the outcomes of optimism and pessimism take anunexpected turn. It is found that the power of positive thinking does not predict well anxiety, depression, stress, and self-appraised health in older age groups. It is reported that a realistically pessimistic perspective among the elderly is associated with "positive negativity," and this makes them adapt to negative life events more easily (Norem & Chang, 2002).

Comparing the Terms Optimism, Hope, and Life Satisfaction

When it comes to subjective well-being, one of the most important things is life satisfaction. Life satisfaction is usually defined as cognitive evaluations regarding one's own life, and this can be in general or specific areas. Life satisfaction motivates people to pursue goals, and it can be felt by an individual as a pleasant inner conscious experience. Also, a strong predictor of life satisfaction is having individual strivings, which helps integrate and organize one's goals (Bailey et al., 2007).The studies regarding hope were historically philosophical, examining the term from spiritual, emotional and existential aspects. Synder et al. have a concept of hope with two components, which are called pathways and agency cognitions. Pathways thinking is about one's perceived capacity to create routes that lead to their goals. Agency thinking is about the perceived motivation to make use of these said pathways, so it is about initiating and sustaining action towards the goals (Bailey et al., 2007).Although they look similar, the concept of hope slightly differs from the concept of optimism. The usual definition of optimism is about believing good things, rather than bad things will happen. Consequently, optimists tend to expect future events to go their way, and this attitude of them is stable across different contexts and times. On the other hand, pessimists tend to expect future events to not turn out well for

them (Bailey et al., 2007). So in summary, researchers argue that optimism is a generally positive view on life in general, while hope is more about goal and path setting, and maybe self-efficacy. We believe that this difference is not that clear and sometimes the terms are used interchangeably.

Discussion and Conclusion

It is clear that optimism is a well-established and evidence-based construct in positive psychology. It is evident that optimism can have a huge impact on one's life, their life satisfaction, and well-being. We especially find research regarding optimism and pain interesting and inspiring, because it shows how powerful optimism is, even having impact on both chronic pain and pain in experimental settings. But optimism is not without any downsides. We believe that even though optimism is a well-researched topic, it tends to have some blind spots, such as over emphasizing pros and discarding cons of it. It looks important to not make optimism a holy grail, as it is also evident in some other research that being too optimistic can be detrimental, and sometimes pessimism has its functions. It all depends on the context and the level of optimism and pessimism, and we also argue that it's about being flexible when we need to change our attitude towards something according to the changing contexts. Accordingly, we suggest that more research should be done to explore how this balance and possible dynamic nature of optimism, pessimism, their kinds and everything in between, can affect our well being, life satisfaction, and other important aspects about our happiness which positive psychology explores.

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EFFECTS OF DROUGHT ON PASPALUM DİLATATUM ANATOMY

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Abstract
The expansion of the tropical belt as a result of global climate change is predicted to lead to an increase in the usage of C_4 grasses in pastures. In particular, the tropical, subtropical, and warm temperate regions of the Americas are home to *Paspalum* species. Dallisgrass (*Paspalum dilatatum*) and bahiagrass (*Paspalum notatum*) are the most economically important and widely used *Paspalum* species for livestock production. Due to the global shortage of water for irrigated agriculture, deficit irrigation has gained popularity as a way to lower the amount of water needed for crops and fodder. Additionally, root herbivores influence plant-water relations in grasslands where they are the dominating taxon. Variations in the water content of the soil can affect phenology, rooting strategy, and plant growth.
Keywords: Drought, water stress, *Paspalum dilatatum*, anatomy

Introduction

Drought restricts growth and productivity in the majority of the world's grasslands. The distribution and timing of water availability vary greatly, and this variation is correlated with the composition of plant communities. Plants adapt their morphology and physiology in response to such heterogeneity. These alterations show an ontogenic, plastic reaction to the surroundings. Stress, both biotic and abiotic, affects the performance of all plants, including genotypes that are resilient. But not every genotype reacts to extreme environments in the same way. Several researchers specify "structural" characteristics to evaluate grass productivity. The main variables are lamina length, number of live leaves per tiller and tiller / plant (number of tillers). These characteristics are influenced by a number of leaf-level 'morphogenetic' growth variables, primarily leaf longevity, leaf appearance rate, and leaf elongation rate. The morphogenetic and structural components are not only determined by genotype but also by growing circumstances. Specifically, these characteristics are associated to developmental changes in response to environmental factors. This is known as phenotypic plasticity (Couso ve Ark., 2010).Plants have been shown to exhibit plastic responses under drought. Leaf elongation rate was discovered to be one of the most drought-responsive characteristics, making it a sensitive indicator of drought-induced growth. Grasses growing under drought conditions have short stature, prostrate morphology, generally consistent tillering, and low tiller biomass. Palatable grasses exhibit similar overall morphological changes in response to grazing, both as a plastic and evolutionary response. Stress not only inhibits present leaf extension and growth, but it can also impede future regrowth potential. Recovery from defoliation is dependent not only on the plant's inherent capacity and type of defoliation, but also on the biotic and abiotic environment. Following a defoliation event, the plant experiences a transient period of rapidly altering carbon and nutrient allocation patterns. Defoliation and drought lower a plant's carbon input, yet carbon allocation priorities appear to be conflicting. Drought causes an increase in carbohydrates allotted to roots, whereas defoliation allocates carbohydrates to shoots (Gastal and Durand, 2000). Bud activation during defoliation would be more critical for tiller production than bud quantity or viability. Drought can inhibit tiller formation in both defoliated and undefoliated plants (Couso ve ark., 2010).

2. Drought tolerance in *Paspalum* spp.

Paspalum notatum, *P. dilatatum*, *P. plicatulum*, and *P. guenoarum* are popular forage plants in south America (Acuña et al. 2011). *Paspalum* is a significant genus in the *Poaceae*, belonging to the subfamily *Panicoideae*, tribe *Paniceae*, and subtribe *Paspalinae*. It contains roughly 400

species (Eichemberg & Scatena, 2013). The majority of them are grown in tropical, subtropical, and temperate areas of America. Brazil is home to roughly 202 *Paspalum* species, which are scattered throughout the grasslands. *Paspalum* stands out for its presence and foraging potential in native Brazilian grasslands. *Paspalum* is the most abundant genus in Brazil's residual grasslands and has a high economic potential (Eichemberg & Scatena, 2013).*Paspalum* species are key components of South American grassland ecosystem biodiversity, and many are exploited as feed (Rua et al., 2010) but, some species, such as *Paspalum virgatum* are considered a pasture weed that causes significant damage to livestock (Nascimento Vasco et al., 2023). In a study, new atra paspalum (*Paspalum atratum*) accessions were discovered to be variably grazed by cattle, with no variations in herbage accumulation or nutritional value. Cattle preference of this species was inversely related to the fraction of lignified tissues, the number of primary vascular bundles, plant height, and leaf-blade length. Cattle preferences were influenced by the growth season and decreased by the presence of leaf structural tissue (Marcon et al., 2023).*Paspalum* species can be found in a variety of habitats, including savannas, forests, and forest margins, as well as dry, sandy, saline, or waterlogged soils (Mollard et al. 2008). Some species, such as *P. candidum* and *P. pygmaeum*, grow in mountainous locations as high as 4500 metres. Others grow in Patagonia's cold-temperate zones, such as *P. distichum* and *P. vaginatum*. The species *P. dilatatum*, *P. guenoarum*, *P. notatum*, and *P. urvillei* are all regarded excellent forage species. Because of the high number of species and morphological heterogeneity within the genus, *Paspalum* has been classified into subgenera, sections, or informal groups based mostly on inflorescence and spikelet morphological characteristics. Many scholars researched the foliar anatomy of *Paspalum*. The entire genus is classified as C_4 and "panicoid type" (Aliscioni & Denham, 2009). Many *Paspalum* species consist of sexual-diploid and apomictic-polyploid cytotypes, and others have arisen through hybridization (Rua et al., 2010).C_4 plants are believed to be less drought-sensitive than C_3 plants due to their CO_2 concentrating mechanism (Carmo-Silva et al., 2007). In warm, dry summer conditions, C_4 grasses produce higher yields than C_3 grasses (Gherbin et al., 2007), but better drought resistance in C_4 grasses is not always observed (Carmo-Silva et al., 2009). Water is one of the most critical constraints on plant development and agricultural productivity in many parts of the world. With the predicted increase in aridity, knowing plant responses to dry conditions, as well as identifying features relevant to climate change, are critical for improving water usage efficiency, plant production, and yields. C_4 grasses use water more efficiently than C_3 grasses as they have a stronger affinity for CO_2 and lower transpiration rates. The presence of a CO_2-

concentrating mechanism makes C_4 photosynthesis more competitive in conditions that promote carbon loss through photorespiration, such as high temperatures, high light intensities, and decreased water availability, resulting in low intercellular CO_2 concentrations due to stomatal closure (Carmo-Silva et al., 2009). Some of *Paspalum* species has been reported to have a low water requirement, a moderate fertilization requirement, and resilience to mowing at various heights, in addition to superior salinity and drought resistance (Shahba 2010). *Paspalum* species, including *P. vaginatum* (Shahba et al. 2014) and *P. notatum* (Acuña et al. 2010), show potential for drought tolerance. Some species have high fodder value but the tolerance to water stress of these species, such as *P. atratum*, *P. conspersum*, *P. dilatatum*, *P. malacophyllum*, *P. quarinii*, and *P. regnellii*, has received less attention (Pezzopane et al., 2017). Drought resistance refers to a variety of processes utilised by plants to survive periods of drought. Drought escape, avoidance, and tolerance are all examples of strategic mechanisms. The significance of each of these techniques is connected to drought length and severity, as well as grass species. These mechanisms are linked to changes in anatomy, morphology, physiology, and biochemistry. Grasses frequently concentrate their roots in the top 30 cm. Grasses can withstand drought by establishing deeper root systems and having shoot morphological or physiological mechanisms that limit evapotranspiration losses. Grass quality and evapotranspiration rate have traditionally been employed to assess drought resistance in grasses. Deeper and larger root masses, as well as a more widespread dispersion of roots, allow for increased water extraction from the soil. Changes in leaves that assist drought tolerance include reduced leaf growth and area, greater pubescence, rolling or folding, and fewer stomates (Shahba et al, 2014).The use of water deficit and waterlogging-tolerant cultivars may help to mitigate climate risks and minimise the susceptibility of pasture-based animal production systems in the tropics. Pasture degradation is regarded as one of the most serious issues impacting tropical animal production systems, and it is frequently linked to abiotic stress. The persistence of grazing swards under water deficiency and waterlogging situations is determined by plant survival mechanisms and their ability to rebound after stress. Despite prior investigations on the response of tropical forages to water shortage stress, the recovery of plants following a period of water deficit has been poorly characterised (Beloni ve ark., 2017).*Paspalum paniculatum* is tolerant to dryness, water scarcity, and flooding. In a study, eleven days after the start of water restriction, variations in stomatal cell density and size, reduction in metaxylem diameter and root cortex, increase in bulliform cell size, and leaf concentrations of amino acid, and starch were identified (Melo et al., 2007). *Paspalum notatum*

(commonly known as Bahiagrass in Brazil) is regarded high-quality feed with good grazing resilience in Southern Brazil's native grasslands. The *P. notatum* has been found to have a broad and deep fibrous root system, which could be connected with the plant's ability to recover water from deep soil layers and hence display drought resistance (Beneragama & Kumara, 2018).

3. Drought tolerance in *Paspalum dilatatum*

Dallisgrass (*Paspalum dilatatum* Poir.) is a warm-season grass endemic to eastern Argentina, Uruguay, and southern Brazil. It is well-known for its feed quality and cattle preference. The introduction of this plant in temperate pastures enhances summer productivity and digestible dry matter production in heavy or clayey soils. It is more common in humid and extremely humid environments. This pattern can be explained by its endurance to flooding. Its low frequency in water-stressed areas could be attributed to issues with seedling establishment. Many years ago, various publications recognised the difficulty of establishing this species. They ascribed it to poor seed quality and slow germination. Several attempts to improve this species' establishment were unsuccessful, with the exception of using seed presowing treatments or residual cover. However, there were inconsistencies in the outcomes of those experiments. One probable explanation for the frequent failures in seedling establishment when presowing techniques were used is that seedlings died after emergence due to dehydration. Slow seed germination and seedling emergence prolong the period of vulnerability. As a result, effective establishment is less likely to occur in varying water conditions. The slow growth of seedlings following emergence is due to the root system's late development. Dallisgrass is more vulnerable to water stress during the seed-germination stage. As water stress rose, total germination reduced and emergence slowed. This species is highly susceptible to water stress during germination and initial growth, and rapid germination and early adventitious root growth can only occur when water is available continuously. The problem is more complicated because high temperatures are required to disrupt seed dormancy (Cornaglia et al., 2005).*Paspalumdilatatum* is a rhizomatous plant with smooth leaves and a robust root structure. Dallisgrass begins to grow in early spring, before most warm season grasses, and persists until late autumn. The pentaploid biotype is suitable as a forage grass because of its adaptation to varied soils, perennial growth, and high dry matter yield production during the summer (García et al., 2007). While *Paspalum dilatatum* has a higher forage quality than other C_4 forage grass species, generally digestibility of warm-season grasses is lower than temperate grasses. The presence of thick-walled parenchyma bundle-sheath cells around vascular bundles in C_4 forage grasses is linked to the deposition of lignin polymers in cell walls. High lignin content correlates

poorly with digestion. Lignin acts as a physical barrier to microbial enzymes that digest polysaccharides, decreasing the rate of cellulose and hemicellulose degradation and the digestible energy available to ruminants (Giordano et al., 2014a). Dallisgrass, valued for its vigour, produces yields of up to 15 tonnes of dry matter per hectare (Cook et al., 2005) and crude protein concentrations of up to 18.6% (Baréa et al. 2007). It can withstand heavy grazing (Giordano et al., 2014a).*P. dilatatum* provides better feed quality than other C_4 forage grasses and is resistant to frost and water stress. This species is mostly cultivated in an apomictic monoculture, which increases the chance that biotic and abiotic stressors may destroy productivity. *P. dilatatum* is expected to be more widely used in animal grazing systems under forecasted climate change scenarios due to its greater drought resistance and water use efficiency when compared to regularly used C_3 grasses. However, standard breeding strategies for improving *P. dilatatum* are frequently hampered by its asexual reproduction mechanism. Apomictic reproduction produces seeds without fertilisation, resulting in uniform progeny that are genetically similar to their parents, limiting the genetic variation accessible for conventional breeding programmes (Giordano et al., 2014b).*Paspalum dilatatum* can be found throughout Argentina's drought-flood gradient (Couso et al., 2010). Huang et al. (2019) selected *Paspalum dilatatum* germplasms with high drought resistance and provided a theoretical foundation for breeding and promoting drought-resistant germplasm. A comprehensive examination of drought resistance revealed that the drought resistance of *P. dilatatum* germplasm from the United States was the the strongest followed by one from China, and then other germplasms.



Fig. 1. *Paspalum dilatatum*: A) habit, B) sheath, ligule, and blade, C) spikelet (Ibrahim & Peterson, 2014).

Paspalum dilatatum, *Cynodon dactylon*, and *Zoysia japonica* are three grasses (*Poaceae*) from various C4 subtypes that grow in natural settings with varying annual rainfall. Their leaf features were investigated by Carmo-Silva et al., (2009) to determine traits associated with drought tolerance. The leaves of *Z. japonica* had the highest relative dry matter content, while *P. dilatatum* had the lowest. Plants had an average of 3 (*P. dilatatum*), 5 (*C. dactylon*), or 15 (*Z. japonica*) fully developed leaves at the start of the drought treatment. These numbers were increased over the period when water was withheld, so that by the end of the experiment, control and drought-stressed plants had around 10 and 9 (*P. dilatatum*), 23 and 19 (*C. dactylon*), or 32 and 29 (*Z. japonica*) completely extended leaves. The drought-stressed plants of *P. dilatatum* and *C. dactylon* had a lower specific leaf area than the control plants. In *Z. japonica*, the percentage of leaf dry matter was higher. The findings show that *C. dactylon* and, particularly, *Z. japonica* have evolved leaf characteristics that are better suited to arid environments.Couso et al. (2010) evaluated three *P. dilatatum* materials for drought tolerance. Drought tolerance qualities were unaffected by genetic differences across species. Despite predictions, the three studied *P. dilatatum* varieties had equal reaction norms (no interaction between drought and variety) for all response variables. Drought lowered the rate of leaf elongation (cm ⁄ leaf ⁄ d). Drought also reduced leaf length. Drought lowered both tiller production and living leaf count.

Drought-induced accelerated senescence would explain the decrease in the number of leaves per tiller. Under drought conditions, all three research materials produced shorter, fewer leaves. However, tiller biomass was comparable in droughted and control plants. Tall material from humid locations (Primo) had higher tiller biomass under all water-availability situations. Despite having features that appeared to be related with drought tolerance (e.g., many, small tillers, short stature), the Alonso and Relincho varieties did not perform better under stress.Henry et al. (2009) investigated the habitat specialisation and competitive differences between dallisgrass (*Paspalum dilatatum*) and bahiagrass (*Paspalum notatum*). Final biomass and survival of shoots and rhizomes were measured for plants cultivated in monoculture or competition with hybrid bermudagrass (*Cynodon transvaalensis* × *C. dactylon*) in sand or sandy loam soil. Dallisgrass shoot and rhizome growth was greatest at the highest soil moisture levels in each gradient tank, regardless of soil type or competition. When planted as a monoculture, dallisgrass survival rate dropped to 50%, and it reduced to 12.5% when grown in competition with hybrid bermudagrass. The survival rate of bahiagrass was 100% regardless of water table depth, soil type, or competition. When grown in sandy loam soil, bahiagrass shoot and rhizome growth increased with increasing depth to the water table. Growing in sandy soil resulted in the opposite pattern. According to the findings, dallisgrass may compete more with hybrid bermudagrass when volumetric soil moisture is high, but bahiagrass may compete when volumetric soil moisture is low.

4. Conclusions

Although *Paspalum dilatatum* is not the best performing C_4 species in arid conditions, its important feature is performing well in both drought and flooded conditions. At the same time, its high yielding and high quality grass production capacity has proven itself in its natural habitat, where the species is widely preferred by both farmers and feeding animals. Dallisgrass (*Paspalum dilatatum*) and bahiagrass (*Paspalum notatum*) may be used in mixture, as found in its native habitat in different locations in the world. More studies are needed on morphological traits of *Paspalum dilatatum* under low water supply on different soil types especially under warming Mediterranean conditions with inclusion of all biotypes of the species along with inclusion of selected competitive C_4 and C_3 forage crops to compare. Special attention is required for failures in seedling establishment.

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BİYOSENSÖR UYGULAMASI İÇİN SERS AKTİF NANOMATERYALLER

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Özet
Kanser, AIDS ve diğer bulaşıcı hastalıklar gibi hastalıkların erken tanısı ve kanda bulunması gereken çeşitli moleküllerin seviyelerinin düzenli olarak izlenmesi tıbbi tedavide her zaman önemli bir adım olmuştur. Bu bağlamda, nano ölçekte doğru ve güvenilir ölçümler elde etmek için yüksek hassasiyete sahip nano-biyosensörlerin geliştirilmesi gerekmektedir. Nano-biyosensörler, nanomol/litre veya pikomol/litre seviyesinde tespit yapabildikleri için geleneksel biyosensörlerden milyonlarca kat daha hassastır. Ayrıca hayvan, gıda ve çevre sağlığı için spesifik moleküllerin çoklu tespitini sağlayan biyosensör cihazların geliştirilmesi önemlidir. Yüzey zenginleştirilmiş Raman saçılması (SERS), DNA, proteinler, bakteriler, kan örnekleri, vb. gibi spesifik moleküllerin hızlı bir şekilde tespiti için en umut verici yaklaşımlardan biridir. Bu olağanüstü teknik, hastalıkların erken tanısına katkıda bulunabilir. Bu derleme esas olarak biyosensör uygulamaları için nanomalzeme temelli SERS aktif alttaşı malzemelerindeki son gelişmelere odaklanmaktadır. İki boyutlu nanomalzemeler (2DN), karbon temelli nanomalzemeler (CBN) ve gümüş ve altın gibi asil nanoparçacıklar ve 2DN kombinasyonu ayrıntılı olarak sunulmaktadır. Ek olarak, elektromanyetik ve kimyasal geliştirme mekanizması teorileri ve yukarıda belirtilen SERS biyosensör platformlarının tasarımı tartışılmıştır.
Anahtar Kelimeler: Biyosensör, nanomalzemeler, nanoparçacıklar, SERS

SERS ACTIVE NANOMATERIALS FOR BIOSENSOR APPLICATION

Abstract
The early diagnosis of diseases such as cancer, AIDS and other infectious diseases and the regular monitoring of the levels of various molecules that need to be present in the blood have always been a crucial step in medical treatment. In this context, nano-biosensors with high sensitivity need to be developed to obtain accurate and reliable measurements at the nanoscale. Nano-biosensors are millions of times more sensitive than conventional biosensors as they can detect at the nanomole/liter or picomole/liter level. In addition, it is important to develop biosensing devices that enable the multiple detection of specific molecules for animal, food and environmental health. Surface-enhanced Raman scattering (SERS) is one of the most promising approaches for the rapid detection of trace amounts of specific molecules such as DNA, proteins, bacteria, blood samples, etc. This outstanding technique can contribute to the early diagnosis of diseases. This review mainly focuses on the recent advances in active SERS active substrate materials based on nanomaterials for biosensing applications. Two-dimensional nanomaterials (2DN), carbon-based nanomaterials (CBN), and the combination of 2DN and noble nanoparticles such as silver and gold were presented in detail. In addition, theories on electromagnetic and chemical enhancement mechanism theories and the design of the above-mentioned SERS biosensor platforms were discussed.
Keywords: Biosensor, nanomaterials, nanoparticles, SERS

Introduction

The early diagnosis of life-threatening diseases such as cancer, AIDS, COVID-19-like infectious diseases, etc., the systematic monitoring of drug quantities that must be exist in the human body over a longer period of time, the immediate monitoring of substance quantities that are introduced into the tissue during serious operations, is one of the most important steps towards saving human life. Biosensors are crucial not only for human health, but also for the health of food, animals and the environment. Various electrochemical methods have been used to develop conventional biosensors. However, all of these methods have their own limitations, such as the costly production of samples, additional steps for sample preparation and analysis, the need for additional specialized personnel, and so on. With this in mind, it is important to develop next-generation biosensors that have multiple detection capabilities to accurately detect trace amounts of specific molecules in a very short time. SERS-based micro/nano biosensors can be a promising approach to overcome these limitations in the above-mentioned methods.

Surface-enhanced Raman spectroscopy (SERS)

Raman spectroscopy is a kind of vibrational spectroscopy associated with the inelastic scattering of photons from a target analyte, causing changes in the photon frequency (Ferraro, 2003). This spectroscopic technique can provide various information, such as the composition and structure of the target material, crystallographic structure, electrical properties and so on. Raman spectroscopy is used in many fields, including physics, chemistry, biology, biochemistry, materials science, drug development and biotechnology. The interaction of the sample is ensured with a laser or other monochromatic light source. Most of the light scattered by the sample carries the same frequency as Rayleigh scattering. One in a million photons is scattered (Raman scattering) from the sample in an inelastic way and has a different energy than the incident one. This provides a specific Raman spectrum for each sample, which provides the final spectral fingerprint of the samples (Ferraro, 2003).

Raman spectroscopy has some limitations and shortcomings in detecting signals from samples. This is because one of the 10 photons shows inelastic Raman scattering and most photons show elastic Rayleigh scattering (Atkins et al., 2014). The SERS method is used to overcome these drawbacks and increase the density of inelastically scattered photons. The SERS technique was developed in 1974 and has become a sensitive and reliable method for qualitative and quantitative analysis of molecules even at very low concentrations (Fleiscmann et al., 1974). Compared to other analytical techniques, SERS is easier to use for the detection of trace amounts. It is a technique that can save time and provide accurate and precise results. In

addition, it is attractive because no additional sample preparation is required prior to analysis. Thanks to its excellent performance, high precision, speed and non-destructive analysis method, it is widely used in biomedicine, food safety, environmental monitoring and so on. Electromagnetic enhancement mechanisms (EM) and chemical enhancement mechanism (CM) are two recognized SERS enhancement mechanism. EM is related to surface plasmon excitation in metal nanoparticles (MNPs) and CM is mainly related to electron charge transfer (Qian and Nie, 2008). To enhance EM, noble gold and silver nanoparticles are often used as SERS materials due to their excellent stability and sensitivity (Lu et al., 2011; Zhang et al., 2012; Çelik et al., 2023).

Above-mentioned metal surfaces can be MNPs, in particular gold and silver, or composite SERS-active substrates in hybrid structure. Free electrons on the surfaces of the substrates on which the analytes to be analyzed are located cause electromagnetic wave movements known as surface plasmons. When these plasmons interact with laser light, the electromagnetic field is enhanced in some regions where the analyte molecules interact with the surface plasmons and enhance Raman scattering. Surface plasmons on SERS-active substrate surfaces illuminate molecules close to the sample more intensely, resulting in a strong enhancement of the Raman signal. Therefore, SERS can detect even traces of certain molecules at much lower concentrations than conventional Raman spectroscopy. Another mechanism that provides surface enhancement and stronger Raman signals is the chemical enhancement mechanism. In this mechanism, a charge transfer with a strong electron pairing occurs between the analyte and the SERS substrate surface (Zou and Dong, 2006). In this process, the molecule is bound to the metal surface to perform the charge transfer. The laser interacts with the active SERS substrate to form electron-vacancy pairs and transfer energy to the molecular bonds. The energy is transferred back to the active SERS substrate so that scattering occurs, resulting in an amplified Raman signal.

Practical Applications of SERS-based Biosensors

The rise of numerous biological menaces worldwide has significantly increased the need for the development of novel, effective and quick approaches for the early of viral pathogens. Techniques such as PCR and ELISA are frequently used to detect viruses. However, these techniques have disadvantages, such as requiring complex incubation and purification steps, requiring a complex pre-isolation procedure, being limited to the use of specific antibodies and requiring a long test time. As an alternative to PCR and ELISA techniques, SERS biosensors

based on metal nanoparticles therefore offer an efficient, reliable, sensitive and rapid detection method for diagnosing viral and bacterial disease infections at an early stage.

Some important medical applications of SERS, such as detection of tumor-like abnormalities during surgery, fiber optic monitoring techniques to detect unhealthy tissue, may be important in the near future. Karabeber et al. reported the ability of a portable Raman spectrometer to detect the microscopic tumor margins by gold-silica SERS-Nps in a genetically modified RCAS/tv-a glioblastoma rat model (Karabeber et al., 2014). In a virtual condition, they tested both a static Raman spectrometer and a mobile Raman spectrometer. They showed that SERS-assisted resection is much more precise than resection using white light imaging. Both techniques complemented each other, and parallel to histology, SERS-Nps was shown to precisely delineate the margins of the tumors. The mobile Raman spectrometer enabled near real-time scanning and identified additional microscopic cancer foci in the resection bed that could not be detected on static SERS images and thus would have remained unused.

Endoscopic monitoring is one of the most promising approaches to detect diseased tissue. Wang et al. have shown that silica-coated AuNps-based SERS materials can improve the detection of esophageal cancer in a rat model (Wang et al., 2015). They applied antibody-conjugated SERS-Nps locally on the luminal surface of rat esophagus to detect EGFR and HER2. A small spectral endoscope with a rotational scanner and axial retraction was used to monitor the SERS-Nps attached to the esophageal lumen.

Recently, various methods have been used to detect different types of cancer by plasmonic nanoparticle-driven SERS biosensors. Bai et al. reported a novel SERS biosensor for liver cancer using plasmonic AuNps (50 nm) to detect CEA, AFP, and proteins with a limit of detection (LOD) of 0.15, 20, and 4 pg/mL, respectively (Bai et al., 2019). Davis et al. developed an AuNps-based SERS platform for bladder cancer detection to identify the tumor proteins CD47 and CA9 (Davis et al., 2018). Li et al. used gold-NS hollow alloy nanocubes in a SERS biosensor for prostate cancer to detect miRNA-107 with an LOD of 10^{-15} M (Li et al. 2019). Carmicheal et al. demonstrated a SERS biosensor for pancreatic cancer using a hybrid structure of AuNPs 10 nm on Ti/Au 40 nm/100 nm slide targeting CD18/HPAF, HPDE and MiaPaca exosomes (Carmicheal et al., 2019). Ag-encapsulated Au nanospheres were developed for the precise diagnosis of three types of breast cancer cell biomarkers, EpCAM, ErbB2 and CD44, with SERS-active substrates (Choi et al., 2020).

SERS-based immunoassays using different biomolecules have also been developed for the detection of hepatitis B virus (Song et al., 2009; Zengin et al., 2017; Lu et al., 2018). Recently,

a highly sensitive SERS immunoassay was demonstrated and a SERS material on a microfluidic chip was designed for the detection of hepatitis B (Kamińska et al., 2015). It was found that fuchsin provides efficient SERS enhancement and has an excellent ability to combine Au nanostructure and antibody. The developed SERS-active substrate proved to be crucial for increasing the effectiveness of SERS immunoassays owing to its perfect stability, reproducibility and strong enhancement ability.

Pandemics are another situation in which early detection measures should be taken. One of the most recent examples of this is the coronavirus (COVID-19), which first broke out in Wuhan, China, and then spread to other cities in China and around the world. Recent research has shown that the severe acute respiratory syndrome coronavirus (SARS-COV-2) has been detected in contaminated water. In order to detect the virus in contaminated water and effectively control the extent of the spread of SARS-COV-2, it is important to determine the true extent of the person infected with the coronavirus (Peng et al., 2020). Consequently, it is necessary to precisely identify SARS-COV-2 in infected body fluids or contaminated water in order to monitor the viruses in real time and diagnose them at an early stage. In this context, novel SERS-based approaches have been used for disease surveillance, early disease assessment and vaccine production (Zhang et al., 2021; Asif et al., 2020; Abid et al., 2021; Awada et al., 2021). SERS-based breath analyzers utilize the main oscillatory changes triggered by the contacts between breath substances and various receptors to advance a powerful PLS analysis model (Leong et al., 2022). Sanchez et al. developed a novel non-invasive diagnostic method using plasmonic and two-dimensional nanomaterials for the rapid detection of SARS-COV-2 virus spike proteins using the SERS technique (Sanchez et al., 2021). Recently, Zhang et al. developed a SERS-based assay for real-time identification of SARS-COV-2 that does not require additional processing when combined with multivariate analysis. In this study, they used Ag nanorods as the SERS-active surface that support the ACE2 receptors (Zhang et al., 2021). Awada et al. developed a novel method to detect the COVID-19 RBD protein using the SERS technique. They succeeded in preparing Au/Ag nanostructured SERS-active substrates that display the RBD protein with high efficiency and accuracy in only 3 seconds. They also achieved a limit of detection (LOD) of 1 pM using this approach (Awada et al., 2021).

Sepsis is defined as "life-threatening organ failure caused by an irregular host response to infection" (Singer et al., 2016). If sepsis is not diagnosed early, it may bring about septic shock, multiple organ failure and even death (Paoli et al., 2018). Procalcitonin (PCT) is a calcitonin precursor protein with 116 amino acids that accumulates in the Golgi. Although the plasma

concentration of PCT is initially low, its concentration increases during the course of sepsis (Prucha et al., 2015). High levels of PCT have also been reported to be directly related to the severity of COVID-19 and SARS-CoV-2 (Zhang et al., 2020; Lu et al., 2020; Huang et al., 2020; Guan et al., 2020; Lippi and Plebani, 2020). SERS could be a promising approach for the rapid detection of sepsis. Kundu et al. reported an AgNp-doped black phosphorus SERS substrate for the detection of PCT, taking into account the opportunity of discriminating between different biomarkers (Kundu et al., 2022). Zhou et al. developed an AgMNps/IMs/CPs hybrid structure for the identification of inflammatory markers such as CRP, IL-6 and PCT (Zhou et al., 2022). Various nanoparticles such as MNPs, lipid-based nanoparticles, fluorescent silica and quantum dots (QDs) have been used for the diagnosis of sepsis-related infections (Kurdekar et al., 2016; Zhang et al., 2017; Mocan et al., 2016; Zhu et al., 2014).

In a recent study, we fabricated for the first time a SERS-active electrode with graphene-based AgNp/Gr@ ITO hybrid platform for the detection of PCT biomarkers (Selimoğlu and Ayhan, 2023). As a result, simple nanostructured SERS electrode materials based on AgNP-doped graphene were designed, allowing the quick detection of PCT. A perfect agreement of AgNPs and single-layer CVD graphene was achieved, resulting in efficient SERS performance. Thanks to the large surface area of graphene, numerous PCT antibody molecules could bind to the surface of the SERS substrates. A high EF of $1.6x10^{9}$ and a significant LOD of 4 $ngmL^{-1}$ indicated that the fabricated SERS substrates exhibited excellent SERS activity.

Conclusion and Recommendations

In the face of changing and evolving living conditions, expectations of science and technology are higher today than ever before. The development and production of reliable, rapid, sensitive, inexpensive, portable and wearable test materials is crucial for the early diagnosis and detection of trace amounts of specific molecules related to human, animal, food and environmental health. SERS-active substrates and the SERS technique developed by utilizing the perfect compatibility of NPs and other nanomaterials with superior properties are a promising approach. Parameters such as shape, size and distribution of all NPs, especially noble metals, can be modified, hybrid structures of NPs and 2D nanomaterials can be modified to produce SERS-active substrates with high EF and sensitivity, and specific molecules at very low concentrations can be reliably detected by mobile Raman devices within seconds.

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DERİN ÖĞRENME İLE METİN ÖZETLEME: EPOCH SAYISININ ETKİSİ ÜZERİNE BİR İNCELEME

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Özet
Eğer bu çalışmanın amacı doğru bir şekilde incelenirse, günlük hayatta birçok paragrafın okunduğu ve bu paragrafların bazen önemli, bazen önemsiz olduğu fakat her bir paragrafın okunması için dakikaların harcandığı ortaya çıkarılabilir. Bu çalışma, tam olarak bu amaca yönelik olarak yapılmıştır. Uzun paragrafların okunması sırasında, zamanın tasarruflu kullanılması ve sadece önemli noktaların anlaşılabilmesi hedeflenmiştir. Metin özetleme üzerine yapılan çalışmalar, derin öğrenme tekniklerinin kullanımıyla büyük bir gelişme kaydetmiştir. Bu bildiride, epoch sayısının, loss değerinin ve metin özetlemesi için kullanılan modelin performansı üzerindeki etkisi incelenmiştir. Deneylerde, 10, 100 ve 1000 epoch ile eğitilen modellerin 5 cümlelik metin özetleri karşılaştırılmıştır. 10 epoch ile eğitilen modelin loss değerinin 2.41 olduğu ve %30'luk bir özetleme başarısı gösterdiği, ancak önemli noktalara yeterince odaklanamadığı gözlemlenmiştir. 100 epoch ile eğitilen modelin ise loss değerinin 1.07 olduğu ve %67'lik bir özetleme başarısı elde ettiği ve önemli noktaların çoğunu kapsadığı tespit edilmiştir. En uzun eğitim süresi olan 1000 epoch ile eğitilen modelin loss değerinin 0.81 olduğu ve %71 oranında metni özetleyebildiği ve önemli noktalara daha derinlemesine değindiği belirlenmiştir. Bu sonuçlar, metin özetleme alanında derin öğrenme yöntemlerinin etkinliğini ortaya koymaktadır. Ancak, optimal özetleme performansı için epoch sayısı gibi faktörlerin dikkate alınması önemlidir.
Anahtar Kelimeler: Metin Özetleme, Derin Öğrenme, Epoch Sayısı, Makine Öğrenmesi

TEXT SUMMARISATION WITH DEEP LEARNING: AN INVESTIGATION ON THE EFFECT OF EPOCH NUMBER

Abstract
If the purpose of this study is examined correctly, it can be revealed that many paragraphs are read in daily life, and these paragraphs are sometimes important and sometimes unimportant, but minutes are spent reading each paragraph. This study has been specifically designed for this purpose. During the reading of long paragraphs, the aim is to use time efficiently and to understand only the important points. Studies on text summarization have shown significant progress with the use of deep learning techniques. In this paper, the effect of epoch number, loss value, and the model used for text summarization performance is examined. In experiments, models trained with 10, 100, and 1000 epochs are compared for 5-sentence text summaries. It was observed that the model trained with 10 epochs had a loss value of 2.41 and showed a summarization success rate of 30%, but it did not sufficiently focus on important points. The model trained with 100 epochs had a loss value of 1.07 and achieved a summarization success rate of 67%, covering most of the important points. The model trained with the longest training duration of 1000 epochs had a loss value of 0.81 and could summarize the text with a success rate of 71%, delving more deeply into the important points. These results demonstrate the effectiveness of deep learning methods in text summarization. However, it is important to consider factors such as the number of epochs for optimal summarization performance.
Keywords: Text summarization Deep Learning, Epoch Number, Machine Learning

Introduction

In today's digital age, the sheer volume of information available to individuals has reached unprecedented levels, making it increasingly challenging to efficiently process and understand textual content. Whether it's news articles, academic papers, or online content, people are often required to sift through lengthy paragraphs to extract the essential information. While some of these texts contain critical details that readers need to grasp, others may be less significant but still consume valuable time during reading.With the exponential growth of textual content available on the Internet, as well as in various archives of news articles, scientific papers, legal documents, and more, the importance of Automatic Text Summarization (ATS) has become increasingly evident. Manual summarization methods are not only time-consuming and costly but also impractical given the sheer volume of textual data. Researchers have been striving to enhance ATS techniques since the 1950s, primarily focusing on extractive approaches where important sentences are selected and concatenated to form a summary. However, this focus on extractive methods has left the potential of abstractive and hybrid approaches relatively unexplored.The extractive approach, which selects and concatenates the most important sentences from the input document(s), has been the primary focus of most research efforts in ATS. In contrast, the abstractive approach represents the input document(s) in an intermediate representation and generates summaries with sentences that may differ from the original text. Hybrid approaches combine elements of both extractive and abstractive methods. Despite the plethora of proposed methods, the summaries generated by ATS still fall short of human-generated summaries in terms of quality and coherence.Recent research has emphasized the importance of exploring abstractive and hybrid approaches to overcome the limitations of traditional extractive methods (El-Kassas et al., 2021). Highlighted the significance of abstractive summarization of multi-documents in generating concentrated versions of documents while preserving the main information (Abualigah et al. 2020). Moreover, introduced a Fuzzy Inference System-based extraction approach and discussed the semantic approach using Latent Semantic Analysis, indicating the potential of alternative techniques in text summarization (Babar and Patil 2015).Given the massive amount of data available today, the importance of text summarization techniques that can efficiently extract relevant information from large documents cannot be overstated. This study aims to contribute to the existing body of knowledge by investigating the impact of epoch number, loss value, and model architecture on text summarization performance, while also considering the potential of abstractive and hybrid approaches.

Materials and Methods

Data Collection:

For this study, a diverse dataset of textual content was meticulously collected from multiple sources to represent the variety of paragraphs encountered in daily life. The sources included news articles, scientific papers, online content, and other text-based materials. To ensure the relevance and quality of the data, we focused on documents that cover a range of topics and styles, including both informative and less significant content.

The collected dataset was subjected to initial preprocessing steps to clean and refine the data. This preprocessing phase involved removing any noise such as HTML tags, special characters, and irrelevant content to create a clean and standardized dataset. Additionally, the data was tokenized into sentences and words to facilitate further analysis and model training.

The primary objective of this data collection process was to create a representative dataset that reflects the type of paragraphs encountered in daily reading, thereby enabling us to train and evaluate our text summarization models effectively.

Model Training and Configuration:

In this study, deep learning techniques were employed to train text summarization models with a focus on exploring the impact of epoch number, loss value, and model architecture on summarization performance. Three different sets of models were trained with varying numbers of epochs, specifically 10, 100, and 1000 epochs, to understand their influence on the quality of generated summaries.The models were configured to use different loss functions to optimize the training process and improve the summarization performance. Additionally, we experimented with various model architectures, including both extractive and abstractive approaches, as well as hybrid models that combine elements of both approaches.Each model was trained on a subset of the preprocessed dataset obtained during the data collection phase. The training process involved feeding the data into the models iteratively, adjusting the model parameters based on the specified epoch number and loss value, and optimizing the model to generate accurate and coherent summaries.By varying the training parameters and model configurations, we aimed to explore the optimal conditions for achieving high-quality text summaries and understand the effectiveness of different approaches in capturing important points from the input paragraphs.

Analysis:

The analysis of the text summarization models' performance was conducted using a multi-faceted approach, involving both automated metrics derived from the program and qualitative

insights from domain experts. This dual-analysis method was employed to provide a comprehensive evaluation of the models' capabilities and limitations.Automated metrics such as loss values and summarization success rates were calculated to quantitatively assess the performance of the trained models. These metrics provided valuable insights into the effectiveness of different training parameters and model configurations in generating accurate and coherent summaries.In addition to automated metrics, qualitative analysis was performed by presenting the generated summaries to text summarization experts. These experts evaluated the summaries based on their relevance, coherence, and overall quality, providing subjective assessments that complemented the quantitative metrics.By combining insights from both automated metrics and expert evaluations, we were able to gain a holistic understanding of the models' performance. The analysis revealed that increasing the number of epochs generally improved the summarization success rate, with models trained for longer durations achieving higher success rates. However, it also highlighted the importance of considering factors such as loss value and model architecture for optimal summarization performance.Overall, the dual-analysis approach enabled us to draw comprehensive conclusions about the effectiveness of deep learning methods in text summarization and identify areas for further improvement and exploration.

Conclusion and Discussion

The aim of this study was to investigate the performance of text summarization models in efficiently capturing the essential points from paragraphs encountered in daily reading, thereby optimizing time utilization and comprehension. Leveraging deep learning techniques, we examined the impact of epoch number, loss value, and model architecture on summarization effectiveness.In our experiments, three sets of models were trained with varying numbers of epochs: 10, 100, and 1000. The quantitative results, as presented in Table 1, showed that the model trained with 10 epochs achieved a loss value of 2.41 and a summarization success rate of 30%, indicating a limited focus on important points. As the number of epochs increased to 100, the loss value decreased to 1.07, and the summarization success rate improved to 67%, covering most of the crucial information. The model trained with 1000 epochs further reduced the loss value to 0.81 and achieved a success rate of 71%, indicating a deeper understanding of the important points.

While these automated metrics provided valuable insights into the models' performance, we also sought qualitative evaluations from text summarization experts to validate the relevance and coherence of the generated summaries. The experts' assessments confirmed that as the

number of epochs increased, the models' ability to capture and summarize the essential points improved, aligning with the quantitative results.Comparing the program outputs with expert evaluations allowed us to draw comprehensive conclusions about the effectiveness of deep learning methods in text summarization. The combination of quantitative metrics and qualitative assessments provided a holistic perspective on the capabilities and limitations of the trained models.In conclusion, our findings demonstrate the effectiveness of deep learning techniques in generating text summaries that focus on the essential points of the input paragraphs. The results highlight the importance of optimizing training parameters, such as the number of epochs, to achieve optimal summarization performance. As the volume of textual content continues to grow, the development of efficient text summarization techniques remains crucial. Future research should further explore innovative approaches and optimization strategies to enhance the capabilities of text summarization models and address the evolving demands of information consumption in daily life.

Table 1. Urban and rural population in Türkiye (TUIK, 2015)

Epoch	Loss	Success Rate
10	2.41	%30
100	1.07	%67
1000	0.81	%71

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NURSING CARE OF A PATIENT WITH A DIAGNOSIS OF PNEUMONIA ACCORDING TO THE HENDERSON NURSING MODEL: CASE REPORT

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Abstract
Pneumonia is defined as infection of lung tissue caused by various microorganisms. The most important mechanism in the formation of pneumonia is the aspiration of organisms in the oropharynx. In this case report, it is aimed to evaluate the nursing care of the patient diagnosed with pneumonia according to the Henderson Model, one of the nursing theories. In this case, a 74-year-old female patient diagnosed with pneumonia applied to the health institution with complaints of cough, sputum, difficulty breathing, constipation, nausea, and body pain and was hospitalized. Additionally, the patient has medical diagnoses of hypertension and heart failure. The problems identified regarding the patient were planned according to the basic requirements in the Henderson Nursing Model and classified with NANDA-I Nursing Diagnoses. It was applied between 06.02.24 and 10.02.24 in line with the Nursing Interventions Classification (NIC) to determine the interventions to be applied to the patient in line with the determined nursing diagnoses and the Nursing Care Outcomes Classification (NOC) to evaluate the results of the care provided. 5 nursing diagnoses from the areas of activity/rest sleep, rest, excretion and gas exchange, comfort, safety/protection in NANDA Taxonomy II are included. The nursing diagnoses determined for the patient are Disruption in Sleep Pattern, Ineffective Respiratory Pattern, Constipation, Oral Mucous Membrane Disruption and Nausea. With the nursing care and education provided to the patient using the Henderson Nursing Model, the patient's problems were tried to be solved and the aim was to reduce the patient's current complaints and increase his independence over his disease. The patient stated that he felt better since coming to the hospital and that he could eat hospital meals. She stated that during her hospitalization, her constipation complaint disappeared and her breathing became easier. The patient was given discharge training and was made aware of the issues he should pay attention to after discharge.
Keywords: Nursing Care, Henderson Nursing Model, Pneumonia

Introduction

Nursing is a health discipline built on research, practice and theories based on philosophy. It guides the formation of knowledge in theories, determination of research methods, realization and implementation of the research process (Velioğlu, 2012). For a profession to be professional, the information must also be scientific. This means we can use theories and models for systematic information. Theories, models and theories that form the conceptual framework of nursing are frequently used in nursing education, management, practice and nursing research (Kaya et al., 2010). The strengthening of the nursing profession will be achieved by understanding the theories, conducting theory-based research and developing new theories (Aydın & Kukulu, 2020; Velioğlu, 2012).

Theoretical Framework: Henderson Nursing Model

Virgina Henderson, known as the best nurse of the 20th century, was born in America in 1897. She is a nursing theorist who advocates that health should be protected or regained by helping individuals with a holistic care approach (Ahtisham & Jacoline, 2015; Fernandes et al., 2019; Parker & Smith, 2010). Henderson defined the role of the nurse as "substituting for the patient, supportive (helping the patient), complementary (working with the patient), and aiming to help the individual be as independent as possible." The main purpose here is to help the patient and make him the most independent (Ahtisham & Jacoline, 2015; Kılıç et al., 2019; Velioğlu, 2012). While making these definitions, he was influenced by basic human needs and Maslow's hierarchy. There are fourteen components in the Henderson nursing care model, which considers humans holistically with their biological, psychological, social and spiritual aspects. While the first nine components consist of physiological needs, the other components consist of love and belonging needs and self-esteem needs (Ahtisham & Jacoline, 2015; Soner, 2018). Henderson's care model and the stages of the nursing process are similar. During the data collection phase, information is obtained from the patient through observation, feeling and listening. Which needs the patient has difficulty meeting and the reasons for these should be investigated (Velioğlu, 2012; Birol, 2016).The nurse should take into account factors such as the patient's age, gender, physiological and emotional state, culture and cultural background, and physical and mental intelligence level during the stages of defining, planning and implementing the patient's care needs. (Velioğlu, 2012; Erol et al., 2016; Soner, 2018). With Henderson theory, the hierarchy of basic human needs is used to determine priorities in the planning phase of nursing care (Velioğlu, 2012; Ahtisham & Jacoline, 2015; Erol et al., 2016). The aim of care planning is to meet the individual's basic needs and help him regain his

independence. The nurse should plan, implement and constantly evaluate the patient's care plan (Acun et al., 2022). In the evaluation phase of the nursing care plan, the results of the care provided by the patient with his/her capacity and power to meet his/her basic needs independently are revealed (Velioğlu, 2012; Erol et al., 2016; Birol, 2016; Soner, 2018).

Pneumonia

Pneumonia is an infection of the lung tissue caused by various microorganisms (rickettsiae, fungi, parasites, viruses, bacteria) (Prina et al., 2015). The most important mechanism in the formation of pneumonia is the aspiration of organisms in the oropharynx. All respiratory tracts, from the nose to the bronchioles, are covered with a layer of mucus that covers the surface and keeps it moist. Mucus traps airborne particles with breathing and prevents them from entering the alveoli (Vaughn et al., 2019). In addition, cilia in the epithelium of the respiratory tract also retain foreign substances in the air. Mucus and cilia work in reverse to clean the respiratory tract. As body resistance decreases, this mucociliary activity is disrupted, pneumococci descend into the lower airways with oropharyngeal mucus and the disease occurs (Prina et al., 2015; Vaughn et al., 2019). Signs and symptoms of pneumonia; hypoxemia, tachypnea and dyspnea, fever, dehydration, pain, sputum cough, decreased lung expansion. The primary aim in nursing care of pneumonia is to reduce the symptoms and ensure the comfort of the patient (Demir et al., 2022; Prina et al., 2015; Vaughn et al., 2019). Hypoxemia is tried to be prevented by keeping oxygen saturation above 90%. To increase ventilation, the patient is seated in an upright position and diaphragm and muscle activities are regulated. The patient's pain level is determined and the appropriate treatment method is selected and applied to relieve the individual. Vital signs should be monitored at frequent intervals until the patient's condition stabilizes. The patient's fluid intake should be monitored. By establishing effective communication with the patient, anxiety is reduced and the person feels relaxed. (Prina et al., 2015).

CASE REPORT

Seventy-four-year-old female patient A.Y is a housewife and has social security. She has two girls and four boys. A.Y. lost her two daughters and three sons for various reasons. Their surviving children married and established their own lives. A.Y. lives in the village with his wife. She lives close to her youngest son and brings her son to the hospital. The patient, diagnosed with pneumonia, was recently admitted to the internal medicine outpatient clinic of a state hospital on 06.02.2024 with complaints of cough, sputum, difficulty breathing, constipation, nausea and body pain. After the examination, it was decided that she would be

admitted to the Internal Medicine Service and she was admitted at 12:00. A.Y. is conscious, oriented and cooperative, has normal hearing and tactile senses, and uses glasses and dental prosthesis. The patient's medical medications are listed in Table 1.

Table 1. Medications that A.Y. has been using continuously and for the last year

Panto 40 mg	1x1 oral
Levotiron 100 mg	1x1 oral
Norvacs 10 mg	1x1 oral
Coledan-D3 20.000 IU	1x1 oral
Zodınasıl 5 mg/100	1x1 intravenous
Meteospasmyl 60 mg	1x1 oral
Parafon 300 mg	1x1 oral
Elektra %1.25	4x1 topical
Etol fort 400 mg	1x1 oral
Meresa 50 mg	1x1 oral
Cabral 400 mg	1x1 oral

A.Y's vital values on 06.02.2024: Respiration 18/min; pulse 100/min rhythmic full; TA 140/80 mm/Hg, body temperature 36.4 C^0; SPO_2: %86 (without oxygen). The patient was started on oxygen support via nasal cannula. The saturation value was measured as %91 with 3lt/min oxygen support. The patient's blood values are shown in Table 2.

Table 2. Laboratory Findings

Biochemistry findings	Creatinine value 0.57 (normal value range 0.70-1.20) ALT value 71 (normal value range 0-33) AST value 64 U/L (normal value range 0-32) Alkaline phosphatase value is 115 U/L (normal value range 35-105) CRP value 107 mg/L (normal value range 0-5) Calcium value 8.0 mg/L (normal value range 8.6-10.2)
Hemogram findings were normal. It was decided to monitor the patient's AST, ALT and CRP on a daily basis.	07.02.24 ALT value: 49 AST value: 27 CRP value: 84 08.02.24 ALT value: 41 AST value: 29 CRP value: 38 09.02.24 ALT value: 38 AST value: 21 CRP value: 21

The surgeries A.Y. has had in her CV include thyroidectomy, cesarean section and cataract. When family risk factors were examined, it was seen that his father had heart disease and her

mother had skin cancer. She has been receiving treatment for 10 years due to a diagnosis of asthma. Chronic diseases include hypertension and heart failure. She complies with drug treatment for these diseases and follows a salt-free diet. She has been diagnosed with osteoporosis for 20 years and has been using medication for it. There is no known food or drug allergy. She does not have any infectious diseases or a smoking habit. The patient, whose blood group is A Rh(+), has not received blood transfusion before. Nutrition is oral and independent. She is on a salt-free diet. She stated that his appetite has decreased recently due to feeling nauseated. The patient's vision, hearing and speech are normal, he has accepted his illness, her approach to the healthcare team is friendly and open to communication. A.Y is 1.55 tall and weighs 60 kg. Body mass index is within the normal range of 24.9. General appearance; It is tidy and clean. The patient can perform personal cleaning and hygiene independently. She does not use an assistive prosthesis for movement and can move independently. She can handle bathing and defecation on her own. The patient's defecation frequency is low. She stated that she had been suffering from constipation for a while A.Y. The lady has no sleep pattern lately and stated that she has difficulty sleeping. She stated that she experienced dry mouth in daily life, that she urinated frequently but could only urinate little, and that she had complaints of burning sensation under her feet and body pain. A.Y. stated that her eating increased after her hospitalization and that the treatment she received quickly helped. She said that he could not sleep on the first night of her stay because the bottoms of her feet were burning, and she was seen walking around the ward throughout the night. This situation was reported to her doctor the next day.

Evaluation of the case and nursing diagnosis according to the Henderson Nursing Model

In the case described above, the patient was interviewed at an appropriate time and interval and the problems were determined with the data collected (Table 3). The identified problems were planned according to the basic requirements in the Henderson Nursing Model and classified with NANDA-I Nursing Diagnoses. The determined nursing diagnoses were applied between 06.02.24 and 10.02.24 in line with the Nursing Interventions Classification (NIC) to determine the interventions to be applied to the patient and the Nursing Care Outcomes Classification (NOC) to evaluate the results of the care provided.

Table 3. Classification of Problems According to the Henderson Nursing Model Basic Needs Problems

Basic Needs	Problems
1-Normal Breathing	The patient's breathing rate is 18-24/min. The initial hospitalization oxygen saturation was 86.
2-Adequate Eating and Drinking	The female patient stated that her appetite decreased due to nausea at home and that she did not want to eat.
3-Intestines and Bladder	The patient experiences polyuria, urinating frequently and urinating small amounts. She has had defecation problems for two weeks.
4-Moving and maintaining the desired position	The patient can move independently in daily living activities without using an assistive prosthesis. There is no movement restriction.
5-Sleep	Before the disease, the patient had no sleep patterns and had difficulty falling asleep. It can wander around at night and sleep for 1-2 hours.
6-Choosing appropriate clothing, dressing and undressing	The individual can choose clothes and dress on her own.
7-Keeping body temperature within normal limits by adjusting clothing and changing the environment	It was observed that she walked around the ward without shoes at night, complaining of burning sensations on the bottom of her feet. The patient's body temperature is between 36.4-37.
8-Keeping the body clean, caring for the skin and protecting its integrity	There is no problem with skin care and integrity.
9-Avoiding dangers in the environment and protecting from accidents and injuries	The patient stated that she had not experienced any falls before. The risk of itachi fall score is calculated as 5 (normal). The bed borders are up and the head of the bed is arranged.
10-Expressing feelings, needs, fears and thoughts by communicating with other individuals	The patient is friendly to the healthcare team, believes in treatment, and is open to communication. She has no problem expressing herself.
11-Worship in accordance with your beliefs	She does not have any problems in fulfilling her religious belief.
12-Achieving a sense of success while working	The patient is a housewife. She used to care for cows, but no longer does so due to her aging.
13-Participating in various entertainment activities or making use of time	The patient lives close to his youngest son. She can also spend time with her grandchildren or relatives whenever she wants.
14-Learning, exploring and satisfying one's curiosity, which will contribute to her normal development and health and benefit from existing health opportunities.	The patient is knowledgeable about her treatment and disease.

Nursing Diagnoses

Nursing Diagnosis-1: Disturbance in Sleep Pattern related to the pneumonia process, where the individual states that she cannot sleep well and it is observed that she cannot sleep on the first night of hospitalization.

Area 4. Activity/rest Class 1. Sleep/Rest Code:00198

NOC-Classification of Nursing Outcomes

• Facilitate regular sleep/wake cycle

• Staying awake at appropriate times

• Feeling refreshed after sleep

NIC-Classification of Nursing Outcomes

• Treatment hours were arranged to avoid interruption of sleep.

• Appropriate sleep time and treatment time were determined for the patient.

• Environmental noises have been reduced to a minimum.

• Care was taken to ensure uninterrupted sleep in the first period of sleep.

• Information was obtained about the patient's daily sleep habits and duration.

• A quiet and calm environment was provided for the patient to sleep.

• Attempts to ensure normal sleep patterns were planned (such as taking a warm shower, deep breathing exercises, drinking warm milk).

Evaluation: Interventions were implemented to increase sleep comfort by ensuring the patient's adaptation to the environment. She was taught how to maintain her sleep pattern at home after discharge. A decrease in the problem associated with this diagnosis was observed. The patient said that she was able to sleep at least 4 hours in the following nights.

Nursing Diagnosis-2: Ineffective Respiratory Pattern related to the Pneumonia process due to asthma and shortness of breath with complaints of cough and sputum in the individual.

Domain 4. Activity/rest Class 1. Cardiovascular/Pulmonary responses Code:00032

NOC-Classification of Nursing Outcomes

• Breath sounds will be normal

• Airway patency will be maintained

• Methods that will increase secretion excretion will be known and applied.

• The patient's SpO2 value will be above 90%

NIC-Classification of Nursing Outcomes

• The patient was administered oxygen therapy via nasal cannula.

• Semi-fowler position was given to relieve breathing.

• The patient's back was supported with pillows.

• Respiratory sounds, wheezing, and presence of secretions were monitored.

• Bronchodilator and inhaler steroid drugs were administered as ordered.

• After inhaler treatment, the patient was told about the oral care he should do.

Evaluation: As a result of the interventions and care, A.Y.'s breathing problems decreased. The patient's saturation values were monitored throughout the day. The SpO_2 value rose above 90 without the need for a nasal cannula. The patient adapted to the treatment with the nebul mask.

Nursing Diagnosis-3: Constipation due to defecation problem lasting for two weeks

Area 3. Excretion and Gas exchange Class 2. Gastrointestinal function Code: 00011

NOC-Classification of Nursing Outcomes

• The patient's defecation is soft, shaped and without straining,

• Bowel sounds are 6-10/min

• Ensuring the patient defecates with normal frequency and consistency

NIC-Classification of Nursing Outcomes

• The patient's general defecation frequency, amount and solidity were evaluated.

• Daily fluid intake and fiber food consumption were evaluated.

• The patient's mobility was evaluated and daily physical activity was increased.

• The patient's privacy was taken into consideration.

• Oralac 670 mg syrup 1x1 oral treatment was ordered.

• It is recommended to walk in the corridor for at least 30 minutes during the day.

Evaluation: The patient used the ordered Oralac syrup until the constipation complaint disappeared. The patient's bowel movements were relieved with increased physical activity and an adjusted diet.

Nursing Diagnosis-4: Risk of Deterioration in Oral Mucous Membrane due to inhaler therapy

Area 11.Safety/Protection Class 2. Physical injury Code.00247

NOC-Classification of Nursing Outcomes

• Intact oral mucous membrane will be protected and precautions will be taken to prevent its deterioration.

• Ensuring the integrity and moisture of the oral-mucosal membrane

NIC-Classification of Nursing Outcomes

• Oral mucous membrane was evaluated regularly.

• The patient's nutrition and adequate fluid consumption were monitored.

• The patient was informed that foods that could harm the oral cavity should be avoided and liquids should be consumed warm.

• The patient was told to take care of his mouth by gargling after using inhaler medication.

• After discharge, the use of a soft toothbrush and oral care/brushing twice a day was explained to the patient.

• Adequate hydration of the patient with dry mouth was ensured.

• Lips were cared for with moisturizer.

Evaluation: The patient was given training to prevent oral injuries. Fluid intake was supported for complaints of dry mouth. The patient's problem in this regard was resolved.

Nursing Diagnosis-5: Nausea due to the patient stating that he cannot eat at home because he has nausea and that his appetite has decreased.

Area 12. Comfort Class 1.Physical comfort Code.00134

NOC-Classification of Nursing Outcomes

• Comfort state

• Hydration

• Nutritional status

NIC-Classification of Nursing Outcomes

• The causes of nausea were evaluated.

• The individual was encouraged to eat little and often.

• Oral care was given to ensure comfort.

• The patient was allowed to rest and sleep

• Unpleasant sights and smells in the patient room were eliminated.

• After the meal, the patient was instructed to rest in the semi-fowler position.

• Nausea reduction techniques were taught.

• Hot or cold liquids, caffeine, and spicy foods were avoided.

Evaluation: The patient, who complained of nausea due to the disease, stated that he could eat hospital food after IV treatments in the hospital and did not experience nausea.

Discussion

Pneumonia, which negatively affects the quality of life of patients, has physical, social and psychological effects on the patient. Symptoms of pneumonia include cough, fever, chills and shortness of breath, sputum, weakness, fatigue, nausea, vomiting, loss of appetite and muscle aches (Prina et al., 2015; Vaughn et al., 2019). In the study of Demir et al. (2022) with a pneumonia patient, it was determined that there was obstruction in the respiratory tract,

increased secretion and phlegm, pain, increased respiratory rate, sweating, feeling of restlessness, and weakness; In the study of Aksoy et al. (2014), it was found that the patient had complaints of dry cough, weight loss, night sweats and back pain. The anamnesis of the pneumonia patient in this case report was taken and it was determined that he had complaints of sputum, cough, difficulty in breathing and nausea. Additionally, other information obtained from the case was provided by A.Y. The woman cannot sleep at night, cannot breathe effectively and has a loss of appetite. In this case, NANDA Taxonomy II classification system was used in the nursing care of A.Y., who was diagnosed with pneumonia. Five nursing diagnoses in NANDA Taxonomy II are included in the areas of activity/rest sleep, rest, excretion and gas exchange, comfort, and safety/protection. In the A.Y. approach, holistic and humanistic care is provided with the Henderson nursing model, which excludes medication practices. The Henderson nursing model, which provides nursing care practices within the framework of supportive, complementary and sustaining nursing roles, aims to protect and restore health. In this case report, it was determined that the patient had been receiving asthma treatment for 10 years. Pneumonia usually presents with symptoms such as cough with phlegm, shortness of breath, nausea and vomiting, and fever (Aksoy et al., 2014; Prina et al., 2015). The patient was helped and helped to become most independent with the care and education provided using the Henderson Nursing Model. A.Y. said that he felt better since he came to the hospital and stated that he could eat hospital food. She stated that during her hospitalization, her constipation complaint disappeared and her breathing became easier. She learned what she could do about her sleep problems at home after being discharged. In addition, it can be said that nursing care provided using the Henderson Nursing Model provides a systematic approach to the detection and solution of multifaceted patient problems in care, makes nursing care visible, and plays a role in improving the nurse's decision-making and critical thinking skills.

Conclusion and Recommendations

Henderson nursing model has enabled us to examine humans holistically with their biological, psychological, social and spiritual aspects. A.Y.'s complaints were listened to, effective communication was established, his problems were identified, and nursing care was provided accordingly to increase the patient's well-being. The care provided with a holistic approach increased the individual's independence in care and the training provided ensured the effectiveness of the healing process.

Thanks and Information Note

We would like to thank the patient diagnosed with Pneumonia who agreed to participate in the study.

Ethical Approval

Informed consent was obtained both verbally and in writing by explaining the purpose of the study and that the information would be used for scientific purposes. The patient's name was shortened considering ethical issues.

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ORLANDO'S NURSING INTERACTION MODEL FOR NURSING CARE İN THE POSTPARTUM PERIOD: CASE REPORT

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Abstract
Theories and models in nursing describe, predict and facilitate evaluation of events. In order for nursing care to have a scientific quality and to meet all the needs of the individual, it must be used together with a nursing model. Nursing theories and models give a systematic view to the nursing process and guide nurses. Ida Jean Orlando's Interaction Theory enables nurses to create an effective and comprehensive nursing care plan in adapting to the health problems that arise in the patient. At the same time, interaction theory is based on meeting the needs of the patient through communication between the patient and the nurse. In this case report, care was given to a mother in the postpartum period, during which she experienced motherhood for the first time, using Orlando's interaction model. Data were collected by interviewing the patient, from the patient file, and by researcher observation. In line with the data collected, a care plan was created taking into account the mother's verbal and non-verbal behaviors. The individual in the postpartum period was given education and care using the Interaction Model in Nursing regarding the postpartum process, newborn care and breastfeeding. Nursing care was planned, implemented and evaluated according to the Orlando Nursing Interaction Model. The NANDA-I diagnoses determined for this patient are mainly Anxiety, Acute Pain and Lack of Information. In this case, it was observed that the mother who went through the postpartum period and the puerperal period felt better psychologically and there were changes in communication and behavior. The ability to adapt and sustain this process has been provided. The mother gave positive feedback with both verbal and non-verbal behaviors. The patient was given discharge training and was made aware of the issues he should pay attention to after discharge.
Keywords: Nursing care, Interaction Model in Nursing, Postpartum, Case report

Introduction

In the nursing profession, which is a professional health discipline, care is provided by using theories and models. Nurses plan care by using models and theories on the basis of the nursing process. The use of nursing models and theories guides the nurse in the care process and ensures that care is planned in a systematic manner. The postpartum period is defined as a process in which healthy attachment between mother, baby and family members is ensured, health is protected and improved, physiological and psychological processes are observed (Yurdal & Aksu, 2021). Postpartum period or puerperium period is a process in which nursing care is extremely important for mother and baby. In this process, both mother and newborn need a lot of nursing care. In this process, mothers may face many problems including newborn care, breastfeeding, breast care, sleep problems, constipation, communicating with the baby, motherhood role, mental problems such as depression. Therefore, the nursing care to be given in the postnatal period should be planned to meet the needs of both the mother, the baby and the family.

Ida Jean Orlando's Interaction Model

Ida Jean Orlando, an American of Irish origin, was born in 1926. In 1947, she graduated from New York Medical College as a nurse and received her master's degree in 1954 (Yurdal & Aksu; 2021; Çakı & Güngörmüş, 2022). Orlando's interaction theory emphasises the communication and interaction between the patient and the nurse. According to Orlando, an individual is a person who completes his/her own independent processes and can act independently without being under stress. However, when any deviation from normal situations occurs and the individual cannot provide independence, nursing care is needed. According to Orlando, the nursing process consists of three basic components. These are; patient's behaviour, nurse's reaction and nursing actions. Patient's behaviour: It includes both verbal behaviours and non-verbal behaviours such as crying and skin discolouration that the nurse observes in the instant communication between the patient and the nurse. The nurse's reaction: while collecting data about the patient, the nurse becomes aware of the patient's behaviour and perceives the behaviour, thus forming thoughts and feelings about the subject. Nursing action: These are the nursing interventions that the nurse creates according to the nurse's reaction. In Orlando's Interaction Model, the centre is the individual and the aim is to establish an effective communication with the individual and to eliminate the existing distress. This model provides autonomy in nurses, but it also has weaknesses. One of the criticised aspects of the model is that it is difficult to apply to conscious patients. According to Orlando, nursing is a process and

there are four basic practices in this process: Observation, Oral report, Recording (written report), Activities with or for the patient (Özer Yurdal & Aksu, 2021).

Purpose of the Study

In this study, it was aimed to evaluate the individual by applying the nursing process under the leadership of Orlando's Interaction Model to the mother who experienced first motherhood and in the postpartum process.

CASE REPORT

She is 27 years old, a university graduate and a housewife, and this is her first experience of motherhood and her first child. M.Ö had a caesarean section due to breech presentation of the baby and her baby girl weighing 2960 g was born healthy. The puerperant was accompanied by her mother-in-law and relatives. The caesarean section was performed under general anaesthesia. After the operation, M.Ö was taken to her room and fed her newborn baby by expressing her first milk 4 hours later. The first vital signs of M.Ö were blood pressure 90/60 mm/Hg, pulse rate per minute 64, respiratory rate per minute 20 and oxygen saturation 96%. The vital signs of the newborn are within normal limits. The newborn's breast searches were active, skin colour, muscle tone and reactions were normal. After general anaesthesia, it was observed that the mother had difficulty in communicating, had pain, could not actively participate in breastfeeding education, did not ask questions and was constantly distracted. It was observed that the mother, who was constantly accompanied by family relatives, had tears in her eyes when her room was entered, family relatives asked more questions than the mother, and questions such as can we give the baby Zamzam water or dates were encountered. In this case, it was deemed necessary to provide detailed training to both the family and the mother. The content of the training includes topics such as the motherhood process, conditions that can be seen after caesarean section, the importance of breast milk and breastfeeding, breastfeeding positions, maternal psychology and postpartum depression. This training content was explained verbally to the mother and her relatives and given as a written brochure. The mother was discharged after 48 hours and it was stated that she should come for a follow-up visit after one week. One week later, M.Ö. was hospitalised and it was stated that the baby should receive phototherapy treatment at grade 4. It was requested by the physician to provide formula support when separate breast milk was not sufficient and to measure vital signs 6 times a day. Having an anxious and stressed appearance, M.Ö came to the hospital with her husband. She stated that she was given breastfeeding training but could not apply it effectively. She stated that her caesarean section and puerperium were very difficult, she could not breastfeed her baby

sufficiently, she could not burp her baby, her family relatives and mother-in-law constantly interfered with her in this process and she felt very inadequate. She stated that her husband did not support her by relying on the experience of her mother-in-law, that she did not feel psychologically well in this process and that they blamed her for the jaundice of the baby. She also stated that she herself was not sufficiently fed, had no appetite and therefore her milk was low.

RESULTS

Observations

Direct Observations: The nurse's reaction to the patient's behaviour

***Non-verbal observations**

-Not being open to communication in the first place

-Look tired

-Appearing tearful

-Distraction of the eye

-No questions asked

***Verbal observations**

-Stating that she feels guilty about not breastfeeding her baby properly

-Expressing that he/she thinks that there is a problem when his/her baby cries

-Otherwise, don't I have milk, nurse? Is my child going hungry?

Indirect Observations Other Information Related to Patient's Behaviour

-From the day the puerperium was admitted to the clinic and afterwards, the situation of the puerperium was discussed with the nurses and it was learned that the puerperium exhibited similar behaviours.

ACTIVITIES

The Activity of the Nurse: Purposeful Nursing Process

***Direct Assistance**

-Understanding the psychological concerns of the mother in the postpartum period, open communication was provided and support was provided for her to ask questions. The main cause of the problem was tried to be found and interventions were provided.

-Non-pharmacological (relaxation techniques and listening to music) as well as pharmacological methods were applied for the pain of the caesarean section mother.

-Breastfeeding techniques and positions, how to hold, how the baby is saturated or not saturated were explained to the mother.

-Gas removal techniques from the newborn and lying in the side position, warnings were given to prevent aspiration of the newborn.

-It was explained that myths about breastfeeding are wrong.

-The importance of breast milk was mentioned.

-Problems that may occur with the breast were mentioned.

-The importance of skin contact with the mother was also shown practically.

-The importance of water, nutrition, sleep and hygiene for the mother was mentioned.

-It was stated to the relatives of M.Ö that the newborn should only receive breast milk, that the increase in milk will increase with the sucking of the newborn, that stress factors should not be reflected to the mother, that we conveyed a lot of information, and that if you have questions, they should contact us, not the mother. It was stated that the mother should be given positive support.

-Support was also given during the neonatal phototherapy process to express her feelings. The mother's questions were repeated where they needed to be repeated in an understandable way.

-The room was ventilated, it was stated that her husband and family relatives should support her to walk in the room.

-In all interviews and interventions in this process, attention was paid to eye contact and communication was kept simple, short and clear.

***Indirect help**

-A milk pump was provided for expressing the mother's milk after general anaesthesia.

REPORTING

Improvement in the patient's behaviour after his/her needs are met

***Non-Verbal Behaviours**

-More open to communication

-Make eye contact

-Reduced distracted gaze

Approach their own baby in a more stress-free and self-confident way

-Facial expression shows that their fear has diminished

***Verbal Behaviour**

-Mother's statement that the pain has decreased

-The mother is willing to breastfeed and expresses her full belief that the newborn's milk will come and be sufficient with the correct breastfeeding techniques

-Expressing that she knows that these processes are natural due to maternity and that she should reduce stressors for the health of mother and baby

-Expression of increased desire to eat over time

-Stating that he expresses himself better

-Stating that these fears will decrease over time

Record Keeping

Help needs of the mother in the postpartum period were met. Effective nursing care was provided. Positive developments were observed in verbal and non-verbal behaviours of the postpartum mother.

DISCUSSION

Orlando's Interaction Nursing model makes a positive contribution to the nursing process by providing the nurse-patient relationship. Nurses plan and implement nursing interventions in line with the needs of healthy or sick individuals. Especially the individual in the postpartum period may face many problems such as newborn care, communicating with the baby, breast care and breastfeeding, motherhood role, communication problems, depression. It has been reported in the literature that nursing care provided by using a model/theory or classification system in these individuals yields effective results (Buldum & Yılmaz, 2020; Dündar & Gerçek, 2020; Yurdal & Aksu, 2021). In this case report, the health problems of a patient who gave birth by caesarean section were evaluated in line with Orlando's Interaction Model, nursing diagnoses were defined with NANDA-I and nursing care was applied in line with the nursing process. Three nursing diagnoses were determined according to NANDA-I Taxonomy II. These diagnoses are Anxiety, Pain and Lack of Information.As a result, it was observed that the individual followed in the postpartum process in this case had a decrease in her current complaints or some complaints were no longer present after both medical treatment and nursing care received in line with the Interaction Model. In this case, it was observed that the mother in the postpartum period felt better psychologically and there were changes in behaviour. It was also observed that she maintained mother-infant harmony more easily and got used to the motherhood process. The mother also made positive feedbacks and engaged in both verbal and non-verbal behaviours, and it was determined that the nurses providing care were satisfied. In this direction, it can be said that using Orlando's interaction model based on the verbal and non-verbal behaviours of the patients improves the quality of nursing care. In addition, it is thought that this study will serve as an example for nurses working in obstetrics and /newborn pediatric clinics or providing clinical care and will increase their awareness on this issue.

NURSING DIAGNOSES

Nursing Diagnosis-1: "ANXIETY" related to the new passpartum processes, which was found when she stated that she felt guilty because she thought that she could not breastfeed her baby properly, that she was afraid of not being able to take care of her baby properly and that she was experiencing stress.

NOC-Classification of Nursing Outcomes

-Use effective coping mechanisms

-Identify their own anxiety and coping patterns

-The individual expresses an increase in psychological and physiological comfort.

NIC- Nursing Interventions Classification

-Reducing anxiety

Initiatives

Situations that would cause anxiety were determined by ensuring a healthy communication, empathic approach and self-expression.

-In order to reduce anxiety, the lack of information that would cause this anxiety was tried to be eliminated.

-Effective coping mechanisms were taught.

-It was determined that the relatives of the mother in the postpartum period created stress on M.Ö and the family was contacted. The reasons for the presence of M.Ö. with them were re-determined and it was stated how appropriate approaches should be.

M.Ö was encouraged to ask all questions about her baby and her fears about her baby were identified and a safe communication was established.

-A realistic hope approach was determined.

-M.Ö was told that the processes and emotions she experienced were normal things unless there was an abnormal situation and that she should be open to communication and that the process could be solved with a healthy communication.

Evaluation

It was observed that her anxiety decreased and the mother-baby process was carried out in a healthier way with the active participation of M.Ö.

Nursing diagnosis-2: "PAIN" related to caesarean section birth, found by expressing that she had pain.

NOC-Classification of Nursing Outcomes

-Explaining the factors that increase pain by associating them

-Explaining the effective interventions by associating them

-The individual will express that he/she is relieved after an adequate, appropriate measure that gives satisfaction.

NIC- Nursing Interventions Classification

-Pain reduction, pain management, management of drug therapy, emotional support, hot and cold application, massage

Initiatives

-Conditions caused by pain explained

How long the pain will last and pharmacological and non-pharmacological methods for reducing it were mentioned.

-In addition to the normal pain of the individual, the reasons why the individual may experience a decrease or increase in pain were discussed.

-The family was told not to put pressure on M.Ö and effective communication techniques.

Evaluation

It was observed that M.Ö's pain decreased day by day and he could cope with the current pain.

Nursing Diagnosis-3: "LACK OF KNOWLEDGE", which was found when she stated that she did not know breastfeeding techniques, in line with the new mother-infant relationship

NOC-Classification of Nursing Outcomes

The level of knowledge on the process of motherhood, the importance of breast milk and breastfeeding, breastfeeding positions, maternal psychology and postpartum depression will be increased.

Initiatives

-Their perceptions, thoughts, experiences related to breast feeding were discussed and their expectations were learnt.

-The importance of self-efficacy perception in breastfeeding was mentioned.

-The importance of breast milk and its benefits for mother and baby were mentioned.

-The structure of the breast, hormones that provide milk production and secretion were mentioned.

-Breastfeeding technique and breastfeeding positions were explained to mother M.Ö.

-First breastfeeding, duration and frequency of breastfeeding, milking and storage of breast milk, breast and nipple problems were mentioned.

-By asking questions and explaining practically, it was ensured that she participated more effectively.

-Encouraged to ask effective questions during and after the teaching phase.

-It was ensured to express and determine what their feelings and thoughts and stress factors were.

-How to ensure mother-infant harmony, processes were mentioned.

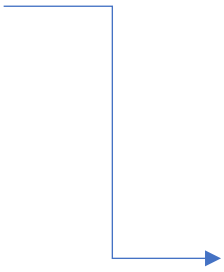
-Emotional moods experienced by the postpartum mother were explained as normal and coping methods were explained in this process.

-The points to be considered in communication with the mother in the postpartum period were explained to the family relatives.

Evaluation

-It was observed that mother M.Ö. participated more actively in the process and expressed her feelings and thoughts better with her baby receiving phototherapy and that mother-infant harmony was achieved when these interventions were applied and explained again.

Ineffective individual coping
Deterioration in self-esteem
Inadequate self-care
Deterioration in sleep habits
Change in family processes
Constipation
Inadequate/unbalanced Nutrition



M.Ö can be diagnosed with these diagnoses.

Conclusion and Recommendations

Nursing, which is a professional profession, bases the nursing process on models and theories. Orlando's interaction model can be used in ensuring the patient-nurse relationship. As seen in this case, it was seen that the mother who had her first baby experience and caesarean section experience contributed positively to the individual in the nursing care evaluated in psychological, physiological and biological aspects.

Thanks and Information Note

We would like to thank the patient in the postpartum period who agreed to participate in the study.

Ethical Approval

Informed consent was obtained both verbally and in writing by explaining the purpose of the study and that the information would be used for scientific purposes. The patient's name was shortened considering ethical issues.

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NURSING CARE PLAN for a COPD PATIENT ACCORDING to ROY ADAPTATION THEORY: CASE REPORT

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Abstract
Chronic obstructive pulmonary disease is a progressive lung disease that manifests itself with shortness of breath, increased secretion and chronic cough due to exposure to harmful gases and particles or tobacco consumption. This study was conducted on a 63-year-old patient with Chronic Obstructive Pulmonary Disease, which negatively affects the quality of life synchronized with shortness of breath, increased secretion and chronic cough, under the leadership of Callista Roy's Adaptation Theory, to collect data, provide nursing care, evaluate the individual, patient-environment-health-care relationship. It was made as a case report in order to identify and support positive stimuli. The patient, who was diagnosed with COPD, applied to the hospital's chest diseases clinic on 25.01.2024 due to shortness of breath due to movement at home, cough, general body pain and change in sputum color, and was admitted to the chest diseases service. The NANDA-I diagnoses identified for this patient are Ineffective Respiratory Pattern, Chronic Pain, Sleep Pattern Disruption, Constipation, Fatigue, Fall Risk, and Lack of Information. The determined nursing diagnoses were used as the basis for determining the interventions to be applied to the patient. In this case, the patient's quality of life and independence were increased with the nursing care provided in line with the Roy Adaptation Model, and the patient's adaptation to the disease was ensured during his hospitalization. He stated that during his hospitalization, his constipation complaint disappeared, his breathing became easier, his cough and pain decreased, and his sleep patterns improved. The patient was given discharge training and was made aware of the issues he should pay attention to after discharge. In this regard, it can be said that this theory is effective in disease management and adaptation to chronic diseases.
Keywords: Nursing care, COPD, Case Report, Roy Adaptation Model

Introduction

The basic use of theories and models is very important in terms of developing the nursing profession and creating a common field and language in nursing education (Callis, 2020; Pazarcıkcı & Uçak, 2021). Nursing education based on theories and models allows the individual to be evaluated holistically and to gain problem-solving skills (Callis, 2020; Koç et al., 2017). The use of theories in addition to pharmacological treatment in nursing allows focusing on the concept of 'Care', which is the main purpose of nursing (Baykara et al., 2019). Nursing theories help to achieve individual-oriented care and well-being by providing more effective, systematic and controlled application of treatment (Dağcı, 2019; Karaca & İster, 2016). In treatment management, patients' participation in treatment and compliance with the disease are important, and it is very important for nurses to work on the basis of patient-care relationship in disease management, especially with individuals with chronic diseases (Karaca & İster, 2016; Pazarcıkcı & Uçak, 2021).According to the research conducted by the World Health Organisation, chronic diseases, which are shown as the biggest health problem of the 21st century, include a large part of the death cases worldwide (Akın & Temiz, 2021; Gosak et al., 2022; Neşe, 2023; Zuhur & Özpancar, 2017). Patient adaptation plays an important role in managing symptoms, reducing repeated hospitalisations and improving quality of life with ongoing treatment and nursing care in chronic diseases (Criner & Han, 2018; Gosak et al., 2022; Karaca & İster, 2016; Zuhur & Özpancar, 2017).Chronic obstructive pulmonary disease is a chronic lung disease characterised by shortness of breath, increased secretion and chronic cough due to exposure to harmful gases and particles or tobacco consumption (Criner & Han, 2018; Neşe, 2023). In patients with COPD, shortness of breath and increased secretion are the most basic symptoms and are synchronised with anxiety and decreased quality of life (Akın & Temiz, 2021; Criner & Han, 2018; Karaca & İster, 2016; Turhal & Koç, 2019). In Callisto Roy's model, nursing care has a healing effect on the individual's adaptation to the disease and the environment not only in the hospital but also in home life, aiming to help patients respond positively to stimuli, and has a healing effect on the adaptation of patients to the disease and the development of awareness of living with the disease (Akın & Temiz, 2021; Dağcı, 2019; Karaca & İster, 2016; Vicdan & Karabacak, 2014; Turhal & Koç, 2019).

Objective: This study was conducted to evaluate the nursing care of an individual diagnosed with COPD according to the Roy Adaptation Model.

Roy Adaptation Model (RAM)

In the model created by Callisto Roy based on adaptation; it is adopted that there is a state of continuous harmony between the patient, health, nursing and the environment (Callis, 2020; Vicdan & Karabacak, 2014; Karaca & İster, 2016; Pazarcıkcı & Uçak, 2021). In the Roy Adaptation model, the task of the nurse in the system is to increase the patient's positive adaptation to the internal and external environment by identifying patient stimuli and organising a nursing care plan according to the patient's four adaptation areas (Callis, 2020; Naga & AL-Khasib, 2014; Phillips & Harris, 2014). Stimuli are analysed in three areas: focal stimuli (reactions to sudden events), situational stimuli (stimuli that increase the effect of the situational stimulus) and possible stimuli (examination of past history, behaviours and environmental areas) (Naga & AL-Khasib, 2014). The areas taken as the basis for defining the patient in the Roy Adaptation model consist of four areas: physiological, self-concept, role function and interdependence adaptation area (Callis, 2020; Naga & AL-Khasib, 2014; Wang et al., 2020).

Physiological Domain: It includes physical responses such as oxygenation, nutrition, excretion and the aim is to ensure continuity in the physical domain (Callis, 2020; Naga & AL-Khasib, 2014; Phillips & Harris, 2014).

Self-Concept Domain: It includes the patient's own belief concept (coping with loss, etc.), moral values and goals in life, and combines with physical identity to address the self as a whole **(**Callis, 2020; Phillips & Harris, 2014; Wang et al., 2020).

Role-Function Domain: This domain defines the roles that the patient has in life and makes sense of his/her identity by sorting them within himself/herself. These roles are considered as primary (gender), secondary (parents-occupation, etc.), and tertiary (presidency of the school family union, etc.) (Callis, 2020; Phillips & Harris, 2014; Wang et al., 2020).

Field of Mutual Commitment: In the field of attachment, the concept of trust is provided by interpersonal attachment through respect, love and mutual valuing, and the ability to communicate is important (sufficient love, consistent love-respect, maturity-learning in relationships, relational trust, etc.) (Callis, 2020; Naga & AL-Khasib, 2014; Phillips & Harris, 2014; Wang et al., 2020).

CASE REPORT

63-year-old A.K. is the mother of a son and a daughter. A.K. is a housewife and lives with her husband. She has been a regular smoker for 15 years and smokes half a packet of cigarettes daily. A.K. was first diagnosed in 2018 and has been receiving regular treatment for 6 years. In addition to COPD, she has diabetes and herniated disc diseases. A.K. has no known food or

antibiotic allergy. The patient diagnosed with COPD applied to the chest diseases outpatient clinic on 25.01.2024 due to shortness of breath, cough, general body pain and change in sputum colour due to movement at home. After being examined by the doctor, he was admitted to the chest ward on the same day.A.K.'s vital signs on 25.01.2024 were measured as respiratory rate 19, pulse 74, blood pressure 130/70 mm/Hg, body temperature 36.4°C, at blood glucose 380 and ECG was performed. The patient was started to be treated with 3 litres of oxygen per minute via nasal cannula. The treatment prescribed by the physician was started. A.K. is 162 cm and weighs 71 kg. A.K., who has diabetes, stated that she was compatible with the meals given in the hospital and that her appetite was open and that her daily water consumption was 1500 ml. A.K. has a good general appearance, her hair and nails are clean and short. A.K. stated that she had constant difficulty in defecation and verbally stated that she was constipated and could not defecate without using Bekunis A.K. stated that she could not sleep at night since her hospitalisation, her daytime naps were short, and she had headache because she felt a constant need for oxygen. She stated that she had shortness of breath while performing daily life activities and that she felt tired due to coughing. She complained that she did not have any companion during her hospitalisation and reproached her children who got married at a young age. She stated that she regretted her marriage with her husband, that he was addicted to alcohol and that there was incompatibility at home. She stated that he had been hospitalised eight times in the last 12 months and that some of these hospitalisations were due to the unrest in his home life.In the last laboratory tests of A.K., CRP was 19.67 mg/dl, haemoglobin 11.6 g/dl, urea 46.04 mg/dl, potassium 4.62 mEq/L and sodium 144.36 mEq/L.

NURSING PROCESS

Ethical approval: Informed consent was obtained both verbally and in writing by explaining the purpose of the study and that the information would be used for scientific purposes (Date: 05.02.2024). The patient's name was shortened considering ethical issues.

Assessment and nursing diagnosis of the case according to the Roy Adaptation Model

In the case described above, the patient was interviewed at the appropriate time and interval and the problems were determined with the data collected. The identified problems were classified with NANDA-I Nursing Diagnoses. The determined nursing diagnoses were taken as the basis for determining the interventions to be applied to the patient. The NANDA-I diagnoses determined for this patient are Ineffective Respiratory Pattern, Chronic Pain, Disturbance in Sleep Pattern, Constipation, Fatigue, Fall Risk and Lack of Information.

Nursing Care According to Adaptation Types According to Roy Adaptation Model

A. Physiological Adaptation Form

Nursing Diagnosis: Ineffective Respiratory Pattern

Nursing Interventions

-Data was collected about what the patient knew about his condition.

-Respiratory rate, respiratory rhythm, respiratory depth and respiratory effort were monitored (short, frequent and shallow audible breathing during movement).

-The individual was encouraged to share her concerns.

-The patient was asked to ask the questions in his mind and they were answered by checking whether the patient understood.

-Breathing and cough exercises were taught.

-In order to minimize respiratory distress, she was taught positions that would facilitate the appropriate ventilation/perfusion balance and enable him to use her breath correctly.

-Observed the patient's ability to cough actively and recorded the onset, characteristics and duration of the cough (short, deep cough at frequent intervals).

Evaluation:

-She stated that the patient's stress and anxiety decreased.

-It was determined that the patient's saturation and respiratory rate were within the normal range.

-The patient stated that she could breathe more easily.

Nursing Diagnosis: Constipation

Nursing Initiatives

-She was informed about the habit and importance of regular defecation.

-It is recommended to drink a glass of warm water 30 minutes before breakfast.

-She was informed not to delay when he needed to defecate.

-It is recommended to add fibrous foods to your meals.

-Daily periodic walking and exercise were recommended.

Evaluation

-The patient defecated daily while she was in the hospital.

Nursing Diagnosis: Chronic Pain

Nursing Initiatives

-The patient's pain was evaluated according to the scale.

-The location of the pain, its severity, time of onset, factors that increase and decrease it were evaluated.

-The patient's pain coping mechanisms and non-pharmacological methods were questioned.

-Requested analgesics were administered and their effectiveness was evaluated.

-The patient's pain, the amount and frequency of medication dose, and his/her response to pain treatment were observed and recorded.

-The patient was informed about non-pharmacological methods such as breathing exercises, heat application and position changes.

Evaluation

-The patient stated that she experienced less pain during his stay in the hospital.

Nursing Diagnosis: Sleep Pattern Disturbance

Nursing Initiatives

-Interventions were planned for pain, which is one of the causes of insomnia.

-Information was obtained about the patient's daily sleep habits and duration.

-A quiet and calm environment was provided for the patient to sleep.

-Interventions were planned to ensure normal sleep patterns (warm shower, deep, breathing, exercises, drinking warm milk).

Evaluation

-It was observed that there was an increase in the time the patient spent sleeping at night.

B. Self-Concept Adaptation Style

Nursing Diagnosis: Lack of Information

Nursing Initiatives

-The patient was listened to carefully and his movements and behaviors were monitored.

-She was made aware of herself by asking some questions.

Evaluation

-Awareness was increased in areas where there was lack of information by providing information about the patient's medications and daily life activities.

C. Role Function Adaptation Type

Nursing Diagnosis: Fatigue

Nursing Initiatives

-Perceptions of patients and their relatives regarding the causes of fatigue were determined.

-The patient was made aware of the improvements and developments observed in her condition.

-The patient was encouraged to manage the process herself.

-Disturbing environmental stimuli were reduced so that the patient could rest.

Evaluation

-The patient stated that she felt better.

D. Interdependence Mode of Adaptation

Nursing Diagnosis: Fall Risk

Nursing Initiatives

-The use of assistive devices while on the move is recommended.

-Necessary safety precautions were taken to prevent the risk of falling in the hospital environment.

-The purpose and use of the nurse call bell was taught.

-Information was given about the use of appropriate shoes and non-slip slippers.

Evaluation

-The patient has no history of falling during her hospital stay.

DISCUSSION

Individuals diagnosed with COPD may experience both psychological and physical problems. Symptoms frequently seen in COPD are dyspnea, anxiety, depression, cyanosis, fear, panic attack, cough, fatigue, wheezing, chest pain, increased secretion, inactivity and inability to tolerate activity (Akın & Temiz, 2021; Neşe, 2023). The COPD patient in this case, who was still on medication, had complaints such as shortness of breath, cough, phlegm, chronic pain, fatigue, inability to sleep at night, restlessness, anxiety, and lack of oxygen, similar to the literature. In their study by Köksal and Durgun (2022) with a patient diagnosed with COPD, the patient experienced complaints of difficulty breathing, cough, increase in the amount of secretion, and fatigue. In the study of Bilgehan et al. (2020), they found that the COPD patient experienced shortness of breath, cough, and an increase in the amount of sputum production. They determined that he had complaints of cyanosis. Symptoms and disorders that negatively affect the quality of life of COPD patients make it difficult for patients to comply with treatment. It is reported in the literature that nursing care provided to these patients using a model/theory or classification system produces effective results (Bilgehan et al., 2020; Dağcı, 2019; Karaca & Lider, 2016; Köksal & Durgun, 2022; Turhal & Koç, 2021) . In this case report, the health problems of the patient who was admitted to the chest diseases service of a state hospital with the diagnosis of COPD were evaluated in line with the Roy Adaptation Model, nursing diagnoses were defined with NANDA-I, and nursing care was applied in line with the nursing process. Seven nursing diagnoses were determined according to NANDA-I Taxonomy

II. These diagnoses are Ineffective Respiratory Pattern, Chronic Pain, Disruption in Sleep Pattern, Constipation, Fatigue, Fall Risk and Lack of Information.

As a result, it was observed that the individual in this case, who was followed up with the diagnosis of COPD, had a decrease in his existing complaints or some of his complaints no longer existed after receiving both medical treatment and nursing care in line with the Roy Adaptation Model. In this case report of a patient diagnosed with COPD, as a result of the nursing care provided with the Roy Adaptation Model and NANDA-I classification systems, it can be said that the classification systems used facilitate decision-making in interventions for the patient, provide a systematic diagnosis and planning, and facilitate the evaluation of nursing care. It is thought that this study will serve as an example for nurses working or providing clinical care in chest diseases clinics and intensive care areas and will increase their awareness on this subject.

Conclusion and Recommendations

In this case, the patient's quality of life and independence were increased with the nursing care provided in line with the Roy Adaptation Model, and the patient's adaptation to the disease was ensured during his hospitalization. In this regard, it can be said that this theory is effective in disease management and adaptation to chronic diseases. In addition, it can be said that nursing care provided using a model or theory provides a systematic approach to the detection and solution of multifaceted patient problems in care, makes nursing care visible, and plays a role in improving the nurse's decision-making and critical thinking skills. It is recommended to increase the studies that can be done using nursing models and classification systems regarding the diagnosis of COPD.

Thanks and Information Note

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MODELLING OF THE GROWTH OF TOBACCO BY INDOLE ACETIC ACID (IAA) USED TO CONTROL SOIL ORGANIC POLLUTION

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Abstract
Effective improvement in the growth of tobacco (*Nicotiana tabacum*) seedlings by Indole Acetic Acid (IAA) hormone was the sole purpose of this study. Seedlings of *N. tabacum* treated with equal quantities of IAA hormone (0.7%) were grown in 1kgs of vermuculate, perlite, planting soil, sand, and equal mixture of all media. The set up were treated equally with water and organic manure. Control set up was made with a mixture of different rooting media without IAA. Data on shoot development were noted for 6 weeks and root length was measured on the day of harvest. The parameters measured were analysed statistically using ANOVA, and it was found out that root and shoot lengths were significant at $p>0.05$ in the entire rooting media and the highest percentage development (49 and 51%) respectively for root and stem respectively, was observed in the rooting media that has equal measure of each constituent (i.e. the mixed constituents). Germination rate among the media were 100, 70, 60, 50 and 40% for mixed, sand, planting soil and vermiculate, perlite and control respectively. Different sections of mature stem tested with IAA hormone were not significant in their root and stem development, although basal cutting stems tend to mature faster than epical. This therefore means that propagating *N. tabacum* by seedlings can be optimally achieved through mixture of 0.7% of IAA in a collection of different rooting media.
Keywords: *Nicotiana tabacum, Indole Acetic acid, Root formation, Rooting media, Growth enhancement*

Introduction

Tobacco is an important commercial and agricultural plants growth in several part of the globe because of its economic need. This is a plant with a common name of several plants in the genus *Nicotiana* of the family *Solanaceae*, and the general term for any product prepared from the cured leaves of these plants. More than 70 species of tobacco are known, but the chief commercial crop is Nicotiana tabacum. (Singh *et al.* 2009). Tobacco is a plant (Nicotiana tabacum and Nicotiana rustica) that contains nicotine, an addictive drug with both stimulant and depressant effects. Tobacco leaves are used to make products that can be consumed in different ways: smoked in cigarettes, cigars or pipes. smoked in loose form in hookahs. All forms of tobacco are harmful, and there is no safe level of exposure to tobacco. Cigarette smoking is the most common form of tobacco use and the reason is because it contains nicotine because of the highly addictive stimulant alkaloid nicotine as well as harmala alkaloids. Tobacco use is a cause or risk factor for many deadly diseases, hence is always advised that tobacco smoking is dangerous to health.Indole acetic acid (IAA) is the main auxin in plants, regulating growth and developmental processes such as cell division and elongation, tissue differentiation, apical dominance, and responses to light, gravity, and pathogens. IAA stimulates overproduction of root hairs and lateral roots in plants and release of saccharides from plant cell walls during the elongation (Sosnowski *et al*. 2023). Saccharides are a source of nutrients for microorganisms and can increase the colonization ability of plant-associated bacteria, this is because IAA production is a major property of rhizosphere bacteria that stimulate and facilitate plant growth. Indoleacetic acid (IAA) is a molecule that is synthesized by plants and a few microbes (Ansari *et al.* 2023). In plants, IAA plays a key role in both root and shoot development. The hormone moves from one part of the plant to another by a designated importer (AUX1) and efflux pumps (PIN1–7). IAA also regulates geotropism by accumulating on the underside of shoots and roots. In shoots, IAA causes cell elongation on the underside of the shoot, causing it to bend upwards, away from the force of gravity. In roots, IAA inhibits cell growth, causing roots to grow downwards, towards the force of gravity.The medicinal properties of plants lie in their phytochemical components like alkaloids, flavonoids, tannins in addition to other phenolics that co-opt as to producing definite physiological functions to the body of man and animals (Taiwo et al. 2000; Che Man 2010). However, analysis of extracts of *N. tabaccum* were found to be rich in flavonoid and flavonones, triterpene, terpenic compounds, chalcone, steroids as well as peroxidise isoenzymes (Anup et al. 2011; Anyasi *et al*. 2019; Raymond Anyasi and Anyasi, 2020). It is also rich in

carbohydrates, high content of total proteins in addition to high percentage of nitrogen. All these contribute to the high phytochemical properties of the plant. *N. tabacum* is therefore grown as a medicinal plant for the treatment of skin wounds especially in Indonesia (Metwally and Ekejuba 1981; Phan et al. 1996). In South Africa for example, the leaf of *N. tabacum* is used for the production of tobacco by the tobacco companies. However, because everyone deserves a fair and just opportunity to be as healthy as possible, this is known as health equity. Therefore, achieving health equity means addressing system-wide problems, unfair practices, and unjust conditions that have a negative impact on the health of specific groups. To achieve health equity, it is important to eliminate health disparities which are differences in health outcomes that are closely linked with social, economic, and/or environmental factors, that affect the entire people of the globe (Taiwo et al, 2000). To improve health equity, we must consider the role of commercial tobacco (Phan et al. 1996; Akinmoladun et al., 2007; Anup et al., 2011). *N. tobacum* has also been implicated by its diuretic, hepatotropic and astringent properties (Weninger and Robenean 1988; Iwu 1993).*N. tobacco* can be propagated mainly by seeds, this is one of the significant agronomic properties of the plant (Tanhan *et al*., 2007; Anyasi *et al*. 2019). However, it has been reported that germination of seeds from weeds are most likely affected by soil compositions especially in the field study, therefore such propagation is aided by agronomic factors that enhances the growth and multiplication of such plant (Adebayo *et al*., 2005; Agbo and Obi 2007). Moreover, as some other types of propagation such as stem cuttings propagation prolongs hybridization of genome as segregation through recombinant gene is avoided, this may not be possible in some plants for example in the tobacco plant we are studying.The success of rooting has been attributed amongst other factors to the rooting medium as well as the presence of rooting hormone and its concentration (Al-Saqri and Alderson 1996; Hartmann *et al*. 1997). Influences of rooting media and hormone on rooting in different kinds of plant have been documented and its effects in structure propagations were elucidated (Akwatulira *et al.* 2011). These media combination used in the rooting of the seedlings provide physical support as well as oxygen and water to the plant seeds (Larsen and Guse 1997). However, IAA; an auxin containing product was reported to stimulate adventitious roots in of some plants (Araya *et al*. 2007). This was buttressed by the study by Rao *et al*. (2005) which reported that IAA was the leading plants hormone used to promote the formation of roots in Tomatoes. Hence with the quest for a systematic search for specific useful factors from plants like *N. tobacum*, even though most plants can root without hormone, there is need for an improved method of propagation and growth for such nutraceutical plants. This will therefore

form a rational approach towards drug and nutritional research. The aim of this study was to evaluate the effect of IAA hormone and rooting media for optimal rooting of propagated *N. tabacum*.

2.0 Materials and methods

Seeds of *N. tobacco* plants was collected from the greenhouse at the University of South Africa in Pretoria (25°46'1"S, 28°12'2"E) and 1439m above sea level. The experiment took place in polyvinyl chloride (PVC) pots with dimensions 30x25x30 at a garden at the University of South Africa at Florida Campus. The pots contain 1kgs of different rooting medium that has been mixed with equal volume of organic manure collected at the animal farm of the University of Pretoria in Onderstepoort. Inside each pot was made holes designed to contain equal weight of IAA hormone (0.7%), for the plants. The set up was made in a complete randomized design containing a 3x4 factorial treatment model (Jeruto *et al*. 2008). The rooting media used here were planting soil and humus in the ration of 2:1 (w/w). About thirty-six plantlets were used in each set of rooting media and IAA hormone concentration by volume percentage. Then sets of water treated seedlings were sawn into holes containing the IAA hormone in the rooting media and were replicated by three. Random allocation of plant seedlings to the rooting media using random digit from a table was employed as to eliminate bias (Johnson and Bhattacharyya 2006).

2.1 Rooting media

The rooting media was homogenized by hand, mixed with equal volume of organic manure and air dried on an impervious polythene sheet for 24 hours, there were pasteurized and fumigated, measured into the PVC pots with the hole containing about 0.7% of IAA hormone. This concentration was chosen because of its optimum performance from other unpublished trials.

2.2 Propagation of the seedlings

The 10.0 cm Plantlets with lateral buds were about 360 collected at tale end of the afternoon when the weather was moist and were kept in a bow containing water (Agbo and Obi 2007). The bases were made squared using sharp sickle to spread the rooting. For each of the cuttings, about half of it was dipped into the IAA hormone that has been made into hole in each of the pots as to soak the powder. Excess of it was shaken off the base of the cuttings and the hormone was manually made to concentrate at the base. The plantlets were then inserted into the soil to about 6 cm, watered and maintained to about 70% humidity (Tanhan *et al.* 2007). Fungicides were sprayed onto the plants to control infections (Yeboah and Amoah 2009). The set up was allowed to grow for six weeks while monitoring in between days to remove any invading weeds.

Data on shoot development was taken at interval of weeks and root length was measured on the day of harvest after weeks.

2.3 Data collection

Data collection which commenced on the first week after propagation continued till the sixth week and the parameters measured were survived seedlings, length of shootings/buds, and the root length, number, and weight of the plant on the day of harvest.

2.4 Data analysis

The data collected was analysed using Microsoft excel to obtain the mean number and percentage of plants that were able to form developed root and sprouted shoots from the series of transplanted seedlings. The data was then imported into SPSS version 13.0 and was analysed using analysis of variance (ANOVA) and standard deviation for the length of shoot and roots. The significance effects were determined at 5% level of significance.

3.0 Results

N. tabacum seedlings treated with concentration of 0.7% (w/w) IAA hormone propagated in different growth media recorded the highest mean number of the seedlings that developed roots and sprouted shoots in the set up with equal mixtures of the 4 growth media with organic manure. While the stem seedlings propagated in the perlite and control recorded the least mean rooted (2 each) and sprouted shoots (4 and 3) as recorded in Table 3.1. Amazingly, perlite and vermiculate maintained almost equal numbers of shoot developed (4 and 3 respectively) like in the root (2 each). However, significant difference existed among the different media with reference to their mean rate of development and formation of root and shoot. The efficacy of IAA hormone to the development of root and shoots was noticed by the difference between the treated samples and the controls without the hormone. There was significance difference between the two samples.Number and length of roots developed among different rooting medium and the concentration of hormone were not significant (Table 1.0) but shoot lengths and number per sprouted stem was significant. Increase in shoot length occurred in this order: mixture>vermiculate>perlite>planting soil>sand>control while increase in root length were in the order: mixture>vermiculate>perlite>planting soil>sand>control. But it made a turnaround in the number that rooted and shooted within the rooting media, i.e., sand and planting soil had the same mean number of roots (4) and a little difference in Shoots (6 and 12). The control media maintained equal numbers. In fresh weight of the plants (apical and basal), there were higher weight measurement in the basal sections than the apical ones, though not significant. Equally, set up containing the mixture of the rooting media still maintained the highest weight

followed by sand, perlite, planting soil, vermiculate and the control. The same sequence was also followed in their dry weights. In sand however, there were greater number of root numbers while in other rooting media had the same number of roots. Shoot and root length of mixture of rooting media and vermiculate were synonymous with each other and were almost significant with the rest of the medium. Root lengths were 34 and 33mm for mixture and vermiculate respectively, 39 and 37mm in sand and planting soil. The shoot length was 41mm in both sand and vermiculate, while 43mm all in planting soil and mixture respectively. The set up containing equal mixtures of all media had 100% germination rate compared to 70, 60 50 and 40% for sand; planting soil/vermiculate; perlite and control respectively. However, the rest of the media demonstrated improved significant effects in all the parameters measures compared to the control.

Discussion

The rooting medium supplement that has mixtures of planting soil, perlite, sand and vermiculate at equal proportion enabled highest development of root and shoot in a cutting of *N. tabacum*. This improved effect could be attributed to the fact that the combined nutrient supplement of the entire rooting media acted optimally with the IAA hormone concentration added which created the enabling soil condition for example, optimum aeration and moisture level (Kalyoncu and Ozer 2000; Akwatulira *et al.* 2011). Meanwhile dose application of IAA hormone was shown to be an aid to improved moisture content in the soil for an optimal rooting and shooting development of cuttings (Milleton *et al*. 1980; Leakey *et al*., 1982; Aminah et al. 2006; Akwatulira *et al.* 2011; Raymond Anyasi and Anyasi 2020). However, most of these past studies maintained their IBA hormone concentration to about 0.7-0.8% of the rooting media used while this study based its IAA measurement on the weight of the cuttings. Morever, the control sample of rooting medium supported low development of root and shoot than the auxin treated samples in the entire experiment. This could perhaps be becouse soil resistant to root penetration is dependent on amongst other factors on water content, structure and strength of soil as well as bulk densities though these were not measured in the rooting media (Amri *et al*. 2009). Soils do not posses the required aeration porosity for optimal gas exchange required for rooting of the cuttings resulting in poor rooting in the control. Poor rooting numbers in control could also be attributed to the feel of anoxia which is an effect of low oxygen in the soil (Hartmann *et al*. 2002). Low incidence of rooting was found in the control samples. Non-theless, there are instances where optimum concentration of IAA in the soil has resulted in the failure of the development of roots by stem cuttings as was reported by Griffin and Shroeder

(2004). That was an indication of the sensitivity of root formations to hormone formulations (Akwatulira *et al.* 2011; Anyasi 2023). It has also been reported that rooting hormone to a certain instance could be inhibitory to the development of roots in the cutting especially during the initiation stage (Akwatulira *et al*. 2011). This then means that different rooting media accommodates different concentration of auxin for optimal growth of plants.

Conclusions

Mixture of various rooting media in the right proportion with 0.7% of IAA hormone has been proven to be effective in the root and shoot development of cuttings of tobacco irrespective of the position of the cuttings. Although the individual medium did not have high incidences in most of the parameters measured, but there were able to support root and shoot development as well. Therefore, there is need for a study of IAA concentration effects on the media as to be able to determine if concentration was not the factor responsible for the low root and shoot development. This will promote mass production of *N. tabacum* especially in areas that the plants do not occur naturally.

Acknowledgements

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Tables and Figures

Table 1.0 Number of rooted and shooted seedlings within rooting media. Values are mean of replicates (Numbers with same superscript within same row are not statistically significant at p=0.05)

Rooting media	**Number of cuttings**		**IAA hormone concentration**
	Rooted	**Shooted**	
Planting soil	**4±0.75^{a}**	**12±2.55^{b}**	**0.7**
Control	**2±0.69^{a}**	**3±0.00^{a}**	**0.7**

Table 2.0 Rate of germination of shoots among rooting media with 0.7% concentration of IAA hormone. Values are mean of replicates (Numbers with same superscript within same row are not statistically significant at p=0.05)

Rooting media	**IAA hormone concentration (%)**	**Rate of germination (%)**
Planting soil	**0.^{7a}**	**60^{b}**
Control	**0.7^{a}**	**40^{a}**

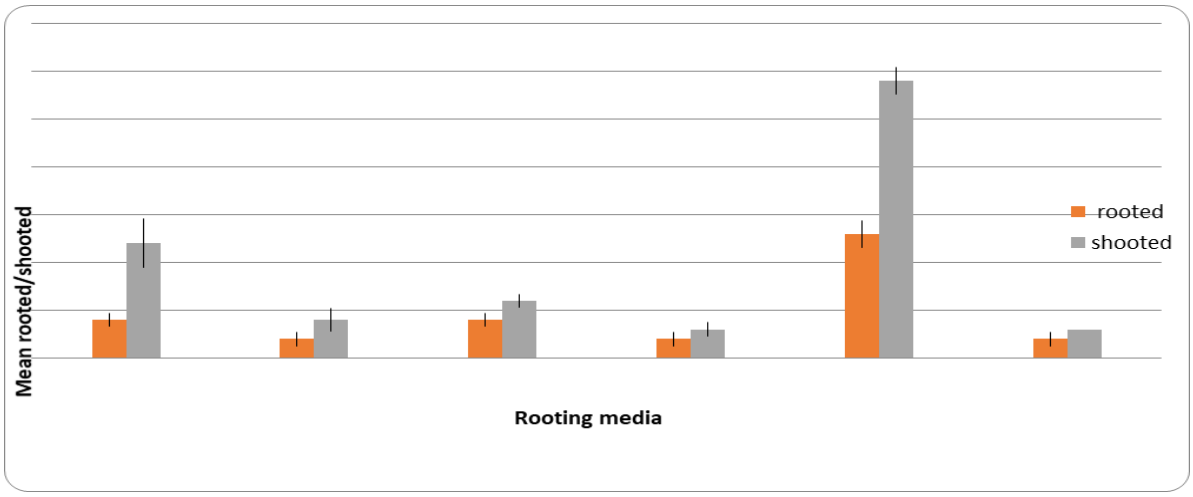


Figure 1.0 Bar chart representation of the means values of rooted and shooted seedlings within rooting media (The error bars represent the standard error from the mean).

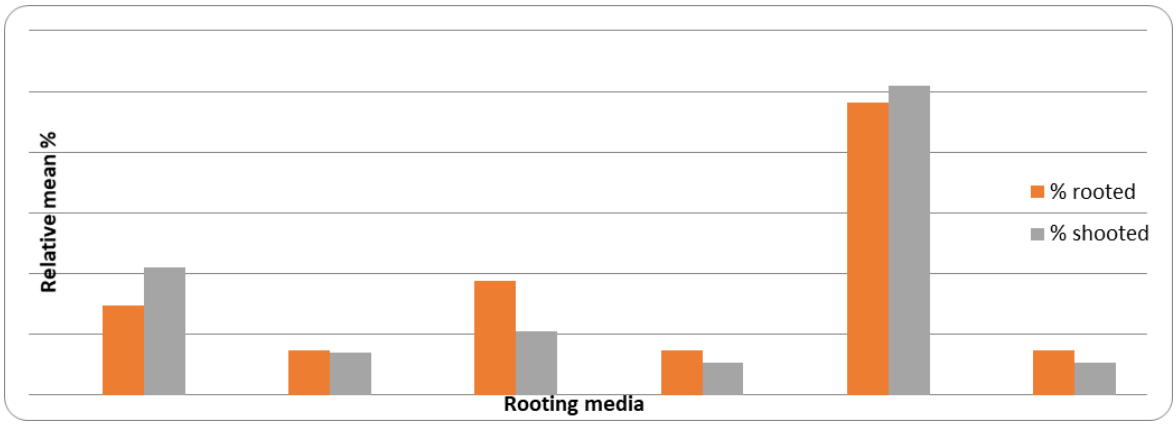


Figure 2.0 Relative mean percentage of the rooted and shooted seedlings among the rooting media.

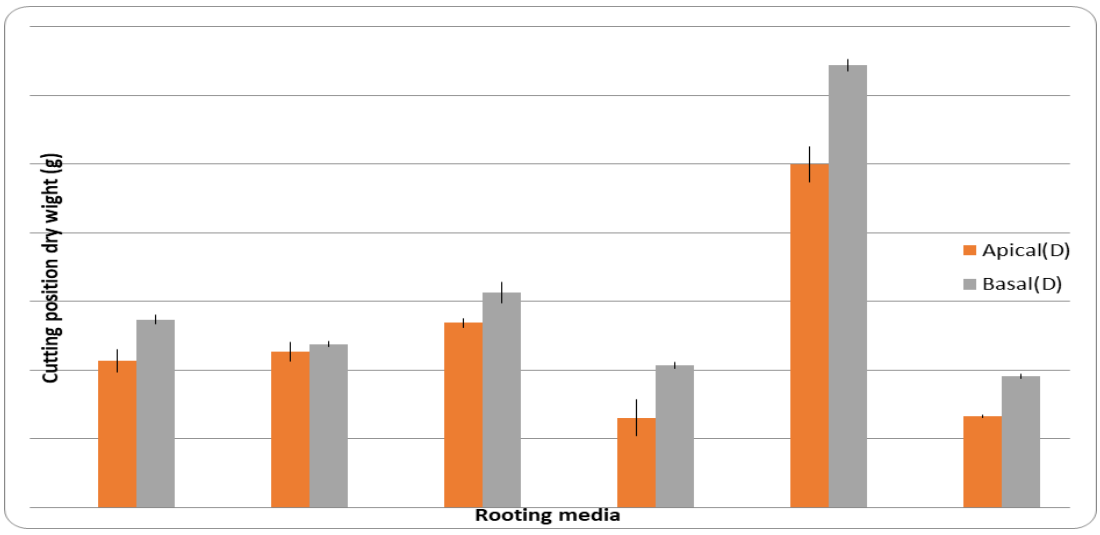


Figure 3.0 Dry weight of Cutting positions within different rooting media (The error bars represent the standard error from the mean)

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INFLUENCE OF ARTIFICIAL INTELLIGENCE IN SUSTAINING AGRICULTURE AND POVERTY ALLEVIATION IN NIGERIA

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ABSTRACT
Artificial intelligence (AI) technology integration is significantly boosting agricultural development in Nigeria, as it is in many other regions of the world. Because of the issues facing the country's agriculture industry and growing population, food security is a major concern in Nigeria. The increasing number of people means that food needs are increasing faster than farmers can supply them via traditional means. Thus, in order to meet the demand for food and sustainability, the agriculture sector has started to use artificial intelligence. Technologies like robotics, nanotechnology, synthetic proteins, cellular agriculture, gene editing, artificial intelligence, blockchain, machine learning, and others that are either already in use or in the process of development make up Agriculture 4.0. These technologies have the potential to significantly transform agriculture and food systems in the future and could have a widespread impact. AI increases farmer sustainability and production, and these technologies have the potential to drastically change food systems and agriculture in the future. Alongside opportunities like precision farming, climate-resilient techniques, and crop monitoring, issues including talent shortages and data accessibility in technology infrastructure are examined. In order to protect the environment and ensure the availability of food for everyone, agricultural production systems must increasingly adopt more sustainable practices. This study looks at artificial intelligence's revolutionary potential and the adoption of sustainable agriculture practices in the context of sustainable agricultural development throughout Nigerian regions.

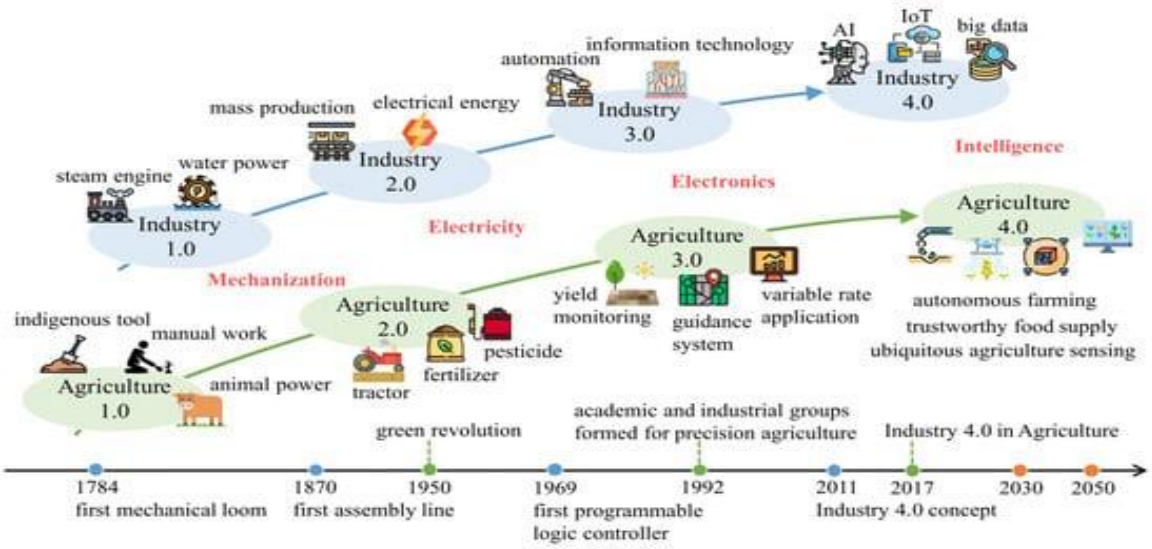
Through financial inclusion and improved data gathering related to poverty through poverty maps, artificial intelligence is revolutionizing the fields of agriculture education and banking.
Keywords: Agriculture, Artificial Intelligence**,** poverty alleviation**,** Sustainability, Transformation and productivity

INTRODUCTION

Background of the Study In Nigeria, a substantial portion of the population still makes their living mostly from agriculture. A nation's ability to prosper economically depends on its agriculture. Given the challenges posed by climate change and the world's expanding population, a creative strategy for transforming and maintaining agriculture is urgently needed. One intriguing avenue for this transformation is the application of artificial intelligence (AI) in agricultural processes. Artificial intelligence (AI)-based solutions have the potential to improve productivity in several industries, including agriculture. These include managing issues related to crop production, irrigation, soil content sensing, crop monitoring, weeding, and crop establishment (Kim et al., 2008). High-value AI applications in the aforementioned area are the aim of agricultural robots. The world's population is expanding at an accelerated rate, endangering the agriculture sector. However, artificial intelligence (AI) has the potential to offer much-needed help. Thanks to AI-based technological solutions, farmers can now produce larger yields with less input. These solutions have also improved the quality of the output and shortened the time it takes for harvested commodities to reach the market.

In addition, Nigeria's agriculture industry is currently battling major issues including resource depletion and climate change while attempting to feed the nation's growing population in an environmentally responsible way (Firstbank et al., 2018). Numerous other fields are also seeing significant technical improvements, such as energy production, robotics, nanotechnology, gene technology, artificial intelligence, and machine learning (De Clercq et al., 2018; NFU, 2019). In contrast, the latter was characterized by invention during the British Agricultural Revolution, leading to the creation of new equipment like Jethro Tull's seed drill. This movement was toward settled agriculture (Agriculture 1.0). What some have referred to as "Agriculture 4.0," or the "fourth agricultural revolution," (Rose and Chilvers, 2018), will be brought about by these new technologies and will include a wide variety of prospective "future agricultures" or "future food systems," each of which will be identified by cutting-edge, sophisticated, and even revolutionary technology. Hunter-gatherers naturally migrated during the first agricultural revolution (known as Agriculture 2.0), and production in developing countries changed during the third agricultural revolution (known as Agriculture 3.0). Chilvers and Rose (2018). At the moment, the term "Agriculture 4.0" is vague and undefined, linking ideas on the Fourth Industrial Revolution, or Industry 4.0, to a range of other ideas and technologies. (Zambon et al., 2019). Future food and agriculture systems under the new Agriculture 4.0 include ideas like

aquaponics, digital agriculture, bioeconomy, vertical farming, and aquaponics (Hermans, 2018; Junge et al., 2017; Pigford et al., 2018; Pinstrup-Andersen, 2018; Herrero Acosta et al., 2019). Furthermore, new automated systems technology using agricultural robots and drones has contributed to the agroindustry. Numerous advanced computer systems, including those for weed identification, yield detection, crop quality assessment, and numerous other applications, are engineered to identify various critical factors (Liakos et al., 2018). Artificial intelligence (AI)-based technologies support increased productivity across industries and address issues that the agricultural sector faces, including crop yield, irrigation, soil content identification, crop monitoring, weeding, crop establishment, and so forth (Kim et al., 2008). Panpatte (2018) asserts that artificial intelligence enables farmers to gather vast amounts of information from websites, offer answers to a variety of unclear issues, and use intelligent farming techniques that will boost agricultural productivity.



Objectives of Artificial Intelligence interventions in agriculture

- Long-term farm profits can be increased via more interconnected farm-to-market supply chains.
- AI systems aim to learn from experience and improve their performance over time.
- Technology and financial accessibility for smallholder farmers
- Dependable and secure food systems and real-time environmental impact monitoring
- Mechanizing farms to increase productivity and efficiency
- Digitizing the infrastructure needed for logistics and storage to cut down on food loss
- Managing natural risk intelligently

2.1 Internet of Things (IoT) and Artificial Intelligence

Artificial Intelligence in Agriculture Artificial intelligence (AI) and the Internet of Things (IoT) are two technical developments that have the potential to significantly change the agriculture industry. Despite certain similarities, the two have different purposes and benefits. The Internet of Things, or IoT, is a network of real, physical objects connected to the internet by connections, software, and sensors. IoT devices can track a wide range of agricultural characteristics, including temperature, humidity, crop growth, and soil moisture. Farms can use Internet of Things (IoT) sensors to gather data from their machinery, livestock, and crops in real time. IoT device data can be utilized for decision-making in areas including resource management, early insect or disease detection, irrigation schedule optimization, and crop health. Sensor-based technologies are the main tools used by IoT in agriculture to collect data, link, and automate processes. The artificial intelligence (AI) used in agriculture, on the other hand, refers to the machine's ability to simulate human intelligence and perform tasks like sensing, thinking, learning, and decision-making that would typically require human cognition. Artificial Intelligence (AI) has the potential to handle and analyze massive volumes of data from Internet of Things (IoT) sensors in agriculture, together with historical data, weather trends, and other pertinent information.



3.0 Artificial Intelligence in Improving Agriculture

The population of several Nigerian countries has been growing steadily, which has increased demand for agricultural land. This growth has affected the principal industry in many countries: agriculture. More food needs to be produced to feed the growing population. This is pushing

farmers and other agro-related stakeholders to come up with creative ways to reduce waste and increase productivity. Artificial intelligence (AI), a technology that is becoming more generally recognized, is going to change agriculture. More uses of artificial intelligence (AI) can be found in agriculture, such as accurate disease and pest management, autonomous harvesting robots, crop and soil monitoring, yield prediction, price forecasting, and disease diagnostics. Some key concepts of artificial intelligence in improving agriculture are as follows:



3.1 Precision Agriculture

Farmers may optimize their use of water, fertilizers, pesticides, and other resources by employing AI systems to continuously monitor their crops through real-time data analysis. Farmers, who usually have few resources at their disposal, can reduce waste and save money by doing this. Devices that use artificial intelligence to make decisions can also provide customized guidance for specific crops and regions. Taking into consideration elements like as weather, soil quality, crop history, market trends, and expert information stored in databases or models developed using machine learning techniques makes measurable gains conceivable. These advancements have the potential to significantly boost Nigeria's agricultural productivity while reducing the harmful environmental effects of excessive pesticide use.



3.2 Crop Monitoring and Management

Using drone, satellite, and aerial photo analysis, AI-powered systems may identify infections, monitor crop health, and identify nutritional deficiencies. Machine learning algorithms have the capacity to process large datasets and then generate recommendations for farmers regarding timely interventions and early warnings. This helps to maximize input utilization and reduce production loss.





3.3 Agricultural Robots and Drones

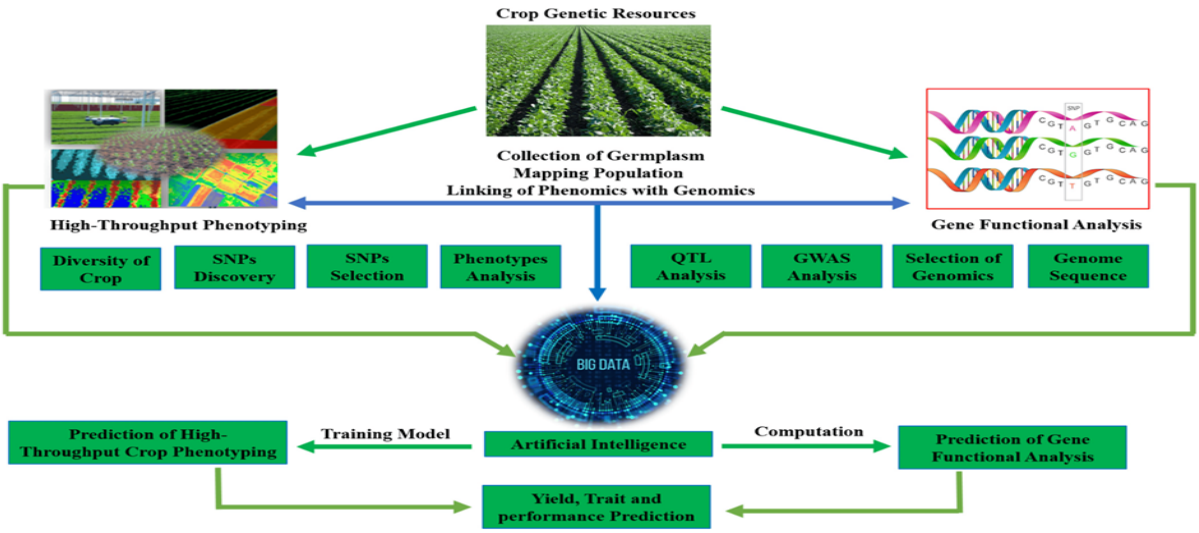
The creation of autonomous robots and drones that can carry out a variety of agricultural activities has been made possible by artificial intelligence (AI). Among the tasks that these robots can do out precisely and effectively are planting, weeding, spraying, and harvesting.

Artificial Intelligence (AI) algorithms have the potential to improve productivity by replacing human labor in tasks like navigation, object recognition, and decision-making.



3.4 Genetics and plant breeding

AI techniques aid in accelerating plant breeding efforts by identifying desirable traits and evaluating genomic data. Machine learning algorithms can process large amounts of genetic data to predict plant features and speed up the development of improved crop varieties. This facilitates the development of crops with high yields and adaptability to meet the demands of changing environmental



3.5 Early Pest and Disease Identification and Monitoring

It is now feasible to fully utilize technology to revolutionize agriculture in Africa. Thanks to the advancement of artificial intelligence (AI), farmers can now successfully detect and manage agricultural illnesses and pests in the current day. This groundbreaking invention has the power to drastically alter Nigeria's agricultural landscape by helping farmers overcome major

challenges and transition to a more sustainable future. This helps farmers identify the problem precisely and take the appropriate preventive measures.



3.6 Weed Detection

AI-powered computer vision and image recognition systems can recognize and classify weeds in crops. By analyzing image data or sensor readings, AI may quickly detect weeds and alert farmers to their presence. This reduces the need for broad-spectrum weedicides and enables targeted weed management.

3.7 Agro Smart Monitoring

Sensors with artificial intelligence (AI) capabilities can be positioned in the fields to monitor elements such as temperature, humidity, soil moisture, and nutrient levels. These sensors continuously collect data, which is subsequently analyzed by AI algorithms. By getting alerts when particular conditions deviate from ideal levels, farmers may make informed decisions about whether to apply fertilizer and when to plan irrigation.



3.8 Livestock Monitoring

4 Artificial intelligence (AI)-powered devices can monitor the health and behavior of animals by analyzing data from wearables, cameras, and sensors. Farmers can profit from this through early illness identification, animal welfare, and the optimization of feeding and breeding strategies.

4.1 Prospera

Is an AI-based platform that monitors crop health and identifies irregularities using computer vision and machine learning. In order to give farmers real-time insights into crop conditions and enable the early diagnosis of illnesses, nutrient deficits, and other difficulties, it analyzes data from aerial photography, drones, and ground sensors.

4.1 CHALLENGES TO AI ADOPTION IN AGRICULTURE

1**. Data Quality and Accessibility**: Reliable data is essential for AI applications to succeed. Significant barriers stand in the way of the successful implementation of AI in African agriculture, including data quality and accessibility issues.

2. Infrastructure and Connectivity: In many agricultural areas, dependable internet connectivity and infrastructure are lacking, making it difficult to transfer and retrieve real-time data needed for AI applications. The implementation of AI technology in remote or rural farming regions may encounter obstacles due to inadequate availability of electricity, network coverage, and consistent connectivity.

3. Cost and Affordability: The initial investment in AI technology is often high and comprises the acquisition of software, hardware, and skilled personnel for both maintenance and

installation. These technology could be too expensive for small-scale farmers and rural locations.

4. Technical expertise and training: AI implementation requires a certain set of skills and knowledge. Farming personnel and farmers must be trained in order to effectively understand and use AI technology and systems. Farmers will not successfully use AI technologies unless they receive adequate training and support.

5. **Legal and Ethical Issues**: As artificial intelligence is used to agriculture, questions about data ownership, privacy, and transparency come up. Concerns over the collection and use of farmer data, potential bias in algorithms, and the appropriate use of AI in decision-making must all be addressed with clear regulations and guidelines.

6. Adaptation to Local Contexts: Agricultural practices can differ greatly between nations and regions. For AI solutions to work with local crops, they need to be adaptable and customizable. Schemes, farming methods, and environmental circumstances

7. Adoption: A lack of knowledge or trust may make farmers reluctant to use AI technologies. For AI to be adopted and embraced more widely, it is imperative to establish credibility and provide evidence of its advantages in agriculture through case studies, pilot programs, and farmer involvement

5.1 CONCLUSION

It's becoming more and more obvious that AI integration is essential to Nigeria's strategy for developing its agriculture sustainably this lead to mitigation of poverty. It will be necessary to overcome barriers, take advantage of possibilities, and establish legal and ethical frameworks in order to fully realize artificial intelligence's potential to enhance agriculture and guarantee food security for future generations through extended advice. Artificial intelligence (AI) the internet of things, and precision agriculture are just a few of the technology innovations that might empower smallholder farmers, boost output, and encourage sustainable farming methods. When combined, technologies can improve farming practices, increase output, and maximize crop yields.

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SÜPER KAPASİTÖRLERDE ENERJİ DEPOLAMA İÇİN MXENLER

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Özet
Nanomalzemeler morfolojilerine, boyutlarına, büyüklüklerine, aglomerasyon durumlarına ve bileşimlerine göre sınıflandırılabilir, bu da her bir özelliğe bağlı olarak onları çok çeşitli uygulamalar için uygun hale getirir. İki boyutlu (2D) nanomalzemeler atomik kalınlığa, geniş aktif yüzey alanlarına, geniş yüzey alanı-hacim oranına ve mükemmel mekanik özelliklere sahiptir; bu da onları enerji depolama, elektronik, sensörler, kataliz ve biyomedikal uygulamalar başta olmak üzere birçok uygulama için ideal hale getirmektedir. Dünya dijitalleşmeye doğru hızlanırken, verimli enerji depolama cihazlarına (ESD'ler) olan talep kısa sürede inanılmaz bir şekilde artmıştır. Tüm ESD'ler arasında bataryalar ve süperkapasitörler, uygun elektrokimyasal özellikleri nedeniyle verimli enerji depolama için önemli rakipler olarak tanımlanmıştır. Bataryalar süperkapasitörlere kıyasla yüksek enerji yoğunluğuna sahipken, süperkapasitörler bataryalara kıyasla yüksek güç yoğunluğuna sahiptir. Bataryaların enerji yoğunluğu boyuta bağlıdır, bu da mikro ölçekli ve giyilebilir cihazlarda kullanımlarını sınırlar. Süperkapasitörler, yüksek hız kapasiteleri ve uzun süreli çevrilebilirlikleri nedeniyle pulse gücünü depolamak için büyük ölçüde kullanılmaktadır. Ayrıca, çevre dostu olmaları ve elektrostatik etkileşimler açısından basit adsorpsiyon ve desorpsiyon mekanizmaları, süperkapasitörleri geleneksel pillerden daha iyi bir seçim haline getirmektedir.Son zamanlarda, MXen olarak adlandırılan bir grup yeni malzemeler, bilimsel araştırmaların her alanında yaratıcı fikirleri önemli ölçüde etkilemiştir. Karmaşık atomik düzenlemesi ve aşırı ayarlanabilir özelliklere sahip çok katmanlı yapısı, çok işlevli davranışlarını geliştirmektedir. Enerji depolama cihazları, katalizörler, sensörler, antenler ve RFID etiketleri, biyomedikal uygulamalar, elektromanyetik parazit kalkanı (EMI), nanokompozit-hibrit malzemeler, çevre ve su arıtma vb. alanlarda yapılan atılımlar buna örnek olarak verilebilir. Bu nedenle, MXenler yeni uygulamalara kapı açmakta ve mevcut uygulamaların performansını değiştirmekte/iyileştirmektedir. Bu çalışmada, MXenlerin enerji depolama uygulamaları üzerindeki potansiyel etkileri tartışılmıştır.
Anahtar Kelimeler: MXenes, Süperkapasitör, Enerji Depolama, Nanokompozit-hibrit malzemeler, Elektrokimyasal karakteristik.

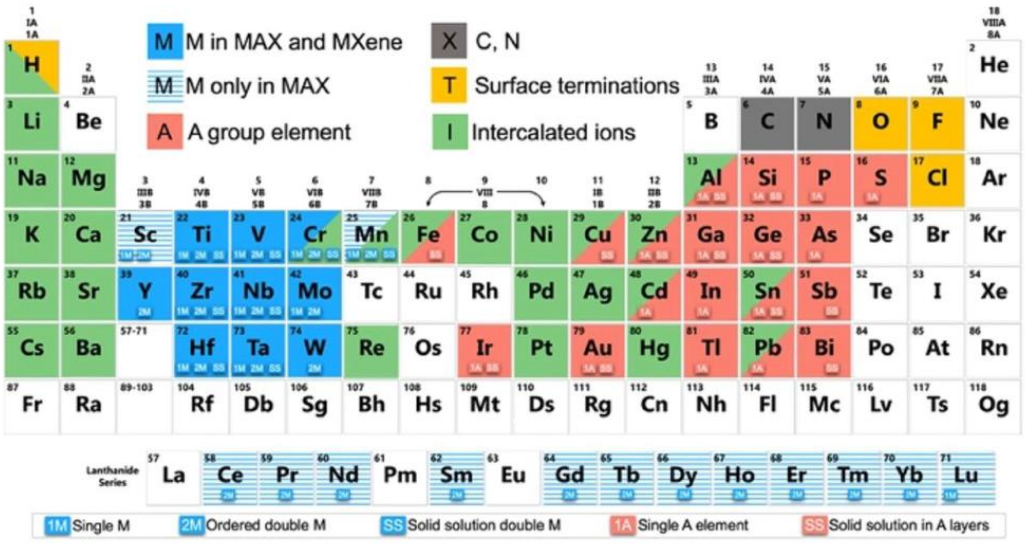
MXENES FOR ENERGY STORAGE IN SUPERCAPACITORS

Abstract
Nanomaterials can be classified based on their morphology, dimensionality, size, agglomeration state, and composition, which, depending on each characteristic, makes them suitable for a wide variety of applications. Two-dimensional (2D) nanomaterials have an atomic thickness, sample active surface sites, a large surface area-to-volume ratio, and excellent mechanical properties, which make them ideal for multiple applications, most prominently in energy storage, electronics, sensors, catalysis, and biomedical applications. As the world accelerates toward digitalization, the demand for efficient energy storage devices (ESDs) has ramped up incredibly in a short period. Batteries and supercapacitors, among all ESDs, have been identified as important contenders for efficient energy storage due to their viable electrochemical characteristics. While batteries have a high energy density compared to supercapacitors, supercapacitors have a high power density compared to batteries. The energy density of batteries is size-dependent, which limits their use in microscale and wearable devices as well. Supercapacitors are massively employed to store pulse power because of their high- rate capability and long-term cyclability. Moreover, their environmental friendliness and simple adsorption and desorption mechanism in terms of electrostatic interactions make supercapacitors a better choice than traditional batteries.Recently, a group of new materials labeled MXenes has significantly influenced inventive ideas in each field of scientific research. Its complex atomic arrangement and multilayered structure with excessive tunable properties enhance its multifunctional behaviors. Examples are the breakthroughs made in energy storage devices, catalysts, sensors, antennas and RFID tags, biomedical applications, electromagnetic interference shielding (EMI), nanocomposite-hybrid materials, environmental and water purification, etc. Therefore, MXenes open the door to new applications and modify/improve the performance of current applications. In this work, we discussed potential impacts on energy storage applications of MXenes.
Keywords: Mxenes, Supercapacitor, Energy Storage, Nanocomposite-hybrid materials, Electrochemical characteristic.

Giriş

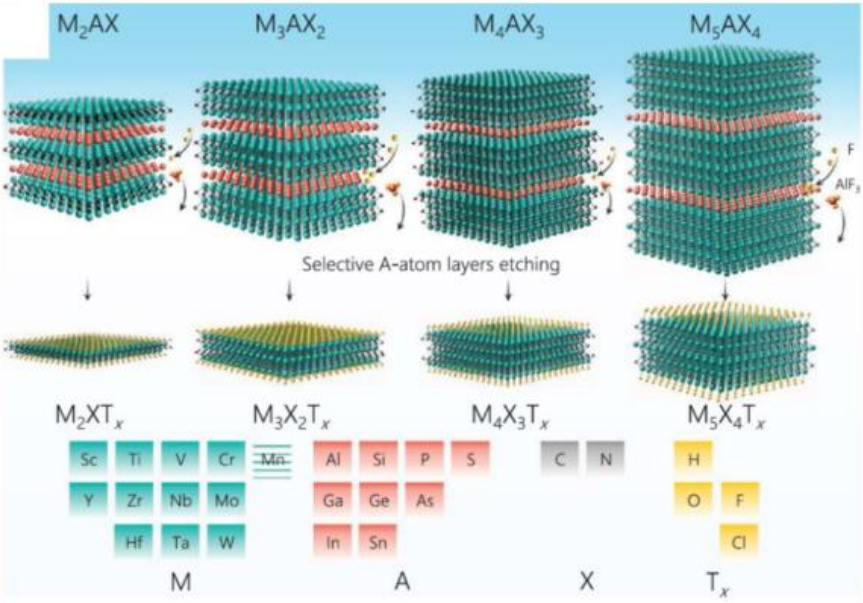
Günümüzde, bilim ve nanoteknolojideki yenilikler nedeniyle, nanomalzemeler ve nanomalzeme bazlı kompozitlere ilişkin bilgi ve uygulamalar sürekli değişmektedir. Nanomalzemelerin benzersiz boyut ve bileşime özgü özellikleri, bilimdeki birçok zorluğun çözülmesine yardımcı olmaktadır. Nanomalzemeler morfolojilerine, boyutlarına, boyutlarına, aglomerasyon durumlarına ve bileşimlerine göre sınıflandırılabilir; bu da her bir özelliğe bağlı olarak onları çok çeşitli uygulamalar için uygun hale getirir. İki boyutlu (2D) nanomalzemeler atomik kalınlığa, geniş aktif yüzey alanlarına, geniş yüzey alanı-hacim oranına ve mükemmel mekanik özelliklere sahiptir, bu da onları enerji depolama, elektronik, sensörler ve kataliz ve biyomedikal uygulamalar başta olmak üzere birçok uygulama için ideal hale getirir (Glavin vd., 2020; Novoselov vd., 2004). Bu anlamda, 2D nanomalzemeler sınıfının şimdiye kadar en çok öne çıkan ve en çok kullanılan/çalışılan malzemelerden biri olduğu daha da doğrulanmaktadır. 2D nanomalzemenin ilk formu olan grafen, 2004 yılında Novoselov ve arkadaşları tarafından keşfedilmiştir (Novoselov vd., 2004). Daha sonra, örneğin altıgen bor nitrür, geçiş metali dikalkojenitleri ve fosforen dahil olmak üzere çok sayıda 2D nanomalzeme ortaya çıkmıştır. Bu liste arasında grafenin benzersiz bal peteği benzeri tek atomlu yapısı onu oldukça iletken ve daha güçlü kılmaktadır (Xu vd., 2019).Grafen bilim ve teknolojide daha önemli ilerlemeler kaydetmiş olsa da diğer tüm 2D malzemelere kıyasla basit yapısı ve kimyası daha fazla ilerlemesini sınırlamaktadır. Son zamanlarda, MXen'ler olarak adlandırılan bir grup yeni malzeme, bilimsel araştırmaların her alanında yaratıcı fikirleri önemli ölçüde etkilemiştir. Karmaşık atomik düzenlemesi ve aşırı ayarlanabilir özelliklere sahip çok katmanlı yapısı, çok işlevli davranışlarını geliştirmektedir. Enerji depolama cihazları, katalizörler, sensörler, antenler ve RFID etiketleri, biyomedikal uygulamalar, elektromanyetik parazit kalkanı (EMI), nanokompozit-hibrit malzemeler, çevre ve su arıtma vb. alanlarda yapılan atılımlar buna örnek olarak verilebilir (Deysher vd., 2019). MXen'in çeşitli alanlarda ortaya çıkan uygulamalarıyla birlikte, bilim camiasında "MXen'lerin nanoteknolojinin geleceği olduğu" fikri ortaya çıkmıştır. Yeni araştırmalarda, grafende olduğu gibi MXen'in yüzey fonksiyonel gruplarını uyarlayarak yüzey, elektrik ve elektrokimyasal özelliklerinin ayarlanabilmesi bu düşünceyi daha da desteklemektedir. Çoğu MXen ve MXen bazlı malzeme yüksek hacimsel kapasitansa, antibakteriyel özelliklere, elektrokromik davranışa, yüksek elektronik iletkenliğe ve optik şeffaflığa sahiptir (Deysher vd., 2019). Bu nedenle, MXen'ler yeni uygulamalara kapı açmakta ve mevcut uygulamaların performansını değiştirmekte/iyileştirmektedir.

2011'de ilk Mxen'in keşfinden başlayarak, birçok akademik araştırmacı Mxen'lerin çeşitli bileşimlerini ve yapılarını kullanarak deneyler yapmıştır. Literatüre göre, MXen ailesi $M_{n+1}X_nT_x$ yapısına sahip karbürleri, nitrürleri ve karbonitrürleri içerir; burada M bir erken geçiş metali (Ti, V, Mo, Ta, vb.), X C ve/veya N, T_x yüzey gruplarını (tipik olarak =O, -OH, -F ve -Cl) ve n = 1-4'ü temsil eder. MXen'ler, MAX fazları olarak bilinen katmanlı karbür/nitrür öncüllerinden belirli atomik düzlemlerin seçici kimyasal aşındırılmasıyla üretilir. Genel olarak, MAX fazı karbür/nitrür öncüleri $M_{n+1}AX_n$ kimyasal formülünden oluşur, burada A Al veya Si'yi temsil eder (Firouzjaei vd., 2022; Wang vd., 2019; Perera vd., 2023).



Şekil 1. MAX fazlarını, MXen'leri ve bunların interkalasyon iyonlarını oluşturmak için kullanılan elementler (Gogotsi & Anasori, 2019).Şekil 1'de gösterildiği gibi, MAX fazındaki geçiş elementlerinin bileşimine bağlı olarak, MXene'de geçiş metalinin 2-5 atomik katmanı bulunabilir. M atomlarının her n katmanı saf A katmanları ile iç içe geçmiştir; X atomları M atomları arasındaki oktahedral bölgeleri işgal eder (Firouzjaei vd., 2022; Wang vd., 2019).

Bugüne kadar dört farklı MXen bileşimi sentezlenmiştir: M_2XT_x, $M_3X_2T_x$, $M_4X_3T_x$ ve $M_5X_4T_x$ (Şekil 2). Yapılarına göre, mono geçiş metal (TM) MXen'ler, çift-TM katı çözelti MXen'ler, çift-TM sıralı MXen'ler ve yüksek entropili MXen'ler olarak tanımlanabilirler.



Şekil 2. MAX yapılarının n = 1'den n = 4'e kadar şematik gösterimi ve bunların geçiş metalleri, karbon/azot, A grubu elementlerin çoğunluğu ve yüzey sonlandırmaları ile kazınmış MXene yapıları (Wyatt vd., 2021).

2.Enerji Depolama Cihazları için MXene'ler

Dünya dijitalleşmeye doğru hızla ilerlerken, verimli enerji depolama cihazlarına (ESD'ler) olan talep kısa sürede inanılmaz bir şekilde arttı. Tüm ESD'ler arasında bataryalar ve süper kapasitörler, uygulanabilir elektrokimyasal özellikleri nedeniyle verimli enerji depolama için önemli rakipler olarak tanımlanmıştır. Bataryaların enerji yoğunluğu boyuta bağlıdır, bu da mikro ölçekli ve giyilebilir cihazlarda kullanımlarını sınırlamaktadır. Süperkapasitörler, yüksek hız kapasiteleri ve uzun süreli çevrilebilirlikleri nedeniyle pulse gücünü depolamak için büyük ölçüde kullanılmaktadır. Ayrıca, çevre dostu olmaları ve elektrostatik etkileşimler açısından basit adsorpsiyon ve desorpsiyon mekanizmaları, süperkapasitörleri geleneksel pillerden daha iyi bir seçim haline getirmektedir. Bu anlamda, her iki cihazın da zayıf yönleri vardır. Bu nedenle, yüksek performanslı piller ve süperkapasitörler üretmek için sürdürülebilir, düşük maliyetli, çevre dostu alternatif malzemeler için büyük bir arayış vardır (Simon & Gogotsi, 2020).MXen'ler, olağanüstü elektriksel ve elektronik özellikleri nedeniyle keşfedildiklerinden bu yana enerji depolama uygulamalarında büyük ölçüde araştırılmıştır. MXen'in atomik kalınlığı, kristal yapısı ve katmanlı yapısı, yüksek spesifik yüzey alanı, elektron taşınımı için düşük enerji bariyeri ve kısa iyon difüzyon yolunu kolaylaştırır. Buna ek olarak, hem teorik hem de deneysel olarak, MXen'lerin elektronik özelliklerinin yüzey sonlandırmaları değiştirilerek modifiye edilebileceği kanıtlanmıştır. Bu nedenle, son enerji depolama

çalışmaları, önümüzdeki kırk yıl içinde etkili ESD'lere ulaşmak için MXen ve MXen bazlı kaynakları kullanmanın yeni yollarını araştırmaktadır. MXen'ler ve MXen bazlı kompozitler, özellikle yeni taşınabilir ve esnek ESD'ler geliştiren birçok çalışmada elektrotlar, elektrolit ve bunların arayüz alanları dahil olmak üzere ESD'lerin çeşitli bileşenlerine dahil edilmiştir (Tripathi & Singh,2019; Wang vd., 2020; VahidMohammadi vd., 2017).

3. Süperkapasitörler için MXene'ler

Elektrokimyasal kapasitörler olarak da bilinen süperkapasitörler, yüksek güç yoğunluklarına, hızlı şarj/deşarj özelliklerine, yüksek döngüsel verimliliklere ve uzun ömürlere sahip enerji depolama cihazlarıdır. İlginç bir şekilde, iyi tasarlanmış 2D nano-MXene elektrotlar benzersiz özellikleri nedeniyle daha yüksek süperkapasitans göstermiştir. Örneğin, değişken oksidasyon sayılarına sahip geçiş metalleri, MXen'lerin benzersiz istiflenmiş yapıları ile birlikte onları içsel olarak iletken hale getirir. Ayrıca, MXen'lerdeki geniş spesifik yüzey alanları ve daha fazla mevcut redoks bölgesi, SC'lerde kullanılan aktif karbon, grafen, iletken polimerler ve geçiş metal oksitleri gibi diğer geleneksel malzemelere kıyasla elektrokimyasal özelliklerini geliştirir (Xu vd., 2022).MXen'lerin 2011 yılında keşfinden bu yana, enerji depolama amaçlı MXen tabanlı SC'ler hakkında çok sayıda araştırma yapılmıştır. Lukatskaya ve arkadaşları $Ti_3C_2T_x$ elektrotların asidik ve bazik elektrolitlerdeki SC'lerdeki performanslarındaki değişikliklerin, bağlayıcı içermeyen $Ti_3C_2T_x$ kağıdın KOH elektrolitinde 2 mV/s'de 442 F/cm^3 hacimsel kapasitans sergilediğini, $Ti_3C_2T_x$ kil elektrotun ise H_2SO_4 elektrolitinde aynı tarama hızında daha yüksek miktarda kapasitans (900 F/cm^3) gösterdiğini bulmuşlardır (Lukatskaya vd., 2013; Lukatskaya vd., 2017). Bu sonuçlar motive edici yeniliklere yol açmıştır. MXene elektrotlarında, MXene nano tabakalarının boşluğunu artırmak için metal oksitler, karbon nanotüpler ve indirgenmiş grafen oksitler gibi ara katmanlar kullanılır. Bunlar her ne kadar tek tek katmanların bağlanmasını engellese de, diğer yandan SC'lerin performansının artmasına katkıda bulunurlar. Burada da MXene kompozitinin elektrokimyasal performansı, bozulmamış MXene elektrotlarınkinden çok daha yüksektir. Geng ve arkadaşları, $Ti_3C_2T_x/MnO_2$ ile kompozitin daha iyi bir performansa sahip oldukça esnek ve iletken bir kompozit olduğunu keşfetmiştir (Liu vd., 2017). Bir başka çalışmada, yüksek elektrot yoğunluğunu üst seviyede korurken hızlı elektron taşıma ve iyon difüzyon kinetiğini barındırmak için oldukça iletken bir MXene ağında bol miktarda kanal oluşturulmuştur. Üretilen süper kapasitör, Fe_2O_3 nanoparçacıkları (Fe_2O_3 NPs@MX) ile interkalifiye edilmiş esnek MXene hibrit kağıdı ile oldukça kompakttır.

Düzgün dağılmış Fe_2O_3 NP'ler, Mxene nano parçalarının katmanlar arası aralığını etkili bir şekilde genişletmiş, iyon difüzyon yollarını kısaltmış ve daha fazla aktif bölgeyi açığa çıkarmıştır. Aynı zamanda, iletken MXene iskeleti redoks reaksiyonları sırasında Fe_2O_3 NP'lerin hacim genişlemesini uygun şekilde bastırmıştır. Böylece, MXene ve Fe_2O_3 NP'lerin sinerjik etkisi 2607 F/cm^3 (584 F/g) gibi son derece yüksek bir hacimsel kapasitans ve mükemmel döngü performansı ile sonuçlanmıştır (Ma vd., 2020). Bu örnekler, metal oksitlerin MXen'ler ile kompozitlerinin SC'lerde üstün psödokapasitif performans sağladığını doğrulamıştır. Titanyum karbür MXen dışında, Wang ve arkadaşları tarafından ilk kez bir polianilin ve V_2C MXen kompoziti bulunmuştur. Bu malzeme kombinasyonunu kullanarak, yüksek yoğunluklu ve yüksek hassasiyetli bir amonyak sensörüne sahip SC'ler sentezleyebilmişlerdir (Wang vd., 2021).

4. Sonuçlar ve Tartışma

İcat edilmelerinden on yıl sonra, özel elektrokimyasal etkilere sahip MXene bazlı NM'ler enerji depolama alanında inanılmaz bir ilerleme kaydetmiştir. Grafen üzerine yapılan önemli yeniliklerle genel bir perakende uygulamasına kıyasla, MXene tabanlı NM'ler yenidir ancak EED için mükemmel olanaklara sahiptir. Dikkat çekici bir şekilde, yönetilebilir film miktarı, katmanlar arası boşluk ve aktif kümelerin belirli bir tanımıyla sabit MXene'in dahil edilmesi, hızlı reaksiyon kinetiği için kolaylaştırıcıdır. Sulu ortamdaki MXene bazlı SC'ler, mükemmel iyonik iletkenlikleri, kolay sentez süreçleri ve düşük birleştirme masrafları sayesinde geniş bir uygulama yelpazesine sahiptir. Bununla birlikte, birkaç durumda, sulu elektrolitlerin dışarı akışı cihazın elektrokimyasal performansını olumsuz etkilemekte ve önemli bir güvenlik tehdidi oluşturmaktadır. Ayrıca, sulu ortamdaki sıvılaştırılmış oksijen, yüzey oksidasyonu yoluyla aktivitesini azaltır. Bu nedenle, sulu ortamın yerine katı ve sulu olmayan elektrolitler kullanan MXene bazlı NMs SC'lerin elektrokimyasal aktivitesini artırmak için daha fazla çalışma yapılmalıdır. MXene bazlı NMs SC'lerdeki EED aracı ve bunları etkileyen farklı özellikler (yüzey etkileşimi, ara katman ağı, film yeniden istifleme, vb.) hakkında daha derin bir bilgi, etkili SC'lerin üretilmesine olanak sağlayabilir. MXen'lerin endüstri ile ilgili olası entegrasyonunun geliştirilmesinde, koruma, kontrol edilebilirlik ve büyük ölçekli üretim potansiyelini kısıtlayan diğer sorunların değerlendirilmesi gerekecektir.

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SÜPER KAPASİTÖRLERDE GÖZENEK YAPISININ ELEKTROKİMYASAL YÜK DEPOLAMA MEKANİZMASI ÜZERİNDEKİ ETKİLERİ

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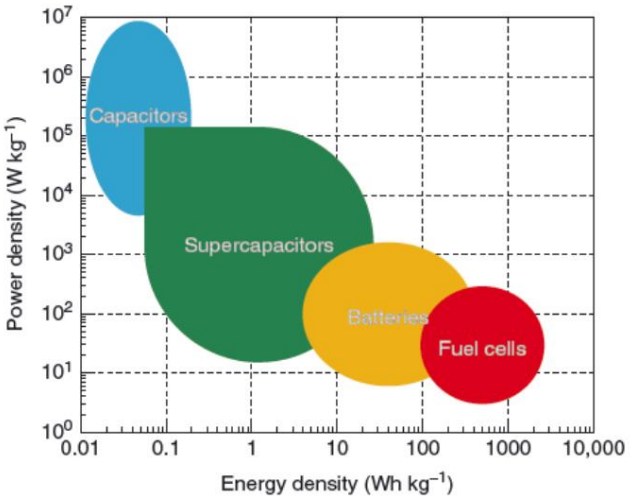
Özet
Yenilenemeyen enerji kaynaklarının hızla tükenmesi ve ciddi çevre sorunları, temiz ve yenilenebilir enerji kullanımını büyük ölçüde teşvik etmektedir. Enerji kullanımı sırasında aralıklı bir adım olan süperkapasitörler, ultra hızlı şarj-deşarj oranları, yüksek güç yoğunlukları, düşük bakım ve uzun çevrim ömürleri nedeniyle büyük ilgi görmüştür. Bir süperkapasitörün enerji depolama mekanizması ve spesifik kapasitesinin üst sınırı, seçilen elektrot tarafından önemli ölçüde baskın hale getirilir. Gözenekli karbon malzemeler, geniş spesifik yüzey alanları, yüksek iletkenlikleri, kararlı kimyasal özellikleri, ayarlanabilir gözenek boyutları ve düşük maliyetleri nedeniyle süperkapasitörler için elektrot malzemeleri olarak uygun bir seçimdir. Son yıllarda, gözenekli karbon bazlı süper kapasitörlerin elektrokimyasal performansı büyük ilgi görmüş ve morfoloji/gözenekli yapı ve yüzey özelliklerinin orantılı tasarımı ile büyük ölçüde geliştirilmiştir. Bununla birlikte, bu gözenekli karbon elektrotlar için, pratik iyon dinamikleri, yük depolama mekanizmaları ve bunların elektrokimyasal performans üzerindeki etkileri sınırlı bir şekilde anlaşılmaya devam etmektedir. Bu nedenle, yük depolama mekanizmalarının, elektronların/iyonların iletim yollarının ve elektrokimyasal olarak aktif bölgelerin derinlemesine anlaşılması, daha etkin süperkapasitörler oluşturmak için son derece önemlidir. Biz bu çalışmada özellikle süperkapasitörlerin gözenekli karbon elektrotlarında iyon/yük depolanmasını ve katkı türleri ile elektrokimyasal performanslar arasındaki yapı-aktivite ilişkilerini ve en son gelişmeleri özetliyor ve tartışıyoruz.
Anahtar Kelimeler: Süperkapasitör, yenilenebilir enerji, gözenekli karbon elektrot, yük depolama mekanizması.

EFFECTS OF PORE STRUCTURE ON ELECTROCHEMICAL CHARGE STORAGE MECHANISM IN SUPERCAPACITORS

Abstract
The rapid depletion of non-renewable energy sources and serious environmental issues largely stimulate the utilization of clean and renewable energy. Supercapacitors, as an intermittent step during energy usage, have attracted wide attention due to their ultrafast charge–discharge rate, high power density, low maintenance and long cycle life. The energy storage mechanism and the upper limit of specific capacity of a supercapacitor is significantly dominated by the selected electrode. Porous carbon materials are an attractive choice as electrode materials for supercapacitors due to their large specific surface area, high conductivity, stable chemical properties, adjustable pore size and low cost. In recent years, the electrochemical performance of porous carbon-based supercapacitors has gained considerable attention and has been greatly improved via the rational design of morphology/porous structure and surface properties. However, for these porous carbon electrodes, there remains a limited understanding of practical ion dynamics, charge storage mechanisms and their influence on the electrochemical performance. Therefore, an in-depth fundamental understanding of the charge storage mechanisms, transport pathways of electrons/ions and the electrochemically active sites is extremely important for further building efficient supercapacitors. We specifically summarize the state-of-the-art progress, understand the ion/charge storage in porous carbon electrodes of supercapacitors, and further discuss the structure–activity relationships between doping species and electrochemical performances.
Keywords: Supercapacitor, renewable energy, porous carbon electrode, charge storage mechanism.

Giriş

Küresel ısınma, çevresel bozulma ve yenilenemeyen enerjiye bağımlılık nedeniyle alternatif yakıt, yüksek değerli kimyasallar ve enerji kaynakları bulmak daha önemli hale geldi (Rawat vd., 2022; Zheng vd., 2022; Fan vd., 2023). Yeni enerji teknolojisindeki gelişmeler geleneksel enerjiye olan talebi azaltabilir (Fu vd., 2019a, Fu vd., 2019b). Yenilenemeyen enerji kaynaklarının hızla tükenmesi ve ciddi çevre sorunları, temiz ve yenilenebilir enerjinin kullanımını büyük ölçüde teşvik etmektedir (Béguin vd., 2014; Li and Wang, 2019; Chen vd., 2020). Bu nedenle, alternatif enerji kaynaklarının ve güvenilir enerji depolama teknolojilerinin geliştirilmesi, mevcut sorunları çözmenin anahtarı haline gelmiştir (Cao vd., 2021).Süperkapasitörler, enerji kullanımı sırasında aralıklı bir adım olarak, ultra hızlı şarj-deşarj hızı, yüksek güç yoğunluğu, az bakım gerektirmesi ve uzun çevrim ömrü nedeniyle büyük ilgi görmüştür (McCloskey,2015;Liu vd.2019; Wang vd., 2020; Xie vd., 2020) (Şekil 1).



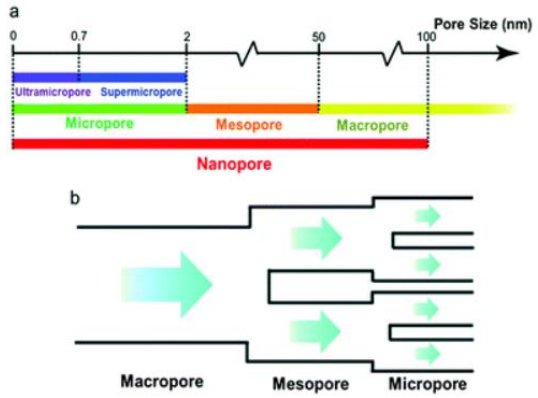
Şekil 1. Batarya ve süperkapasitörlerin Ragon eğrilerinin mukayesesi (Kim vd., 2015).

Bu nedenle, gelişmiş bir süper kapasitör için önemli bir hedef, ideal bir elektrot malzemesi seçmektir. Çeşitli elektrot malzemeleri arasında gözenekli karbonlar, geniş yüzey alanları, ayarlanabilir gözenek boyutları, yüksek iletkenlikleri ve geniş kimyasal stabiliteleri nedeniyle süper kapasitörler için çekici bir elektrot adayı olarak kabul edilir. Bununla birlikte, mevcut süper kapasitörlerin sınırlı enerji yoğunluğu, yaygın uygulamalarını büyük ölçüde engellemektedir. Süper kapasitörlerin enerji yoğunluğu, gözenekli karbon elektrotun yapısına ve özelliklerine kritik olarak bağlıdır ve bu nedenle bunu optimize etmek, süper kapasitörlerin elektrokimyasal performanslarını arttırmanın anahtarıdır (Xie vd., 2020). Gözenekli malzeme yüksek bir özgül yüzey alanına sahiptir, şarj ve deşarj işlemi sırasında kimyasal reaksiyonlara girmez ve şarjı yüksek güvenilirlik ve döngü kararlılığı ile depolamak için elektrikli çift

katmanlı mekanizmaya dayanır (Wang vd., 2021; Han vd., 2020; Yang vd., 2021). Bu tür malzeme için, spesifik yüzey alanı ve gözenek yapısı, kapasitansı etkileyen temel faktörlerdir. Elektrikli çift katman teorisine göre, daha büyük bir özgül yüzey alanı, daha fazla şarj depolama alanı sağlar ve özgül kapasiteyi artırır. Karbon malzemenin özgül yüzey alanı küçük olduğunda, özgül kapasitans, özgül yüzey alanı ile pozitif korelasyon gösterir (Cao vd., 2021). Bu çalışmada ise elektrokimyasal yük depolamada gözeneklerin etkisi ele alınmıştır.

2.Süperkapasitör Elektrotlar İçin Gözenekli Yapılar

Daha küçük ve büyük gözeneklerin biraraya getirilmesi, elektrot malzeme içindeki iyon transferi için güvenli ve oldukça önemlidir (Schwieger vd., 2016; Borchardt vd., 2018). Bu durumda, mikro (<2 nm), mezo (2~50 nm) ve makro gözeneklere (>50 nm) kadar farklı uzunluktaki gözeneklerden oluşan çok sayıda gözenekli karbon geliştirilmiştir (Trogadas vd., 2016; Liu vd., 2017; An vd., 2017; Gadipelli vd., 2020) ve gözenek tipleri Şekil 2a'da gösterilmektedir (Liu vd., 2017). Bu makro-mezo-mikro gözenekli karbonları kullanmaktaki temel amaç, belirli geometric sınırlamalar içerisinde küçük mikro gözeneklerin, zıt iyon yükünü filtrelemedeki etkinliği ve yüksek bir enerji yoğunluğu elde edebilmesidir. Makro- ve mezo-gözenekler ise hızlı ve etkin yük transferi için 'iyon yolu planlaması' sağlayabilir (Şekil 2b) (Zhou vd., 2018; Yu vd., 2015; Lee& Pyun, 2006).

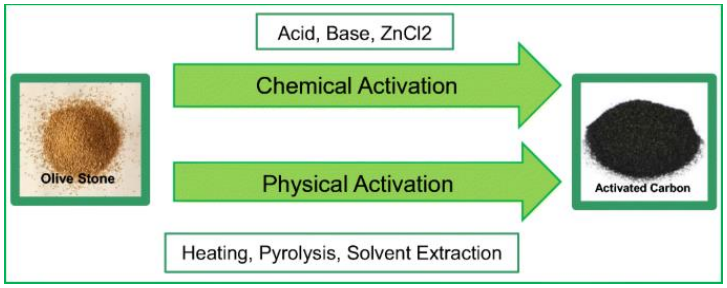


Şekil 2. a) Gözeneklerin genişliğine bağlı sınıflandırma, **b)** Gözenek yapısına bağlı iyon difüzyon yolunun şematik gösterimi (Xie vd., 2020).

2.1. Gözenekli Aktif Karbon Yapılar

Aktif karbon (AC'lar), geniş yüzey alanı, iyi elektriksel özellikler ve düşük maliyet avantajlarına sahip, yaygın olarak kullanılan bir elektrot malzemesidir. AC'ler genellikle odun, kömür, fındık kabukları vb. gibi çeşitli karbonlu malzemelerin fiziksel (termal) ve/veya kimyasal aktivasyonu ile üretilir (Wang vd., 2021; Wang vd., 2020; Nguyen vd., 2021) (Şekil 3). Fiziksel aktivasyon genellikle buhar, karbondioksit ve hava gibi oksitleyici gazların

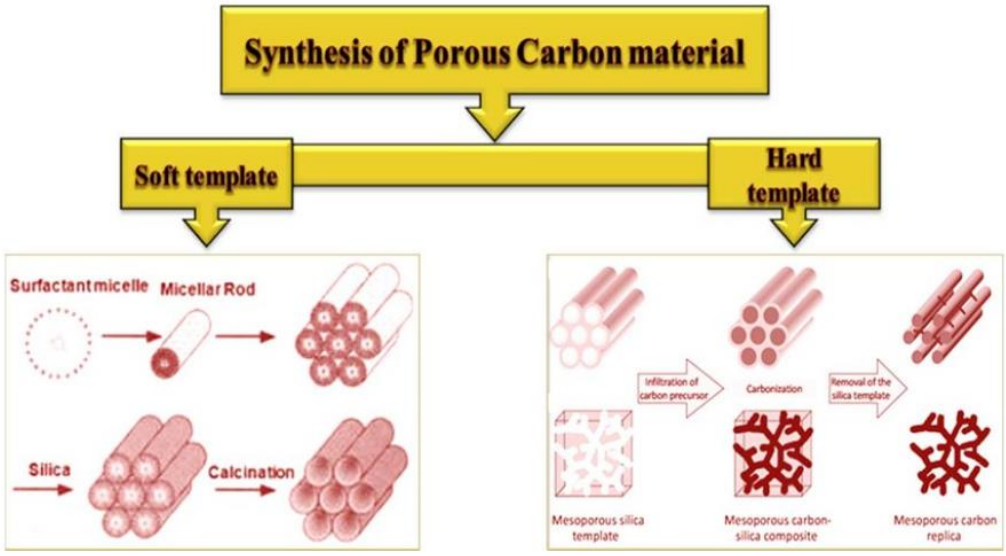
varlığında karbon öncüllerinin yüksek sıcaklıkta (700~1200 °C) işlenmesini ifade eder. Kimyasal aktivasyon genellikle potasyum hidroksit, sodyum hidroksit ve çinko klorür gibi aktivatörler kullanılarak daha düşük bir sıcaklıkta (400~700 °C) gerçekleştirilir (Lin vd., 2018; Jin vd., 2010). Aktif karbonun elektrik iletkenliği genellikle düşüktür, bu da gelişimini engellemektedir (Salunkhe vd., 2015). Yüksek iletkenlik ve elektrolitler için iyi gözenek afinitesi, AC tabanlı yüksek hızlı süper kapasitör elektrotlar için iki önemli özelliktir.



Şekil 3. Aktif karbon prosesi (Saleem vd., 2019).

2.2. Gözenekli Şablonlu Yapılar

Şablonlu karbonizasyon tekniği kullanılarak oluşturulan şablon gözenekli karbon (TC'ler), nanometre seviyesinde yapısal kontrol ile yapılabilir. Yumuşak şablon sentez yöntemi ve sert şablon sentez yöntemi olmak üzere iki farklı TC üretim yöntemi vardır (Şekil 4) (Xie vd., 2016).



Şekil 4. Sert ve yumuşak şablon sentezi (Lama, 2018).

Yumuşak şablon tekniği, düzenli mezzo-gözenekli karbon üretmek için, karbonizasyonu takiben, bir karbon öncülü ve genellikle yüzey aktif maddenin kendiliğinden bir araya getirilmesi ile oluşur. Sert şablon yöntemi, benzersiz bir gözenek yapısına ve morfolojiye (zeolit veya metal oksit gibi) sahip bir şablonlama maddesinin seçilmesini, yüksek sıcaklıkta karbonizasyon için karbon öncülünün gözeneklerine sokulmasını ve daha sonra şablona benzer

morfolojili gözenekli karbon elde etmek için şablonlama maddesinin çıkarılmasını içerir. Şablon tekniğiyle üretilen düzenli gözenekli karbon, gözenekli şablonların birbirine bağlı mezogözenekli yapısıyla eşleşir (Nishihara& Kyotani, 2012). Şablonun gözenek yapısının seçilmesi veya değiştirilmesi, gözenekli karbonun gözenek yapısını doğrudan yönlendirebilir (Wang vd., 2021). Şablon gözenekli karbon, şablonun yardımıyla düzenli mezzo-gözenekli bir yapı üretebilir, ancak sınırlı mikro gözenekleri nedeniyle, spesifik yüzey alanı nadiren 1000 m^2 g^{-1}'i aşabilir. Sonuç olarak, spesifik yüzey alanının arttırılması, mikro gözenekler oluşturmak için aktivatörlerin kullanılmasını gerektirir ve bu da aynı zamanda şablon tekniğinin bir kısıtlamasıdır (Lu vd., 2017).

2.3. Grafen

Grafen, sayısız özel özelliği nedeniyle süper kapasitörlerde daha sık kullanılmaktadır. Grafen, olağanüstü elektriksel iletkenlik, termal kararlılık, kimyasal kararlılık, esneklik ve spesifik yüzey alanı sergiler. Grafen, şu anda geliştirilen karbon malzemeler arasında en kapsamlı özellikleri göstermektedir. Xu ve çalışma arkadaşları, grafen oksidin hidrokinon ile tek aşamalı indirgenmesiyle işlevselleştirilmiş grafen jeller hazırlamıştır. Elde edilen işlevselleştirilmiş grafen jeller, süper kapasitörlerde yüksek elektrokimyasal performans sergiler ve ek katkı maddelerine ihtiyaç duymadan elektrot malzemeleri olarak kullanılabilir (Xu vd., 2013). Tek bir gözenekli karbonun bir elektrot malzemesi olarak oynayabileceği rolün hala sınırlı olduğunu ve üç ana eksiklik olduğunu bulmak zor değildir: Birincisi, gözenekli karbonun grafit yapısı zayıftır, grafitleşme derecesi düşüktür; İkincisi, gözenekli karbonun gözenek yapısı gelişmemiştir ve etkili yüzey alanı düşüktür; son olarak, heteroatom katkılamanın olmaması. Bu sorunları ele almak ve süper kapasitörlerin performansını zirveye çıkarmak için, gözenekli karbon, ikili ve hatta üçlü kompozit sistemler oluşturmak için diğer maddelerle birleştirilmelidir (Yang vd., 2023). Grafen tabakaları arasındaki π-π etkileşimleri, grafenin kolayca topaklaşmasına ve istiflenmesine yol açar, bu da spesifik yüzey alanının, spesifik kapasitansın ve enerji yoğunluğunun azalmasına neden olur.

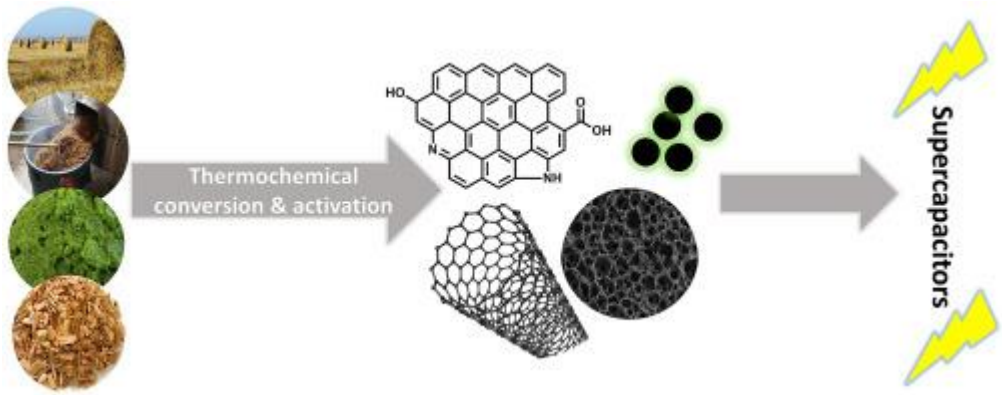
2.4. Karbid Türevli Gözenekli Yapılar

Karbür türevi karbon (CDC), metal atomlarının karbür kafesinden aşındırılmasıyla üretilen yeni bir karbon malzemesi türüdür. CDC hazırlama yönteminin en avantajlı özelliği aşındırma işlemi sırasında karbürün şeklinin ve boyutunun değişmemesi ve karbon malzemenin atomik seviyede düzenlenebilmesidir. CDC'nin en basit ve yaygın olarak kullanılan hazırlama yöntemi ise halojen aşındırma yöntemidir, yani gözenekli karbon malzemeleri hazırlamak için karbürleri 150~1650 °C'de aşındırmak için taze hazırlanmış halojen (F_2, Cl_2, Br_2, I_2) veya halojen

bileşikleri (CCl_4, $CHCl_3$, Cl_2-HCl, Cl_2-H_2, HF) kullanılır. Şimdilerde ise TiC, SiC, Mo_2C, Al_4C_3, Fe_3C_4, Ti_2AlC ve ZrC öncüller olarak bildirilmiştir (Jänes vd., 2007; Ding vd., 2016). CDC, ideal bir çift katmanlı elektrot malzemesinin bütün özelliklerine sahiptir: geniş spesifik yüzey alanı, hassas ve ayarlanabilir gözenek boyutu dağılımı , yüksek elektronik iletkenlik gibi (Lukatskaya vd., 2014). CDC'nin bu gözenek yapısı, çeşitli öncüller kullanılarak veya üretim boyunca aşındırma sıcaklığı değiştirilerek 0,6 ile 1,1 nm arasında hassas bir şekilde ayarlanabilir (Chmiola vd., 2006; Jänes vd., 2007; Ding vd., 2016; Cao vd., 2021).

2.5. Biyokütleden Üretilen Gözenekli Yapılar

Biyokütleden üretilen karbon, karbon öncülü olarak karbon açısından zengin biyokütle kullanılarak yüksek sıcaklıkta karbonizasyon ve aktivasyon reaksiyonları ile oluşturulan gözenekli bir karbon malzemesidir. Şu anda, biyokütle gözenekli karbonun hazırlanması için iki yaygın hammadde bulunmaktadır: biri glikoz (Feng vd., 2020; Tooming vd., 2015) fruktoz (Cao&Yang, 2018) sakaroz (Vazquez-Samperio vd., 2020) ve nişasta gibi bir karbonhidrattır (Yadav vd., 2018), diğeri ise doğal bir bitki ve hayvan matrisidir. Polen (Cao vd., 2021), kitin (Zheng vd., 2021), üzüm (Wang vd., 2020), selüloz (Ewulonu vd., 2019), saç (Zhao vd., 2020) vb. gibi malzemeler. Biyokütle hammaddeleri çok sayıda doğal mikroskobik gözenek yapısına ve çeşitli heteroatomlara sahiptir, dolayısıyla biyokütle bazlı karbon malzemeleri de farklı mikroskobik morfolojiye sahiptir, yüzey kimyasal özellikleri ve çok sayıda gözenek yapısı gibi (Şekil 5).



Şekil 5. Süperkapasitörler için biyokütle türevli karbon malzemeler (Rawat vd., 2022).

Biyokütle, aktif karbon üretimi için sadece karbon kaynağı olmayıp aynı zamanda doğal bir yapıya da sahip olduğundan bu yapıların tam potansiyelleriyle kullanılması, biyokütle türevi gözenekli karbon ürünlerinde etkili gözenek yapılarının oluşmasını sağlar. Biyokütle bazlı gözenekli karbon malzemelerin avantajları, düşük maliyetleri, geniş kullanılabilirlikleri, çevre

dostu olmaları ve hazırlanma kolaylığıdır. Enerji depolama alanındaki uygulamaları, çevrenin uzun vadeli gelişimi ve korunması için kritik öneme sahiptir (Cao vd., 2021).

3. Sonuçlar ve Tartışma

Aktif karbon, safsızlıklardan büyük ölçüde etkilenir. Şablon karbon, şablonların tanıtılması yoluyla karbon malzemelerin gözenek yapısını kontrol edebilir. Makro gözenekler-mezoporeler-mikro gözeneklere sahip gözenekli karbon, yalnızca iyon taşıma direncini azaltmakla kalmaz, aynı zamanda geniş spesifik yüzey alanı sağlar. Yumuşak şablon yönteminin şablonu çıkarması gerekmese de, mezoporların oranı mikro gözeneklerinkinden çok daha yüksektir, bu da düşük özgül yüzey alanına ve zayıf kapasitans performansına yol açar. Grafen çok yüksek bir iletkenliğe ve çok geniş bir özgül yüzey alanına sahiptir. Süper kapasitörlere uygulandığında, hızlı şarj-deşarj özellikleri ve iyi çevrim kararlılığı gösterir. Bununla birlikte, grafenin dezavantajı, katmanlar arasında yığılmasının kolay olması ve diğer gözenekli karbonlarla karşılaştırıldığında çok pahalı olmasıdır. Bu nedenle, süper kapasitörler için yüksek performanslı elektrot malzemeleri olarak gözenekli malzemelerin fonksiyonel özelliklerinin geliştirilmesi büyük önem taşımaktadır.

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DOĞUM SONRASI HİPERTANSİYON VE GÜNCEL YAKLAŞIMLAR

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Özet
Hipertansiyon doğum sonu dönemde anne sağlığını etkileyebilecek önemli bir sağlık sorunudur. Bu dönemde hipertansiyon; kronik hipertansiyon geçmişi, gebelik hipertansiyonu, preeklampsi ve eklampsi olarak sınıflandırılmaktadır. Genellikle gebelikte seyreden yüksek kan basıncının doğum sonrası dönemde de aynı yükseklikte devam etmesi sonucu meydana gelmektedir. Hipertansiyon mutlaka tedavi edilmeli ve kan basıncı dikkatle takip edilerek normal seviyede tutulmalıdır. Başlangıç tedavisi hastalığın geçmişine, klinik bulgularına, ilgili semptomlara, laboratuvar bulguları olan idrarda protein, trombosit sayısı, karaciğer enzimleri, serum kreatinin, elektrolit düzeyine ve hipertansiyon tedavisine verilen cevaba bağlıdır. Çoğu anneye doğumdan önce başlanan antihipertansif ajanlara devam edilir, ancak doz artışı gerekli olabilir. Bu çalışma, güncel literatür incelenerek doğum sonu dönemde gelişen hipertansiyona ilişkin güncel yaklaşımlar konusunda sağlık profesyonellerini ve kadınları bilgilendirmeyi amaçlamaktadır.
Anahtar kelimeler: Doğum sonu dönem, hipertansiyon, ebelik, güncel yaklaşımlar

POSTPARTUM HYPERTENSION AND CURRENT APPROACHES

Abstract
Hypertension is an important health problem that may affect maternal health in the postnatal period. Hypertension in this period is classified as chronic hypertension history, pregnancy hypertension, preeclampsia and eclampsia. Generally, it occurs as a result of high blood pressure during pregnancy continuing at the same height in the postnatal period. Hypertension must be treated and blood pressure must be carefully monitored and kept at a normal level. Initial treatment depends on the history of the disease, clinical findings, related symptoms, laboratory findings such as protein in urine, platelet count, liver enzymes, serum creatinine, electrolyte levels and the response to hypertension treatment. Antihypertensive agents started before delivery are continued in most mothers, but dose increase may be necessary. This study aims to inform healthcare professionals and women about the current approaches to hypertension in the postpartum period by reviewing the current literature.
Keywords: Postnatal period, hypertension, midwifery, current approaches

GİRİŞ

Hipertansif bozukluklar gestasyonel hipertansiyon, preeklampsi ve eklampsiyi içermektedir. Gebelikte gelişen hipertansiyon doğum sonrası devam etmekte veya gebelik boyunca kan basıncı normal aralıkta seyrederken doğum sonrası yükselebilmektedir. Bu nedenle doğum sonrası dönemde yeni başlayan hipertansiyonun da hipertansif bozukluklar içerisine dahil edilmesi gerekmektedir. Doğum sonrası dönemde hipertansiyon, gebelikteki maternal komplikasyonları içermektedir (Katsi ve ark., 2020). Güncel çalışmalar göstermektedir ki gebeliğinde hipertansif hastalığı olan bir kadın yaşamının ilerleyen dönemlerinde Kardiyovasküler Hastalık gelişme açısından da risk altındadır (Sukmanee and Liabsuetrakul, 2022).Bir derleme ve meta analiz çalışması sonucunda; gebelikte hipertansif hastalık öyküsünün bulunması doğumdan sonraki 2 yıl içinde hipertansiyon gelişme riskini, normal kan basıncı olan gebelere kıyasla altı kat daha yüksek olduğu sonucuna ulaşılmıştır (Giorgione ve ark., 2021). Türkiye'de anne ölüm nedenleri içerisinde hipertansif durumlar ilk dörtte yer almaktadır (Sağlık Bakanlığı, 2021). Ayrıca Dünya Sağlık Örgütü verilerine göre anne ölümlerinin %75'inden sorumlu komplikasyonlar içinde hipertansif durumlar yer almaktadır (WHO, 2023).Gebelikte hipertansiyon sistolik kan basıncının140/90 mmHg ve üzerinde olması veya 4 saat ara ile ölçülen diyastolik kan basıncını 90 mmHg ve üzerinde olmasıdır. Ayrıca 15-20 dakika aralıkla yapılan iki kan basıncı takibinde sistolik kan SKB ≥ 160 mmHg ve diyastolik kan basıncı ≥ 110 mmHg olması ciddi hipertansiyon olduğunu gösterir ve acil müdahale gerektirir (Katsi ve ark., 2020).

GENEL BİLGİLER

Gebelikte kadın ile karşılaşılan ilk andan itibaren, preeklampsi oluşması için altta yatan bir risk faktörü var ise bunun belirlenip kontrol altına alınması gerekir. Kadın sağlıklı beslenme düzeni ve egzersiz yapması açısından desteklenmelidir (Karahan ve diğerleri, 2022). Aspirinin preeklampsinin önlemesi ile ilgili yayınlanan raporlar 1980 yılından beri devam etmektedir. ASPRE denemesi, yüksek preeklampsi riski taşıyan kadınlarda 150 mg aspirin kullanımını plasebo grubu ile değerlendiren randomize bir çalışmadır. Çalışmanın sonucunda aspirin alan grupta preterm PE insidansı daha düşük bulunmuştur (Tousty ve ark., 2023). 2018 yılında yayınlanan preeklampsi (FACT) plasebo çalışmasında beş ülkede yürütülen uluslararası özellikte olup 8-16 gebelik haftasından doğuma kadar gebe kadınlara günde 1,1 mg folik asit takviyesi almaları sağlanmış ve yüksek doz folik asit takviyesinin preeklampsinin önüne geçemediği sonucuna ulaşmışlardır (Wen ve ark., 2018).

Günlük diyete kalsiyum takviyesi yapılmasının (500/600mg-2 gr) preeklampsinin gelişim riskini düşürebilir ancak etkililiği tam doğrulanmamıştır (Gunabalasingam ve ark., 2022). Doğum sonu dönemde kan basıncının kontrol altında tutulması için farklı antihipertansif ilaçlar kullanılmaktadır. En fazla nifedipin ve labetalol kullanılır. En sık kullanılan hızlı etkili hipertansif ajan nifedipin olmakla birlikte başka bölgede yapılan bir çalışmada en sık reçete edilen ilaç labetalol olmuştur. Bu durum farklı bölge, ilaca ulaşabilme durumuna göre değişiklik gösterebilir (Ngene ve Moodley, 2020; Al-Duqhaishi ve ark., 2022). Şiddetli preeklampsi, eklampsi gibi durumlarda, konvülsiyon oluşumunu veya tekrar gelişmesini önlemek için Magnezyum Sülfat kullanımı genel olarak kabul edilmektedir (Hogg III ve ark., 2020).Doğum sonu dönemde belirli bir sıvı yönetimi protokolünü destekleyen önemli kanıtlar bulunmamaktadır ancak kılavuzlar kısıtlayıcı bir yaklaşım olmasını ve ek sıvı uygulamasını belirli durumlarda önermektedir. Genellikle, doğum için kabul edilen preeklamptik kadınlar, su ve elektrolit dengesinin korunması veya kaybedilen intravasküler hacmin yerine konması için sıvı tedavisine ihtiyaç duyabilir. Kristaloidlerin infüzyon hızı sabit 60 ila 80 mL.h-1 olabilir. Aşırı sıvı yüklemesi durumu göz önünde bulundurulmalıdır (da Silva ve ark., 2021).Diüretikler ile ilgili bazı çalışmalar, postpartum annenin tansiyonunun daha çabuk kontrol altına alınmasını ve kan basıncı kontrolü için daha az tedaviye ihtiyaç duyulduğunu belirtse de kesin bir sonuç yoktur (Hogg III ve ark., 2020). Diüretikler gebe olmayan kadınlarda kan basıncını düşürür, ancak artık gestasyonel hipertansiyon için önerilmemektedir (Nimra ve ark., 2023). Şiddetli hipertansiyonu olan gebeler tromboemboli açısından daha fazla dikkat edilmesi gereken bir konumdadırlar. Sezaryen doğum olan kadınlarda pnömotik kompresyon cihazları kullanılması tavsiye edilmektedir (Hogg III ve ark., 2020). Yapılan bir çalışmada HELLP hastalarına kortikosteroid uygulanmasının, klinik belirtilerde azalma ve laboratuvar sonuçlarında olumlu gelişmeler saptanmıştır (Yang ve ark., 2016). Ancak literatürde doğum sonu dönemde kortikosteroid kullanımı ile ilgili kesinleşmiş bir bilgi bulunmamaktadır (Hogg III ve ark., 2020).Güncel veriler doğum sonu dönemde Nonsteroid antienflamatuvar ilaç uygulamasının, kan basıncı kontrolünde ciddi bir negatif durum geliştirmediği yönündedir. ACOG, ağrı yönetiminde NSAID kullanımını opioid ağrı kesici yerine tavsiye etmektedir (Hogg III ve diğerleri, 2020).Dünyada hipertansif durumların kontrolünde ve anne ölümlerinin azaltılmasında prepartum ve postpartum birçok izlem ve model bulunmaktadır. Bunlardan bazıları şunlardı: Safe@Home, evde kan basıncı ölçümü ve preeklampsi semptomlarının takibini gebenin kendisinin yapmasına olanak sağlayan dijital bir platformdur. Preeklampsi gelişme riski yüksek olan gebelerin 16. gebelik haftasından itibaren ve doğum öncesi ziyaret

sayısında azalma ile karakterize olarak değerlendirmeyi amaçlar (van den Heuvel ve ark., 2020).Nurse-Family Partnership, genç, düşük gelirli, ilk kez anne olan kadınlar ve ailelerinin anne ve çocuk sağlığının iyileştirilmesinde kanıta dayalı bir programdır. Doğum öncesi dönemden doğum sonu bebeğin iki yaşına kadar olan süreçte hemşirenin ev ziyaretleri ile karakterizedir. Hipertansif durumlar açısından, sağlıklı doğum öncesi davranışların teşvik edilmesi ile doğum sonu dönemde olumlu gebelik sonuçları almak bu programın önemli hedeflerindendir (Jack ve ark., 2012). Teknolojinin yaygınlaşması sağlık alanında da yenilikler getirmiştir. Sağlığın takibi mHealth gibi uygulamalar ile dijitale dökülmüştür. Bu uygulama ile bireylerin vital bulgularının zamanında izlenmesi, sağlıkta bakımın sağlanmasında sağlık profesyonellerinin ortak çalışmasını sağlar (Demir Yıldırım ve Hotun Şahin, 2022).

SONUÇ VE ÖNERİLER

Hipertansif durumların kontrolünde sağlık profesyonelleri durumu bütüncül bakış açısı ile ele almalıdır. Postpartum dönemde kan basıncının kontrolü esasen gebelik dönemine dayanmaktadır. Gebelikte hatta prekonsepsiyonel dönemde kadında hipertansif bir durum gelişmesi yönünden risk var ise tespit edilip önlem alınmalıdır. Hem gebelikte hem de doğum sonu dönemde medikal tedavi yöntemleri ise her gün gelişmektedir. Sağlık profesyonellerinin anne ölümlerinin önüne geçecek izlem ve modellerden yararlanması ile koruyucu sağlık hizmetleri, bakım ve postpartum dönemde hipertansif durumların kontrolünün sağlanması önem arz etmektedir.

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ADOPTION OF ELECTRIC VEHICLES (EVs) AS A SUSTAINABLE TRANSPORTATION SOLUTION: RESHAPING THE TRENDS IN CONVENTIONAL AUTOMOBILE APPLICATIONS

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Abstract
The purpose of this study is to inform policymakers, industry stakeholders, and the general public about the potential benefits and challenges of adopting EVs as a sustainable transportation solution, using literature review based approach. The findings of this study indicated that a transition process from conventional vehicles to EVs is rapidly taking effect already due to the numerous advantages offered by EVs. Firstly, EVs contribute to reducing greenhouse gas emissions, as they produce zero tailpipe emissions during operation. This reduction in emissions can help mitigate climate change and improve air quality, leading to better public health outcomes. Also, EVs have lower operating costs compared to conventional vehicles, primarily due to the lower cost of electricity compared to gasoline or diesel. Additionally, EVs require less maintenance, as they have fewer moving parts and do not require oil changes. The development and adoption of EVs can stimulate economic growth and job creation, as it requires investments in manufacturing, charging infrastructure, and research and development. However, several challenges need to be addressed to facilitate a successful transition to EVs. Firstly, the limited driving range of EVs compared to conventional vehicles remains a concern for potential buyers. Although the range of EVs has been improving, it is essential to continue investing in battery technology to increase their range and reduce charging times. Moreover, the availability and accessibility of charging infrastructure need to be expanded to alleviate range anxiety and ensure convenient charging options for EV owners. Furthermore, the upfront cost of EVs is currently higher than that of conventional vehicles, primarily due to the cost of batteries. However, as technology advances and economies of scale are achieved, the cost of EVs is expected to decrease, making them more affordable for consumers. Policymakers should prioritize investments in battery technology, charging infrastructure, and financial incentives to promote the widespread adoption of EVs. By doing so, a more sustainable and environmentally friendly transportation system can be achieve.
Keywords: Sustainable transportation, Electric vehicles, Reduced emissions, Automobiles.

Introduction

The adoption of electric vehicles (EVs) as a sustainable transportation solution has gained significant attention in recent years due to the increasing concerns about climate change and air pollution. EVs are vehicles that are powered by electric motors and batteries, rather than internal combustion engines that run on gasoline or diesel. This shift towards EVs is seen as a crucial step towards reducing greenhouse gas emissions and promoting a cleaner and more sustainable transportation system (Alanazi, 2023; Muratori et al .2021).The key operating principle of EVs lies in their use of electric motors to drive the vehicle. These motors are powered by rechargeable batteries, which store electricity that is used to propel the vehicle. The batteries can be charged using a variety of sources, including traditional electrical outlets, dedicated charging stations, or renewable energy sources such as solar panels. This reliance on electricity as a fuel source eliminates the need for gasoline or diesel, reducing the emissions of harmful pollutants such as carbon dioxide, nitrogen oxides, and particulate matter (Ortar & Ryghaug, 2019).One of the main driving forces behind the adoption of EVs has been the increasing awareness of the environmental impact of fossil fuel-powered vehicles. With concerns about climate change and air pollution on the rise, governments and consumers alike have been looking for cleaner and more sustainable transportation options. EVs, with their zero emissions and lower carbon footprint, have emerged as a promising solution to these pressing issues. Another factor that has contributed to the adoption of EVs is the advancement of technology. Over the years, significant improvements have been made in battery technology, allowing EVs to travel longer distances on a single charge and reducing the need for frequent recharging. Additionally, the development of charging infrastructure has made it easier for EV owners to recharge their vehicles, further increasing the appeal of EVs as a practical transportation option (Singh et al., 2023; Pinto et al.,2021; Yao et al.2023; Tambunan;2022).From a technical perspective, EVs offer several advantages over traditional gasoline-powered vehicles. EVs produce zero tailpipe emissions, which helps to improve air quality and reduce the harmful effects of pollution on human health and the environment. Additionally, EVs are more energy-efficient than gasoline-powered vehicles, as electric motors convert a higher percentage of energy from the grid into power to drive the vehicle. This efficiency can help to reduce overall energy consumption and dependence on fossil fuels. In terms of general introduction, the adoption of EVs is seen as a key strategy for achieving sustainability in the transportation sector. Governments, businesses, and individuals are increasingly recognizing the benefits of EVs in terms of reducing carbon emissions, improving air quality, and promoting energy

independence. (Hu et al., 2021; Li et al., 2020; Merfeld, 2019). As a result, there has been a growing investment in electric vehicle (EV) infrastructure, such as charging stations and incentives for EV purchases, to support the widespread adoption of EVs. EVs have gained significant attention in recent years as a sustainable transportation solution to combat climate change and reduce dependence on fossil fuels. From an industrial view, the adoption of EVs presents numerous opportunities for innovation and growth in the automotive sector. However, from a practical standpoint, there are still challenges that need to be addressed in order to fully realize the potential of EVs as a sustainable transportation solution (Kumar et al 2021; Srivastava et al, 2022; Hall & Lutsey, 2017). From an industrial perspective, the adoption of EVs offers a range of benefits for manufacturers, suppliers, and consumers. The shift towards electric vehicles has created new opportunities for innovation in battery technology, charging infrastructure, and vehicle design. Companies that invest in EV technology stand to benefit from increased market share and revenue as consumer demand for sustainable transportation options continues to grow. Additionally, the adoption of EVs can help reduce greenhouse gas emissions and improve air quality, leading to a healthier and more sustainable future for all. (Krishna, 2021; Singh et al., 2020; Jaiswal et al., 2022).There are several challenges that need to be addressed in order to accelerate the adoption of EVs. One of the main barriers to widespread adoption is the high upfront cost of EVs when compared to traditional gasoline-powered vehicles, and this can deter some consumers from making the switch. While the cost of EVs has been decreasing in recent years, it still remains a significant barrier for many consumers. In addition, the lack of charging infrastructure and range anxiety are also major concerns for potential EV buyers (Egbue et al., 2017; Broadbent et al, 2019). Without a robust network of charging stations, consumers may be hesitant to switch to electric vehicles due to concerns about running out of power while on the road. Additionally, the limited range of EVs and the availability of charging infrastructure can also be obstacles to widespread adoption. Despite these challenges, there are several strategies that can be implemented to promote the adoption of EVs as a sustainable transportation solution. Governments can offer incentives such as tax credits and rebates to encourage consumers to purchase EVs. Additionally, investing in charging infrastructure and public transportation options can help alleviate range anxiety and make EVs more convenient and accessible for consumers. Collaboration between government, industry, and consumers is essential to overcome the barriers to EV adoption and create a more sustainable transportation system for the future (LaMonaca & Ryan, 2022; Mastoi, et al., 2022; Mohammadi et al., 2023). However, advancements in battery technology, government

incentives, and increased public awareness are helping to address these challenges and drive the growth of the EV market. The adoption of electric vehicles as a sustainable transportation solution presents both opportunities and challenges from an industrial and practical standpoint. While the shift towards EVs offers numerous benefits for the automotive sector and the environment, there are barriers that need to be addressed in order to accelerate the adoption of EVs. By implementing strategies to reduce costs, improve infrastructure, and increase consumer awareness, we can create a more sustainable transportation system that benefits both current and future generations (Alanazi, 2023; Aijaz & Ahmad, 2022). Also, the adoption of electric vehicles as a sustainable transportation solution is a critical step towards reducing greenhouse gas emissions, improving air quality, and promoting energy efficiency. While there are challenges to overcome, the benefits of EVs in terms of sustainability and environmental protection make them a promising alternative to traditional gasoline-powered vehicles. By investing in EV infrastructure, incentivizing EV purchases, and raising awareness about the benefits of EVs, we can accelerate the transition to a cleaner and more sustainable transportation system. The present study argues that the adoption of EVs) as a sustainable transportation solution can reshape the trends in conventional automobile applications, while it also explore the advancements in this field as well as demerits associated with EVs (Hossain et al.2022; Adnan et al .2018; Karduri & Ananth,2023).

2. Historical Development of Electric Vehicles

EVs have been around for over a century, with the first known electric car dating back to the late 19th century. EVs have a long history dating back to the 19th century, when inventors such as Thomas Davenport and Robert Anderson first experimented with electric-powered vehicles. However, it was not until the late 20th century that EVs began to gain traction as a viable alternative to traditional gasoline-powered vehicles. In recent years, the development of EVs has been closely linked to the concept of sustainable transportation, as governments and consumers alike seek to reduce greenhouse gas emissions and combat climate change. One of the key drivers of the historical development of EVs has been the increasing awareness of the environmental impact of gasoline-powered vehicles. The transportation sector is a major contributor to greenhouse gas emissions, with cars and trucks accounting for a significant portion of these emissions. As a result, there has been a growing push for cleaner and more sustainable transportation options, with EVs emerging as a promising solution. The first EV was invented in the 1830s by Scottish inventor Robert Anderson, who created a crude electric carriage powered by non-rechargeable primary cells. However, it wasn't until the late 19th and

early 20th centuries that electric vehicles began to gain popularity. One of the earliest successful EVs was the Baker Electric, which was produced in the United States from 1899 to 1914 (Agamloh et al., 2020). These vehicles were popular among wealthy individuals, as they were quiet, easy to operate, and required minimal maintenance. In fact, EVs accounted for a significant portion of the automobile market in the early 20th century, with companies like Detroit Electric and Columbia Electric producing a wide range of models. However, the rise of the internal combustion engine and the availability of cheap gasoline led to a decline in the popularity of EVs. By the 1920s, most major automobile manufacturers had shifted their focus to gasoline-powered vehicles, and EVs were largely relegated to niche markets such as golf carts and delivery trucks. It wasn't until the late 20th century that EVs began to make a comeback. The oil crises of the 1970s and growing concerns about air pollution and climate change led to renewed interest in EVs as a cleaner and more sustainable alternative to gasoline-powered cars. In the 1990s, companies like General Motors and Toyota began producing EVs for the mass market, although these early models were limited by their range and performance. In recent years, advances in battery technology and the growing availability of charging infrastructure have made EVs more practical and affordable for consumers. The early days of EVs were marked by limited range and high costs, making them impractical for widespread adoption. However, advancements in battery technology and the push for sustainable transportation solutions have led to a resurgence in interest in EVs. (Hung & Lim 2020; Salmeron-Manzano & Manzano-Agugliaro, 2018). Today, EVs offer comparable performance to gasoline-powered vehicles, with the added benefit of zero emissions. Companies like Tesla have led the way in developing high-performance EVs with long ranges, while traditional automakers like Ford and Volkswagen have also begun to invest heavily in EV technology. Despite these advancements, electric vehicles still face challenges such as high upfront costs, limited charging infrastructure, and concerns about battery life and recycling. However, many experts believe that EVs are the future of transportation, as they offer a cleaner and more sustainable alternative to gasoline-powered cars. EVs have a long and complex history that stretches back to the 19th century. While they have faced challenges and setbacks over the years, recent advancements in technology and growing concerns about climate change have renewed interest in EVs as a viable alternative to conventional gasoline-powered cars. As the world continues to transition towards a more sustainable future, EVs are likely to play an increasingly important role in the transportation sector ((Singh et al., 2023; Pinto et al.,2021; Yao et al.2023; Tambunan;2022).

3. Advancements in EVs for Sustainable Transportation

EVs have emerged as a promising solution to the environmental challenges posed by traditional gasoline-powered vehicles. With advancements in technology and innovation, EVs have become more efficient, affordable, and practical for everyday use. Electric vehicles (EVs) have witnessed significant technological advancements in recent years, making them a viable and sustainable alternative to traditional gasoline-powered vehicles. These advancements have been driven by a combination of factors, including government regulations, consumer demand for cleaner transportation options, and advancements in battery technology (Asghar et al., 2021; Sanguesa et al., 2021).One of the key innovations driving the adoption of EVs is the development of more efficient batteries. Lithium-ion batteries, which are commonly used in EVs, have witnessed significant improvements in energy density, charging speed, and lifespan. These advancements have led to longer driving ranges on a single charge, faster charging times, and reduced costs for consumers. As a result, EVs are now able to compete with traditional vehicles in terms of performance and convenience (Liu et al., 2022).Another important innovation in the EV industry is the development of smart charging infrastructure. With the increasing popularity of EVs, there is a growing need for reliable and efficient charging stations. Companies like Tesla and ChargePoint have been investing in fast-charging networks that can charge EVs in a matter of minutes, making long-distance travel more feasible. Additionally, smart charging technology allows EV owners to schedule charging times when electricity prices are lower, reducing the overall cost of ownership (Liu et al., 2022).Furthermore, advancements in electric motor technology have improved the efficiency and performance of EVs. High-efficiency motors and power electronics have made EVs more responsive and enjoyable to drive, while also reducing energy consumption.Furthermore, advancements in autonomous driving technology are also contributing to the sustainability of EVs, and also has the potential to further revolutionize the electric vehicle industry. Self-driving features such as lane-keeping assist, adaptive cruise control, and automatic parking can help reduce accidents and improve traffic flow, leading to lower emissions and fuel consumption, making EVs even more attractive to consumers. In the future, fully autonomous EVs could revolutionize the way we commute, making transportation more efficient and environmentally friendly (Nurliyana et al., 2023; Iranmanesh et al., 2023)Overall, the key technological advancements in electric vehicles have made them a more practical and sustainable transportation option. As battery technology continues to improve, charging infrastructure expands, and autonomous driving technology advances, the future of electric vehicles looks promising. With continued investment and

innovation, EVs have the potential to play a significant role in reducing greenhouse gas emissions and combating climate change.Despite these innovations, there are still challenges that need to be addressed in order to fully realize the potential of EVs as a sustainable transportation solution. One of the main barriers is the limited availability of charging infrastructure, especially in rural areas and developing countries. Governments and private companies need to invest in expanding the charging network to make EVs more accessible to a wider range of consumers.Innovations and technological advancements in EVs have made them a viable and sustainable transportation solution. With improvements in battery technology, charging infrastructure, and autonomous driving features, EVs are becoming more practical and convenient for everyday use. By transitioning to electric vehicles, we can reduce our carbon footprint, improve air quality, and decrease our dependence on fossil fuels. It is imperative that governments, businesses, and consumers work together to accelerate the adoption of EVs and create a more sustainable future for transportation. (Nurliyana et al., 2023; Sankeerthana, & Raghuram Kadali, 2022).

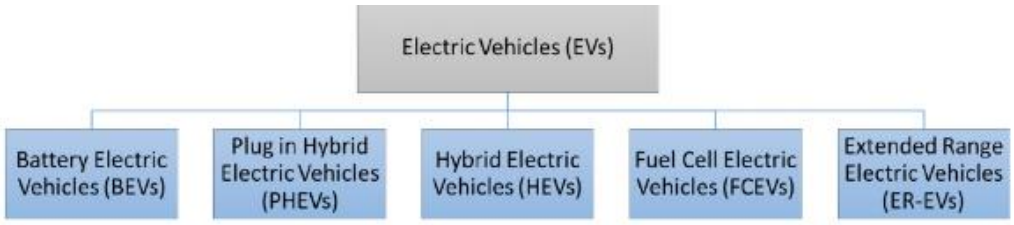


Figure 1: Classification of Electric Vehicles (EVs) according to engine technology and settings

4. Why there must be Standards for Regulating (EVs)

Yu et al. (2022) observed that with the increasing focus on sustainability and reducing greenhouse gas emissions, the adoption of EVs is seen as a crucial step towards achieving a more sustainable transportation system. However, in order to ensure the widespread adoption and success of EVs, it is essential to establish and adhere to standards that regulate their design, production, and operation.

i. One of the key arguments in favour of implementing standards for EVs is to ensure safety and reliability. As EV technology continues to evolve, it is important to establish guidelines and regulations that govern the design and manufacturing of these vehicles. Standards related to battery safety, charging infrastructure, and vehicle performance can help to mitigate risks and ensure that EVs meet the necessary safety requirements.

ii. Furthermore, standards can also play a crucial role in promoting interoperability and compatibility among different EV models and charging stations. By establishing

common standards for charging connectors, communication protocols, and battery technologies, it becomes easier for consumers to adopt EVs without having to worry about compatibility issues. This can help to accelerate the adoption of EVs and create a more seamless and user-friendly experience for consumers.

iii. In addition, standards can also help to drive innovation and improve the overall performance of EVs. By setting benchmarks for energy efficiency, range, and charging times, standards can incentivize manufacturers to develop more advanced and efficient EV technologies. This can lead to the development of more reliable, affordable, and sustainable EVs that can compete with traditional gasoline-powered vehicles in terms of performance and convenience.

Standards regulating electric vehicles are essential for promoting sustainable transportation solutions. By establishing guidelines for safety, interoperability, and performance, standards can help to ensure the widespread adoption and success of EVs. Furthermore, standards can also drive innovation and improve the overall quality of EV technology. Therefore, it is imperative for policymakers, manufacturers, and stakeholders to work together to develop and implement robust standards that will help to accelerate the transition towards a more sustainable transportation system.

5. Key components in EVs

Sharma et al. (2020).in their survey studies opined that electric vehicles (EVs) have shown promise as a solution for sustainable transportation, offering numerous environmental and economic benefits. In order to fully realize the potential of EVs in reducing greenhouse gas emissions and dependence on fossil fuels, it is essential to understand the following key components that make up these vehicles.

i. One of the most important components of an EV is the battery. The battery is responsible for storing and providing the energy needed to power the vehicle. Advances in battery technology have led to increased energy density, longer driving ranges, and faster charging times, making EVs more practical and convenient for everyday use.

ii. Another key component of EVs is the electric motor. Unlike traditional internal combustion engines, electric motors are more efficient and produce zero emissions. This not only reduces air pollution but also decreases noise pollution, creating a more pleasant driving experience for both the driver and surrounding communities.

iii. Charging infrastructure is also a critical component of EV adoption. In order for EVs to become a mainstream transportation option, there needs to be a widespread network of

charging stations that are easily accessible to drivers. Governments and private companies are investing in expanding charging infrastructure to support the growing number of EVs on the road.

iv. In addition to the physical components of EVs, software and connectivity play a crucial role in enhancing the driving experience. Features such as regenerative braking, energy management systems, and remote monitoring capabilities help optimize energy efficiency and performance, making EVs more attractive to consumers.

Overall, the key components of EVs work together to create a sustainable transportation solution that reduces greenhouse gas emissions, improves air quality, and decreases reliance on finite fossil fuels. As technology continues to advance and costs decrease, EVs have the potential to revolutionize the way we travel and contribute to a cleaner, greener future. EVs offer a viable solution for sustainable transportation, with key components such as batteries, electric motors, charging infrastructure, and software playing a crucial role in their success. By investing in EV technology and infrastructure, we can accelerate the transition to a more sustainable transportation system and reduce the environmental impact of our daily commutes.

6. Applications of EVs as Sustainable Transportation Solution

Feng & Magee (2020) in their investigative study also observed that EVs have gained significant attention in recent years due to their potential to reduce greenhouse gas emissions and dependence on fossil fuels. While EVs are commonly associated with personal transportation, their applications extend beyond individual use to industrial, traffic, road, economic, and societal contexts highlighted as follows:

i. In the industrial sector, EVs are increasingly being adopted for various purposes, such as material handling in warehouses and factories. Electric forklifts, pallet jacks, and other industrial vehicles offer lower operating costs, reduced emissions, and quieter operation compared to their diesel or gasoline counterparts. Additionally, EVs can be integrated into smart grid systems to provide grid stabilization and energy storage capabilities, contributing to a more sustainable industrial infrastructure.

ii. In the realm of traffic and road applications, EVs play a crucial role in reducing air pollution and traffic congestion in urban areas. Electric buses, taxis, and delivery vehicles are becoming more prevalent in cities worldwide, offering cleaner and quieter transportation options for residents and visitors. Furthermore, the development of electric autonomous vehicles holds promise for improving road safety and efficiency, as well as reducing the environmental impact of transportation.

iii. From an economic perspective, the widespread adoption of EVs has the potential to create new job opportunities in manufacturing, maintenance, and infrastructure development. The shift towards electric mobility also presents opportunities for innovation and investment in renewable energy sources, charging infrastructure, and energy storage technologies. Moreover, the reduced reliance on imported oil and the potential for cost savings on fuel and maintenance expenses can lead to economic benefits for individuals, businesses, and governments.

iv. In terms of societal impact, the adoption of EVs can contribute to improved public health outcomes by reducing air pollution and noise pollution in urban areas. By transitioning to electric transportation, communities can mitigate the negative effects of vehicle emissions on respiratory health and overall well-being. Additionally, the promotion of EVs can help raise awareness about sustainable transportation practices and encourage individuals to make environmentally conscious choices in their daily lives.

EVs offer a wide range of applications beyond personal transportation, including industrial, traffic, road, economic, and societal contexts. By embracing the potential of EVs in various sectors, stakeholders can work towards a more sustainable and resilient future for both the environment and society as a whole.

7. Advantages of EVs as a Sustainable Transportation Solution

(Hamurcu, & Eren, 2020; Kjellén & Tasala, 2020) opined that EVs have gained significant attention in recent years as a sustainable transportation solution. With the increasing concerns about climate change and air pollution, the adoption of EVs has been seen as a promising alternative to traditional gasoline-powered vehicles. The various advantages of adopting EVs as a sustainable transportation solution are as follows:

i. One of the key advantages of EVs is their environmental benefits. EVs produce zero tailpipe emissions, which helps reduce air pollution and greenhouse gas emissions. Unlike conventional vehicles that run on gasoline or diesel, EVs are powered by electricity, which produces no emissions when driving. This not only helps to reduce air pollution in urban areas but also contributes to mitigating climate change by lowering greenhouse gas emissions. EVs produce significantly lower emissions compared to gasoline-powered vehicles, even when accounting for the emissions from electricity generation. This makes EVs a cleaner and more environmentally friendly option for transportation.

ii. Another important characteristic of EVs is their energy efficiency. Electric motors are much more efficient than internal combustion engines, converting a higher percentage of the energy from the battery into motion. This means that EVs require less energy to travel the same distance as a conventional vehicle, resulting in lower energy consumption and operating costs. In addition, the regenerative braking system in EVs allows them to capture and store energy that would otherwise be lost as heat during braking, further improving their efficiency.

iii. Furthermore, EVs offer the potential for renewable energy integration. By charging EVs with electricity generated from renewable sources such as solar or wind power, it is possible to further reduce the carbon footprint of transportation. This can help to accelerate the transition towards a low-carbon energy system and increase the overall sustainability of the transportation sector.

iv. In addition to their environmental benefits, EVs also offer economic advantages. With the decreasing costs of battery technology and the availability of government incentives, the upfront cost of purchasing an EV has become more competitive with conventional vehicles. Moreover, the lower maintenance requirements of EVs, due to their simpler drivetrain and fewer moving parts, can result in long-term cost savings for consumers.

v. Another advantage of EVs is their energy efficiency. EVs are more energy efficient than gasoline-powered vehicles, with electric motors converting over 60% of the electrical energy from the grid to power the wheels, compared to only about 20% for internal combustion engines. This higher efficiency means that EVs require less energy to operate, reducing overall energy consumption and dependence on fossil fuels.

vi. In addition to their environmental and energy efficiency benefits, EVs also offer economic advantages. While the upfront cost of purchasing an EV may be higher than a traditional gasoline-powered vehicle, EVs have lower operating costs due to lower fuel and maintenance costs. The average annual fuel cost for an EV is about half that of a gasoline-powered vehicle. EVs have lower fuel and maintenance costs over their lifetime, making them a cost-effective option for consumers. Additionally, EVs have fewer moving parts than internal combustion engines, resulting in lower maintenance costs over the lifetime of the vehicle.

vii. Furthermore, the adoption of EVs can also help reduce dependence on imported oil and improve energy security. By shifting to electric-powered vehicle transportation, countries can reduce their reliance on foreign oil imports and diversify their energy

sources. This can help reduce the vulnerability of transportation systems to oil price fluctuations and geopolitical tensions.

The adoption of EVs as a sustainable transportation solution offers numerous advantages, including environmental benefits, energy efficiency, lower operating costs, and improved energy security. Their zero emissions, energy efficiency, potential for renewable energy integration, and economic advantages all contribute to their appeal as a solution to reduce greenhouse gas emissions and improve air quality. As governments and industries around the world continue to promote the transition to electric transportation, it is clear that EVs have the potential to play a significant role in reducing emissions and creating a more sustainable future for transportation. As the technology continues to advance and become more widespread, EVs have the potential to play a significant role in achieving a more sustainable transportation system (Singh et al., 2023).

8. Drawbacks of EVs as a Sustainable Transportation Solution

(Balali & Stegen, 2021; Shah et al., 2021 & Sadeghian et al., 2022). EVs have been hailed as a sustainable transportation solution that can help reduce greenhouse gas emissions and combat climate change. However, the adoption of EVs also comes with its own set of disadvantages that need to be carefully considered. The key drawbacks of widespread adoption of EVs as a sustainable transportation solution are enumerated as follows:

i. One of the main disadvantages of EVs is their high upfront cost. EVs are typically more expensive to purchase than traditional gasoline-powered vehicles, which can be a barrier for many consumers. Additionally, the cost of EV batteries, which are a key component of these vehicles, can be quite high and may need to be replaced after a certain number of years, further adding to the overall cost of ownership.

ii. Another disadvantage of EVs is their limited range. While EV technology has improved in recent years, many EVs still have a limited driving range compared to traditional vehicles. This can be a major concern for consumers who need to travel long distances or who do not have access to charging infrastructure. Range anxiety, or the fear of running out of battery power while on the road, is a common issue for EV owners and can be a significant barrier to widespread adoption of these vehicles.

iii. Charging infrastructure is another key disadvantage of EVs. While the number of charging stations is increasing, there are still not enough charging stations available to support widespread adoption of EVs. This can be a major inconvenience for EV owners, especially those who do not have access to a home charging station. Additionally,

charging times for EVs can be longer than refuelling times for traditional vehicles, which can be a major inconvenience for consumers.

iv. Finally, the environmental impact of EVs is not as clear-cut as it may seem. While EVs produce zero tailpipe emissions, the production of electricity used to charge EVs can still generate greenhouse gas emissions, depending on the source of the electricity. This makes EVs a crucial tool in combating climate change and improving air quality in urban areas. Additionally, the production of EV batteries can have a significant environmental impact, as they require the extraction of rare earth metals and other resources.

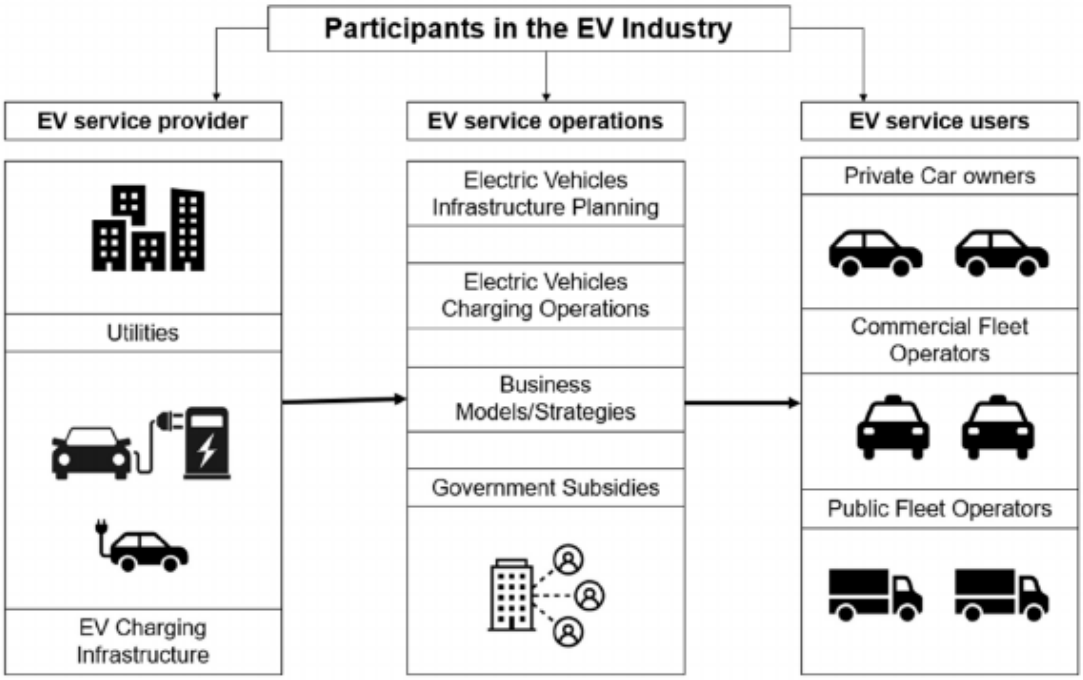


Figure 2: EV service operations/participants.

While EVs have the potential to be a sustainable transportation solution, they also come with a number of disadvantages that need to be carefully considered. High upfront costs, limited range, lack of charging infrastructure, and environmental impact are all key drawbacks of widespread adoption of EVs. It is important for policymakers, manufacturers, and consumers to carefully weigh these disadvantages against the potential benefits of EVs in order to make informed decisions about the future of transportation. However, the EV service industry's stakeholders and some of the key challenges that they deal with is illustrated in figure 2.

9. Conclusion and Recommendations

The adoption of EVs) as a sustainable transportation solution is crucial in addressing the environmental challenges posed by traditional gasoline-powered vehicles. The transition to EVs offers numerous benefits, including reduced greenhouse gas emissions, improved air quality, and decreased dependence on fossil fuels. One of the key arguments in favour of EV adoption is the significant reduction in carbon emissions. EVs produce lower emissions over their lifetime compared to gasoline-powered vehicles, even when accounting for electricity generation from fossil fuels. This makes EVs a more environmentally friendly option for transportation. Furthermore, the adoption of EVs can also help improve air quality in urban areas. The emissions from gasoline-powered vehicles contribute to air pollution, which can have detrimental effects on public health. By switching to EVs, we can reduce harmful pollutants such as nitrogen oxides and particulate matter, leading to cleaner and healthier air for all. Additionally, the shift towards EVs can help reduce our dependence on fossil fuels, which are finite resources with negative environmental impacts. By utilizing electricity as a power source for transportation, we can take advantage of renewable energy sources such as solar and wind power, further reducing our carbon footprint. Despite the numerous benefits of EV adoption, there are still challenges that need to be addressed, such as the availability of charging infrastructure and the upfront cost of EVs. However, with advancements in technology and government incentives, these barriers can be overcome.The adoption of electric vehicles as a sustainable transportation solution is essential in combating climate change and promoting a cleaner, healthier environment. By making the switch to EVs, we can reduce emissions, improve air quality, and decrease our reliance on fossil fuels. It is imperative that we continue to support and promote the adoption of EVs to create a more sustainable future for generations to come. Based on the findings obtained from this study, the following recommendations are suggested for accelerated adoption and improved performance of EVs.

i. Despite these benefits, the adoption of EVs still faces challenges. One of the main barriers to widespread adoption is the lack of charging infrastructure. To address this issue, policymakers and stakeholders should invest in expanding the charging network to make it more convenient for consumers to charge their EVs particularly in urban areas and along major highways. This could include installing charging stations in public places, workplaces, and residential areas, as well as offering incentives for businesses to install charging infrastructure. This will not only make it more convenient for EV

owners to charge their vehicles but also encourage more people to make the switch to electric transportation.

ii. Another challenge is the upfront cost of EVs, which can be higher than traditional vehicles. While the cost of EVs has been decreasing in recent years, they are still more expensive than their gasoline-powered counterparts. To overcome this barrier, policymakers should consider implementing financial incentives such as tax credits, rebates, and subsidies to make EVs more affordable for consumers. In addition, promoting leasing and financing options for EVs can help make them more accessible to a wider range of consumers. Additionally, automakers should continue to innovate and find ways to reduce production costs without compromising on quality.

iii. One of the main limitations of EVs is their limited driving range. Most EVs currently on the market have a range of around 200-300 miles on a single charge, which is significantly less than the range of traditional gasoline-powered vehicles. To address this limitation, it is important to continue investing in research and development to improve battery technology. This includes developing batteries with higher energy density, faster charging times, and longer lifespan. Additionally, expanding the infrastructure for charging stations is crucial to alleviate range anxiety and encourage more consumers to switch to EVs.

While there are still limitations that need to be addressed, the future of electric vehicles looks promising. By implementing the key recommendations discussed in this paper, such as improving battery technology, reducing upfront costs, and expanding charging infrastructure, we can overcome these limitations and accelerate the transition to a more sustainable transportation system. It is crucial for policymakers, automakers, and other stakeholders to work together to support the growth of the EV market and make electric transportation a viable option for all consumers (Alanazi, 2023; Asghar et al., 2021).

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IMPROVING THE APPROACH TO SOFTWARE CONFIGURATION OF AUTOMATED CONTROL SYSTEMS USING EXPERIMENTAL-STATIC MODELS

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ABSTRACT
The purpose of the article is to improve the approach to software configuration of automated control systems. The subject of the study is experimental-static models used in this process. The work was carried out using the theory of relations, graphs and matrices. As a result, a universal method for machine synthesis of corresponding models was obtained. The algorithm implemented on its basis allows you to automate the process of configuring control systems for distributed technological objects.The development of modern metallurgical production is accompanied by the intensive introduction of automated process control systems (APCS) in all its areas. A special class of tasks is represented by the automation of centralized control of distributed technological objects (mainly on a territorial basis). Such facilities include both main production units (sinter plants, converter shops, mines, etc.) and industrial energy, telecommunications and transport systems and networks. The latter play an important role in the technological cycle of metallurgical, mining and coke-chemical enterprises [1 – 3].The basis for the functioning of automated process control systems are mathematical models of production facilities and processes. Most modern automated process control systems are based on program logic, which determines the unity of the basic core software (software) of the systems themselves and experimental models for their research. However, complex distributed automation objects of a single series are characterized by different configurations of specific technical solutions. In this regard, it is necessary to adapt the software to a specific technical project, which is a separate stage in the design of the system itself [1, 4].Traditionally, this task is solved using configuration files created in xml, txt, cfg, dll, ini, etc. format. Their direct compilation requires highly qualified designers, incl. certain knowledge and skills in the field of programming. To simplify and speed up this procedure, multiple tools and computer-aided design (CAD) systems have been developed for such files, which are based on experimental-static models (ESM) of the corresponding objects [1, 4 – 6].However, a significant drawback of most of these CAD systems is the lack of their unification in relation to heterogeneous process control systems. Another disadvantage is the limitation of the dimensions of the designed objects due to the limited capabilities of the visualization tools for the user interface, the accumulation of analyzed information, etc.The goal of this work is to develop universal methods for synthesizing input ESMs for process control systems of large-dimensional objects on a computer.
Keywords: software configuration, automated control system, experimental-static model, machine synthesis, algorithm, distributed technological object.

INTRODUCTION

A distributed technological object can be characterized by a set, where A, U and Z are, respectively, subsets of local management and control objects, their functional properties and logical connections between them. This set can be constructed in such a way that each element corresponds to a single element that connects it with the element, as well as a subset that specifies its properties that reproduce its functions. Based on this, each of the subsets of Y defines relations on its other subsets or external sets [7]:

$$\begin{cases}(\forall a_i \in A) \to (\exists! z_{i,i+1} \in Z) : a_i(z_{i,i+1})a_{i+1} \\ (\forall a_i \in A) \to (\exists \{u_{ij}\} \in U) : a_i(u_{ij})\{f_{ijl}\}\end{cases} \to \begin{cases}A \subset Z \times Z \wedge U \times U \\ U \subset A \times F \\ Z \subset A \times A\end{cases}$$

where F={fijl} is the set of functions of the element ai, specified by its properties {uij} U.

The set F is a characteristic of the dynamic component of the process control system or its test model and is uniquely determined by the set U onto which it is bijectively mapped (F↔U). The relationship in formula (1), which must be embedded in the source code of the application software, connects the input ESM with the system itself. Therefore, the input model may not include the set F.Based on expression (1), the set Y can be uniquely displayed by a connected, mixed and weighted p×q graph for which , where ΔU is an additional subset of the proper properties of vertices vi and edges ej in the graph GY to identify its elements. The correspondence GY↔Y is reproduced in one of the following ways:

$$\begin{cases}A \leftrightarrow V \\ Z \leftrightarrow E \\ U = U^G/\Delta U\end{cases} \vee \begin{cases}A \leftrightarrow E \\ Z \leftrightarrow V \\ U = U^G/\Delta U\end{cases} \vee \begin{cases}A \leftrightarrow G_Y^{T_h} \\ Z \subset V \times E \\ U = U^G/\Delta U\end{cases} \vee \begin{cases}A_1 \leftrightarrow V_1 \wedge A_2 \leftrightarrow G_Y^{T_p} \\ Z \subset V \times E \\ U = U^G/\Delta U\end{cases}$$

where are the trees of the graph GY;

– subsets reproduced by the vertices and trees of the graph GY (,), respectively.

The relation in formula (2) determines the incidence between the corresponding vertices and edges of the graph GY. Given that graph trees are always limited to vertices, matching is impossible [7].Linking ESM with application software requires an analytical interpretation of the GY graph. An approach based on the direct use of topological matrices is not acceptable in this case for large-dimensional objects. The solution to this problem was found in the initial formation of ordinary blocks of a matrix of vector elements, which reproduces both topological and parametric (weight) properties of the graphical model.

Such a matrix is called a complex topological matrix (CTM). Blocks are created on the basis of components formed by cuts and adjacent to the reference vertices: . Each component must have structural completeness, which consists of maintaining the integrity of each element when it is reproduced by trees. The developed procedure for forming CFT blocks is as follows [7, 8]:

1. Determining the direction of analysis of the graph GY=(V, E) and numbering its elements in such a way that any of its components, obtained by an arbitrary cut, has a continuous (continuous) end-to-end numbering of vertices and edges.2. Unification of the powers of sets specified by vectors (,), by supplementing them with zero elements to the power of the most powerful vector: 3. Defining a set of ordered subsets of support vertices V'={V't} for partitioning the graph into components as follows:- numbering of t sets is performed in the direction of graph analysis; - each subset must form, according to the principle of contiguity with respect to its elements (vertices), two simple cuts E't and E"t;- provided or supporting vertices are selected in such a way that they enclose the corresponding trees.4. Determination of cuts E'={e'i} and E"={e"i}, the corresponding elements e'i, e"i of which are adjacent relative to the vertices v'i according to the following principles:- for support vertices of sets with odd numbers, edges e"i, incident to the vertices, are assigned first in the direction of analyzing the graph relative to the support vertices, and edges e'i - second;- for support vertices of sets with even numbers - on the contrary, edges e'i are assigned first in the direction of graph analysis relative to the corresponding support vertices, and edges e"i are assigned second.

The above rules can be expressed by the following relations f±1, φ1,2±1:

$$f^{1}(E'_t, E''_t) = f^{-1}(E'_t, E''_t) = \left[\left(e'_i \in E'_t\right) \wedge \left(e''_i \in E''_t\right)\right] \updownarrow \left[v'_i \in V'_t\right]$$

$$\varphi_1^1(V'_t) = \varphi_1^{-1}(E'_t) = \begin{cases} \left(e'_i \in E'_t\right) \downarrow \left(v'_i \in V'_t\right), \text{если } t = x \\ \left(e'_i \in E'_t\right) \uparrow \left(v'_i \in V'_t\right), \text{если } t = y \end{cases}$$

$$\varphi_2^1(V'_t) = \varphi_2^{-1}(E''_t) = \begin{cases} \left(e''_i \in E''_t\right) \uparrow \left(v'_i \in V'_t\right), \text{если } t = x \\ \left(e''_i \in E''_t\right) \downarrow \left(v'_i \in V'_t\right), \text{если } t = y \end{cases}$$

where x, y are, respectively, even and odd values of the number (index) t;

“↕” is a conventional symbol of contiguity;

“↓” is a conventional symbol of the incidence of an edge “to” the support vertex;

“↑” is a conventional symbol for the incidence of an edge “after” the support vertex.

5. Partitioning the graph into two ordered sets of components {GE'k} and {GE"k}, the elements of which have properties (3). The number k is assigned to them in the order in which the graph is analyzed, starting from one.

6. Compilation of CFT blocks for components GE'u and GE"w, where u and w are even and odd values of index k, respectively:

$$\left|M_{ктм_k}\right| = \begin{vmatrix} \overline{m_{11}^k} & \overline{m_{12}^k} & \dots & \overline{m_{1c}^k} \\ \overline{m_{21}^k} & \overline{m_{22}^k} & \dots & \overline{m_{2c}^k} \\ \dots & \dots & \dots & \dots \\ \overline{m_{d1}^k} & \overline{m_{d2}^k} & \dots & \overline{m_{dc}^k} \end{vmatrix} \begin{matrix} i = \overline{1, c}, p \geq r \\ j = \overline{1, d}, d \geq r \\ \overline{m_{ij}^k} = \left\langle n_e, n_v, u_\chi^e, u_\psi^v, \theta \right\rangle \end{matrix}$$

where are topological-parametric vectors;

, are the numbers, respectively, of the edges and vertices of the complete CFT, which correspond to the row and column in which the element is located;

, – weight parameters for the corresponding element of the edge and vertex (indices χ and ψ determine the numbers of these elements in the weight vectors);

θ is a topological property of the corresponding edge and vertex element.

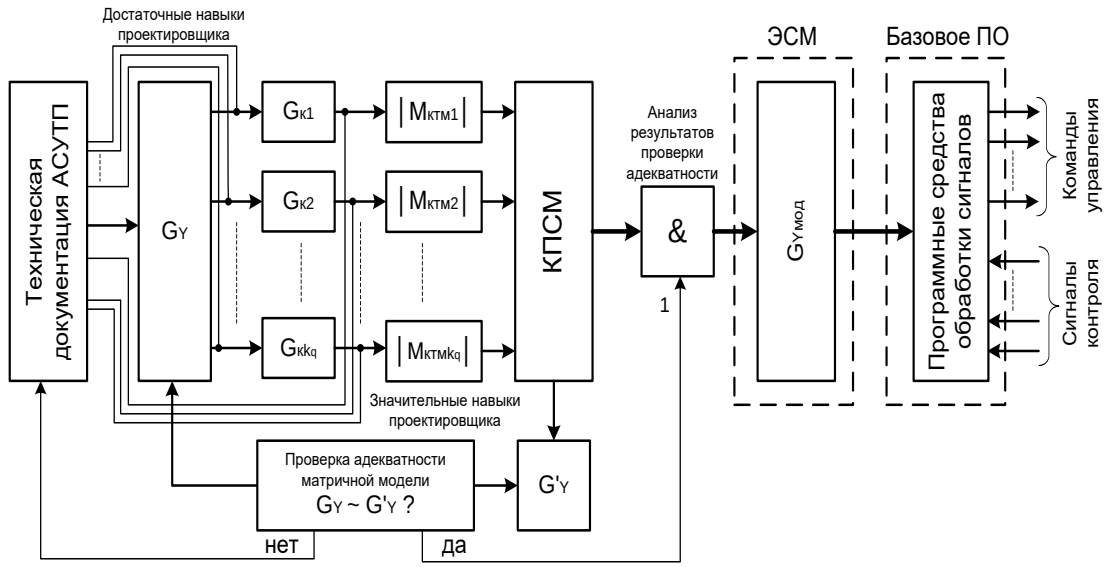
The values of the elements are assigned according to the following rule:

$$u_\chi^e = \begin{cases} u_1^e, \text{если } j = 1 + rh \\ u_2^e, \text{если } j = 2 + rh \\ \dots\dots\dots\dots\dots\dots\dots \\ u_r^e, \text{если } j = r + rh \end{cases}, u_\psi^v = \begin{cases} u_1^v, \text{если } i = 1 + rs \\ u_2^v, \text{если } i = 2 + rs \\ \dots\dots\dots\dots\dots\dots\dots \\ u_r^v, \text{если } i = r + rs \end{cases}, \begin{matrix} h = 0, 1, \dots, \left\lfloor \frac{c}{r} \right\rfloor, \\ s = 0, 1, \dots, \left\lfloor \frac{d}{r} \right\rfloor, \end{matrix}$$

Based on formula (5), the minimum dimension of each matrix in formula (4), ensuring coverage of all vector elements for each vertex and edge of the graph, should be r×r: cmin=r, dmin=r.

The topological property θ = 0 ±1 is determined by the type of matrices and corresponds to direct or indirect relationships between the elements of the graph. The most obvious way is to use the incidence property.Given the unity of the basic software of objects of the same type, machine synthesis of the ESM and its integration with the software is carried out according to

the following scheme (Fig.1)



Rice. 1. Functional diagram of machine synthesis of ESM

CONCLUSION

The proposed method of ESM synthesis has the following advantages: universality of application for process control systems of any distributed objects, ease of implementation from the position of qualified designer (who has sufficient knowledge of the operating technology of the control object and its properties, encoded in the form of weight vectors), the ability to localize spatial areas of the object at different stages design, the ability to form test models only for a certain part of a large object.At the same time, the main disadvantage of the method should be considered the presence of a minimum threshold for the dimension of CFT blocks, which, in the presence of multiple properties in the elements of a technological object, can lead to an excessive size of individual local areas. This drawback can be eliminated by superposition of local and global objects, which can be interpreted by the nested and outer matrices, respectively. The implementation of this approach requires additional research in this direction.

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JAYA-INTEGRATED HYBRID OPTIMIZATION: ACCURATE ESTIMATION OF SINGLE-DIODE MODEL PARAMETERS IN PHOTOVOLTAIC CELLS

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ABSTRACT
This study proposes a hybrid optimization approach that integrates two distinct procedures, analytical and metaheuristic, aiming to estimate the five parameters of the single-diode model. The primary objective of this approach is to achieve increased accuracy, high stability, and a fast convergence rate for the proposed algorithm compared to conventional optimization algorithms. The methodology involves the analytical determination of three parameters based on the estimation of the other two provided by the JAYA metaheuristic optimization algorithm. By reducing the search space to two dimensions instead of five, the optimization becomes more flexible, simplifying the improvement process. The effectiveness of our approach is validated by applying it to an RTC France solar cell. The assessment of the quality of the obtained solutions is done by comparison with the results of classical optimization, significantly highlighting the remarkable performance of our approach.
Keywords: Single diode model, Photovoltaic, Solar cell, Hybrid optimization, Analytical method, JAYA algorithm

NTRODUCTION

Nowadays, the exploitation of photovoltaic (PV) energy in green electricity production is experiencing exponential growth globally [1], [2]. This development represents one solution among others to address concerns related to the risks of atmospheric pollution and the exhaustive consumption of non-renewable resources such as oil, coal, and natural gas [3], [4]. Solar energy is acknowledged for its numerous advantages, including cleanliness, sustainability, and universal availability. For these reasons, photovoltaic technology (PV), primarily based on PV cells, is the subject of extensive scientific research aimed at efficiently harnessing this energy resource to meet a portion of our energy needs. Photovoltaic cells (PV) are primarily composed of semiconductor materials with the property of absorbing photons to impart mobility to electrons through the photoelectric effect. This mobility, guided by forced polarization, generates electrical power dependent on the ambient temperature and illumination received by the PV cell [5]. This dependence poses a challenge in achieving a stable quantification of the produced energy and its suitability in terms of electrical power supply. Therefore, it is crucial to adopt electrical models capable of reproducing the electrical responses of these cells to estimate their energy productivity as a preventive step during assembly and installation. Models with a single diode (SD) [6], double diode (DD) [7] and three diodes (TD) [8] are widely used for this purpose. In practice, the (SD) model is preferred due to its simplicity and high precision. Fig. 1 illustrates its components, including a current generator with intensity I_{ph}, a diode D traversed by a current I_d where the reverse saturation current intensity is I_o, a series resistance R_s related to ohmic losses, and a shunt resistance R_{sh} associated with leakage current I_{sh}.

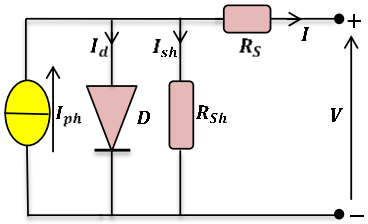


Fig.1. Equivalent electrical circuit for the SD.

By applying Kirchhoff's laws and using the Shockley equation expressing the diode current, $I_d = I_o.\left(exp\left[\frac{V+R_S.I}{a.V_t}\right]-1\right)$, we can derive the characteristic equation (I-V) that relates the output current I and the output voltage V:

$$I = I_{ph} - I_o.(exp\left(\frac{V+R_s.I}{a.V_t}\right)-1) - \frac{V+R_s.I}{R_{sh}} \quad (1)$$

where $V_t = \frac{k \times T}{q}$ represents the thermal voltage, a: ideality factor of the diode, k: Boltzmann constant, q: electronic charge and T: cell temperature in Kelvin (K).To characterize this model, it is essential to determine its five optimal parameters, namely I_{ph}, I_o, R_s, R_{sh} and a. The approaches used at this stage are mainly divided into three categories: analytical methods that employ mathematical simplifications and approximations to make the parameter expressions explicit [9], [10], iterative methods that use incrementation procedures and numerical calculation techniques [11], [12], and metaheuristics based on evolutionary optimization algorithms [13], [14]. In our work, we will adopt a combined approach that integrates both analytical techniques and metaheuristics. The specific steps of this approach will be detailed in the following section.

1. MATHEMATICAL PROBLEM FORMULATION

The five parameters of the single-diode model can be simultaneously determined conventionally using a metaheuristic optimization algorithm. It involves optimizing the objective function F, defined by Eq. (2), representing the root mean square error (RMSE).

$$F = \sqrt{\frac{\sum_{i=1}^{N}\left(I_{exp}(i) - I_{est}(i)\right)^2}{N}} \quad (2)$$

where I_{exp} and I_{est} respectively denote the experimental current and the current estimated by the model, and N represents the number of data points in the (I-V) characteristic.

To obtain I_{est}, it is sufficient to solve Eq. (3) using the Newton-Raphson method:

$$I_{est}(i) = I_{ph} - I_o.\left\{exp\left[\frac{V_{exp}(i) + R_s.I_{est}(i)}{a.V_t}\right] - 1\right\} - \frac{V_{exp}(i) + R_s.I_{est}(i)}{R_{sh}} \quad (3)$$

By minimizing F, the optimal combination of parameters, denoted as $\theta = (I_{ph}, I_o, R_s, R_{sh}, a)$, can be derived. Fortunately, the (I-V) characteristic of a photovoltaic cell is always defined by three essential points: $(I_{sc}, 0)$, $(0, V_{oc})$ and (I_m, V_m). These points are typically provided in the manufacturer's technical specifications. By evaluating Eq. (1) at these points, we can analytically develop the following system of equations [15]:

$$I_{ph} = \frac{I_{sc}.\left(1 + \frac{R_s}{R_{sh}}\right).\left(exp\left[\frac{V_{oc}}{a.V_t}\right] - 1\right) - \frac{V_{oc}}{R_{sh}}.\left(exp\left[\frac{R_s.I_{sc}}{a.V_t}\right] - 1\right)}{exp\left[\frac{V_{oc}}{a.V_t}\right] - exp\left[\frac{R_s.I_{sc}}{a.V_t}\right]} \quad (4)$$

$$R_{sh} = \frac{(V_m + R_s.I_m).\left(exp\left[\frac{V_{oc}}{a.V_t}\right] - 1\right) - V_{oc}.(exp\left[\frac{V_m + R_s.I_m}{a.V_t}\right] - 1)}{I_{ph}.\left(exp\left[\frac{V_{oc}}{a.V_t}\right] - exp\left[\frac{V_m + R_s.I_m}{a.V_t}\right]\right) - I_m.(exp\left[\frac{V_{oc}}{a.V_t}\right] - 1)} \quad (5)$$

$$I_o = \frac{I_{ph} - \frac{V_{oc}}{R_{sh}}}{exp\left[\frac{V_{oc}}{a.V_t}\right] - 1} \quad (6)$$

where I_{sc} representing the short-circuit current, V_{oc} the open-circuit voltage, and I_m, V_m denoting respectively the current and voltage corresponding to the maximum power point *(MPP)*. The three parameters from Eqs. (4-6) can be easily calculated if a and R_s are known. Therefore, instead of searching for all five parameters simultaneously, we will narrow the search to a et R_s while incorporating the expressions for de I_{ph}, R_{sh} and I_o into the objective function *F*. For the optimization algorithm, we chose JAYA due to its high capability for local search and simplicity, requiring no specific tuning of these intrinsic parameters [16]. This algorithm is based on the following equation :

$$x_{new\ i,j} = x_{i,j} + \alpha.\left(x_{best\ j} - |x_{i,j}|\right) - \beta.\left(x_{worst\ j} - |x_{i,j}|\right) \quad (7)$$

where $x_{i,j}$ denotes the j[th] component of the i[th] candidate solution, with its absolute value noted as $|x_{i,j}|$; $x_{new\ i,j}$ represents the updated value of $x_{i,j}$; $x_{best\ j}$ and $x_{worst\ j}$ denote, respectively, the values of the j[th] component of the optimal solution and the worst solution. α and β are two random numbers ranging between 0 and 1. The update of each solution's components is based on approximating the current best solution and measuring the distance from the least performing solution within the population. This strategy ensures the enhancement of solution quality throughout the evolution. The flowchart of JAYA, incorporating the analytical phase (*), is depicted in Fig. 2

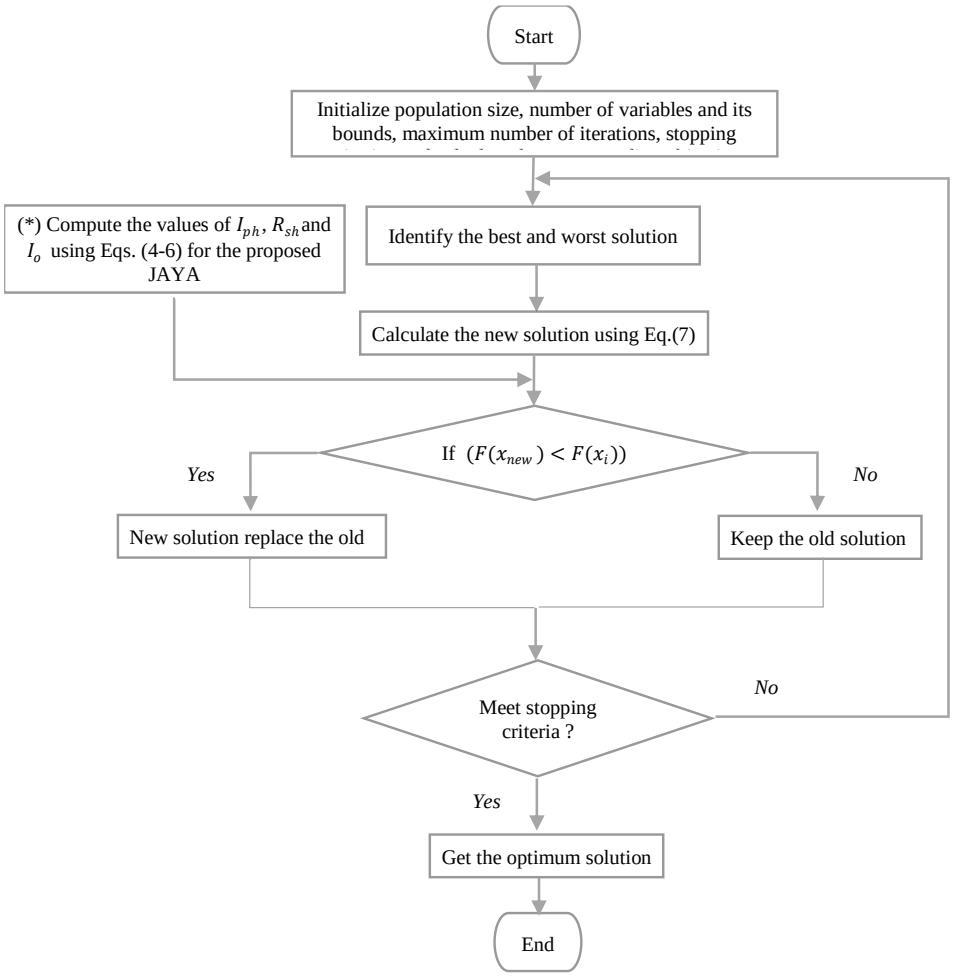


Fig.2. Flow chart of the JAYA proposed (*)

2. RESULTS AND DISCUSSIONS

To validate the proposed method, we used an RTC France solar cell, and its characteristics are presented in Table 1. The experimental data for this cell are extracted from [17].

Table 1

RTC France solar cell electrical characteristics.

Electrical characteristics	Values
Current at MPP(A)	0.6894
Voltage at MPP(V)	0.4507
Short circuit current(A)	0.7603
Open circuit voltage(V)	0.5728
Test temperature (°C)	33
Test radiation ($W.m^{-2}$)	1000

In this study, the proposed algorithm and the standard JAYA algorithm were executed separately for thirty iterations. The population size was set to thirty, with a maximum number of iterations fixed at one hundred. The lower and upper bounds of the search space are selected as follows: $1 \leq a \leq 2$, $0 \leq R_s \leq 1\Omega$, $0 \leq R_{sh} \leq 100\Omega$, $0 \leq I_{ph} \leq 1A$ and $0 \leq I_o \leq 1\mu A$. The statistical results, including the minimum (*Min*), maximum (*Max*), mean (*Mean*), and standard deviations (*Std*) of the objective functions *RMSE,* were consolidated in Table 2.

Table 2

The results of thirty tests performed.

Algorithm	Min	Max	Mean	Std
JAYA proposed	7.809288897E-04	7.809289125E-04	7.809288921E-04	5.956171839E-12
JAYA standard	8.558837315E-04	7.256816220E-03	2.950435049E-03	1.626164973E-03

The analysis of Table 2 highlights a remarkable consistency in the *RMSE* values obtained by the proposed JAYA, while the classical JAYA exhibits quite significant differences. These observations are supported by the standard deviation (*Std*) values recorded for the two compared algorithms. Indeed, the standard deviation obtained by our approach is significantly smaller than that of JAYA, indicating an increased stability of our algorithm compared to JAYA. Additionally, when examining the minimal *RMSE* values achieved, our algorithm shows a notably higher precision compared to the standard JAYA. These outstanding performances in terms of stability and precision undoubtedly confirm the effectiveness of reducing the search space through the integration of the analytical procedure within the metaheuristic algorithm.To illustrate this precision, we recorded the parameters associated with the best RMSE value obtained by our algorithm. These parameters are listed in Table 3 and are used to plot the (I-V) characteristic. Fig. 3 provides a comparison between experimental results and simulations

Table 3 Best parameters obtained by the proposed algorithm.

Parameters	Values obtained
a	1.4777
$R_s(\Omega)$	0.036
$R_{sh}(\Omega)$	52.995
$I_{ph}(A)$	0.7608
$I_o(\mu A)$	0.3119

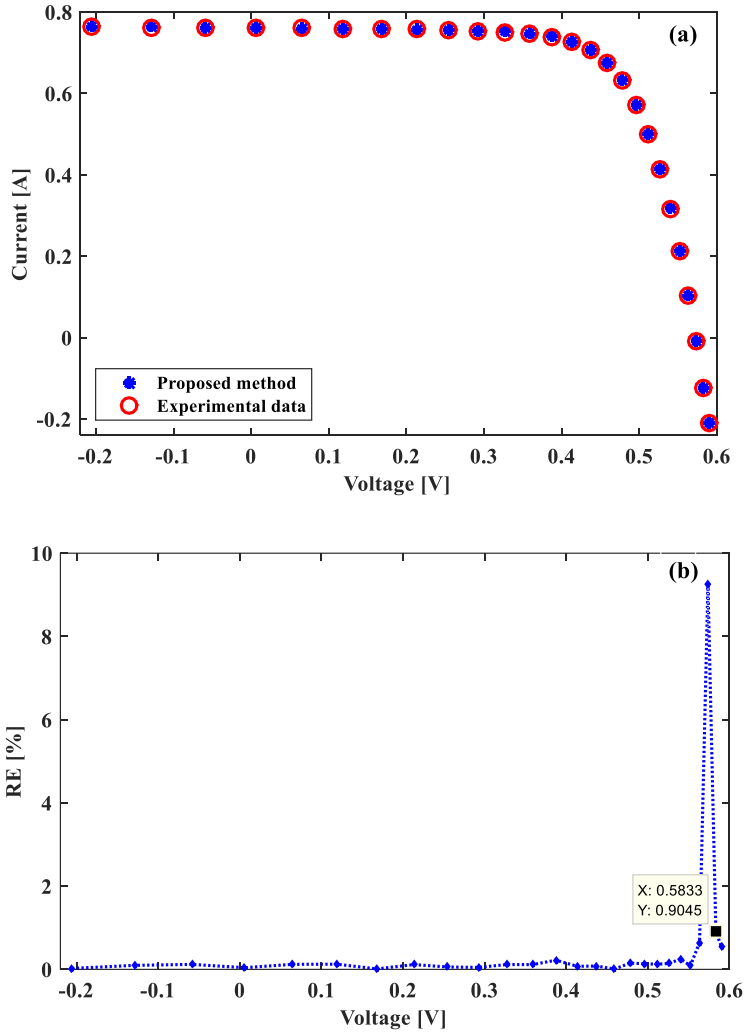


Fig.3. (a): The experimental and simulation I-V characteristics; (b): The relative error at each point.

According to Fig. 3, an excellent agreement between measurement and simulation data is observed. Regarding the relative error, it is also noted that, except for a few points, especially beyond the point corresponding to the open-circuit voltage, the error margins are minimal and do not exceed 0.9045%. Thus, the proposed method allows for a precise identification of the equivalent model parameters, enabling it to adequately describe the actual behavior of the studied cell.To highlight the impact of the analytical phase on the convergence rate, we plotted the convergence curves for the presented approach and the standard JAYA algorithm. The results are shown in Fig. 4. These graphical data reveal a significantly faster convergence of the proposed method compared to the standard JAYA algorithm. Specifically, our algorithm reached the best solution after fifty-five iterations, while the JAYA algorithm is still in the search phase at this point. This observation strengthens our positive assessment regarding the

beneficial impact of integrating the analytical phase on the convergence rate of the JAYA algorithm.

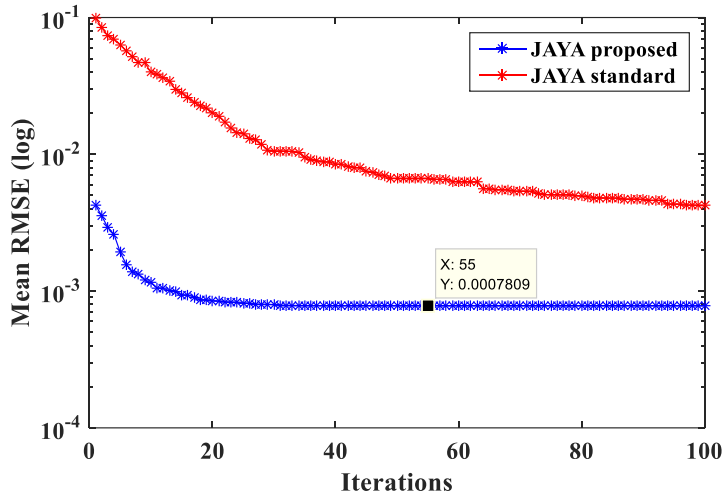


Fig.4. Convergence results for the tested algorithms.

CONCLUSION

In this study, we have developed a hybrid approach for extracting parameters of the single-diode model. This method integrates an analytical phase into the JAYA algorithm during the search for optimal solutions. We assessed the effectiveness of this technique by applying it to an RTC solar cell. The results of the comparison clearly highlight the advantages of the proposed method over the conventional JAYA optimization algorithm. The integration of the analytical phase in tandem with JAYA has stabilized and accelerated the convergence of the algorithm, achieving remarkably high precision. These findings were corroborated by in-depth statistical analysis, convergence studies, and the calculation of precision indicators such as root mean square error (RMSE) and relative error. In summary, our hybrid approach has proven to be an effective and enhanced method for accurately estimating parameters of the single-diode model, paving the way for more reliable applications in the field of solar cell modeling.

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EFFECTS OF ARTIFICIAL INTELLIGENCE ON THE LABOR MARKET

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Abstract
Introduction
This study looks into artificial intelligence in the workplace and the challenges associated with utilizing this type of platform. Artificial Intelligence takes a multidisciplinary approach to understand how the dynamics of job growth. Investigating and analyzing the effects of artificial intelligence on employment and labor market dynamics is the goal of this study. However, there are a number of ways that the employment sector has been impacted by AI. The aim of this study is to analyze effects of artificial intelligence on the labor market. Methodology This study is based on a review of existing literature, academic journals, government reports, and various publications. This will show where the study stands in terms of the knowledge currently available and point out any gaps in the body of research. In addition to doing a literature analysis, the project will employ research surveys to collect data regarding the experiences and perspectives of artificial intelligence from a sample of employers and employees. We also detect the growing application of AI in labor market structure and employment dynamics by evaluating current labor market analyses. Results This study highlights the importance of adapting job seekers and organizations to these profound changes in technology, as well as the need for appropriate policy strategies to identify and take advantage of the opportunities AI brings to the labor market. An increase in the automation of routine tasks and a greater focus on data analysis and management skills are identified. Based on the studies conducted regarding the effect of artificial intelligence on the security of the labor market, it was found that it increased by 20%, no change by 60%, and decreased by 20%. Conclusion According to this study, we concluded that investing in artificial intelligence in the labor market is necessary for providing workers with the required abilities, as this kind of investment improves the efficient operation of work processes. Programs designed to assist staff members in keeping up with the rapid advancements in technology. Employers need to give improving training first priority.
Keywords: Artificial Intelligence, labor market, business, growth, routine tasks

Introduction

In an era where technology is advancing quickly and reshaping how we work, artificial intelligence has emerged in the labor market as a driver of transformation and progress. Artificial Intelligence (AI) stands out as a groundbreaking technology, in today's world bringing about shifts, in the labor market dynamics and how tasks are carried out. This study looks into artificial intelligence in the workplace and the challenges associated with utilizing this type of platform. Artificial Intelligence takes a multidisciplinary approach to understand how the dynamics of job growth. Investigating and analyzing the effects of artificial intelligence on employment and labor market dynamics is the goal of this study. However, there are several ways that the employment sector has been impacted by AI. As such, it is essential to analyze the effects of AI on the labor market carefully. This study looks into how AI algorithms can be utilized to improve recruitment practices, performance management, and labor market data analysis. Various studies have shown different attitudes regarding the effects of new technologies on the labor market. While some researchers have expressed concerns about the potential replacement of jobs by AI, others have offered a more optimistic view, highlighting opportunities to create new tasks and enhance productivity. According to research findings, it has been shown that emerging technologies impact the labor market in ways leading to three outcomes; enhanced productivity, job displacement, and workforce relocation.[1] However, many of these studies have focused on the conditions, inside countries. In addition, according to recent analyses, there is a lack of specialized studies on the effects of artificial intelligence on the labor market in the context of Albania. However, these shortages are evident again; the rapid developments of artificial intelligence technology have also involved Albania. The aim of this study is to analyze and to investigate the effects of artificial intelligence on the labor market, focusing on the situation of the labor market, in Albania. The adoption of intelligent technologies has grown significantly over the past decade, presenting both opportunities and challenges in the professional sphere. This analysis purpose to provide a broad understanding of the impact of new technologies on employment at the global and local level, as well as to create a clear and detailed understanding of the effects of AI on the labor market, to face the challenges and benefits from the opportunities that this technology brings. The primary objective is to develop an understanding of the impact of intelligence, on employment and the

[1] Acemoglu, D., & Restrepo, P. (2019). "Automation and New Tasks: How Technology Displaces and Reinstates Labor". Journal of Economic Perspectives, 33(2), 3-30.

economy. This will be achieved by conducting research and data analysis. Additionally, the objective is to propose measures and regulations to adapt to these transformations and promote the integration of AI, in workplaces. Some of the objectives that we can mention in this study are:

1. The goal is to explore the benefits and obstacles associated with implementing AI in work environments.
2. We propose to understand how AI influences work dynamics reshaping employee roles and enhancing productivity.
3. Our objective is to suggest and evaluate strategies and policies that can address challenges and maximize the benefits of AI advancements, in the labor market.
4. We seek to comprehend how AI adoption affects recruitment methods and procedures across organizations.

In studies exploring the impact of Artificial Intelligence, on the labor market, researchers have distinguished between two perspectives, the view and the hopeful outlook. A major issue, in this field, is the threat, to service sector jobs posed by the progress of computerization and automation. Based on the model some researchers have determined that high degrees of jobs in the European Union are at high risk of automation.[2] Some researchers have shown that the labor market has undergone a split, over the decades favoring both low-skilled and high-skilled positions while positions requiring moderate skills have decreased due, to the advancement of computer technology. However, this polarization may change, given that some low- and medium-skill jobs may be relatively resistant to automation, while some high-skill but routine jobs may be vulnerable, potentially by technologies like AI.[3] In contrast, to the impact of computers and robots experts believe that the rise of intelligence will not necessarily lead to labor market polarization but will instead influence the evolution of jobs, across skill levels. Nonetheless, AI has indeed made its mark on the employment landscape in many ways. Albania, a nation changing at the end of the communist era, in the 1990s has seen shifts in its labor market due to factors like moving towards a market-based economy, labor migration, and advancements, in sectors.[4] Over the last ten years, we have seen a rise, in the tech and information industry leading to the emergence of IT firms and the generation of fresh

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employment opportunities. Investments in the field of artificial intelligence are of great importance for the development of the technology sector and international competition. The application of intelligence, in industries such, as finance, healthcare, transportation, and customer service could enhance productivity and lead to the development of fresh employment opportunities.[5] Startups and technology companies in Albania are focused on the development and implementation of artificial intelligence applications, contributing to the growth of the technology sector. The government and academic institutions offer programs and training in the field of artificial intelligence to accelerate the development of the competencies of employees in the country. The integration of intelligence, in the workforce presents both challenges and opportunities for employers, employees, and the economy overall. This includes adjusting the workforce to technologies and shifts, in skill requirements and talent demand. Through this extensive analysis, we aim to contribute to the development of employment policies and practices in Albania, ensuring that the country benefits from the advantages of artificial intelligence while minimizing potential social and economic challenges. In this context, a keyword for the future of the labor market is the adaptation of the workforce to new technologies, investing in training, and developing the skills needed to work with artificial intelligence. In addition, to help increase the awareness and use of artificial intelligence in the country, it is important to create a stimulating environment for innovation and technological progress, supporting start-ups and new firms in the technology sector.

Methodology

This study is based on a review of existing literature, academic journals, government reports, and various publications. This will show where the study stands in terms of the knowledge currently available and point out any gaps in the body of research. In addition to doing a literature analysis, the project will employ research surveys to collect data regarding the experiences and perspectives of artificial intelligence from a sample of employers and employees. We also detect the growing application of AI in labor market structure and employment dynamics by evaluating current labor market analyses. The study proposes to use an appropriate methodology to examine the effects of artificial intelligence on the labor market in Albania. Initially, a review of existing literature, including academic journals, government reports, and various publications, will be conducted to identify and assess current knowledge

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https://akep.al/wp-content/uploads/2023/07/AKEP_RAPORTVJETOR-20223.pdf

in the field. After reviewing the literature, a survey was developed via Google Forms to collect data on the experiences, opinions, and perceptions of employers and employees regarding artificial intelligence and the labor market globally and locally, including Albania. 100 employers and 100 job seekers responded to this survey. The survey questions were carefully designed to address the key themes of the study and to provide qualitative information for further analysis. After completing the data collection phase through the survey called "Effects of AI on the labor market", the data were analyzed with different methods appropriate to our study. Analysis is done using statistical tools to identify trends and different percentages in survey responses while evaluating individual responses to identify deep motives, experiences, and perceptions that cannot be captured through numbers. Finally, this study will examine the outcomes of research surveys. Evaluate the increasing integration of AI, in the structure of the labor market and employment dynamics in Albania. This will involve an evaluation of labor market patterns and the influence that AI technology has or could potentially have on these patterns. Furthermore, this study seeks to put forth suggestions and consequences for employment policies and practices in Albania based on the discoveries from the analysis. These suggestions encompass recommendations for employers, job seekers, government bodies, and educational institutions to enhance the utilization of intelligence in the labor market while also addressing the obstacles and opportunities stemming from this technology. This research also contributes to comprehending how artificial intelligence affects Albania's labor market and aids in formulating the policies and strategies to confront challenges and leverage the benefits of this technology, within employment scenarios.

Discussions

The integration of methods offers an approach, to research. Analytics delve into individual's perspectives and experiences while also tracking trends and statistics. Assessing the impact of intelligence on Albania's labor market involves identifying sectors or professions most affected by automation and pinpointing areas with potential for increased employment through AI. Examining the economic implications of AI in Albania's workforce includes analyzing its effects on unemployment rates, productivity growth, and shifts in employment patterns. Drawing insights from this analysis allows for the formulation of recommendations and strategies to address challenges and leverage opportunities presented by AI in Albania's labor market. These recommendations may encompass initiatives such as training programs for AI skill development fostering innovation, in AI-related sectors, and implementing measures to mitigate disparities arising from technological advancements.

Results

This study highlights the importance of adapting job seekers and organizations to these profound changes in technology, as well as the need for appropriate policy strategies to identify and take advantage of the opportunities AI brings to the labor market. An increase in the automation of routine tasks and a greater focus on data analysis and management skills are identified. Based on the studies conducted regarding the effect of artificial intelligence on the security of the labor market, it was found that it increased by 20%, no change by 60%, and decreased by 20%. After examining the gathered data, the findings of this research reveal viewpoints and encounters shared by employers and job seekers concerning the adoption of intelligence, within Albania's labor market.

Graph 1 shows indicates that a notable portion of employers (45%) perceive that artificial intelligence has influenced the setup of their workplaces indicating an impact this technology has, on their overall structure and functioning.

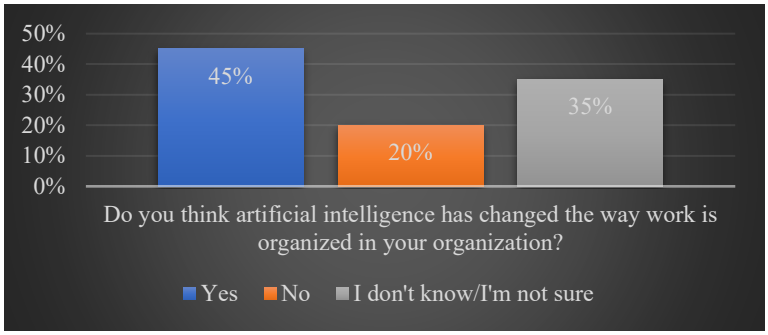


Figure 1. The Effect of AI on Work Organization

Graph 2 shows that 30% of employers have either utilized or intend to utilize intelligence in their employee hiring practices suggesting that there is potential, for further adoption of this technology, in the recruitment process.

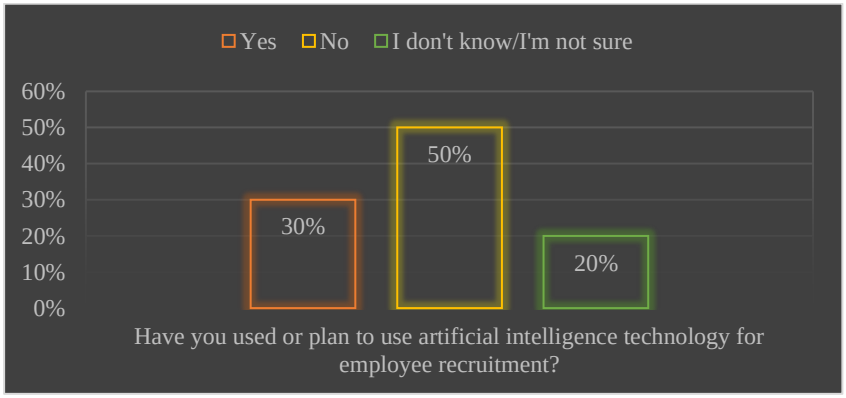


Figure 2. The Effect of AI on Work Organization

Graph 3 shows that an important part of employees, in summary, 40%, see the use of artificial intelligence as something positive in the labor market in Albania. A smaller percentage, 20%, see it as something negative, while another equal percentage, also 40%, have a neutral attitude towards the use of artificial intelligence in employment.

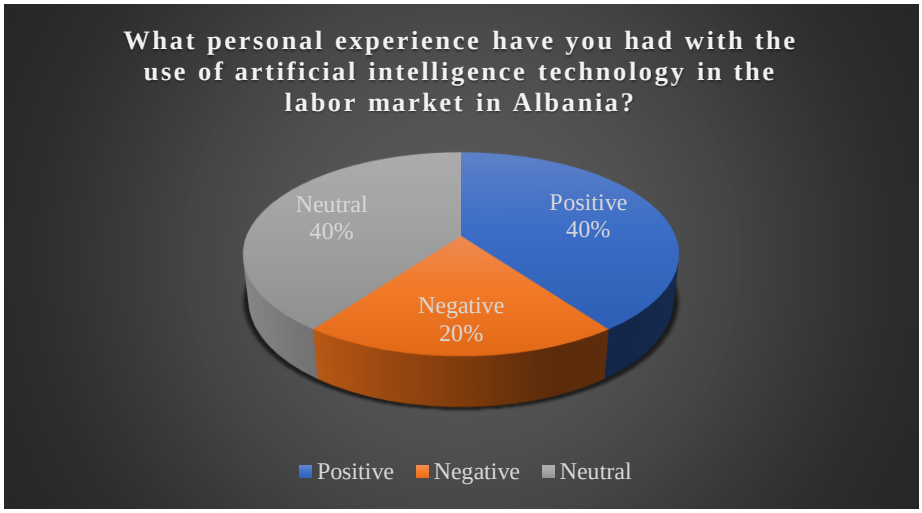


Figure 3. Personal Experiences with AI in Albania's Labor Market

Most employers estimate that artificial intelligence has improved work efficiency and productivity in their organizations, pointing to the advantages this technology brings to business performance. The main challenges they reported are the lack of technical knowledge (25%) and data security (30%), which indicates the need for further investment and preparation to address these challenges. On the employee side, a significant percentage (35%) have noticed any change in the way work is organized or performed in their workplace after using artificial intelligence. This shows the real changes that the application of this technology brings to the work environment. Meanwhile, a higher percentage (50%) of employees see the use of artificial intelligence as an opportunity to develop their skills and careers, a feeling described as positive by many of them. Personal experiences with the use of artificial intelligence in the labor market in Albania are generally divided, with 30% of employees considering it positive and 15% considering it negative. This points to a wide spectrum of individual experiences and perceptions, which must be taken into account in the design of employment policies and strategies to face the challenges and take advantage of the advantages of artificial intelligence in the context of employment in Albania. On the side, many employees have observed shifts, in how work is structured or carried out following the incorporation of artificial intelligence in their workplace. This indicates that the adoption of this technology has resulted in alterations to routines and work procedures leading to a shift in organizational dynamics. Additionally, a

considerable number of employees view the integration of intelligence as a chance to enhance their skills and advance their careers. This showcases a sentiment, among employees regarding the advantages and prospects presented by intelligence technology for their career growth. Employee's opinions, on using artificial intelligence vary. Some find it beneficial, noting efficiency and work methods. However, others have faced challenges, like support or unclear procedures. This shows the range of experiences and viewpoints emphasizing the importance of considering these variations when shaping future employment guidelines and approaches.

Conclusions

According to this study, we concluded that investing in artificial intelligence in the labor market is necessary for providing workers with the required abilities, as this kind of investment improves the efficient operation of work processes. Programs designed to assist staff members in keeping up with the rapid advancements in technology. Employers need to give improving training priority. In summary, the findings of this research reveal an overview of how artificial intelligence is utilized and perceived in the labor market, in Albania. While some organizations have embraced this technology to some extent there remains a portion that has yet to adopt it or harbors uncertainties about its implementation. This suggests the potential for increased adoption and utilization going forward. Generally, artificial intelligence has received assessments for enhancing work efficiency and productivity with challenges such as lack of expertise and concerns about data security being highlighted. This underscores the importance of training employees and implementing measures to safeguard data integrity and privacy. Additionally, employees view intelligence as a means to enhance their skills and careers but also recognize it as a threat to job security. This underscores the need for training initiatives. Raising awareness among employees about the possibilities and impacts of this technology. To maximize the benefits and utilization of intelligence in Albania's labor market organizations must address challenges while leveraging opportunities offered by this technology ensuring a sustainable adaptation, to technological advancements aligned with societal needs. Transitioning to a work environment that embraces intelligence would pave the way, for growth and sustainable development for everyone in the labor market, in Albania.

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DIPLOMATIC RELATIONS BETWEEN VIETNAM AND THE UNITED STATES AS SEEN FROM US'S COVID-19 VACCINE AID POLICY TO VIETNAM

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Abstract
Vietnam and the United States are two countries with diplomatic relations many years ago. During the cold war, the Vietnam War (1961 - 1975) caused the relationship between Vietnam and the US to crack and the US had to withdraw from Vietnam in 1975. Since 1995, the two countries have resumed foreign relations and the United States has become an important country with Vietnam in economic development and has friendly diplomatic relations in all fields. The covid 19 pandemic has caused many health and life losses around the world, and vaccines are seen as the key to solving the difficulties caused by the covid 19 pandemic.Vietnam has to go through a lot of difficulties in dealing with the pandemic because of the scarcity of covid 19 vaccine resources. In that context, the help of a covid 19 vaccine from the United States is very important and necessary. As of March 2022, the United States is the largest vaccine donor to Vietnam. This affirms that the diplomatic relations between the two countries are in the best period, especially during the period when President Joe Biden focused on Southeast Asia, including Vietnam.
Keywords: Vietnam, The United States, diplomacy, COVID-19 vaccine, Asia

Overview of diplomatic relations between Vietnam and the US

After the Vietnam War, the US and Vietnam restored diplomatic relations in 1995 and began to take diplomatic steps to serve the development strategy of both countries. The US has increased its economic support and aid to Vietnam. The impressive statistics increase year by year and the US has become a very important country in the economic development of Vietnam. In an effort to build Vietnam's self-reliance, the United States works to spur further growth and trade competitiveness, combat pandemic threats, promote renewable energy, address war legacy issues, and conserve Vietnam's forests and biodiversity.U.S. assistance in Vietnam focuses on consolidating gains to ensure sustainable economic development while promoting good governance and the rule of law. Assistance projects aim to deepen regulatory reforms, improve the capacity and independence of Vietnam's judicial and legislative bodies, and promote more effective public participation in the law and regulation-making processes. The United States also assists the Government of Vietnam to bring its laws and practices into compliance with international labor standards and effectively enforce labor laws and uphold workers' rights. U.S. assistance seeks to support Vietnam's response to climate change and other environmental challenges, including remediating Agent Orange/dioxin contamination, strengthening the country's health and education systems, and assisting vulnerable populations. The United States and Vietnam successfully concluded the first phase of dioxin remediation at Danang International Airport in 2017, and in December 2019 commenced a 10-year remediation project at Bien Hoa Air Base as well as a $65 million initiative to provide assistance to persons with disabilities in conflict-affected provinces.Since entry into force of the U.S.-Vietnam bilateral trade agreement in 2001, trade between the two countries and U.S. investment in Vietnam have grown dramatically. The United States and Vietnam have concluded a trade and investment framework agreement; they also have signed textile, air transport, customs, and maritime agreements. U.S. exports to Vietnam include machinery, computers and electronics, yarn/fabric, agricultural products, and vehicles. U.S. imports from Vietnam include apparel, footwear, furniture and bedding, agricultural products, seafood, and electrical machinery. U.S.-Vietnam bilateral trade has grown from $451 million in 1995 to over $90 billion in 2020. U.S. goods exports to Vietnam were worth over $10 billion in 2020, and U.S. goods imports in 2020 were worth $79.6 billion. U.S. investment in Vietnam was $2.6 billion in 2019 (U.S Embassy and Consulate in Vietnam, 2021).

Situation of the Covid 19 Pandemic in Vietnam

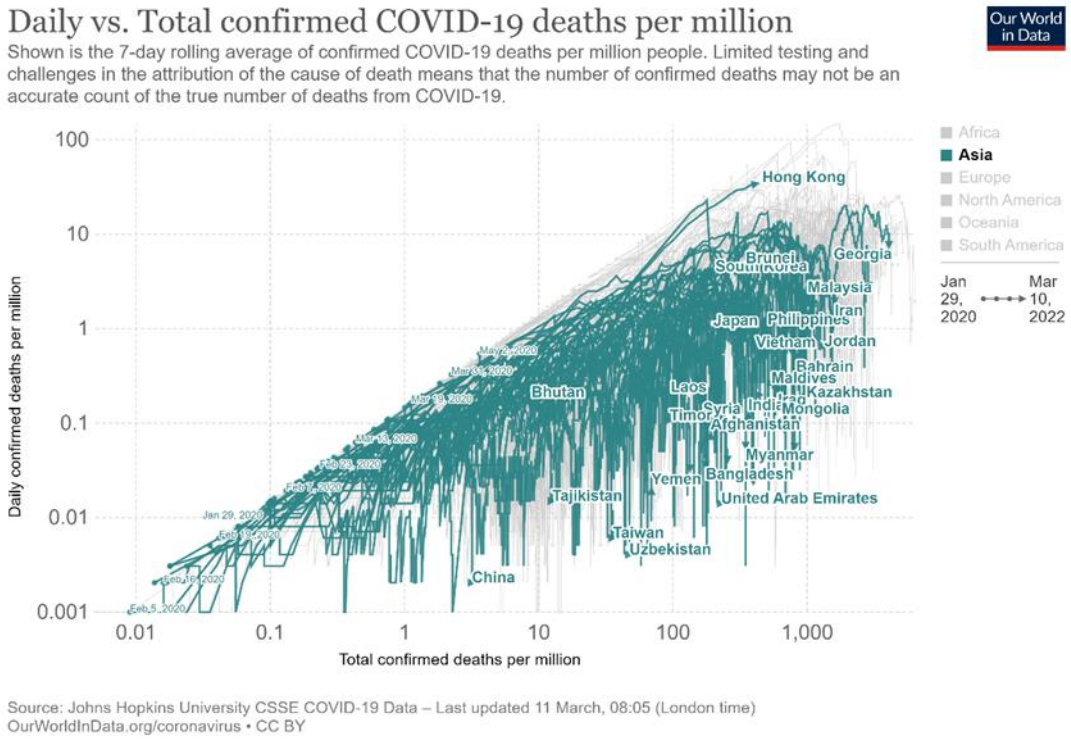
In 2020, Vietnam was cited by global media as having one of the best-organized epidemic control programs in the world. This success has been attributed to several factors, including a well-developed public health system, a decisive central government, and a proactive containment strategy based on comprehensive testing, tracing, and quarantining.From the end of April 2021, Vietnam experienced "a fast-spreading outbreak" of more than 350,000 cases. Clusters have been found in industrial parks in Bac Giang province and then in at least ten major hospitals in the country. As the epidemic has spread to many provinces in Vietnam, many outbreaks are occurring in many localities at the same time, making it "nearly impossible" to trace and cut the chain of infection. According to WHO, to prepare for the worsening situation, the country has built more than 30 field hospitals with a scale of 1,500 ICU beds and 30,000 non-ICU beds. When total cases reached a few thousands per day, the Central government decided to lock down the entire Southern Region with 35 million people, along with the capital, Hanoi, to contain the spread. On 26 July 2021, for the first time in the country's disease prevention history, Ho Chi Minh City imposed a daily night curfew beginning at 6:00 PM. As a result, no one is permitted to leave the city, and only emergency services are permitted to operate. On 28 July, the National Assembly gave the central government in Hanoi mandate to implement emergency measures for curbing the pandemic locally. The government also mobilized 10,000 troops to the city to enforce the lockdown and deliver food supplies. One of the main reasons for this outbreak is a four-day holiday for Reunification Day and International Workers' Day, which saw many vacation destinations packed with travellers. In addition, gene sequencing results show that the SARS-CoV-2 Delta variant is the dominant variant in this wave, especially among cases in central and southern localities of Vietnam. On 29 August, Vietnamese Prime Minister Pham Minh Chinh announced that Vietnam may face a protracted battle and cannot rely on indefinite closures and quarantines. He also acknowledged the possibility that Vietnam will have to live with the virus. This marks a major change in the country's approach to COVID-19.

Table 1: Reported Cases, Deaths and Recovereds in Vietnam and the world

(Newest updated to 12AM GMT+7 March 12 2022)

	Vietnam	**World**
Cases	5.954.222	457.000.000
Deaths	41.290	6.040.000.

Source: Vietnam Ministry of Health



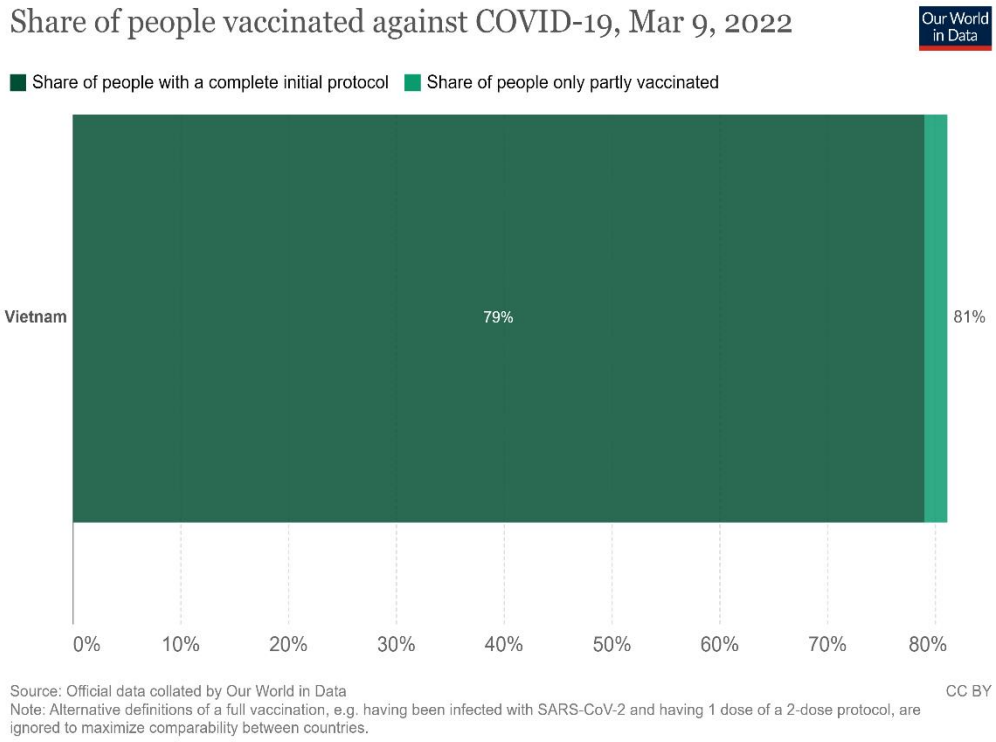
Figures 1: Daily total confirmed COVID-19 deaths per million people

Source: Johns Hopkins University CSSEcovid -19 Data

In response to the covid 19 pandemic, Vietnam has stepped up its covid 19 vaccination campaign[6]. In an effort to find a supply of the covid 19 vaccine to fight the pandemic. Vietnam has activated a strategy of covid 19 vaccine diplomacy and achieved some desirable achievements.On 16 June 2021, Vietnam also received 966,320 doses of AstraZeneca COVID-19 vaccine donated by Japan. On 25 June, it is announced that Japan will donate another 1 million doses of AstraZeneca vaccine to Vietnam. The first batch of this donation (400,000 doses) arrived at Tân Sơn Nhất International Airport on 2 July, while the second batch arrived

[6] Following the approval of the Oxford–AstraZeneca COVID-19 vaccine on 30 January 2021, vaccinations commenced on 8 March 2021, and will continue throughout the year with the goal of vaccinating 80% of the population by June 2022. The Sputnik V was later approved for use on 23 March 2021. Sinopharm COVID-19 vaccine was approved for emergency use on 4 June 2021, while Pfizer–BioNTech COVID-19 vaccine, Moderna COVID-19 vaccine and Janssen COVID-19 vaccine were approved on 12 June 2021, 29 June 2021, and 15 July 2021, respectively. This is the country's largest-ever immunization campaign with over 150 million doses. Although Vietnam is a success story in disease prevention and has kept outbreaks under control, the country's COVID-19 vaccination program is considered to be slower than most countries in Asia. As of 27 August 2021, Vietnam has administered 19,151,122 vaccine doses across the country. It expected that a total of 124 million doses would be available by the end of 2021

on 9 July. On 16 July, Japan sent another 996,740 doses of AstraZeneca vaccine to Vietnam. On 3 August 2021, Vietnam received 415,000 doses of AstraZeneca vaccine donated by the UK Government. On late August, Vietnam also received 501,600 doses and 300,000 doses of AstraZeneca vaccine donated by Poland and Romania. On 26 August 2021, Vietnam received 404,000 doses of COVID-19 vaccine part of Australia's commitment to provide 1.5 million doses of AstraZeneca vaccine for Vietnam through UNICEF. In total, Vietnam has received 18.92782 million AstraZeneca COVID-19 vaccine doses.On July 10, Vietnam received 2,000,040 doses of Moderna COVID-19 vaccine donated to the COVAX Facility by the United States Government.On 7 July 2021, the first batch of Pfizer's vaccines, containing 97,110 doses, arrived at Nội Bài International Airport. It was later confirmed that Vietnam received 746,460 doses of Pfizer's vaccines that day. A day earlier, on 6 July, it is also confirmed that the United States would send Vietnam two million doses of Moderna COVID-19 vaccine via Covax mechanism. This batch of vaccines arrived in Vietnam on 10 July. Another batch containing 3,000,060 doses of Moderna vaccine donated to COVAX by the US Government arrived in Hanoi on 24 and 25 July. On 11 August 2021 and 26 August 2021, Vietnam received 217,620 and 770,000 doses of Pfizer's vaccines purchased by the government. On 25–27 August 2021, Vietnam received 1,065,870 doses of Pfizer vaccine donated by the US government. Vietnam received 250,800 doses of AstraZeneca and Moderna COVID-19 vaccine donated by the Czech Republic on 30 August.



Figures 2:

Share of people vaccinated against Covid-19, Mar 9, 2022

https://github.com/owid/covid-19-data/tree/master/public/data/vaccinations

Looking at the above statistics, it shows that vaccination against covid 19 in Vietnam is faster than many other countries in the world.

3. The US's COVID-19 vaccine aid policy for Vietnam

On August 3, the White House released a notice saying that so far, the US has donated and handed over 110 million doses of Covid-19 vaccine to more than 60 countries and territories around the world to affirm its position "Global leader in support of Covid-19 vaccines".

According to the United Nations, the number of covid 19 vaccines that the US gives is higher than all the vaccines aided by all other countries combined and shows the generosity of the US. Based on the list attached to the notice by the White House, Vietnam ranks 7th in the list of countries receiving the most vaccines from the US with 5 million doses, after Indonesia (8 million), the Philippines (over 6.2 million doses).), Colombia (6 million), South Africa (more than 5.6 million), Pakistan (5.5 million doses), Bangladesh (5.5 million).

According to the White House, the US vaccine aid is part of President Joe Biden's strategy to stop the pandemic from spreading globally. Mr. Biden has pledged that the US will become "the army of vaccines for the world".

The visit of US Vice President Kamala Harris to Vietnam from August 24-26 can be considered a new milestone in the Vietnam - US relations when in the last two consecutive terms, leaders

at senior level The highest ranking officers in the new US administration all visited Vietnam within the first year after taking office. Vice President Kamala Harris announced that the US will continue to support Vietnam with 1 million doses of Pfizer vaccine, bringing the total number of US vaccines for Vietnam to 6 million doses; said it will continue to support Vietnam to access vaccines faster, including vaccines for children. At the same time, support in medical equipment, improve medical capacity to cope with other epidemic risks in the long run.Through the American Rescue Plan Act (ARPA) and other emergency resources, the United States Agency for International Development (USAID) and CDC provide an additional $23 million in technical assistance to Vietnam to respond to the pandemic. COVID-19 pandemic, bringing the total support since the beginning of the pandemic to nearly $44 million.This support will promote equitable access and safe and effective delivery of a Covid-19 vaccine, strengthen Vietnam's health system to respond to Covid-19 and build capacity to detect, monitor Covid-19 and future disease threats. USAID also donated $1 million to the Vietnam Red Cross to reduce the impact and prevent the spread of Covid-19 in vulnerable communities.Vice President Kamala Harris and Vietnamese Prime Minister Pham Minh Chinh attended the opening ceremony of the Southeast Asia Regional Office of the US Centers for Disease Control and Prevention (CDC) in Hanoi. The U.S. CDC Office will promote global health security by maintaining a sustained presence in the region, enabling a rapid and effective response to health threats whenever they occur. and reinforces CDC's core mission of protecting the American people. Vietnam is very supportive and grateful to the United States for choosing Hanoi as the location for the Office, thereby demonstrating the good development as well as bright prospects of the diplomatic relations “Comprehensive Partnership United States- Vietnam” and affirmed that Vietnam will create favorable conditions for the Office to operate effectively.



Pic.1: President of Vietnam Mr. Nguyen Xuan Phuc and Vice President of the United States Kamala Harris.

Source: Reuters

Table 3: The amount of vaccines aided for Vietnam

(covid 19 vaccines received compared to commitments)

(Newest updated to March 1 2022)

Countrys & Organization	**The amount of vaccines aid for Vietnam**
USA	21.000.000
Germany	10.000.000
Japan	6.500.000
COVAX	6.270.000
Australia	2.600.000
Italia	2.000.000
United Kingdom	415.000
China	500.000
Poland	501.600
Romania	300.000
Russia	100.000
Total	**49.685.501,6**

Source: Vietnam Ministry of Health

Looking at the above statistics, it shows that the United States is the country with the most support for the covid 19 vaccine for Vietnam in dealing with the covid 19 pandemic. The US covid 19 vaccine aid for Vietnam has been helped Vietnam a lot in responding to the pandemic and this action of the United States has given great affection of the Vietnamese government and people to the United States.

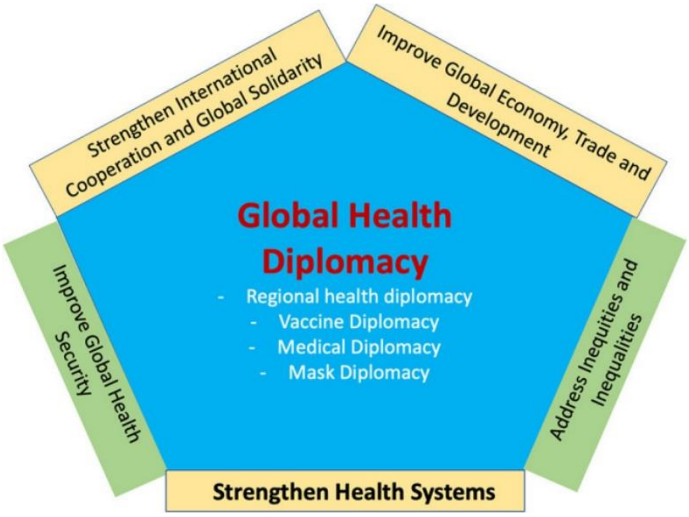
4. The causes of the support of the covid 19 vaccine that the US has for Vietnam and the prospects of diplomatic relations between Vietnam and the US

4.1. The competition between China and the US in "Vaccine diplomacy"

According Hotez (2014) Vaccine diplomacy refers to almost any aspect of global health diplomacy that relies on the use or delivery of vaccines and encompasses the important work of the GAVI Alliance, as well as elements of the WHO, the Gates Foundation, and other important international organizations. Central to vaccine diplomacy is its potential as a humanitarian intervention and its proven role in mediating cessation of hostilities and even cease-fires during vaccination campaigns. Among the initiatives relevant to vaccine diplomacy in the 21st century are international efforts to ensure universal or equitable access for low- and

middle-income countries to urgently needed vaccines for diseases of pandemic potential (Hotez, 2014) .Over a long period of time, vaccines and vaccine diplomacy have been increasingly developed, which is associated with the progress and development of medicine, and also contains political elements. The modern era of American vaccine diplomacy followed on the heels of the Marshall Plan when US technical and scientific resources were first engaged in foreign policy. In the 1950s, when polio epidemics occurred every summer in North America, Europe and the USSR, Albert Sabin began to work closely with Soviet virologists in order to develop, test and license the live polio vaccine. It is not widely known that the attenuated polio strains developed in Sabin's laboratory at the University of Cincinnati were transformed into a clinically useful oral vaccine with the help of Soviet virologists. Presumably it was the terror that polio inflicted into parents on both sides of the Atlantic that prompted both the Americans and Soviets to set aside their ideological differences in 1956 (Benison, 1982). At the height of the Cold War, leading Soviet virologists travelled to Cincinnati where they obtained a commitment from Dr Sabin to provide them with his vaccine strains. In a landmark reciprocal visit a few months later, Sabin received permission to visit the laboratories of Soviet scientists. Both exchanges proceeded with the tacit approval of a stridently anti-communist Republican Eisenhower administration. What followed was a remarkable example of Cold War diplomacy, in which Soviet children were among the first to receive test doses of the oral polio vaccine. By 1960, millions of Soviet children were vaccinated. Only after its safety had been established in the USSR and validated by Dorothy Horstmann from Yale, was the Sabin vaccine approved and licensed in the USA. Similar co-operation channelled through the WHO led to the introduction of essential smallpox freeze-drying technology (Hotez, 2001). During the covid 19 pandemic, countries such as the US, China, Russia, and Japan have used vaccine diplomacy as a tool to increase political and economic influence. It is like a series of "soft power" in the pandemic and post-pandemic era. According Nicholas (2020), As the Biden transition team plots out how best to rebuild the alliances and international cooperation mechanisms that were so badly eroded during the Trump presidency, one early proposal floated by some of Biden’s key advisors seems likely to rise to the fore, and could even serve as the centerpiece of a new “Biden Doctrine” in the first 100 days. According to Jake Sullivan, a top Obama era official routinely mentioned as a possible National Security Advisor, Biden should, “put values and democracy back at the center of US foreign policy… Rally[ing] like-minded free democratic nations in common purpose to both push back against authoritarian competitors and also construct and build the kind of long-term durable solutions for the challenges that afflict us all.”

Concretely, this may manifest itself in a US-convened global "summit of democracies" possibly based on the D-10 model, the world's 10 largest democracies, a concept the Atlantic Council has advanced through the work of its Scowcroft Center.For China, because it was an early producer of the covid 19 vaccine and quickly controlled the pandemic, it quickly implemented vaccine diplomacy as an effective tool of influence. According Soew Ting Lee (2021) Despite international efforts to address vaccine access, most notably through the creation of COVAX, low- and middle-income countries have struggled to procure vaccines for their populations. The UN, describing the vaccine inequity as a "catastrophic moral failure," found that residents in 10 countries have received 80% of the world's COVID-19 vaccine, as of February 2021—prompting it to launch a new global campaign, Only Together, to advance fair and equitable access to COVID-19 vaccines worldwide (UN launches Only Together 2021). Leveraging on the vaccine inequity, China has targeted the low- and middle-income countries largely left behind as rich nations scooped up most of the pricey vaccines produced by Pfizer and Moderna, and capitalized on slower-than-hoped-for deliveries by U.S. and European vaccine makers (Seow Ting Lee, 2021)Although India was severely impacted by the covid 19 pandemic, it quickly entered into vaccine production and aid abroad with the desire not to be left behind in the race to aid in the covid 19 vaccine. Being a leader in vaccine manufacturing, India's ability to offer complimentary COVID-19 vaccines to low-income countries, especially the immediate neighbors, will not only help strengthen its ties with partner countries but also achieve equitable access to vaccines. Furthermore, India's move to provide vaccine assistance to low- and middle-income countries will boost the efforts in achieving global vaccination coverage. India's ability to develop and manufacture cost-effective COVID-19 vaccines on a large scale will help to meet the global vaccine requirements without causing an additional economic burden (Taghizade et al, 2021).



Pic.2: Global health diplomacy and the five key areas of impact

*Source: Varshney, S. K., & Prasanna, N. K. (2021). Vaccine diplomacy: Exploring the benefits of international collaboration. Current Trends in Biotechnology and Pharmacy, 15(1), 110-114.*Thus, it can be seen that, in addition to the humanitarian reasons, there is competition between powerful countries such as the US, China and India, through vaccine diplomacy through vaccine diplomacy... Bollyky, T. J., Murray, C. J., & Reiner (2021) said that Renewed state-to-state systemic competition between the two largest economies today will have an important effect on the overall ability of the world to combat COVID-19, as well as recover economically from the detrimental economic effects of lockdowns, which will in turn impact countries' future ability to manage a major health crises (Bollyky et al, 2021).World bank (2021) warns that In the first two months of 2021, the production of COVID-19 vaccines has suffered setbacks delaying the implementation of national inoculation strategies. These delays have revealed the concentration of vaccine manufacture in a small club of producer nations, which in turn has implications for the degree to which cross-border value chains can deter more aggressive forms of Vaccine Nationalism, such as export curbs. During 2017–19, vaccine producing nations sourced 88 percent of their key vaccine ingredients from other vaccine producing trading partners. Combined with the growing number of mutations of COVID-19 and the realization that this coronavirus is likely to become a permanent endemic global health threat, this finding calls for a rethink of the policy calculus towards ramping up the production and distribution of COVID-19 vaccines, its ingredients, and the various items needed to deliver them. The more approved vaccines that are safely produced, the smaller will be the temptation to succumb to zero-sum Vaccine Nationalism (Simon J et al, 2021).Vietnam is a country in the

Asia-Pacific region, bordering China and having traditional diplomatic relations with this country. Besides, at present, Vietnam has friendly diplomatic relations and cooperation in many fields with the US. Therefore, during the covid 19 pandemic, Vietnam implementing a vaccine diplomacy strategy should pay attention to its relationship with both these countries.China: In the context of Southeast Asian countries struggling to order vaccines from scarce supplies in the world, the covid 19 vaccine that China soon sponsored and provided to Southeast Asian countries has enhanced the position of China. China, it reinforces the image of a responsible "neighborhood". Sinovac's first batch of 200,000 doses of covid 19 vaccine has arrived in Bangkok, the vaccination campaign in Thailand will kick off this week. Similarly, the Philippines is also ready to deploy vaccination when a shipment of 600,000 vaccines is also from Sinovac. If all goes well, Thailand and the Philippines, along with Indonesia, Laos and Cambodia, will become 5 out of 10 ASEAN countries that launch a large-scale vaccination campaign, all of which use vaccines manufactured by China. . Previously, in January, Indonesia launched Sinovac's vaccination campaign, while Laos and Cambodia also deployed vaccination using Sinopharm's vaccine on January 27, 2021 and October 10, respectively. February 2021. Brunei also received a vaccine aid batch from Sinopharm in February 2021. China's covic 19 vaccine has somewhat worked in some countries, but with the pandemic spreading strongly in countries using the sinovac vaccine and the pandemic also returning in China, the Questions about the quality of the Chinese-made covid 19 vaccine are raised more than ever.In addition, there is concern that Beijing could use vaccine supply as leverage to achieve geopolitical goals in the region, or cut off supplies if disagreements arise. China also used the vaccine to ask the Brazilian and Dominican governments to withdraw their decision to exclude Huawei from their 5G network development plans. In Honduras, in order to have a vaccine against Covid-19, President Juan Orlando Hernandez had to commit to opening a commercial office in China.US: From the end of 2020 to the beginning of this year, when the US and Europe were focusing on dealing with the crisis of the pandemic, China took advantage of the opportunity to deploy “vaccine diplomacy”, China provided more than 300 million domestically produced dose for over 80 countries. However, the situation changed when the US basically controlled the epidemic situation in the country. President Biden declared to the world “America is back” and ready to play the role of a responsible power. The core and cross-cutting foreign policy goal of the administration of President J. Biden over the next four years is to gradually re-establish America's global leadership position, and at the same time realize three strategic goals in the relationship with the US and China. China, it is to contain China militarily; maintain peace and

stability in the South China Sea in accordance with international law and change China's perception of relations with the US (Thuy, 2021). On the eve of the G7 summit, President Biden announced the aid of 500 million doses of the US Pfizer vaccine to the poorest countries. He stressed that this donation does not come with any pressure to support or make concessions. This contrasts with China's use of a Covid-19 vaccine to promote its own political and economic interests. It is expected that the US vaccine donation will start from August. According to the plan, the US will donate a total of 200 million doses by the end of 2021 and continue to donate 300 million doses in the first half of next year. Previously, on May 17, 2021, President Biden announced that by the end of June 2021, he would donate about 80 million doses to countries, including 20 million doses produced by Pfizer, Moderna and Johnson & Johnson corporations and 60 million doses. million doses of AstraZeneca that the US has pledged to support countries. Following the US pioneering step, G7 leaders pledged to expand production, sharing at least 1 billion doses of vaccine with the world through existing mechanisms and bilateral aid. This will be the largest relief operation of the G7 after World War II. It has opened up a new area of competition between the US and China.Vietnam's vaccine diplomacy stands in the face of fierce competition from the US and China, but Vietnamese people have skepticism towards China's covid 19 vaccine, as evidenced by only 500,000 doses China's Covid-19 vaccine in Vietnam and this vaccine is only given to Chinese citizens in Vietnam and some people who do business at the Vietnam-China border. In July 2021, a company in Vietnam imported about 5 million doses of Sinopharm vaccine but not a single dose has been used yet due to the rejection reaction of the Vietnamese people. The US is the country that donates the most Covid-19 vaccine to Vietnam, which puts Vietnam in a diplomatic difficulty that is facing conflicts between the US and China. That requires Vietnam to have a smart diplomatic strategy to be able to ensure its interests when receiving COVID-19 vaccine aid.

US Foreign Policy under President Joe Biden towards Southeast Asia

Based on the first steps of the US government after the election, it can be seen that the administration of President J. Biden will pursue a number of diplomatic measures as follows:

Regarding bilateral cooperation: the administration of President J. Biden will continue to strengthen bilateral relations with countries in the Asia-Pacific region to promote the signing of FTAs with six countries, including: Japan, South Korea, Australia, Vietnam, New Zealand and Indonesia in the period of 2021 - 2022. At the same time, the administration of President J. Biden will also conduct bilateral diplomatic activities with allies and partners. cooperation on issues such as: trade wars, currency manipulation, and negotiations to extend the new Strategic

Arms Reduction Treaty (START) with Russia.Regarding multilateral cooperation, despite the commitment to abandon a number of foreign-defense initiatives under the D. Trump administration, such as the prosperous economic network, the Indo-Pacific Treaty organization …, but the administration of President J. Biden will still maintain initiatives such as the Free and Open Indo-Pacific Strategy (FOIP), the Asian High Quality Infrastructure Initiative. In addition, the US will also make efforts to negotiate to join other multilateral organizations such as the Comprehensive and Progressive Agreement for Trans-Pacific Partnership (CPTPP), and the Regional Comprehensive Economic Partnership RCEP).Thus, in the coming time, the administration of President J. Biden will still inherit some of the policies of the previous Trump administration, but will basically make adjustments to suit the conditions and circumstances of the country. America today when the US commits to "reconciliation" instead of "confrontation", "cooperation" instead of "antagonism" and "conflict". However, whether this new foreign policy can be implemented or not depends a lot on the economic potential, the role of the United States and the policy-making ability of the administration of President J. Biden.

With its geo-strategic location, Southeast Asia is in the midst of a spiral of strategic competition of major countries. In particular, the number one US adversary in the region, China, considers Southeast Asia a starting point to deploy the "Belt and Road Initiative" (BRI), in order to expand political influence, maintain the stabilize and affirm China's influence in the region.The US "Free and Open Indo-Pacific Strategy" (FOIP) is deployed to protect national interests, freedom and maritime security, maintain the balance of forces, promote diplomatic activities and socio-cultural exchanges in the region, and at the same time, challenge the strong rise of China. This is a global strategy that determines the prospect of Washington's position and strength in the world order and in the Asian region in the present and in the future. In particular, the US takes Southeast Asia as the focal point connecting the two oceans.Inheriting the vision of a free and open Indo-Pacific region under the Trump administration, President Biden's administration has taken steps to adjust and supplement its approach. in a more skillful and methodical way to achieve the collective goal and increase the collective strength in handling challenges.

For Southeast Asian countries, the Biden administration attaches great importance to the Strategic Partnership with ASEAN, supports the central role of ASEAN and ASEAN's View of the Indo-Pacific (AOIP), promotes promote the strengthening of US-ASEAN cooperation and

cooperation between ASEAN member countries and the countries of the "Quad"[7] group to solve the challenges posed. The US will closely coordinate to contribute to maintaining peace, security and stability in the region, including maritime security and safety in the East Sea.The United States continues to contribute to ASEAN's regional cooperation mechanisms such as the ASEAN Regional Forum (ARF), the ASEAN Defense Ministers' Meeting Plus (ADMM+) and the East Asia Summit (EAS). The US actively supports ASEAN's efforts to negotiate a Code of Conduct in the East Sea (COC) with China in accordance with international law, including the 1982 United Nations Convention on the Law of the Sea (UNCLOS).Over the years, the US-ASEAN has had many diverse cooperation activities in many fields such as science, health, education, and livelihoods. Existing cooperation programs and initiatives such as the ASEAN-US Trade and Investment Framework, the ASEAN-US Connectivity Initiative, the ASEAN-US Smart Cities Partnership, the Southeast Young Leaders Initiative Asia (YEASLI) and cooperation programs on trade-investment, human resource development, renewable energy, maritime cooperation, disaster response, climate change, support ASEAN response to Covid-19,... The US-ASEAN cooperation action plan for the period 2021-2025 has also been implemented.Therefore, the support of covid 19 vaccines for Vietnam and some Southeast Asian countries such as Vietnam, the Philippines, and Thailand represents a vision in a policy towards Southeast Asia under US President Biden.

Conclusion

Vietnam is experiencing the outbreak of the covid 19 pandemic and the situation is very difficult right now. In that context, international support is very important, especially the source of the covid 19 vaccine. The covid 19 vaccine aid from the United States has made a very important contribution to the response to the covid-19 pandemic in Vietnam. The help from the US shows that the foreign policy under US President Joe Biden has had certain interests in Southeast Asia, considering it a very important area in expanding US influence in Asia. and worldwide. This is also an area where China is currently expanding its influence and now has huge covid 19 vaccine support for Indonesia, Cambodia and Malaysia. The US has given a huge aid to Vietnam, Thailand, and the Philippines to help fight the pandemic. It can be said that the

[7] Quad (Quadrilateral Security Dialogue): is an informal strategic forum between India, the United States, Japan and Australia, maintained by semi-regular summits, information exchange and military exercises. between member states. The forum was founded in 2007 by Prime Minister Shinzo Abe of Japan with the support of Vice President of the United States Dick Cheney, Prime Minister John Howard of Australia and Prime Minister Manmohan Singh of India.

competition "vaccine diplomacy" that the US and China are carrying out has helped Southeast Asian countries access vaccines to overcome the covid-19 pandemic, but it has also caused political effects. and diplomacy of countries in Southeast Asia, including Vietnam. Hopefully in the future, the conflict between China and the US will "cool down" and the two countries will join hands to fight the epidemic, only then will the Southeast Asian countries including Vietnam is not subject to one of the largest geopolitical disputes in history.

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ANATASE/RUTILE COMPOSITES – ON THE PHOTOCATALYTIC DEGRADATION OF ORANGE II AZO-DYE

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Abstract
The investigation is focused to clarify photocatalytic discoloration and purification of Orange II water solutions under UV irradiation with anatase/rutile composite powder catalysts samples. Comparative experiments with the commercial anatase, rutile and Degussa P 25 are provided. The variation of the pH values during the experiments is reported. The photocatalysts samples are characterized by SEM and XRD analysis. The photocatalytic destruction of Orange II was determined by spectroscopic and total organic carbon analysis. Faster and total discoloration of 20 ppm Orange II suspensions with Degussa P 25 is observed comparing the photocatalytic activity of the prepared anatase/rutile composites to the commercial catalysts. The apparent rate constants of the process generally increase with the anatase content in the composite samples. However, the total organic carbon measurements of the investigated solutions show better mineralization of the dye treated with the anatase 75 % catalyst sample.
Keywords: TiO_2 composites, heterogeneous photocatalysis, UV light, Orange II, dye mineralization

INTRODUCTION

Textile colorants are common contaminants in the aquatic ecosystems, due to their large scale production, slow biodegradation and toxic effects on human and animals [1-3]. Nowadays at least 15 % of the manufactured worldwide dyes are lost in waste waters during their production and application [4]. The most common dyes present in the textile industry are azo-dyes. In general, as the traditional techniques used for dye removal are physical methods (adsorption on activated carbon, coagulation by chemical agents, filtration, reverse osmosis, ion exchange on synthetic adsorbents, etc.) [5-8], the majority of dyes is only adsorbed and not degraded [9,10]. UV induced heterogeneous photocatalysis of TiO_2 suspensions is an advanced oxidation technology applicable for waste waters complete remediation at low concentrations of organic pollutants [11-15].The organic dye Orange II (O II) is common and very stable azo-dye [15]. In this investigation it is used as model pollutant in respect to its well known structure, suitable spectophotometric properties and low sorption level onto glassware and TiO_2 particles. The aim of this work is to investigate the process of photocatalytic purification of water solutions from Orange II under UV irradiation with prepared by us anatase/rutile composites. It is a continuation of our previous research, focused on the optimal anatase/rutile ratio [16] and the influence of the temperature and gas atmosphere during the preparation procedure [17] on the photocatalytic activity of mixed anatase and rutile powders. As the great part of the studies on the photocatalytic degradation of azo dyes relies only on the monitoring of solution decolorization, in this investigation monitoring of the pH during photocatalysis and mineralization of degraded organics is also presented.

In our previous study on anatase/rutile based powder composites [16] better results have shown the samples, prepared in air atmosphere. Here we present their photocatalytic performance compared to these of the commercial TiO_2 brands.

MATERIALS AND METHODS

The composite photocatalysts were prepared from commercial anatase and rutile supplied from KRONOS TITAN GmbH Leverkusen Germany. The initial mixture consists from precisely homogenized quatntities of the both allotropic forms, calculated in correspondance to 25, 50 and 75 wt % of anatase content in the different powder samples. Small ammounts of ethanol (a few droplets per g) were used as mixing media. All TiO_2 samples were treated thermally at 200°C in an oven for 2 h. Then the as prepared composite powders and commercial ones were characterized by Scanning Electron Microscope (SEM JEOL JSM-5510) and X-ray analysis (diffractometer Siemens D 500, CuKα source-radiation at a step of 0.05 deg for 2Θ and counting

time 2s/step). The surface area of all powder samples was determined by BET analyses, using standard BET apparatus and volumetric technique. N_2 adsorption and desorption processes were performed at 77 K. Before the N_2 adsorption the analyzed samples were completely degassed at 150 °C for 4 h.The acid azo dye Orange II ($C_{16}H_{11}N_2NaO_4S$, dye content >85 %, λ_{max} = 484 nm), used as modal contaminant in the photocatalytic experiments, was supplied from Fluka. The calibration curve of O II determined by UV-VIS Spectrophotometer Jenaway (300-1000 nm) and its stuctural formula are shown in Figure 1.

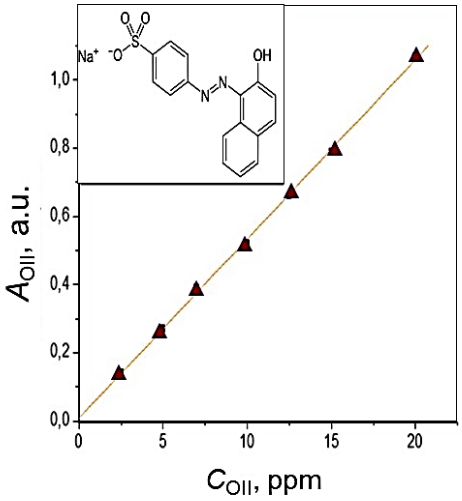


Figure1. Calibration curve and structural formula (inset) of the organic dye Orange II.

The photocatalytic tests were performed in cylindrical Pyrex glass reactor. The source of illumination was OSRAM DULUX DL18W/71 UV lamp, emitting mainly in the range of 350-400 nm. The lamp with a length of 22.5 cm and diameterof3.8 cm, is placed in a Pyrex tube axially inside the reactor. The volume of the treated dye solutions was 250 ml. The selected initial O II dye concentration was 20 ppm. The catalyst concentration in the suspensions was 0.5 g L^{-1}. The suspensions were at first stirred for 30 min in complete darkness (without any illumination) to achieve sorption-desorption equilibrium of the dye on the catalysts surface, before the photocatalytic experiments.Aliquot samples of 6 ml were taken from the treated suspensions at determined time intervals of UV irradiation. The aliquots were filtered through 0.22 μm membrane filters to remove the TiO_2 particles. The change in O II dye concentration with illumination time was monitored by UV-VIS Spectrophotometer Jenaway (300-1000 nm) at the maximum of absorbance of the dye. Comparative experiments with the commercial brands (Degussa P 25, and KRONOS anatase and rutile) were also performed.

Stirring of 350 rpm and air bubbling of 35 L h^{-1} were kept constant along the experiments. The degradation was carried out at the natural pH of the solutions and at room temperatute of 23±2°C. The change in pH of the dye solutions was observed by pH meter 211 Hanna instruments. The treated solutions were analyzed for total organic carbon (TOC) content by Shimadzu 5000A TOC analyzer.

RESULTS AND DISCUSSION

The crystalline phase of the obtained TiO_2 powder composites is identified by X-ray diffraction analysis (Figure 2). The average crystallite sizes were calculated by Scherrer's equation:

$$d_{hkl} = k.\lambda/\beta.\cos(2\theta) \quad (1)$$

where d_{hkl} is the average crystallite size (nm), λ is the wavelength of CuKα radiation (λ = 0.154056 nm), θ is the Bragg's diffraction angle, β is the full-width at half maximum intensity of the main characteristic peak (at 2θ converted to radians) and k is a constant ~0.9.

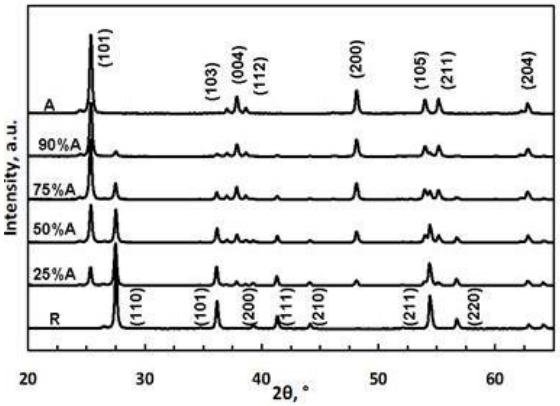


Figure 2. Comparative XRD of the prepared composites of different anatase content and KRONOS commercial brands (anatase and rutile). The TiO_2 phases are denoted as "A"for anatase and "R"for rutile.

The average crystallite size, calculated from the most intensive peaks (101) for anatase is d_{hkl} = 40.7 nm and from the main peak of (110) is d_{hkl} = 40.9 nm for rutile phase in the prepared mixed samples. The characteristic peaks for anatase and rutile in Figure 2 manifest smooth transition in their intensity in accordance with the corresponding composition of the prepared samples.The average crystallite size of Degussa P25 sample, calculated also by the Scherrer equation is 42 nm for the anatase and 56 nm for the rutile phase.The morphology of prepared composite powder is illustrated in Figure 3. The SEM micrographs of the prepared titania composites at different magnifications represent general overview of catalysts surface. The obtained powders seem homogeneous, of uniform grain size of about 0.2 μm, as the initial

commercial catalysts. The larger agglomerates (as seen in Fig. 3 d), are biult up of pellete shaped smaller and uniform TiO_2 particles.

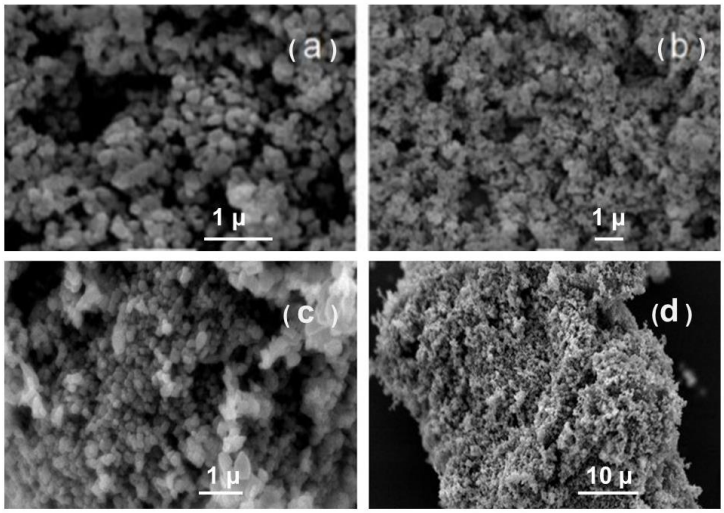


Figure 3. Scanning electron micrographs of TiO_2 composite of 50% anatase content at different magnifications: (**a**) 25000, (**b**) 10000, (**c**) 15000 and (**d**) 2000.

The determined specific surface area values according to BET analysis of mixed powder samples are found to be for anatase surface area of 35.67 $m^2.g^{-1}$ and for rutile respectively - surface area of 37.56 $m^2.g^{-1}$. The surface area of Degussa P 25 catalysts is greater than that of pure titania modiffications - 57.60 $m^2.g^{-1}$. The greater illuminated surface area plays a key role for more effective photocatalysis. The effect of this parameter will be confirmed in the photocatalytic experiments – the enlarged surface increases the total illuminated surface area, this way increasing the number of active surface sites and enhancing the photocatalytic activity of the sample Degussa P 25 (Figs. 4 and 5).Figure 4 represents the observed color change of the 20 ppm O II suspensions at the 30 minute contact with the catalysts particles without or under UV irradiation. The sorption values *D*s for the investigated catalyst after 30 minutes stirring of the slurry without any illumination, also given in Figure 4, are determined by the equation:

$$D_S\% = (A_0 - A_{EQ})/A_0 \times 100 \quad (2)$$

where A_0 is the absorbance at 484 nm of the initial O II solution and A_{EQ} is the absorbance at λ_{max} of the dye suspension after 30 minutes contact (stirring) with the catalyst particles in complete darkness.

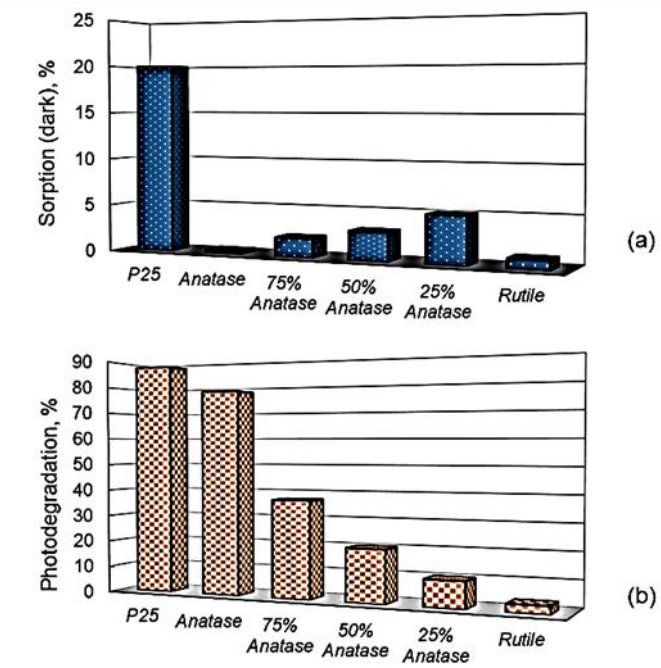


Figure 4. Sorption degree of O II onto the catalysts samples without illumination (a). Degree of photobleaching of 20 ppm O II water solution with the different titania catalysts after 30 minutes of UV irradiation (b).The best result in photodiscolorization (90%) of O II is achieved with Degussa P 25. The composite samples show regular tendency for better photobleaching of the dye solution with higher anatase content (Figs. 4 and 5). The pure anatase performance is relatively efficient and quite (80% dye degradation) comparable to that of Degussa P 25. Lowest photocalalytic efficiency is observed in case of rutile – only 3% contaminant photodegradation.

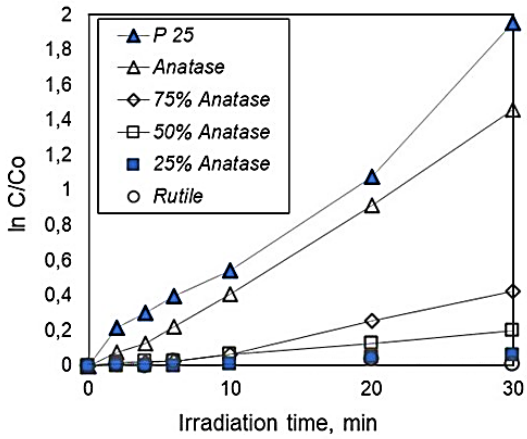


Figure 5. Kinetics of water photopurification from the pollutant OII with the different catalyst samples. The initial O II concentration is 20 ppm.The experimental data points are the average from two or three independent photocatalytic experiments in slurry.It is also seen from the data

in Figs. 4 and 5, that Degussa P 25 expresses quite different sorption ability and photocatalytic behavior, compared to the rest samples. In order to check the observed effect additional measurement and analysis were performed.The values *k* of the rate constants of O II photodegradation, shown in Figure 6, are calculated from the experimental data following the equation:

$$C = C_{in} \cdot e^{-kt} \quad (3)$$

where *C* is the concentration of the dye solution at the moment *t*, C_{in} – the initial dye concentration and *t* is the UV irradiation time in minutes.

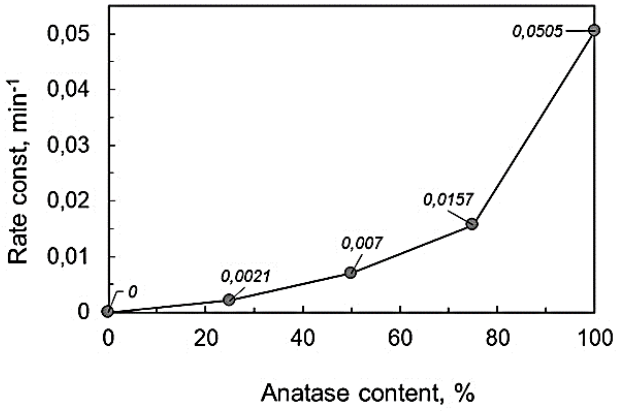


Figure 6. Rate constants of photodecolorization versus anatase content in the prepared composite powders.

As seen from the figure, the values of the rate constants for the composite powders increase with the rise of the anatase content in the sample. The rate constant of 5.58×10^{-2} min^{-1}, calculated in case of Degussa P 25 is slightly higher, compared to that of pure anatase.

The pH values of the suspensions during the catalytical experiments are plotted in Figure 7. pH is measured first for the pure 20 ppm O II solutions (corresponding to point -30 min „negative“ time before the start of UV irradiation), after the end of the sorption-desorption period without illumination (zero time) and after 30 minutes photocatalysis.As seen from the experimental data in Figure 7, two controversial trends are presented – before and after the UV irradiation. Such effect has been also observed in our previous work on photocatalytic degradation of the organic dye Malachite green hydrochloride from TiO_2 composite suspensions under UV irradiation [17]. It can be attributed to rise in pH of the initial acidic dye solution before illumination, due to the basic properties of the TiO_2 added and next decrease of the pH values with the photodegradation of the organics. The exceptions of this tendency are rutile and the anatase

75% composite. Rutile inspires slight decrease of the suspensions pH and practically has no catalytic activity. The anatase 75% sample leads to slight decrease of the pH values with time and has the best catalytic behavior from the prepared composite catalysts.

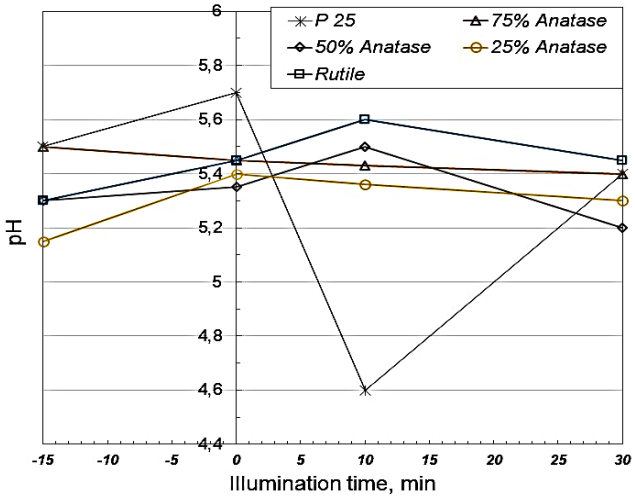


Figure 7. Time dependence of pH changes in 20 ppm O II solutions during the photocatalytic experiments with the different catalysts: commercial brands and anatse/rutile composites. The time interval -15÷0 min represents the period without illumination.

In addition to the observed trends from the results of the photocatalytic experiments, we analyzed the suspensions, treated with Degussa P 25, anatase and anatase 75% composite (the samples with the most effective catalytic performance). The results of TOC analysis are shown in Table 1.

Catalyst	**Total carbon (TC)**	**Inorganic carbon (IC)**	**Total organic carbon (TOC)**
Degussa P25	*16,85*	*0,185*	*16,67*
75% Anatase	*13,55*	*0,451*	*13,1*
Anatase	*10,89*	*0,258*	*10,63*

Table 1. TOC analysis of 20 ppm O II solution after 30 minutes of photocatalysys with the different samples

The presented data show highest value for TOC/TC for the Degussa P 25 treated solution, followed by the anatase treated, respectively. That fact leads to the assumption that Figures 4 and 5 illustrate fast discoloration of O II in case of Degussa. Moreover, this observation is in accordance to the literature data [18] reporting TiO_2 photocatalytic discoloration of O II in 50

minutes and mineralization in 4 hours under UV light. The values for IC indicate also higher presence of HCO_3^- or CO_3^{2-} ions in the treated with the composite catalyst dye solution. Taking in account the later, one can conclude that slow but best mineralization is achieved with the anatase 75% sample.The reason for the observed effect can be different pathways of O II degradation resulting in fast discoloration and slow degradation in case of Degussa P 25 and relatively slow discoloration and higher demineralization in case of the anatase 75 % catalyst.

CONCLUSION

The photocatalytic efficiency and the respective rate constants values of the process generally increase with the anatase content in the titania composite samples. Comparing the photocatalytic activity of prepared by us anatase/rutile composites we observed faster and total discoloration of 20 ppm Orange II suspensions with the rise of anatase content in the prepared photocatalysts – from 3% (rutile) to 80% dye degradation in case of anatase sample. Best performer is P 25with 90% degradation of dye contaminant. However, the TOC measurements show better mineralization of the dye treated with our anatase 75 % catalyst in comparison to that in case of Degussa P 25.

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SYNTHESIS OF ZnO, $ZnFe_2O_4$ AND ZnO/$ZnFe_2O_4$ FILMS AND INVESTIGATION OF THEIR PHOTOCATALYTIC EFFICIENCIES

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Abstract
The application of heterogeneous photocatalytic water purification processes is very popular due to its effectiveness in mineralizing the organic compounds as well as the possibility of utilizing the UV and visible-light spectrum. The photocatalytic degradation of the organic pollutants with the ZnO as photocatalyst is widely studied in the world. In this paper, various morphologies of ZnO, $ZnFe_2O_4$ and ZnO/$ZnFe_2O_4$ composite films are prepared via a two-step route including precipitation process and sol-gel method. The films are deposited on glass substrates via dip coating technique and characterized by means of Scanning Electron Microscopy, X-ray diffraction and UV-vis spectroscopy. Nanostructured ZnO thin films with different concentrations of $ZnFe_2O_4$ (0, 0.25, 0.5 and 1.0 wt%) are investigated and compared for photocatalytic degradation of Malachite Green (3, 5 and 10 ppm) under UV and visible illumination. The experimental results indicate that the combination of spinel structure with ZnO (hexagonal wurtzite) reduces the photocatalytic efficiencies (UV – D_{ZnO} = 98%, $D_{ZnO/ZnFe2O4}$ = 68% and Vis – D_{ZnO} = 86% , $D_{ZnO/ZnFe2O4}$ = 56%)
Keywords: ZnO/$ZnFe_2O_4$, thin films, photocatalytic efficiencies, sol-gel, Malachite Green

INTRODUCTION

Advanced oxidation processes are particularly attractive as a method for removing organic pollutants from water because they can destroy hazardous contaminants, not simply transfer them to another phase as do air stripping and granular activated carbon adsorption. Photocatalytic oxidation processes providing an interesting route to the destruction of toxic and hazardous pollutants in the μg/l or few mg/l range alternative to well established oxidation technologies such as ozonolysis or oxidation with H_2O_2 under UV irradiation [1,2]. Among them the ZnO/UV process is known to have many important advantages [3,4]. Ideally, the end products of these processes are carbon dioxide, water and inorganic mineral salts. Thus, the mineralization of organic compounds sensitized by semiconductor photocatalysts such as TiO_2 [5,6] or ZnO [7-10] is an area of intensive research. Zinc oxide is the most widely accepted photocatalyst for pollutant destruction in water as it is considered a very efficient catalyst that, unlike other semiconductors (wide band gap 3.2 eV), non toxic, stable to photocorrosion, low cost and suitable to work using sunlight as energy source [11]. However, for higher photocatalytic efficiency and many practical applications, it is desirable that ZnO photocatalyst should absorb not only UV but also visible light. In order to absorb visible light, band gap of ZnO has to be narrowed or split into several subgaps, which can be achieved by implanting or doping with metal ions [12-15], the coupling of zinc and the other semiconductor with visible light absorption, e.g. CdS [16], WO_3 [17], and SnO_2 [18] systems by sol–gel process, co-precipitation or simply physical mixing.Spinel zinc ferrite is a semiconductor (band gap 1.9 eV) characterized by structure with a tetrahedral A site by Zn^{2+} ions and an octahedral B site by Fe^{3+} ions [19]. $ZnFe_2O_4$ is most prominently known for its magnetic and electrical properties, gas sensing and catalytic characteristics have also been studied. However, because of the lower valence band potential and poor property in photoelectric conversion, zinc ferrite cannot be used directly in the photocatalytic destruction of toxic organic compounds [20]. $ZnFe_2O_4$ does face its share of problems, including an energetically unfavorable conduction band and surface adsorption characteristics. In contrast to ZnO, $ZnFe_2O_4$ is usually and perhaps most facilely prepared using chemical coprecipitation procedures performed under alkaline conditions followed by calcination temperatures ranging from 600-900°C [20,21], although several recent reports have suggested synthesis through sol-gel procedures [22,23] and mechanochemical methods by the mechanical alloying (MA) of ZnO and Fe_2O_3 [24].In the present work, we obtained spinel zinc ferrite by facile precipitation process without use of any templates or surfactants. The aim of this study is to make ZnO films modified with $ZnFe_2O_4$ for

photocatalysis. ZnO and ZnO/$ZnFe_2O_4$ films are deposited by sol-gel method via dip-coating technique. The photocatalytic performance for Malachite Green (MG) degradation over the $ZnFe_2O_4$, ZnO and ZnO/$ZnFe_2O_4$ nanomaterials. The photocatalytic mechanism is systematically investigated with UV and visible illumination at different initial concentration of Malachite Green (3, 5 and 10 ppm).

MATERIALS AND METHODS

Zinc acetate dehydrate (≥99.5%), 2-methoxyethanol (≥99.5%), monoethanolamine (≥99.0%) were supplied from Fluka. Malachite Green (λ_{max} = 615 nm, dye content ca. 55%) was from Sigma-Aldrich. Glass slides (76 x 26 mm), used as substrates for ZnO and ZnO/$ZnFe_2O_4$ films, were from ISO-LAB (Germany). Distilled water was used in all experiments. Ferrous(III) chloride, $FeCl_3.6H_2O$, was from Stanlab (Poland), $ZnCl_2$, NaOH and HCl were from Fluka (>99.0%). All reagents are analytically pure and used as-received without further purification.

$ZnFe_2O_4$ powders were synthesized by precipitation method as follows [25]: 300 ml NaOH was added slowly to 100 ml $ZnCl_2$ under continouns stirring. The obtained clear solution ($Na[Zn(OH)_3]$) was transferred to Fe^{3+} containing solution ($FeCl_3.6H_2O$, HCl were dissolved in 5000 ml water) and then heated at 60^{o}C for 30 min. The precipitate (black, highly lustrous, brittle pieces) was collected by filtration and washed several times under sonication with water and ethanol and then dried under vacuum at 80^{o}C for 2 h before characterization and application. Two spinel interferences of the as-prepared $ZnFe_2O_4$ powder were detected by XRD spectra. After annealing for 1 hour at 500°C, the spinel pattern becomes completely expressed.ZnO/$ZnFe_2O_4$ films were prepared by sol-gel method as follows: Zinc acetate dihydrate and zinc ferrite were dissolved in 2-methoxyethanol, followed by the addition of monoethanolamine (stabilezer) under continouns stirring to form a clear solution (Figure 1). The obtained sol was heated to 60^{o}C for 1 hour and let to age overnight. The detailed procedure for the preparation of ZnO sol-gel films is described in our previous study [26].

Different weight percentages (0, 0.25, 0.5 and 1.0) of $ZnFe_2O_4$ were incorporated into ZnO. The sol-gel films were prepared by dip coating technique. The films were deposited with 5 coatings and dried at 80^{o}C for 30 min after each successive coating. The as-prepared gel films were annealed at 500^{o}C for 1 hour. For comparison, pure zinc ferrite and zinc oxide films were also prepared with the same procedures described previously.

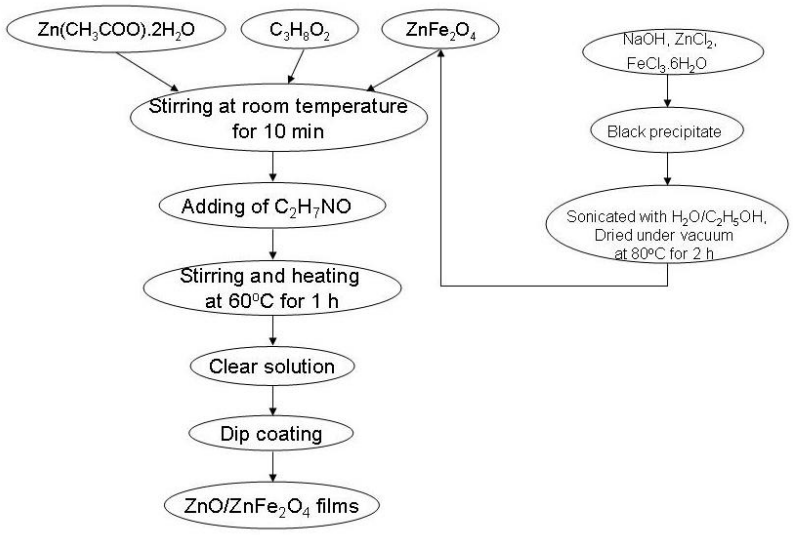


Figure 1. Schematic diagram for the preparation of ZnO, ZnO/$ZnFe_2O_4$ films.

The morphology of ZnO, $ZnFe_2O_4$ and ZnO/$ZnFe_2O_4$ were examined by Scanning Electron Microscope (JSM-5510 (JEOL) operated at 10 kV of acceleration voltage). The crystallinity of the prepared samples was determined from XRD using a powder diffractometer (Siemens D500) with CuKα radiation within 2θ range of 10-80 deg and step 0.05 deg and counting time 2 s/step).The photocatalytic activities of the sol-gel films were evaluated by the decomposition of Malachite Green under ultraviolet and visible light irradiation in an aqueous solution. The initial concentration of MG was 3, 5 and 10 ppm.

The photocatalytic experiment was carried out in a 150 mL glass reactor supplied with magnetic stirred and covered with a UV-lamp (maximum emission at 370 nm) or visible lamp (TUNGSRAM lamp 500 W, maximum emission at about 700 nm). The lamp was fixed at 15 cm above the treated solution. The mineralization process of MG was monitored by UV-vis absorbance spectroscopy (Jenway 6400) in wavelength range from 400 to 800 nm. All photocatalytic tests were performed at a constant stirring rate of 500 rpm at room temperature (23±2°C). The effect of initial concentration of MG (3, 5 and 10 ppm) was investigated with catalyst films.Photocatalytic efficiency of the catalysts was calculated by using following equation:

$$D = \left[\frac{C_0 - C_i}{C_0}\right] \times 100 \quad (1)$$

where C_0 is the initial concentration of dye and C_i is the concentration of dye after irradiation at selected time interval, t (min).

RESULTS

X-ray diffraction analysis is conducted for the determination of crystal structure and phase purity of the produced samples. The XRD pattern of ZnO, $ZnFe_2O_4$ and $ZnO/ZnFe_2O_4$ nanostructures are illustrated in Figure 2.All of the peaks of the pattern can be readily indexed to cubic $ZnFe_2O_4$ (Figure 2. c) with spinel structure (JCPDS No. 22-1012), where the diffraction peaks at 2θ values of 30.1°, 35.3°, 42.6°, 52.9°, 56.7° and 62.2° can be ascribed to the reflection of (220), (311), (400), (422), (511) and (440) planes of the spinel $ZnFe_2O_4$, respectively. The crystal plane of pure ZnO (JCPDS No. 36-1452, Figure 2. a) showed three intense diffraction peaks at 2θ = 31.6°, 34.2°, 36.1°, 47.3°, 56.4° and 62.5° which corresponds to the (100), (002), (101), (102), (110) and (103), which is responsible for the hexagonal wurtzite structure. The results indicate that the samples consist of pure phase and no characteristic peaks were observed for other impurities. The narrow width of the peaks confirms that both samples are of high purity and good crystallinity.

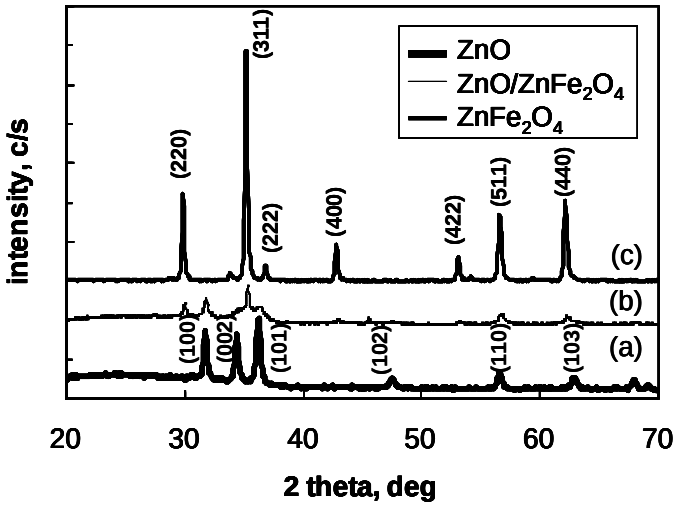


Figure 2. XRD patterns for films of **a.** pure zinc oxide, **b.** zinc oxide/zinc ferrite and **c.** zinc ferrite annealed at 500°C for 1 h.In case of $ZnO/ZnFe_2O_4$ nanocomposites (Figure 2. b), all diffraction peaks correspond to hexagonal phase of zinc oxide and crystal plane of spinel zinc ferrite (peaks at 2θ = 35.3° and 62.2° represented (311) and (440) planes). The presence of a diffraction peak (311) and the low intensity of the three characteristic peaks (100, 002 and 101) in the crystal lattice of $ZnO/ZnFe_2O_4$ - confirms that ZnO is modified with zinc ferrite.

The morphology and structure of the obtained samples are determined by SEM (Figure 3). The surface of $ZnFe_2O_4$ film consists of fine granules with particles of various size and shapes (Figure 3. a). The smooth surface is the reason for the their lowest photocatalytic activity.

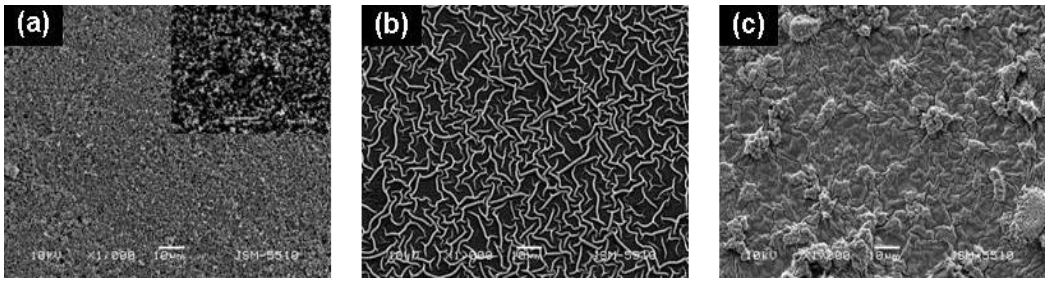


Figure 3. SEM images of thin films surface: pure **a.** $ZnFe_2O_4$, **b.** ZnO and **c.** ZnO/1 wt% $ZnFe_2O_4$.Figure 3.b shows the surface of ZnO film, which is homogeneous and much more developed. There are different ganglia like hills with a typical width of about 1 μm, length from 5 μm to 15 μm and a height of 2-3μm. A similar structure is observed on the surface of zinc ferrite, but this time it is not so pronounced (Figure 3 .c). Coating zinc ferrite over zinc oxide reduces the photcatalytic efficiency of the sample. The photocatalytic tests under UV and visible with such films showed lower photocatalytic activity in comparison with pure ZnO.

DISCUSSION

The possible mechanism for the MG photodegradation over $ZnFe_2O_4$, ZnO and ZnO/$ZnFe_2O_4$ films can be proposed, as illustrated by Figure 4.

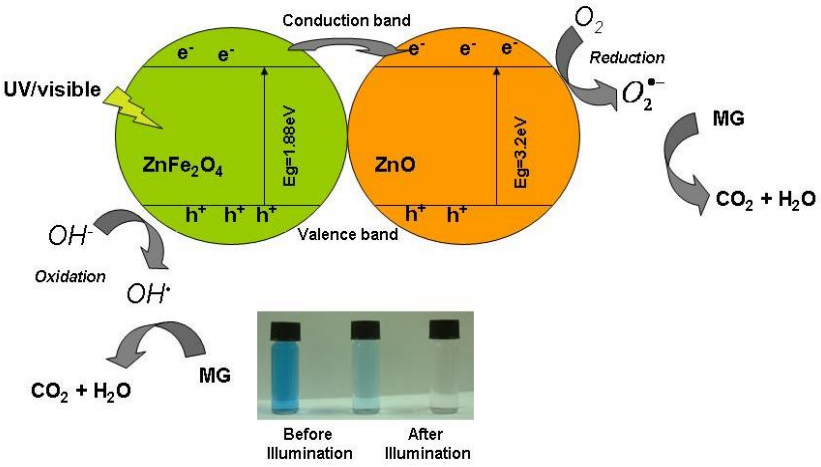


Figure 4. Suggested mechanism of the photocatalytic degradation of MG with $ZnFe_2O_4$, ZnO and ZnO/$ZnFe_2O_4$ films.When the energy of illuminate is greater than the photoabsorption threshold value of photocatalyst, the photogenerated electron–hole pairs will be produced in photocatalyst. Then electrons in the valence band (VB) can be excited to the conduction band (CB) and simultaneously the same amount of holes are generated in the VB. The photoinduced holes directly react with MG or interact with surface-bound H_2O or OH^- to produce the $OH^{\bullet}$ radical species which is an extremely strong oxidant for the mineralization of MG. Meanwhile, the electrons formed can react with the adsorbed molecular oxygen to yield $O_2^{\bullet-}$. The generated

$O_2^{\bullet-}$ then further combine with H^+ to produce $HO_2^{\bullet}$, which can react with the trapped electrons to generate OH^- radicals. All the reactive species can effectively decompose the organic dye of MG to final harmless degradation products. Based on the above analysis, the photocatalytic reaction can be expressed as follows:

$$ZnFe_2O_4 + h\nu \rightarrow ZnFe_2O_4(e_{cb}^- + h_{vb}^+) \quad (2)$$

$$ZnO + h\nu \rightarrow ZnO(e_{cb}^-) \quad (3)$$

$$ZnO(e_{cb}^-) + O_2 \rightarrow O_2^{\bullet-} \quad (4)$$

$$O_2^{\bullet-} + H^+ \rightarrow HO_2^{\bullet} \quad (5)$$

$$ZnFe_2O_4(h_{vb}^+) + OH^- \rightarrow ZnFe_2O_4 + OH^{\bullet} \quad (6)$$

$$h_{vb}^+ + H_2O_{ads} \rightarrow {}^{\bullet}OH_{ads} + H^+ \quad (7)$$

$$h_{vb}^+ + OH_{ads}^- \rightarrow {}^{\bullet}OH_{ads} \quad (8)$$

$$OH^{\bullet}, HO_2^{\bullet}, O_2^{\bullet-} + MG \rightarrow \text{degradation products} \quad (9)$$

Upon light illuimination, the photogenerated electrons from CB of zinc ferrite are transferred to the CB of zinc oxide, oppositely, the photogenerated holes lefted in the VB of $ZnFe_2O_4$. The photogenerated electrons and holes can be effectively separated. The photogenerated electrons transferring into the CB of ZnO and holes left in the VB of $ZnFe_2O_4$ can be captured by water-dissolved O_2 and OH groups to form $O_2^{\bullet-}$ and $OH^{\bullet}$, which can effectively decompose MG to final harmless small molecules.To evaluate the photocatalytic efficiencies of ZnO/$ZnFe_2O_4$ photocatalyst under UV and visible light illumination, MG is employed as a model organic pollutant. As contrast, the activity of pure $ZnFe_2O_4$ and ZnO photocatalysts are also carried out at the same conditions. Two effects in photocatalytic experiments are studied – initial dye concentration (3, 5 and 10 ppm) and irradiation conditions (UV and visible).Figure 5 shows the change in concentration (C/C_0) of the dye as a function of reaction time in the presence of $ZnFe_2O_4$ with different weight percentage in the starting ZnO material under UV and visible light irradiation. The pure ZnO films have the highest photocatalytic activity and quickly decomposed MG. The degradation of MG with $ZnFe_2O_4$ modified ZnO catalysts exhibit higher photocatalytic activity, compared with that of zinc ferrite. Increasing the weight percentage of zinc ferrite in ZnO thus reduces the photocatalytic activity and the degradation rate of the dye. The photocatalytic efficiencies of the pure $ZnFe_2O_4$ film is negligible.

The possible reason for the lower photocatalytic efficiency of ZnO/$ZnFe_2O_4$ film is the difference in energy levels of the coupled semiconductor systems ($ZnFe_2O_4$ with the narrow band gap – 1.92 eV and ZnO with the wide band gap – 3.2 eV). This difference plays an important role for achieving charge separation. In the modified ZnO film, the photogenerated electrons can be transferred from $ZnFe_2O_4$ to the conduction band of ZnO, while holes occur in the valence band of zinc ferrite. Therefore, the primary charge separation in this electron transfer is efficient, thus improving the photocatalytic properties of zinc oxide to degrade MG in the presence of ultraviolet and visible light.

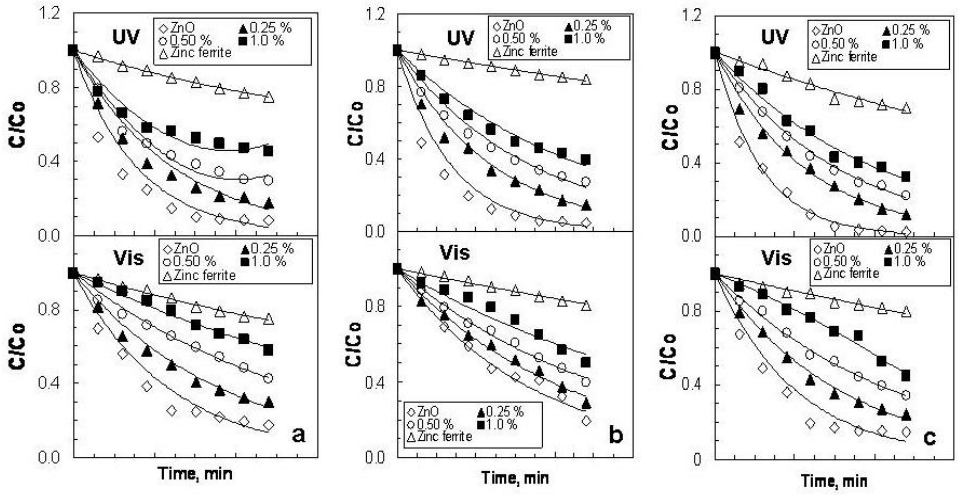


Figure 5. Degradation of Malachite Green with different photocatalysts under UV-light and visible. The initial dye concentration is **a.** 3 ppm, **b.** 5 ppm and **c.** 10 ppm.

These experimental results are confirmed by the rate constants and degree of degradation of the dye. The kinetic process of photocatalysis is described by pseudo-first order reaction equation:

$$\ln(C/C_0) = -kt \qquad (10)$$

where C_0 is the initial concentration of dye, C is the concentration of dye after irradiation in selected time interval, t and k is the rate constant, which has a positive correlation with the photocatalytic activity. The fitting results (rate constants, k) and dye degradation rates (D%) of photocatalytic process and are shown in Table 1. Experimental results show that the ZnO has the highest rate constant (k_{UV} = 0.0171 min^{-1}, k_{vis} = 0.0098 min^{-1}) and fastest degradation the dye (D_{UV} = 97.76%, Dvis = 85.35%), which indicates that the pure ZnO films has the best photocatalytic activity.

Samples	**Rate constants, *k* (min^{-1})**		**Degree of degradation, *D* (%)**	
	UV	**Visible**	**UV**	**Visible**
Pure $ZnFe_2O_4$	0.0016	0.001	29.98	20.02
$ZnO/ZnFe_2O_4$(0.25wt%)	0.0049	0.0028	67.95	55.26
$ZnO/ZnFe_2O_4$(0.50wt%)	0.0035	0.0016	54.37	38.45
$ZnO/ZnFe_2O_4$(1.0wt%)	0.0021	0.0013	41.26	26.58
Pure ZnO	0.0171	0.0098	97.76	85.35

Table 1. The rate constants and degree of degradation of MG. The initial concentration of the dye is 10 ppm.The degradation rate of MG, catalyzed by $ZnO/ZnFe_2O_4$ decreases with increasing $ZnFe_2O_4$, and ZnO films modified with 1.0 wt% $ZnFe_2O_4$ content show the lowest degree of the degradation. While the $ZnFe_2O_4$ content exceeds 0.25 wt%, the catalytic activity of the $ZnO/ZnFe_2O_4$ samples decreases. The photocatalytic efficiency of these catalysts is ranked in an order from the highest to the lowest: ZnO > $ZnO/ZnFe_2O_4$ (0.25wt%) > $ZnO/ZnFe_2O_4$(0.50 wt%) > $ZnO/ZnFe_2O_4$(1 wt%) > $ZnFe_2O_4$.

CONCLUSION

In this study, we investigated photocatalytic degradation of Malachite Green using synthesised $ZnFe_2O_4$, ZnO and ZnO modified with different concentration of ZnFe2O4 (0.25, 0.50 and 1.0 wt%) photocatalysts via chemical precipitation and sol-gel method. The X-Ray diffraction of the pure ZnO catalyst showed its well-crystalline hexagonal wurtzite structure and those of the pure $ZnFe_2O_4$ – spinel strucutre. In addition, the scanning electron microscopy images revealed the surface morphology of the $ZnFe_2O_4$, ZnO and ZnO/Fe_2O_4 films. The photocatalytic results show that the pure ZnO films has highest photocatalytic eficiencies in comparion with those modified with zinc ferrite.

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WALKS IN THE PERSONAL OPINIONS AND FICTIONAL WORKS OF VIRGINIA WOOLF AND GRAHAM SWIFT

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Abstract
The purpose of the present paper is to look at similarities in vision expressed by Virginia Woolf and Graham Swift with respect to the way they feel about walks, whether in nature or in London, in the center of the city or, in the case of Swift especially, in the suburban areas. Swift claims that after taking a walk in the park, he feels that his mind is refreshed and that he can write efficiently. Woolf also mentioned the refreshing effect of walks in the countryside, for her writing, as well as for her psychological well-being. Woolf has been diagnosed by research to have had bipolar disorder, as this would explain her moments of depression. We can find in the works of fiction of both authors moments when the characters feel very well in nature, whether in parks in the city or in the countryside, to the point where they experience moments of revelation, and where they feel that they are one with their surroundings. Additionally, the same refreshing and beneficial effect is noticed by both author with respect to walking in the city. Both of them live in London or, in Swift's case, in its suburban areas. The city is experienced as generating lots of energy and vitality, both for the authors personally and for their characters. As an example, Mrs Dalloway in the novel with the same title by Woolf feels extremely good and full of energy when she walks in the streets of London while going to buy flowers for the party she is preparing to host. We can connect fiction with reality, and claim that it makes reference to the intuitively noticed aspect of human psychology of feeling benefits from taking walks. Nowadays, popular psychology articles write about the beneficial effects of us taking walks and connecting with nature. This aspect is universal across cultures, as we can find the practice of meditation in nature in traditional Japanese culture, and also the practice of forest bathing, or shinrin-yoku, which refers to connecting with nature and meditating while walking in the forest. The European Union health policies raise awareness to the benefits of green spaces in big cities and of physical activity prompted by walking.
Keywords: environmental psychology, moments of revelation, popular psychology, health policies.

INTRODUCTION

Walks in parks, in the countryside, in the suburbs of London, or in the centre of the city of London are common elements both in the personal lives and in the fictional works of writers Virginia Woolf and Graham Swift. For the authors, as well as for the characters, these walks feel beneficial, since they are enjoyed, and they experience the vitality of the surroundings, to the point where they can feel no separation from their environment. The feelings of merging with nature, of not feeling separate from it is a spiritual practice, which is transferred in the case of Woolf's and Swift's works to the setting of the city, where the characters feel so comfortable. The states of psychological and physical well-being which appear during and right after taking a walk go hand in hand. One influences the other. We can start from the evidence given by the way that Swift and Woolf claim that they feel so well and inspired for their works after taking walks and to continue asking ourselves the question: "Why?" Based on these observations, which reflect common experiences, we can find out, by looking at scientific research present in popular science articles, that taking walks increases our blood flow, as well as oxygen transporation in our bodies to all organs, including our brain (Jabr, 2014). The result is that our thinking capacity increases, together with our potential for writing and creative activities. In turn, this influences our capacity for creativity in any type of work we have to do. In the examples dealt with in this paper, we have the confessions of two writers whose intent is to be able to create after these walks. Overall, taking walks can make us all feel good. Virginia Woolf and Graham Swift can describe experiences with taking walks which can be extremely relatable, yet, as writers, they have the gift to describe the experiences in words which maybe we cannot find at the moment. Once we have lived the experience of enjoying taking walks, we can easily relate to Woolf and Swift's writings, and find our own experience put into words by these two authors. What draws these two authors close for justifying the comparison is the way they enjoy taking walks both personally and the way they describe these walks in their fictional works, attributing, likely, what they have experienced themselves to their own characters. Readers may find, by connecting both autobiographical and fictional works, the experiences described as being completely authentic and honest, not just the work of make-believe and imagination. Readers may often wonder once they read very convincing experiences in fictional works if the authors have truly lived such experiences themselves, and then the experience is all the more convincing if the answer is yes. Another aspect which connects the two writers, Woolf and Swift, is their writing style, based on the stream of consciousness, on poetic style, and, overall, on the interior world of the characters. The action in their novels relies less on suspense, if at

all in some cases, and more on the way the various experiences are lived, at emotional and reflective level. The characters go through all the experiences and phases in life we all go, through issues regarding their relationships with the other characters as well as with themselves, as well as through various experiences of loss of dear ones, with the need for imagination and to feel loved, with isolation, with finding the joy in being able to feel connected again with the persons dear to them. Taking walks are natural parts of our everyday lives, yet for the characters in a fictional world these moments need not be present, just like any other activities we do on a daily basis, e.g. shopping, taking a bath, combing our hair, dressing up, and so on. The fact that taking walks is mentioned in Woolf's and Swift's fictional worlds shows that this practice is significant for some reason.

MATERIALS AND METHODS

Environmental psychology (Steg & DeGroot, eds., 2019) deals with the way we react emotionally to our surroundings. We are never neutral to what surrounds us, even though, at some point, we feel that we are no longer paying attention to places that we know and where we go on our way of our daily routine. As an example, we may no longer pay attention to the road to and back from work. Even so, the changes in the seasons can draw our attention to our environment. Some cultures are portrayed through their practices as more concerned with nature than others. As an example, the Japanese culture includes, through the religions of Shintoism (Ashinova et al, 2019) and Buddhism (Nagatomo, 2006; Suzuki, 1991), the element of nature in the very practice of workship. Shintoism believes there are good spirits everywhere around us in nature, called kami. This belief definitely emphasizes the ense of well-being in nature for human beings. According to Zen Buddhist belief, the life cycle of nature can be understood in parallel with our own human lives. We grow old just as the seasons in nature succeed one another, starting from sprin, symbolizing childhood, going on with summer, symbolizing adulthood, then with autumn, showing mature age and ending with winter, symbolizing old age. The changes nature goes through are occasions of us to reflect on the ephemeral nature of things in our lives. The cherry blossoms are symbols of Japanese culture members' understanding of the ephemerality of the beauty of the cherry blossoms which should be enjoyed while it lasts. Everything in our lives is going to be lost in a similar way. The Japanese culture members have their temples situated in the middle of nature, and they also meditate in a natural setting. Buddhist gardens are places where those willing to meditate but still continue with their usual everyday life routine and not retreating into solitude and into the lives of monks can take their time to reflect and afterwards return to their usual lives in the city.

Parks offer the opportunity for Japanese Zen Buddhist gardens. While the Japanese culture has precise habits and rituals, as well as various practices related to being in nature and which also imply walking, not all cultures in the world have them. Instead, the members of these cultures do take walks, without having formed ritualized practices around them. This state of affair proves, all the more, the universality of the well-being we all experience while walking in nature. In the meantime, walking has been extended, as a way of adapting it to our modern lives, to walking in the urban setting. While both nature and urban setting can be found together, as parks and gardens, together with green spaces can be found everywhere we live nowadays, we can also see how separate practices related only to nature can be found. The Japanese culture includes the practice of shinrin-yoku, which has been translated as forest bathing, and which includes walking in the forest, and focusing on the immediate sensations as we do breathing exercises, include the various smells of the forest and its fresh air. While breathing in the forest, we can also inhale those oils which are meant to draw away bacteria from the plants, and which have the effect of raising the immunity for human beings. We can find ourselves through the practice of shinrin-yoku experiencing relaxed states of mind, and feeling very well after such walks.The Japanese culture members have created a ritualized dimension around shinrin-yoku as well, yet walking in the forest can have the same benefits as a pass-time activity for other culture members as well and without practicing shinrin-yoku specificially. When there is vacation time, we generally feel the need to take a break from our usual environment, and change it, in order to experience new realities. We can go to the countryside, to the mountains, seaside, or to other cities. Walking, while on vacation, becomes our main pass-time activity since we are definitely going to explore our new environment. Sight-seeing is one of the main preoccupations while we go on vacation, yet it can also be practiced while in our own area. We may not practice walking to see new things in our city, yet there can be changes at some points in the way it looks, there can be events organized by the city hall, and, of course, the change of seasons can bring significant changes to the way the city, the parks and nature in general can look. Our state of mind can be further on improved by taking walks. Graham Swift confesses about enjoying taking walks anytime. He also mentions that, on the one hand, walking can allow him to reflect, or, on the contrary, to take a break from thinking: “Half a dozen times a year, at least – in all weathers. One of the great things about walking is that you can think while you walk or, of course, you can totally switch your mind off and just go along. I love being on my own two feet and steering myself” (Beckerman, 2014).

Swift would definitely gather his inspiration for his writing from walking, once he would go about his area. Woolf would believe that a walk through the city could bring her inspiration: "London itself perpetually attracts, stimulates, gives me a play and a story and a poem, without any trouble save that of moving my legs through the streets" (Bell, ed., 1982). We could claim that walking and thinking can be regarded comparatively. They both involve explorations of various kinds, external and internal. In the meantime, the works of both authors include characters walking in the city or in nature and, in the process, reflecting on their lives, both past and presents. Such examples include the novel *Mrs Dalloway* by Virginia Woolf, where the title characters is walking energetically through the city of London and thinking about various episodes in her youth. In the novel *The Light of Day by* Graham Swift, George Webb, the detective, think about his past and present life while walking through the suburbs of London. The characters are exploring their past while externally exploring the streets of the city and suburbs. Both novels also involve moments when Septimus Warren Smith in Woolf's novel and the husband of Sarah, whom George tries to help, experience moments of feeling one with nature, to the point where there is no separation between them and their surroundings (Drobot, 2014). These can be called moments of being, as Woolf (1976) called them, or of enlightenment, or revelation, when we experience reality in a very intense way and we feel extremely aware of the present moment. In the essay *Street Haunting* by Virginia Woolf, the narrator imagines various stories based on what he or she sees around while on an evening walk through London (Bowlby, 2012). This essay can be seen in direct relationship with the way both Woolf and Swift find their inspiration for their writing while taking walks. While focusing on their concerns as writers when taking walks, as well as on combining walking with thinking and analysis various issues which preoccupy the characters with respect to their past, Woolf and Swift show how we can use walking as a means of refreshing. We can feel refreshed once we take a break from our work and from our thinking and, at the same time, we can feel more enrergetic and our mind can think more clearly once we have taken or are taking a walk. The moments of enlightenment characters have while taking their walks come from their clearer judgment while taking their walks. They become more connected with their present concerns. The process of reflecting while walking does not mean they are not enjoying their walks. They can feel connected here and now while walking, while they can take a clearer look at the past and at its relationship with the present. Mindfulness teaches us to be present here and now, and reflecting on the past, as characters do, as well as on the future, as the writers do, thinking about what they could write next when they get home can seem to contradict our presence here and

now. Still, reflecting on the past and future both have in common our present concerns and preoccupations. We can see walks, in the case of Woolf, Swift, and their fictional characters, as means of meditation about their present concerns.

RESULTS

Taking walks can be seen as occasions for meditating on what we are preoccupied with at present, even if these preoccupations will extend to the past, as we can find in the past the root cause for our present-day crisis, and to the future, as we can use, as writers, the present material for our future works.

The present, past and future are definitely not separate from one another. At some point, they intersect and influence one another. We cannot just cut ties with the past and future and live completely in the present. What matters is to be aware of what is significant, and to select those important moments, as we do when we write fiction. Fiction writing involves a selection of interesting and relevant moments. Nothing that is presented or focused on in a work of fiction is random. It is not just a matter of not boring the audience, but also a matter of tying in a coherent story.

Self-analysis of the characters and the reflections of the writers while taking walks can be compared to the meditation practices present in Japanese culture. These practices have in common the element of increased awareness.

DISCUSSION

We are constantly reminded nowadays through popular science articles about the physical and psychological well-being which comes from having a bit of physical activity. Outings and occasions for various activities created by city halls in big cities, such as moments when some portions of boulevards are available for pedestrians, and closed to cars, with various street shows, and activities fr children and adults organized in parks can all be included under the health policies category promoted by various supranational organizations such as the European Union. The topic is, thus, one of actual concern. Reading fiction and writer's autobiographical writings, diary entries and essays can help promote this part of present-day ideology related to health. The concern raised for the environmental care goes hand in hand with citizens' health, since a poluted environment can be harmful to humans' health as well. Caring for natural spots, parks and green areas in large cities is currently a common practice all over the world. This practice ensures we have the right environment for taking walks beneficial to our health. Walking is a practice which can come in handy to anyone of us. We do not need to practice sports, to have expensive training, to go to a sports hall and pay for the training. We do not need

to learn how to ride a bicycle if we cannot. Walking is not even taking too much effort, as it can come naturally to us all. The benefits are clear, and it can even be a very pleasant activity. Virginia Woolf and Graham Swift's writings, both fictional and autobiographical, can help promote the healthy, beneficial practice of walking for anyone of us today. We tend to be inspired in the way we live our lifestyle through fiction and autobiographical writings. Writers of fiction such as Virginia Woolf and Graham Swift are personally convinced of the benefits they can get from taking walks in the city, as well as in nature. This is a practice accessible to us all. Life in the big city can mean long hours of waiting in the traffic, while driving our own car or while going by common means of transport, as well as an overall sedentary lifestyle since we spend, function of our jobs, a lot of time in the office, sitting, not moving frequently around, and the same can be said about working from home, in front of our laptops. Our possibilities for entertainment nowadays, with the Internet, and home cinema can also diminish our outings as we can have everything in our own homes, readily accessible. We can download a film, or watch it online, we can even have food delivered at our door and not even need to go shopping. Once the weather is not very good, we may not feel like going out at all, as it is well-known that the weather conditions can influence our mood. Once spring arrives and it is a beautiful day, we can notice how we can feel energized and willing to take walks. The same holds true for beautiful summer days. We can, nowadays, notice such practices in big cities. Activities in parks are organized, including workshops and activities for children, fairs with various products, ranging from healthy foods to handmade jewelry, bikes and electric scooters are available for rent, and so on. Additionally, in parks and in the city streets the cafes open up and provide the opportunity to sit in enclosed, backyard areas in old houses' gardens, in passageways, as well as in the streets to watch the busy city life or the beautiful architecture of the nearby buildings.

CONCLUSIONS

The wrtings by Virginia Woolf and Graham Swift can be used to offer an example of emotional connection with readers feeling the same about taking walks, or simply willing to try out the experience more often than usual. While Woolf and Swift write about their own and their fictional characters' walks in the city of London and in the London suburbs and parks, such experiences can be relatable when applied to any other city in the world. Big cities can be, to some extent, alike in that they offer us so much variety of experiences. They can be busy streets, with shops and parks, they can offer us a sense of freedom and anonimity, as well as, at the same time, of emotional connection with the crowds. We tend to project our mood on our

surroundings, and we also have our mood influenced by the surroundings. The big city streets, with their fast pace of life, can suggest not only a sense of being busy and feeling stressed, but also a sense of fast pace rhythm, and plenty of energy. Once we start walking in the same rhythm as the others, we can feel that we start sharing the same fast pace rhythm to our thinking and capacity for taking care of many thing we need to do. We can become more efficient at everything we do. Our state of mind is influenced by the fast pace of others in the city streets the same way it is influenced by the fast pace of music. Once we are already in a good mood, we can further improve our mood by taking walks and feeling energized. Psychological and physiological well-being go hand in hand, as a better circulation of blood in our bodies can further on contribute to our feeling full of energy and increased efficiency in what we do afterwards. Woolf and Swift can be seen as communicating, through autobiographical writings and interviews, as well as through their fictional works, the experience of the benefits of taking walks. These descriptions of taking walks can be seen as sharing pleasant experiences, confessing, as well as advising us readers in a friendly way to take walks, or to recommend them to us, precisely since they can bring such states of well-being. Since the author experience these walks themselves, their recommendations are all the more believable and they can be seen as trustworthy, persuasive sources of information about walks. When we are recommended a certain activity, it seems that we need someone's example. Woolf's and Swift's works could be regarded as being able to teach us beneficial habits, to set up examples to follow, and they can be seen as role models for us all. We can imagine them giving to us readers a friendly advice regarding taking walks. Particular examples of real-life authors and fictional characters can have a larger impact through the better emotional connection than being told through various informative means, raising awareness campaigns and reading purely objective, scientific information about the benefits of taking walks. We can see how fiction and the personal experience of these two authors can resonate with us personally today, as well as with the values and lifestyle promoted for us through health policies of supranational organizations such as the European Union. Once we realize the universality of the experience, we can be all the more convinced that it is beneficial for us personally as well, and that it is not just a simple trend regarding the way we pass our free time. It is a practice that they do not just promote at ideological level, but one that they practice themselves. Ideology is nowadays present in the way our lifestyle is guided by supranational institutions such as the European Union through health policies and illustrated through popular science articles and other cultural products. Woolf's and Swift's writings show how they can overlap with our values today and with healthy

practices that we share with them. At the same time, for these two authors taking walks as a healthy practice overlaps with this practice being a hobby.

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AYNI DİLDEKİ İKİ DİLDEKİ ÜNLÜLER KARŞILAŞTIRMALI ÇALIŞMADA AİLE

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Özet
İki ve ikiden fazla dilin biçimbilgisel yapısında ve leksikolojik anlamında ortak özelliklerinin gözlemlenmesi söz konusu dillerin çoğunlukla jeneolojik açıdan akraba diller olduğunu ve kendilerinin bir ortak kaynaktan, "kök dil" adlandırabileceğimiz bir ortak dilden türendiğini kanıtlar. Araştırmamızın konusu Hint-Avrupa dilleri ailesinin İran dilleri öbeğine ait olan Farsça ve Peştu dillerinin ünsüz sesleridir. Çok eski tarihe sahip Farsça Doğu`da oldukça büyük alanda yaygınlaşmış , klâsik eserlerin yazıldığı Hint-Avrupa dil ailesinin İran dilleri öbeğine aittir. Söz konusu dil İran İslam Cumhuriyetinin resmi devlet dilidir. Hint-Avrupa dillerinin İran dilleri öbeğine ait olan Peştu dili Peştunların ana dili olarak genellikle bütün Güney və Güneydoğu Afganistan`da, Kuzey Batı ve Batı Pakistan`da yaygınlaşmıştır. Darice ile beraber Afganistan`da resmi devlet dili olarak bilinir. Her iki dile yazıda Arap alfabesini kullanmakla Arap alfabesinin mevcut bulanan harflerine, dillerine uygun çeşitli harfler, , diakritik işaretler eklenilmiştir. Farslar Arap alfabesine 4 grafik örnek , Peştunlar ise 18 grafik örnek ekleyerek telâffuzlarına uygun olarak alfabelerini geliştirmişler. Peştu ve Farsça dilleri aynı dil grubuna ait olmalarına rağmen ünsüz ve ünlü seslerinin sayılarına göre birbirlerinden esaslı olarak farklıdırlar. Farsçada 23 ünsüz , 6 monoftong ünlü ve 1 diftong bulanmasına karşın Peştucada 30 ünsüz, 9 ünlü, 7 monoftong ünlü ses bulunmaktadır. Sonuçta Farsçada harf sayısının 30 şema örneği şeklinde belirlenmesine rağmen Peştucada harf sayısı toplam olarak 46`dır. Peştu dilinde harf sayısının çoğunluk oluşturması Peştunların telâffuzunda monoftong, diftongların sayıca yeğlik oluşturması ,aynı zamanda ünlü ve ünsüzlerin birçoğunun burun sesleri özelliklerini alabilmesi *(ing.: nasal vowel; nasal consonant)* ve söz konusu dildeki özel ünsüzlerin bulunmasının sonucudur.
Anahtar Kelimeler: Hint-Avrupa dilleri ailesi, İran dilleri, Peştu dili, ünlü sesler, ünsüz sesler.

CONSONANTS IN TWO LANGUAGES OF THE SAME LANGUAGE FAMILY WITHIN COMPARATIVE STUDY

Abstarct
If two or more languages have common features in their grammatical structure and lexical composition, these languages are genetically related languages and they are descended from one common source, conventionally called the “root language”. The object of our research is the consonant sounds of the Persian and Pashto languages belonging to the Iranian group of the Indo-European language family.Widespread in the East with classical works written on it the Persian language which has an ancient history, belongs to the Iranian group of the Indo-European language family. This language is the official state language of the Islamic Republic of Iran.The Pashto language, which belongs to the Iranian group of Indo-European languages, as the mother tongue of the Pashtuns, is mainly spread throughout southern and southeastern Afghanistan, as well as in northwestern and western Pakistan. It is the official state language in Afghanistan along with Dari language. By using the Arabic alphabet in writing, both languages have added different letters and diacritical marks to the existing letters of the Arabic alphabet. The Persians added 4 graphic samples to the Arabic alphabet: the Pashtuns added 18 and improved their alphabet according to their pronunciation.Although Pashto and Persian belong to the same language group, they differ significantly in terms of the number of consonants and vowels. In Persian there are 23 consonants, 6 monophthong vowels and 1 diphthong; while Pashto has 30 consonants, 9 vowels and 7 monophthong vowel sounds. Thus, if the letters of the Persian language are identified in the form of only 30 graphic patterns, the total number of letters in the Pashto language is 46. This happens mainly due to the presence of many monophthongs and diphthongs in Pashtun pronunciation, as well as the nasalization of many vowels and consonants (nasal vowel; nasal consonant) and the presence of special consonants of this language.
Keywords: Indo-European language group, Iranian languages, Pashto language, vowel sounds, consonant sounds.

Giriş: Araşdırma obyektimiz Hind-Avropa dilləri ailəsinin İran qrupuna aid fars və puştu dillərinin samit səsləridir. Samitlər ingilis dilində - /*consonants/;* rus dilində -/*согласные/;* fars dilində -/*həmxanha/;* puştu dilində - /*samet/*adlanır. "Ümumi şəkildə danışıq cihazında mərkəzləşməsi ilə səciyyələnən, saitlə yanaşı gəldikdə heca nüvəsi əmələ gətirməyən səslərə deyilir"[4, s.183]Danışıq aktının üzvlənməsi zamanı ciyərlərdən səs tellərinə daxil olan hava cərəyanı xaric olarkən öz yolunda müxtəlif maneələrə rast gəlir. Bu maneələr isə danışıq cihazının müxtəlif üzvləri vasitəsilə yaradılır. Bunun nəticəsində ciyərlərdən gələn hava cərəyanı bu orqanlarda maneələrə təsadüf etdikcə və onları dəf etdikcə öz əvvəlki gücünü nəzərə çarpacaq dərəcədə azaldır. Bu zaman hava cərəyanı səs tellərindən başlayaraq, keçdiyi yolda ayrı-ayrı danışıq üzvlərinin bir-birinə yaxınlaşması, dar keçidin yaradılması, sədd yaradılması, yaxud böyük bir maneənin olmaması nəticəsində müxtəlif dillərin müxtəlif samitlərini əmələ gətirir.

Əsas araşdırma: Hind-Avropa dillərinin İran dilləri qrupuna mənsub olan puştu dili puştunların ana dili kimi əsasən bütün cənub və cənub-şərqi Əfqanıstanda, şimal-qərbi və qərbi Pakistanda yayılmışdır. Dari dili ilə birlikdə Əfqanıstanda rəsmi dövlət dilidir. Leksik fonduna hind, fars, ərəb, türk, monqol, Avropa dillərindən külli miqdarda söz və tərkiblər daxil olmuşdur. "Çoxsaylı ləhcə və şivələri əsasən iki dialektdə birləşir: şərqi və ya pişəvər-Cəlalabad və qərbi və ya Qəndəhar dialekti [2 ; 6]. Yazıda ərəb əlifbasından istifadə edilir. Ərəb əlifbasının mövcud hərflərinə dillərinə uyğun müxtəlif hərflər, diakritik işarələr artırmaqla əlifbalarının qrafik nümunələrini xeyli zənginləşdirmişlər. İlk yazılı abidə nümunələri XIII-XIV əsrlərə aiddir. Puştu və fars dilinin samit səsləri saylarına görə bir-birindən kəskin fərqlənirlər. Fars dilində 23 samit; 6 monoftonq sait və 1 diftonq olduğu halda, puştu dilində 30 samit; 9 sait; 7 monoftonq sait səs mövcuddur. Beləliklə, fars dilinnin hərfləri cəmi 30 qrafik nümunə şəklində təsbit olunursa, puştu dilindəki hərflərin ümumi sayı 46-dır. Bu da əsasən puştunların tələffüzündə monoftonq, diftonqların çox olması, eləcə də sait və samitlərin bir çoxunun burunlaşması *(ing.: nasal vowel; nasal consonant)* və bu dilin xüsusi samitlərinin mövcudluğunun nəticəsidir.Qeyd edək ki, həm fars, həm də puştu dilinin samitlərinin xüsusiyyətlərini müəyyənləşdirmək məqsədilə mütəxəssislər arasında aşağıda verilən prinsiplər ümumi qayda kimi qəbul edilir:

I prinsip. Səs tellərinin iştirakına görə,

II prinsip. Danışıq üzvlərinin iştirakı və fəal üzvə görə ,

III prinsip. Maneənin növü və dəf edilməsi üsuluna görə .

Məqalənin həcmini nəzərə alaraq hər iki dilin samit səslərinin formalaşmasında yalnız səs tellərinin iştirakını araşdırmağı qarşımıza məqsəd qoyaraq davamını gələcək tədqiqatların öhdəsinə buraxdıq.

Səs tellərinin iştirakına görə hər iki dilin samitlərinin tədqiqi

I Samitlərin cingiltili səslənmə (*vakdar; voiced)* xüsusiyyəti

Fars və puştu dili səslərinin çoxu əmələ gəldiyi anda səs tellərindən, qırtlaqdan keçən hava axını onları (hər iki orqanı) titrədir və bu zaman cingiltili səslər yaranır. Başqa bir qrup səslərin yaranmasında isə səs telləri titrəmir. Birinci qrup səsləri cingiltili, ikinci qrup səsləri isə kar səslər adlandırırlar. Fars dilinin cingiltili samitləri : /b/, /m/, /v/, /d/, /z/, /l/, /n/, / ž /, /j/, /y/, /g/ /q/- sadaladığımız 12 fonemdən ibarətdir. Puştu dilinin cingiltili samitlərinin sayı 18 olmaqla aşağıdakı samit səsləri əhatə edir: /b/, /dz/ , /dj/, /d/, /d./, /z/, /p/, /p./, /j/, /j. /, /q/, /q./, /l/, /m/, /n/, /n./, /v/, /y/. Avazlılıq hər iki dilin səsləri üçün fərqləndirici və qarşılaşdırıcı (*təmayoz-dəhənde; oppositive or distinctive)* əhəmiyyət kəsb edir. Səslərin bu xüsusiyyəti əmələgəlmə yeri (*məhəll-e toulid; place of articulation*) və əmələgəlmə üsuluna (*nəhve-ye toulid; manner of articulation*) görə bir-birinə oxşar olan səslər üçün xarakterikdir. Lakin qeyd edilməlidir ki, fars və puştu dillərinin bütün səslərini cingiltili və kar səslər kimi cüt-cüt qarşılaşdırmaq mümkün deyildir. Fars dilində /m, n, l, r, y/ samit fonemlərinin kar qarşılığı yoxdur. Fars dilinə müvafiq olaraq puştu dilindəki/m/, /n/, /n./, /l/, /r/, /r./ kimi sonor samitlərin də qarşılaşdırıla biləcək kar cütlüyü mövcud deyildir. Bundan əlavə hər iki dilin kar, nəfəsli /h/ samitinin də cingiltili qarşılığı mövcud deyildir. Danışıq aktı zamanı cingiltili samitlər heç də həmişə öz cingiltililik xüsusiyyətlərini sona qədər qoruya bilmirlər. Bəzən cingiltili samitin söz daxilində yerləşdiyi fonetik şərait, pozisiya və qonşuluğundakı səslərin distributiv təsirləri nəticəsində bu səslər öz cingiltililik xarakterinin bir hissəsini, bəzi hallarda isə hamısını itirir və karlaşmış (devoiced) şəklə düşürlər. Məsələn, (səbt) sözündəki /b/ cingiltili samiti hər iki dildə kar /t/ samitinin təsiri ilə cingiltilik xüsusiyyətinin bir hissəsini itirərək özünün kar variantı /p/-ya oxşar bir şəkildə tələffüz edilir.Lakin sonralar dəqiq tədqiqat nəticəsində görəcəyik ki, cingiltili samitlərin cingiltili olması onların yerindən, fonetik şəraitindən asılı olur. Samitlərin cingiltili və kar terminləri altında iki qrupa bölünməsi bütün fonetistlər tərəfindən qəbul edilsə də bunların özü də şərtidir. Çünki müxtəlif adamların tələffüzündən söz daxilindəki yerindən hansı səslərlə yanaşı gəlməsindən, distributiv xüsusiyyətindən asılı olaraq samitlərin cingiltililiyi özünü müxtəlif şəkildə nümayiş etdirir.

Cingiltili samitlərdə küy və sonorluq xüsusiyyətləri:

Hər iki dilin (fars və puştu) cingiltili samit səslərinin xarakterindəki küyün və tonun üstünlüyünə görə daha bir bölgü aparmaq mümkündür: Fars dili samitləri:

a) Küylü samitlər: /b/, /p/, /d/, /z/, /ş/, /j/ və s.

b) Sonor samitlər: /m/, /n/, /l/, /r/, /y/.

Puştu dilinin samitləri:

a)Küylü samitlər: /b/, /dz/ , /dj/, /d/, /d./, /z/, /p/, /p./, /j/ və s.

b) Sonor samitlər: /m/, /n/, /n./, /l/, /r/, /r./ , /y/.

Sonor samitlər də hansı rezonatorda əmələ gəlmələrinə görə ağız və burun sonorlarına bölünür. Nitq səslərinin formalaşmasında 2 əsas rezonator, ağız və burun boşluğunun mühüm rolu olduğu məlumdur. Damaq pərdəsi, dilçək aşağı düşərək ağız boşluğunun yolunu kəsdikdə bronxlardan gələn hava ağız boşluğuna deyil, burun boşluğuna gedir və buradan keçib, xaricə çıxır. Fars dilinin burun sonorları /m/, /n/ samitləridir.

Əgər damaq pərdəsi yuxarı qalxıb burun boşluğunun yolunu kəsərsə, nəticədə səs axını ağız rezonatoruna daxil olar. Bu zaman fars dili ağız səsləri olan sonorlardan /l/, /r/, /y/ və küylü samitlərinin hamısı formalaşar.

Fars dili ilə müqayisədə puştu dilinin sonor samitləri /r/ və /n/samitlərinin burunda tələffüz edilməsi nəticəsində bu dilin sonorları sayca daha çoxdur. Fars dilində beş, puştu dilində isə yeddi sonor samit mövcuddur.

II Samitlərin kar səslənmə (*bivak; voiceless*) xüsusiyyəti

İkinci qrupa, başqa sözlə kar samitlər qrupuna fars dilinin 11 samit fonemi : /t/, /p/, /f/, /s/, /č/, / š /, /k/, /q /, /h/, /x/, /'/- aiddir.

Puştu dilinin 12 kar samit fonemi isə aşağıdakılardır: / p/, /t/, /t./, /s/, /ts/, / č /, / š /, / š./, /f/, /k/, /x/, /h/ .

Hər iki dilin kar samitlərini nəfəslilik (*придыхательные; aspirate; nəfəsli*) baxımından da özlərinə məxsus xarakter sərgiləyirlər. Qeyd edək ki, ümumiyyətlə, /p/, /t/, /k/ samitləri hər iki dildə adətən vurğulu saitdən əvvəl və mütləq sonluqda nəfəsli tələffüz olunurlar. Bu samitlərin bir hissəsi isə nəfəssiz samitlər adlanır. Əlbəttə, bu bir fonetik istilah olaraq dilçilik ədəbiyyatında qəbul olunmuşdur. Məlumdur ki, nəfəs olmasa heç bir səs tələffüz edilə bilməz. Birinci qrup samitlərinə nisbətən burada sadəcə nəfəsin rolu bir qədər az hiss olunur. Samitlərin bu qrupu bir çox dünya dillərində vardır və dilçilik termini kimi (*rus dilində: непридыхательные; ingilis dilində: unaspirated; azərbaycan dilində: nəfəssiz samit)* adlanır.

III Fars və puştu dilinin samitlərini nəfəsli və nəfəssizlik xüsusiyyətləri

Hər iki dilin samit səslərini formalaşmasında nəfəsin nə dərəcədə iştirakı baxımından da iki qrupa bölmək olar:

a) Fars dilinin nəfəsli samitləri: /p/, /f/, /t/, /s/, /č/, /š/, /k/, /x/, /h/.

b) Fars dilinin nəfəssiz samitləri: /b/, /d/, /q/, /ğ/, /'/, /v/ və s.

a) Puştu dilinin nəfəsli samitləri: / p/, /t./, /s/, /ʦ/,/ č /, / š /, / š./, /f/, /x/, /k/, /h/.

b) Puştu dilinin nəfəssiz samitləri: : /b/, /d/, /q/, /j /, /'/, /k/ və s.

Araşdırmalar göstərir ki, müəyyən şərait və fonetik pozisiyaya uyğun olaraq öz cingiltili xüsusiyyətini itirmiş samit bütün əlamətlərinə görə tam şəkildə kar qarşılığı ilə əvəzlənmir. Burada səslərin cingiltili, kar, küylü, tonlu olması üçün onu bu əlamətlərə görə formalaşdıran başqa fiziki, fizioloji xüsusiyyətlər də əsasdır. Kar samitlərin formalaşmasında cingiltili samitlər və saitlərdən fərqli olaraq səsi əmələ gətirən hava cərəyanında küyün şiddətinin, davamlılığın, nəfəsliliyin də əhəmiyyəti böyükdür. Kar samitlərin tələffüzündə hava cərəyanı səs tellərini titrətmədən, başqa sözlə gücünü, qüvvəsini itirmədən ağız boşluğuna daxil olur. Sonra ağızda fəal və qeyri-fəal danışıq üzvləri tərəfindən yaranmış maneəni qüvvətlə dəf edərək müvafiq kar samiti formalaşdırır. Belə ki, novlu, kar /s/ samitinə sərf olunan enerji onun cingiltili qarşılığı /z/- ya sərf olunan enerjidən xeyli dərəcədə güclü olur. Bildiyimiz kimi, cingiltili /z/- nın tələffüzündə hava cərəyanının gücü bir qədər zəifləmiş olur (ona görə ki, bu təzyiqin bir hissəsi səs tellərini titrəyişə gətirməyə sərf olunur). Məhz buna görə də fars dilinin kar samitlərini sərt (*səxt; tense, fortis*), cingiltili samitlərini isə yumşaq (nərm; lax, lenis) adlandırırlar.Kar samitlər cingiltili samitlərlə müqayisədə özlərini daha davamlı və uzun kəmiyyətdə (*keşeş; lenght*) nümayiş etdirirlər. Ossiloqraf lentlərində bizim təcrübəmizdə /serešk/ və /zereh/ sözlərindəki /s/ və /z/ kar, cingiltili cütlüyünü davamlıqlarına görə qarşılaşdırsaq, kar samitdə t_{zaman} = 120 msan; cingiltili samitdə isə bu rəqəm cəmi 65 msan. təşkil etmişdir. Kar samitlərin formalaşmasının daha bir xüsusiyyəti isə onların cingiltili samitlərə və saitlərə nisbətən nəfəsli (*dəmeşi; aspiration*) olmalarıdır. Bu xüsusiyyət adətən kipləşən- partlayışlı *(enfecari; plosive)* samitlərə xasdır. Onların tələffüzü zamanı maneənin arxasında toplanmış hava cərəyanın səsə çevrildiyi anda sanki əsas səslə yanaşı tələffüzdə kicik bir /^{h}/səsi də eşidilir. Bu zaman kar samit nəfəsli (dəmide; aspirated) olur. Fonetik transkripsiyada samitlərin bu xüsusiyyəti kar samitlərin sağ tərəfində yuxarıda qoyulmuş kiçik bir "h" səsi ilə işarə edilir: /p^{h}/,/ k^{h}/ və s.

Fars və puştu dili samitlərinin tədqiqinə araşdırmaçıların yanaşması.

Qeyd etmək lazımdır ki, puştu dilinə nisbətən, fars dili daha çox tədqiqatçılar tərəfindən araşdırma obyekti olmuşdur

Şərqşünaslardan N. H. Hatəmi [6], V. S. Rastorquyeva [15] fars dilində 22 samit fonem - /b/, /p/, /t/, /d/, /k/, /q/, /m/, /n/, / č /, /j/, /f/, /v/, /s/, /z/, /y/, /x/, /ğ/, / ž/, /š/, /l/, /r/ olduğunu;

Y. A. Rubinçik [16] eləcə də fars dilçilərindən P.N. Xanləri [8], Ə. Həqşenas [7], Y. Səməreh [18], M. Müşkədəddini [13] 23 samit fonem, L. Jirkov [9] və bir çox Avropa alimləri fars dilində 24 samit fonem olduğunu qeyd edirlər. Araşdırmalardan aydın olmuşdur ki, fars dilində 22 samit fonem olduğunu qəbul edənlər "ع" və "ء" – nin verdiyi /'/- ni nəzərə almamışlar. Bu dildə 24 samitin olduğunu iddia edənlər isə "غ" və "ق" samitlərinin verdiyi səsi müxtəlif fonem hesab etmişlər.

P. N. Xanləri fars dili samitlərini 3 prinsipə: a) maneənin dərəcəsinə ; b) səs tellərinin iştirakına; b) maneənin dəf edilməsinə görə bölmüşdür [8, s. 31]. Y.Səməreh fars dili samitlərinin ümumi xüsusiyyətlərindən danışaraq, onların bölgüsündə iki prinsipi: 1. maneənin əmələ gəlməsi və dəf edilməsi üsulunu; 2. samitlərin əmələ gəlməsində səs tellərinin iştirakını əsas götürmüşdür [18, s. 27]

Puştu dilinə gəldikcə bu dil bir növ fars dilinin yeni dövrü, Dəri ilə müəyyən yaxınlığı olsa da fonetik, morfoloji, sintaksisdə baş verən inversiya baxımından xeyli dərəcədə fərqli olması ilə hind dilinə yaxınlığı aydın şəkildə hiss edilir.

Puştu dilinin əsas tədqiqatçılarından olan [N. B. Dvoryankov [5], K. A. Lebedev [10], İ. Y. Novqorodova [14], M. Mərhun [11] , bu dilin səsləri haqqında demək olar ki bir-birindən cüzi və əsas məsələyə təsir edə bilməyəcək dərəcədə fikir bildirmişlər. Onların əsas fikir ayrılıqları qrafik nümunələrin transkripsiyası haqqındadır. Fikrimizcə bunu dəqiqləşdirmək üçün geniş eksperiment işləri aparılmalıdır.

Biz tədqiqatımızda puştu dilindəki mövcud səslərinin transkripsiyasını latın qrafikası ilə verdik. Xarici tədqiqatçılar da latın və Beynəlxalq transkrisiyadan istifadə edirlər. Lakin qeyd edilməlidir ki, puştu dili tədqiqatçıları arasında rus araşdırmaçılarına daha çox rast gəlindiyindən paralel olaraq kiril əlifbasına uyğunlaşdırılmış transkrisiyadan da istifadə olunur. Hətta bir çox səslərin rus dilinin səslərinə uyğun olduğuna əmin olan araşdırmaçılar da vardır. Onlardan biri K. A. Lebedevin aşağıdakı qeydi maraq doğurur: « В языке пушту тридцать согласных звуков. Половина из них, а именно: /б/, /п/,/т/, /с/, /з/, /ц/, /ч/, /г/, /л/, /р/, /м/, /н/, /ф/, /й/ по своим артикуляциям почти не отличаются от подобных им в русском языке.» [10, s.14]

Bu sadalanan məsələlərə aydınlıq gətirmək tədqiqatımızın əsas məqsədi olmuşdur. Fars dilinə aid araşdırmalar Sank-Peterburq Dövlət Universitetinin Rus dili kafedrasının Fonetika laboratoriyasında dörd iranlı tələbənin diktorluğu ilə, ən müasir aparatlardan istifadə etməklə yerinə yetirilmişdir. 3600 söz və tərkibdən tərtib olunmuş proqramlar oxunduqdan sonra 102 tipli 8 şleyfli ossilloqraf aparatında, SZÇ tipli spektometrdə, "Görünən titq" nümunələri .... və s.-də analiz və təhlil edilmişdir. Aşağıda fars dili samit səslərinin fonetik xüsusiyyətlərini əks etdirən cədvəli sizinlə bölüşürük:

Cədvəl **Fars dili samitlərinin xarakteristikası**

		Səs tellərinin iştirakı və küyün kəmiyyəti					Maneənin dərəcəsi və dəf edilməsinə görə				
		Cing.	kar	küy.	ağız son.	burun son.	partlayışlı	süz-gün	sürtün. novlu	saf	qov. mür.
qoşa dod.	b	+	+	+	-	-	+	-	-	+	-
	p	-	+	+	-	-	+	-	-	+	-
	m	+	-	-	-	+	-	-	-	+	-
dod. d.	v	+	-	+	-	-	-	+	+	+	-
	f	-	+	+	-	-	-	-	+	+	-
dil önü diş	d	+	-	+	-	-	+	-	-	+	-
	t	-	+	+	-	-	+	-	-	+	-
	z	+	-	+	-	-	-	-	+	+	-
	s	-	+	+	-	-	-	-	+	+	-
	l	+	-	-	+	-	-	+	+	+	-
	n	-	-	-	-	+	+	-	-	+	-
dil önü yuvaq	r	+	-	-	+	-	-	+	-	+	-
	j	+	-	+	-	-	+	-	-	-	+
	č	-	-	+	-	-	+	-	-	-	+
	ž	+	-	+	-	-	-	-	+	+	-
	š	-	+	+	-	-	-	-	+	+	-
dil ort. dam	y	+	-	+	-	-	-	-	+	+	-
	k	-	+	+	-	-	+	-	-	+	-
dil arx. dam	q, g	+	-	+	-	-	+	-	-	+	-
dil dibi	x	-	+	+	-	-	-	-	+	+	-
dilç.q.	ğ	-	+	+	-	-	+	-	-	+	-
boğaz	h	-	+	+	-	-	-	-	+	+	-
udlaq	’	+	-	+	-	-	+	-	-	+	-

Tədqiqatdan aydın olmuşdur ki: - fars dilinin fonetik quruluşunda 23 əsas samit fonem, samitlərin distribusiyasından asılı olaraq, hər birinin bir neçə allafonu da mövcuddur. Tədqiqat işində hər bir fonemin distributuv xüsusiyyəti, variativliyi, allafonları, omofon yaratma xüsusiyyəti, bir sözlə akustik və fonoloji təhlili aparılmışdır

Sonuc:

• Fars dili əsasən İran ərazisində farsların işlətdiyi dildir. Bu dil İran İslam Respublikasının rəsmi dölvlət dilidir.

• Hind-Avropa dillərinin İran dilləri qrupuna mənsub olan puştu dili puştunların ana dili kimi əsasən bütün cənub və cənub-şərqi Əfqanıstanda, şimal-qərbi və qərbi Pakistanda yayılmışdır.

• Səs tellərinin iştirakına görə hər iki dilin samitləri ən ümdə, vaciv xüsusiyyətlərinə görə bölgüyə cəlb edilmişdir.

• Fars dilinin fonetik quruluşunun mühüm bir hissəni təşkil edən konsonantların /samitlərin/ təkcə bölgüsü, növü, keyfiyyəti deyil, hətta sayi haqqında da mütəxəssislər arasında fikir ayrılığı mövcuddur.

• Fars dilində 23 samit, 1 diftonq və 6 monoftonq sait olmaqla cəmi 30 qrafik nümunə və onların qarşılığı səs mövcuddur.

• Puştu dilində 30 samit, 7 diftonq və 9 monoftonq sait olmaqla 46 qrafik nümunə və qarşılığı olan səs vardır.

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QUBA QƏZASINDA YAŞAYAN ETNİK QRUPLAR

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Xülasə
Ölkə tarixində bəzi qara səhifələr mövcud olmuşdur. Buraya repressiyalar, qətliyam, sürgün və terror aktlarını misal göstərmək olar. Məhz bu cür müsibətlər Quba regionundan da yan keçməmişdir. Həmin tarix ərzində Azərbaycanın bir çox bölgələrində soydaşlarımıza və digər etnik azlıqlara qarşı soyqırımı hadisələri törədilmişdir. Buraya misal olaraq 1918-ci il mart soyqırımını qeyd edə bilərik. 1918-ci il martın əvvəllərində rus bolşevik Qızıl Ordusunun dəstəklədiyi erməni qüvvələri Azərbaycanın digər bölgələri də daxil olmaqla Quba qəzasına da hücuma keçdi. Quba qəzasında yerli əhali, ilk növbədə, azərbaycanlılar həmin amansız qətliyam atəşi altında qaldıqları üçün dəhşətli tarix ilə üzləşdilər. Ölənlərin sayı ilə bağlı proqnozlar müxtəlifdir, ancaq Quba hadisəsi zamanı çoxsaylı günahsız insanın terror nəticəsində həlak olduğu geniş yayılmışdır. Terrora qurban gedən təkcə azərbaycanlılar deyil, həmçinin bölgədə yaşamış müxtəlif etnik qrup nümayəndələridir. Araşdırmalar nəticəsində aşkar edilmişdir ki, qazıntı zamanı üzə çıxarılan kütləvi məzarlıqda azərbaycanlılar ilə yanaşı, Qubada etnik azlıqlar, yəni tat, yəhudi, ləzgi və başqaları da qeyri-insani əməllərlə terrora qurban edilmiş və cəsədləri vəhşicəsinə basdırılmışdır. Bu məqalədə 1918-ci ildə baş verən mart soyqırımı zamanı Quba qəzasında yaşamış etnik azlıqların rolları, hadisə zamanı onlara qarşı törədilən amansızlıqlar vurğulanmışdır.
Açar sözlər: Quba, etnik qrup, ləzgi, yəhudi, soyqırım
Key words: Guba, ethnic group, lezgi, jew, genocide

QUBA QƏZASINDA YAŞAYAN ETNİK QRUPLAR

Abstract
There have been some black pages in the country's history. Examples include repressions, massacres, exiles and acts of terrorism. Such calamities have not escaped the Guba region either. During that history, genocide was committed against our compatriots and other ethnic minorities in many regions of Azerbaijan. We can mention the March 1918 genocide as an example. At the beginning of March 1918, the Armenian forces supported by the Russian Bolshevik Red Army attacked Guba district, including other regions of Azerbaijan. In the Guba accident, the local population, first of all, the Azerbaijanis, faced a terrible history because they were under the fire of that merciless massacre. Estimates of the death toll vary, but it is widely believed that many innocent people died as a result of terrorism during the Guba incident. Victims of terrorism are not only Azerbaijanis, but also representatives of various ethnic groups who lived in the region. As a result of research, it was found that in addition to Azerbaijanis in the mass grave discovered during the excavation, ethnic minorities in Guba, such as Tats, Jews, Lezgi and others, were victims of terrorism with inhuman acts and their bodies were brutally buried. In this article, the roles of the ethnic minorities who lived in the Guba district during the March genocide in 1918, and the atrocities committed against them during the event, are highlighted.
Key words: Guba, ethnic group, lezgi, jew, genocide

1918-ci il martın əvvəllərində erməni nizamsız qüvvələri Azərbaycanın regionlarında dağıdıcı hücuma keçdi. Həmin regionlar arasına Quba qəzası da daxildir. Quba qəzasındakı azərbaycanlılar ilk növbədə olmaqla digər etnik qruplar da bu amansız terror atəşi altında amansızlıqla üzləşdilər. Qətlə yetirilənlərin sayı ilə bağlı təxminlər müxtəlifdir. Quba hadisəsi Azərbaycan xalqının yaddaşında yaşayır. Quba qəzasında baş verən hadisələr Azərbaycan Respublikasının tarixində faciəvi bir səhifə olaraq qalsa da, Azərbaycan xalqının milli kimliyinin formalaşmasında mühüm rol oynamışdır. Bu da həmin dəhşətləri unutmaq istəməyən bir cəmiyyətin davamlı ruhunun sübutu kimi dayanır. Hadisə tarixi ədalət ətrafında müzakirələrin əsas nöqtəsi olaraq qalmaqdadır. Hər il qurbanların unudulmaması və hadisənin tanınması üçün müxtəlif tədbirlər həyata keçirilməyə davam edir [5.s.8].Quba qəzasında 1918-ci ilin qanlı mart kimi tanınan terror hadisələrindən sonra Şamaxı və Bakı qəzalarında bolşeviklər qurduqları Sovet hakimiyyətini daha da böyük çərçivədə genişləndirmək məqsədində idilər. Ancaq, Quba qəzasında olan real vəziyyət Şamaxı və Bakı qəzalarından nisbətən fərqli idi. Tarixi çərçivədən baxıldıqda Quba qəzasının və eyni adlı xanlığın iqtisadi və sosial-siyasi həyatında ermənilər heç də gözə çarpan bir rol oynamamışdı. Qeyd olunan ildə - 1918-ci ildə Quba qəzasında və onun 3 kiçik erməni kəndində məskunlaşan azsaylı erməni birliklərinin öz dini məktəbləri, kilsələri və s. olsa da yerli nüfuzlu elitası və zəngin təbəqəsi mövcud olmadığından onlardan təxminən heç biri qəzanın inzibati-idarəçilik strukturlarında təmsil olunmurdular. İnzibati-idarəçilik kimi strukturlarda başlıca vəzifələri azərbaycanlı, rus, ləzgi, yəhudi və tat kimi etnik xalqların nümayəndələri tuturdu [4].Bu səbəblərdən 1918-ci ilin mart qırğınlarından bir qədər sonra Bakıda yaradılan bolşevik-daşnak hökuməti Qubanı sülh yolu bolşeviklərin qəza üzərində hakimiyyətini tam könüllü şəkildə razılaşdırmağa qərar verir. Qubanın yerli sakinləri ilə danışıqların aparılması D.A. Gelovaniyə verilir. Gelovaninin əsası ermənilərdən və tərkibində az sayda yəhudi və ruslardan ibarət dəstəsinin Quba qəzasına yaxınlaşdığı məlumatını alan qubanın sakinləri qəzanın yəhudi, rus və müsəlman nümayəndələrindən ibarət bir heyəti Xaçmaz stansiyasına - bolşeviklərin dayandığı nöqtəyə göndərirlər. Yerli sakinlər Şamaxı və Bakıda törədilmiş qanlı toqquşmalardan zorakılıqlardan xəbərdardılar. Hədə-qorxu nəticəsində düşünmələri üçün çox az bir vaxt verilən Qubada yaşayan azərbaycanlılar və digər etnik xalqlar Şamaxı və Bakıda baş verən hadisələrin vəhşiliklərini nəzərə alaraq öz doğma regionlarını qorumaq naminə məcburi olaraq ultimatumu qəbul etdilər və bu hadisə nəticəsində Quba səkkiz gün Sovet birliyinin

hakimiyyəti altında qaldılar. Ancaq, yaranmış bu yeni hakimiyyəti imtina edən və qətiyyətlə tanımayan yerli ləzgi əhalisi həmin hadisələrə ciddi şəkildə müdaxilələr edirdilər. Sovet hakimiyyətinin Qubada IX günü qəzanın yəhudi məhəlləsi hissəsindən çoxluq ləzgilərdən ibarət dəstənin silahlı qarşıdurmaları başlanır. Həmin münaqişə üç gün davam edir və bu müddət ərzində şiddətli baş verən münqaişə nəticəsində ləzgi qrupu dəstələri bolşeviklərin komandasını Quba qəzasından qovurlar. Bu mübarizədə hər bir tərəf tələflərlə nəticələnir, ləzgi dəstələrdən iki yüzə yaxın adam, dinc sakinlərdən təxminən 70 nəfər qətlə yetirilir, bolşevikləm məğlubiyyətə uğrayır. Quba qəzasında Ləzgilərin bolşeviklərə qarşı xüsusi qarşıdurması burada Sovet hakimiyyətinin yaradılmasına son qoyur [5.s.30-91].1918-ci il Qubada mart hadisələrindən bəhs edərkən məskunlaşmış qeyri-müsəlman sakinlərinin də vəziyyətindən bəhs etmək mühümdür. Bolşevik-daşnak qüvvələrinin əsas hədəfinin heç bir etnik faktorlara baxmadan qəzanın hər bir müsəlman sakinin olduğu təkcə azərbaycanlı-türk və digər müsəlmanlar deyil, tat və ləzgi kəndlərinin darmadağın edilməsi, yandırılması sübut edilirdi. Quba qəzasındakı yəhudi əhalisi ilə bağlı faktlar bir qədər daha mürəkkəb hal almışdır. Quba faciəsi zamanı yerli yəhudilərin müsəlman həmyerlilərinə kütləvi çıxış eləmədikləri və bununla yanaçı yəhudi birliklərinin bəzilərinin erməni talançılarına qatılaraq qəzanın müsəlman sakinlərinə qarşı terror aktlarında birbaşa iştirakı kimi faktlar yerli əhalinin şahid olduğu ifadələr ilə sübuta yetirilir. Qeyd etmək yerinə düşər ki, Quba qəzasında məskunlaşan yəhudilər Hamazaspın "ləzgilər və müsəlmanlar bir saat ərzində sizə hücum edib çoxsaylı bəlalar gətirəcək, sizi tikə-tikə doğrayıb qətlə yetirəcək" kimi yalanlarla aldanmış və minlərlə yəhudi erməni birliklərinə qatılaraq birlikdə çıxıb Qubanı tərk etmişdir. Bəzi yəhudilər isə tələşa düşərək ayaq yalın, hazırlıqsız təşvişlə qaçmış, tezliklə hava şəraiti ilə əlaqədar xəstəliklərlə üzləşmiş və həlak olmuşdur [1.s.6],[6].Qubada mart terroru zamanı qəzada qalan yəhudi sakinləri itkilər vermişdi. İstər Gelovaninin dəstələri, istərsə də Hamazaspın dəstələri Qubanı top atəşinə tutaraq yəhudi sakinlərinin nümayəndələri qətlə yetirmişdi. Qubada qalan, təkcə baş vermiş məlum hadisələr zamanı qətlə yetirilmiş yəhudilər deyil, kütləvi şəkildə qaçan yəhudilər aclıqdan, müxtəlif əziyyətlərdən və xəstəliklərdən dünyasını dəyişmiş digər yəhudi qrupları da müsəlman həmyerliləri kimi ermənilərin törətdiyi təcavüzkar, ağılasığmaz millətçilik siyasətinin xüsusi qurbanları olaraq sayılırdılar [3.s.8].Bunu da qeyd etmək yerinə düşərdi ki, çoxsaylı araşdırmalar aparıldıqdan sonra məlum oldu ki, ermənilər Qubadakı sakinlərə zorakılıq tədbiq edərkən təkcə odlu silahdan istifadə etməmişlər. Qurbanların sümüklərdə aparılan tədqiqatlarda güllə izi aşkar olunmamışdır. Məlum olub ki, qətlə yetirilmiş dinc əhalinin baş

nahiyəsindən balta və digər kəskin alətlərdən istifadə etməklə baş nahiyəsini bədəndən ayırmış, digərlərinin baş nahiyəsinə isə küt alətlə, dəmir və mismar ilə vurmaqla ağlasığmaz işgəncələrlə qətlə yetirmiş, qırğından sonra kütləvi şəkildə hər bir cəsədi quyulara doldurulub və üzəri torpaqla örtülüb. Tədqiqatlar nəticəsində məlum olub ki, kütləvi məzarlıqda təkcə azərbaycanlılar deyil, Quba qəzasındakı digər milli azlıqlardan yəhudi, tat, ləzgi və digər etnik qruplar qeyri-insani əməllərlə qətlə yetirilərək basdırılmışdır [7].Bir sıra mənbələrə əsaslansaq qırğın zamanı beş minə yaxın tat və azərbaycanlı əhali, on minədək ləzgi terror qurbanı olmuşdur. Qubada Amazaspın olduğu günlər ərzində qəzanın kəndlərində təxminən iki minə yaxın azərbaycanlını, min beş yüzə yaxın ləzgini, beş yüz nəfərə yaxın tat əhalisi amansızlıqla qətlə yetirilmişdir. Bütün statistikanı göz qabağında saxlasaq Quba qəzasında qətlə yetirilən əhalinin mövcud əhalinin beşdə bir hissəsinə bərabər olduğunu qeyd edə bilərik [2.s.6].Quba qəzasındakı mart soyqırımı Azərbaycan tarixində yaralı yazılmış səhifə olaraq qalmaqdadır. Burada törədilən həmin ağlasığmaz soyqırımın Azərbaycanın digər bölgələrdə həyata keçirilən terrordan başlıca fərqi bundan ibarətdir ki, başqa qırğınlar təkcə müsəlmanlara, azərbaycanlılara qarşı yönəldilmişdisə, Qubada etnik düşmənçilik təkcə azərbaycanlılara deyil, qrızlara, ləzgilərə, buduğlara, tatlara və ceklərə qarşı yönəlmişdi. Hər il soyqırım qurbanlarının xatirələri anılır və bu günədək həmin terror haqqında maarifçilik nəsildən nəsilə ötürülərək təbliğ edilir. Azərbaycan və burada yaşayan digər xalq nümunələri bu dəhşətli qırğını əsla unutmayacaqdır.

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ORGANIZATION OF INTERDISCIPLINARY RESEARCH AT THE AZERBAIJAN NATIONAL ACADEMY OF SCIENCES: A PHILOSOPHICAL APPROACH

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Abstract
In recent years, great importance has been paid to the study of interdisciplinarity in philosophy and epistemology in terms of the organization and theoretical features of scientific creativity. At the same time, interdisciplinarity is examined philosophically in the context of a more perspectival organization of science-education interaction.Philosophers call the philosophical reflection of interdisciplinary studies "co-creativity" (A.Creech et al.), "strategy supporting collective creativity" (et al.). They also emphasize that interdisciplinarity accelerates the integration of knowledge in general. But “different contexts can produce different kinds of integrations” (O'Rourke).From these we can draw the following conclusion: the strategy of organizing interdisciplinary research has a significant impact on the mechanism and content of knowledge acquisition. Especially in large research institutions, the organization of this work comes to the fore. In this regard, the strategy of organizing interdisciplinary research at the Azerbaijan National Academy of Sciences is considered one of the important factors for the development of science as a whole in the country.In recent years, comprehensive programs in this direction have been prepared and implemented. We consider these philosophically at two levels.The first is the strategy of organizing interdisciplinary research in the internal environment of the Azerbaijan National Academy of Sciences. This includes conducting research in accordance with Azerbaijan's strategic development programs as the main direction. Secondly, organizing the exchange of experience between the Academy and scientific organizations outside this institution.In the first direction, the programs implemented at the Academy are designed to reorganize creative relations between different fields of socio-humanities. An example of this is the organization of joint creative events in recent years between History and Ethnology, Philosophy and Sociology, Linguistics, Oriental Studies and other institutes of the Academy.What results could research in the highlighted direction yield? At the Academy of Sciences, above all, interdisciplinary creative skills are developed and more comprehensive research opportunities are created. The potential for “collective creativity” is developing within the framework of certain projects.The cooperation of the Academy of Sciences with other research institutions seems more current in this respect. The development of cooperation in the field of creativity, especially with Turkey's TÜBİTAK institution, seems promising. Thanks to such collaborations, the Academy of Sciences and Azerbaijani scientists gain new and broad opportunities to publish their research in Turkey's indexed and respected journals.Thus, in the Academy of Sciences, more importance is given to the organization of interdisciplinary research in the internal environment, and the scope of interdisciplinary research is expanded mainly in the context of developing relations with the scientific organizations of the Turkis republics. The interactive development of these two lines will give serious impetus to the rise of interdisciplinary research in Azerbaijani science to a new level.
Keywords: Azerbaijan National Academy of Sciences, interdisciplinarity, collective creativity, research strategy, TÜBİTAK, indexed journals, interdisciplinary research organization, socio-humanities.

Introduction

Philosophers consider interdisciplinary research to be the dominant direction of philosophical and scientific understanding. Interdisciplinary research is usually expressed with the term "interdisciplinarity". Here, the main focus is on conducting research in the common epistemological field of various disciplines. This entails considering the methodologies and methods of disciplines to be mutually related. This feature distinguishes interdisciplinarity from other integrative research approaches, such as multidisciplinarity. Multidisciplinarity involves various disciplines investigating a problem as separate research projects, each maintaining its own autonomy in methodology and methods. Transdisciplinarity, on the other hand, refers to transcending the epistemological and methodological boundaries of a single discipline.

Thus, when we refer to the organization of interdisciplinary research at the ANAS, we consider two levels of organizing interdisciplinary research. The first level is the formation of a common epistemological and methodological ground among research conducted in various profiled research institutes within the ANAS.The second level involves implementing interdisciplinary collaboration projects on various topics with external scientific structures outside the ANAS.

Methodology and Method

The interdisciplinary approach applied in modern science for the philosophical reflection of the emphasized two directions is utilized through a unified methodological prism. Specifically, principles of non-linearity, openness, intersubjectivity, and synergistic formation are employed in methodology.Non-linearity is understood in this article as the expression of the principle "the whole is greater than the sum of its parts" during the mutual interaction of various disciplines on a unified topic. This implies the potential to form integrative knowledge through interdisciplinary understanding.Openness in interdisciplinary research denotes the perpetual openness of mutual interactions to new levels of understanding. We can metaphorically refer to this as "system openness." "System openness" reflects the constantly renewing character of interdisciplinary research.Intersubjectivity refers to the collective activity of subjects rather than the individual nature of research. From this perspective, it is accepted that interdisciplinary research is always intersubjective in nature.Finally, the principle of synergistic formation identifies the dynamic establishment of new knowledge with a unified structure and functional properties as a result of research.Methods of system synthesis and dynamic integration, which are consistent with the content and strategy of these principles, are applied. System synthesis involves approaching interdisciplinary research as a unified system, while integration reflects the expression of acquired information in a unified form of knowledge.

Interdisciplinary Research as a Strategic Approach

In numerous philosophical studies conducted worldwide, it is emphasized that the influence of research conducted on the mutual relationship of various disciplines is increasing. For example, A.C.Edmondson and J.Harvey specifically highlight this point. They write that interdisciplinary research is now considered a leading approach and its "influence continues to grow" [Edmondson, Harvey, 2018, pp. 348-350].Philosophers often associate the effective collaboration of representatives from various fields of knowledge as a unified team with interdisciplinary cooperation. According to some philosophers, "collective creativity" can be stimulated precisely through "interdisciplinary methods" [Parjanen, Hyypiä, pp. 27-32].

In recent years, the perspectives of applying interdisciplinary research in education are also being explored. E.R. Skayvark and colleagues have concluded that teaching doctoral students with interdisciplinary methods positively influences their development in the field of creativity [Skayvark et al., 2022, pp. 3-8].These highlighted studies indicate that the strategy of organizing interdisciplinary research revitalizes the mechanism of knowledge acquisition. The unique characteristics of the mutual relationship between methodology and epistemology in the common understanding field of various disciplines actually create different situations. As a result, there is a close connection between the content of the new knowledge acquired and the formation of knowledge. In addition to other intellectual positions, the organizational problem of research in scientific institutions emerges with new urgency.

Strategy for Organizing Scientific Research at ANAS

In recent years, the issue of organizing international research has become increasingly relevant. In this regard, research is organized in accordance with the provisions of the "Law on Science" ["Law on Science", 2016]. On August 9, 2023, President Ilham Aliyev issued a decree regarding amendments to the "Law on Science", which included the replacement of the phrase "various fields of science" with "its areas of activity" in amendment 5.2. of Article 11.3 [see: "Azerbaijan" newspaper, 2023, p.1]. This provided legal guarantees for broader inclusion of international research.Currently, the mechanisms for organizing and conducting international research at ANAS are determined by the organization's Charter [Charter of ANAS, 2024]. ANAS development of interdisciplinary research has set the goal of further expanding the development of international research within the context of new information and communication technologies and artificial intelligence.In this aspect, joint research projects among various institutions of the organization are increasingly prioritized to elevate creative connections to a new level.

ANAS's International Collaboration Strategy

In this regard, there is a noticeable acceleration and expansion of activities. In this context, greater attention is paid to creative connections between ANAS and Turkey's TÜBİTAK institution. Both sides believe in the prospects of this collaboration. A representative of Turkey's TÜBİTAK organization participated in ANAS's General Assembly held in 2024. This is a very interesting and current event. It is the first occurrence of scientific collaboration between Azerbaijan and Turkey in the history of independent Azerbaijan. The Decision draft of that assembly states in clause 5.2.1.2: "In the framework of reforms aimed at the development of international relations, scientific cooperation between the scientific institutions of ANAS, the International Turkic Academy, the Turkish Academy of Sciences, the Atatürk Culture, Language and History High Institution, TUBİTAK, and the Academies of Sciences of the Central Asian Republics should continue, with the expansion of joint research and implementation of other scientific and scientific-organizational events" [Decision, 2024, p. 11]. From the highlighted point, it is evident that ANAS has chosen to align its collaboration with Turkey in the direction of international research with the overall framework of scientific cooperation among Turkic states. This implies that in the near future, the elevation of collaboration in the new directions of science within the framework of the Turkic States Organization will be seen as an important task.

Conclusion

The analysis conducted shows that there is an increasing emphasis on international research at ANAS. This process has its own specific internal dynamics. The alignment of ANAS's historical path with the requirements of the contemporary era is also gaining traction in determining its characteristics.From the conceptual documents prepared by ANAS in recent years, it is apparent that international research is being conducted at two levels in close connection with each other.The first level involves organizing interdisciplinary research within the internal environment of the organization. This includes the implementation of joint scientific projects by research institutes.The second direction is related to collaboration with other scientific research structures of ANAS. Currently, it is observed that ANAS prioritizes collaboration mainly with Turkey's TÜBİTAK institution in this direction. At the same time, ANAS also pays special attention to relations with other Turkic states.

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ALMANYA'DA TÜRK ÇOCUKLARININ EĞİTİMİNDE MASALIN ROLÜ VE YÜCEL FEYZİOĞLU

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ÖZET

Masallarda çocuklar için önemli olan kavramlar mecazi anlamda verildiği için daha iyi özümsenir ve bilinçaltında kalır. Masal, çocuğu karşılaşabileceği zor durumlara önceden hazırlar, gündelik sorunları çözebilmenin yollarını sunar. Çocuk masallar aracılığıyla dünyadaki yerini öğrenir, iyi ve kötü, cesaret ve korkaklık, dostluk ve ihanet hakkındaki ilk fikirlerini edinir. Çocuğa neyin iyi neyin kötü olduğunu anlatan, ahlaki ve toplumsal değerleri aşılayan masalların etkisi daha güçlü olur. Masallar bir karakter oluşturur ve ruhu eğitir. Masallar çocuğun hayal gücünü ve fantezisini geliştirir. Bir milletin milli-manevi değerlerinin ilkin kodları masallarda saklıdır. Masallarla yetişen çocukların bilinç altında mensup oldukları milletin değerleri oluşur ve bu da onların birey olarak yetişmesinde mühim rol oynar.1974 yılından itibaren Anadolu ve Mezopotamya'dan, Kafkasya, Orta Asya ve Uzakdoğu'dan Avrupa içlerine kadar Türklerin yaşadığı bütün ülkelerden masallar derledi, çağdaş psikolojinin ihtiyaçlarını dikkate alarak onları yeniden yazarak "Kardeş Masallar" başlığı altında 32 kitaplık bir dizi oluşturdu. Bu bağlamda Yücel Feyzioğlu'nun bir araya getirip yayınlattırdığı masal kitapları çok önemlidir. Almanya'da Türk neslin oluşumunda ve onların milli-manevi değerlerine sarılarak, modern ruhta yetişmesinde bu eserlerin büyük önemi vardır. Bu masal kitapları okul çağındaki gençlerin ve gençlerin sanatsal beğenilerinin oluşmasına, Türkçe okuma ve yazma alışkanlıklarının oluşturulmasına, zihinsel yeteneklerin güçlenmesine hizmet etmektedir. Yücel Feyzioğlu farklı ülkelerin ve Türk topluluklarının masallarını bir araya getirerek Almanya'daki Türk gençlerinin milli-manevi bağlarını kaybetmemesine verdiyi tarihi armağandır.Bu çalışmanın amacı, masalların eğitimsel işlevselliği ve Yücel Feyzioğlu'nun topladığı masalların çocukların eğitimindeki etkileri değerlendirilecektir.

Anahtar kelimeler: Yücel Feyzioğlu, Çocuk Edebiyatı, karşılaştırmalı tahlil, Almanya'da Türk edebiyatı, milli-manevi değeler, çocuk eğitimi

THE ROLE OF YÜCEL FEYZIOĞLU IN THE UPBRINGING OF TURKISH IMMIGRANT CHILDREN IN GERMANY IN LINE WITH NATIONAL-SPIRITUAL VALUES

SUMMARY
Since concepts that are important to children in fairy tales are given in a figurative sense, they are better assimilated and remain in the subconscious. Fairy tales prepare the child for difficult situations he may encounter and offer ways to solve everyday problems. Through fairy tales, the child learns his place in the world, acquires his first ideas about good and evil, courage and cowardice, friendship and betrayal. The effect of fairy tales that tell the child what is good and what is bad and inculcate moral and social values is stronger. Fairy tales build character and educate the soul. Fairy tales develop the child's imagination and fantasy. The primary codes of a nation's national-spiritual values are hidden in fairy tales. Children who grow up with fairy tales subconsciously develop the values of the nation they belong to, and this plays an important role in their growth as individuals.Since 1974, he compiled fairy tales from all countries where Turks lived, from Anatolia and Mesopotamia, the Caucasus, Central Asia and the Far East to the interior of Europe, and rewrote them taking into account the needs of contemporary psychology, creating a series of 32 books under the title "Sister Tales". In this context, the fairy tale books that Yücel Feyzioğlu brought together and published are very important. These works are of great importance in the formation of the Turkish generation in Germany and their upbringing in the modern spirit by embracing their national-spiritual values. These fairy tale books serve to form the artistic tastes of school-aged youth and teenagers, to form Turkish reading and writing habits, and to strengthen mental abilities. By bringing together the tales of different countries and Turkish communities, Yücel Feyzioğlu is a historical gift to the Turkish youth in Germany in preserving their national and spiritual ties. The purpose of this study is to evaluate the educational functionality of fairy tales and the effects of fairy tales collected by Yücel Feyzioğlu on children's education.
Keywords: Yücel Feyzioğlu, Children's Literature, comparative analysis, Turkish literature in Germany, national-spiritual values, child education, fairy tales

Giriş

Masallar toplumların, kültür aktarımının ve bireylerin geçmiş ile bağ kurmasının en temel öğelerindendir. Geçmişten günümüze kadar geçen süreçte, insanlar ve toplumlar birçok kere benzer olaylara tanık olmuş ve bu olaylardan çıkarımlarda bulunmuşlardır. Bu anlamda çocukların eğitiminde ve olaylar karşısında bilinçli davranmasında masalların önemi daha fazla ön plana çıkmaktadır. Masalların çocukların sosyalleşmesine, dinleme becerilerini geliştirmesine, kullandıkları dili geliştirmelerine ve yaşadıkları toplumun dil özellikleri ile tanışmalarına ve hayal gücünün gelişmesine katkı sağlar. Bunların yanında masallar, çocukların duygularını tanımalarını, farklı durumlara göre bakış açısı geliştirmelerini, olayların sonuçlarından ders çıkarmayı öğrenmelerini sağlar

Türk Dünyası masalları farklı lehçelerde, farklı yönlerde gelişmiş olsa bile dil, duygu ve kültür birliğini bir çatı altında tutuyor. Bu anlamda masallar toplumun tarihi kodlarını barındıran bellek görevindedir. Yetişen genç neslin milli ve manevi değerlerini öğrenip bunu davranış haline getirmesinde ilk okutulan ve ya dinletilen edebi metin olarak masalların rolü inkar edilemez. Bebekler gözlerini dünyaya açtıkları andan itibaren yaşamı anlamlandırmaya çalışır. Bu süreçte yaşamın anlamına dair zihninde beliren soruları kendi gelişimini sağlamak ve tamamlamak için yanıtlamak zorundadır. Çocuğun, zihinde beliren soru 2 ve sorunların çözümlerini doğrudan, hazır ve paketlenmiş olarak bir kaynaktan veya yetişkinlerden öğrenmesi neredeyse imkânsızdır. Değerlerin edinilmesi olarak da düşünebileceğimiz bu süreçte masallar vazgeçilmez araçlardır (Dilidüzgün, 1994: 169-173). Masallardaki alegorik kahramanlar çocuklarda insani değerlerin öğrenilmesinde ve hayal gücünün oluşmasında çok önemli rol oynar. Bu anlamda Yücel Feyzioğlu'nun masal kitapları çok değerlidir. Yücel Feyzioğlu hayatı boyu bir çok eser yazmış ve bu eserlere göre farklı ödüller almıştır. Yazdığı eserler içinde Türk dünyasını karış karış gezerek topladığı ve yeniden düzenleyerek yazdığı masal kitapları çok değerlidir. Nitekim Almanya'da Türk gençlerinin milli ve manevi değerler yönünden yetişmesinde önemli katkı sağlıyor. Bu masallar aynı zamanda Almanya'daki Türk çocuklarına Türkçenin saflığını, temizliğini aktarması bakımından da kıymetlidir. Yücel Feyzioğlu'nun 1979 yılından bu yana yurtdışında yaşayan Türk çocukları için ders kitapları yazan ilk yazarlardandır. Onun bu konudaki çalışmaları ortak Türk kültür mirasına önemli hizmettir. Bu çalışmalar bir de ona göre değerlidir ki, değişen, yenileşen dünyada genç neslin psikolojisini göz önünde bulundurarak yeniden düzenlemiş. Özellikle Almanya'daki Türk çocuklarının entegrasyon sürecinde asimle olmasına engel olur, onların milli ve manevi değerlerinin, soy kökünün tanımalarına ve unutmamalarına yardımcı oluyor. Nitekim daha ilk

okul döneminde Batı kültürü ile tanışan, Batı masal kahramanlarıyla arkadaş olan Türk çocuklara milli masal kahramanlarını tanıştırarak sevdirmeğe çalışmıştır. Yücel Feyzioğlu'nun yazdığı 35 masal kitabının tamamının değerlendirilmesi büyük bir araştırma konusudur.

Almanya'da çocuk edebiyatı

Almanya'da çocuk ve gençlik edebiyatı, ağırlıklı olarak 12-15-21 yaş arası gençlere yönelik yazılmış eserler olarak kabul ediliyor. Almanya'daki Türk yazarlar başlangıçta bu yaş gruplarının yaşamının belirli bölümlerini konu alan eserler yazmış olsalar da bunlar tam olarak gençlik edebiyatı sayılmaz. Gençlik edebiyatı sadece gençlerin eserleri değil, onların iç dünyalarını ve duygularını yakalayan, onları ilgilendiren konulara değinen, bu sorunları çözmenin yollarını öneren eserler olarak kabul edilir. 19. yüzyılın sonlarında Almanya'da Heinrich Wohlgast şöyle yazmıştı: "Was sollen unsere Jugendliche lesen?" (Gençler Ne Okumalı?) başlıklı makalesiyle, hangi kitapların gençlere ait olduğu araştırmasıyla Avrupa'da yeni bir tartışma konusu yarattı. (Wohlgast, 1899: 210 Ewers, 1993: 217)

Çocuk ve gençlik edebiyatı, genel edebiyat alanında olduğu gibi, tarihsel ve eleştirel konulara, çocuk ve gençlik edebiyatının kuramına ve kavramına dayalı, biraz spesifik bir yaklaşımla çocuk ve genç okur kitlesini hedef alan özel bir alandır. Türk edebiyatında bu konu günümüze kadar bazı tartışmalara neden olmuştur. Çoğu durumda çocuk ve gençlik eserleri çocuk ve gençlik edebiyatı başlığı altında toplanmaktadır. Ancak çocuk ve gençlik edebiyatı, "çocuk ve gençlere yönelik, kendileri tarafından veya bir kısmı tarafından kabul edilen bütün edebiyatlar" olarak bilinmektedir. (Dahrendorf, 1979 :159) Hatta pek çok Avrupalı yazar çocuk ve gençlik edebiyatını gruplara ayırıp her biri hakkında bir sınıflandırma yapmaktadır. Almanya'da yaratılan Türk çocuk ve gençlik edebiyatı bu anlamda Avrupa edebiyatının etkisinden uzak kalmamıştır. Özellikle Almanya'ya gelen Türk çalışan ailelerin çocuklarının karşılaştıkları sorunlar Türk yazarların dikkatinden kaçmamıştır. Türk yazarların ilk dönemlerinde çocuk ve gençlik edebiyatını formüle etmekten ziyade, Almanya'ya gelen ailelerin, okul çağındaki çocuklarının içinde bulundukları yeni sosyal ve kültürel çevreye uyum sürecinin zorluklarını yansıtmayı amaçladılar. Bu nedenle Almanya'da yaşayan birinci ve ikinci dönem Türk yazarları çocuk ve gençleri merkeze almak yerine onların sorunlarını ele alan eserleri çocuk ve gençlik edebiyatı grubuna ayırmışlardır. Yukarıda da belirttiğimiz gibi Türkiye'de çocuk ve gençlik edebiyatının son yıllarda gelişmesi ve Türk yazar ve şairlerinin Avrupa edebiyatından etkilenmesi sonucu bu edebiyat alanına uygun eserler yazılmıştır. Çocuk ve gençlik edebiyatının Almanya'da erken şekillenmesi ve yaş gruplarına göre bölünmesi Türk yazarları da etkilemiştir. Dolayısıyla son dönemde Almanya'da gelişen Türk edebiyatında çocuk ve

gençlik edebiyatının sistemli bir şekilde geliştiğine tanık oluyoruz.Almanya'da çocuk ve gençlik edebiyatının gelişim sürecine baktığımızda, 60'lı yıllardan itibaren siyasi ve ekonomik nedenlerden dolayı, Türkiye'nin de aralarında bulunduğu yabancı ülkelerden gelen işçi ailelerin ve başta onların çocukları olmak üzere yaşam tarzları, Alman çocuk ve gençlik edebiyatı kapsamına alınmıştır. Sayıları az da olsa Türk çocukları bu eserlerde baş kahramanlardan biri olarak seçilmiş, amaç Türk ve Alman çocuklarını birbirileriyle kaynaştırmak olmuştur. Bu tür hikayeler farklı kültürlerin buluştuğu diğer toplumlar üzerinde de etkili olmuştur.Edebiyatın işlevlerinden biri kuşkusuz insanın içindeki iyiyi ortaya çıkarmaktır. Ama her edebî eserin bireyi iyiye yönlendirmediğini de göz ardı etmemek gerekir. Nitelikli olmayan bir eserle "iyi insan yetiştirme" amacına ulaşmak mümkün olmayacaktır. Bu yüzden edebî eserler bireylere değerleri aşılamada kullanılabilecek önemli araçlar olmalarına rağmen, bütün edebî eserlerin bu görevi yerine getirdiği söylenemez. Eserlerin yazarı, konusu, okurun gelişim düzeyine uygun olması, şiddet ögeleri içermemesi, yanlı yönlendirmelerde bulunmaması gibi birçok unsur edebî eserin niteliğini belirler. Bu yüzden özellikle çocuklara ve gençlere hitap eden kitaplar yazan yazarlara büyük sorumluluklar düşmektedir.Almanya'da Türk yazarlar ilk yıllarında çocuk ve gençlik edebiyatı adı altında bir çok eserler yazmışlar, ama çocukların iç dünyalarını, felsefelerini, dünya görüşlerini, tutkularını ve özlemlerini bir kenara bırakarak ağırlıklı olarak Türk işçi ailelerin sorunlarını kaleme almışlardır. Nitekim eserlerinde çocukların yaşadıklarş sosyal çevreyi anlatırken bunu çocuk ve gençlik edebiyatı olaraq nitelemişler. Ancak aynı dönemde Alman edebiyatında yazılan çocuk ve gençlere yönelik kitaplar birbirinden ayrılmış, çocukları eğlendiren, gençlerin sorunlarına odaklanan, onları her yönüyle yansıtan, sanatı, kültürü ve bilimi aşılayan eserler yazılmıştır. Elbette zaman içinde bu durum tamamen değişmiş ve Almanya'daki Türk yazarlar çocuk ve gençler için bir-birindən farklı ve yaş grubuna ve çocukların ilgi alanine uygun, gençlerin sosyal yaşamını ve gelecek planlarını belirlemeye, onlara bu konularda yol gösterici nitelikte bir edebiyat türü geliştirmeye başlamıştır. Çocukların ve gençlerin kendi kültürünü öğrenmekle birlikte diğer medeniyetleri de tanımasına ve kaynayıp karışması için çocuk ve gençlik edebiyatının müstesna rolu vardır. Aynı zamanda bu çocukların daha küçük yaştan okuma becerisini ve alışkanlığını oluşturur. "Okuma pek çok kapının anahtarıdır. Bunun için ilköğretimde çocuklara okumayı sevdirmek ve onları okumaya yönlendirmek son derece önemlidir. Zira ilköğretimde pek çok öğrenci hiç kitap okumaz ya da çok az okur. Bu nedenle edebiyatın derslerde etkin bir biçimde kullanılması yönteminin amacı, çocukları kitapla buluşturmak ve onlara edebi metinlerle nasıl çalışacaklarını kendi deneyimleriyle öğretmektir" (Arkılıç-Songören, 2011: 85)

Almanya'da 70-li yıllardan itibaren göçmen ailelerin çocuklarını eserlerine konu eden yazarlar daha sonra 80-90-lı yıllarda Alman araştırmacıların da dikkatini çekmiştir. Başta problemleri anlatmak ve ya Alman dilini öğrenme kolaylığı sağlamak maksadıyla yazılan çocuk eserleri sonraki dönemlerde daha da olgunlaçarak onlara kendi kültürünü öğretmekle birlikte bulundukları topluma kaynayıp karışmayı öğretir. Yüksel Pazarkaya, Alev Tekinay, Neşet Erol, Özdemir Başargan, Nazif Telek ve Aygen Sibel Çelik arasında "Çağımızın masalcı dedesi" olarak anılan Yücel Feyzioğlu'nun müstesna bir rolü var. Yücel Feyzioglu'nun yazdığı masallar Almanya'da Türk ve Alman çocukları arasında bir köprü oluşturdu. Yücel Feyzioğlu 2020 yılından yayınlanan "Masallar Bize Ne Anlatır?" adlı eserinde masalların kırktan fazla işlevini anlatırken, kitabın sonunda masalları yaş gruplarına göre tasniflendirmiştir. Bu tasniflendirmenin dışında yazar çocukların kendi iç dünyasına ve zihinsel olgunluğuna göre masallar seçebileceğini belirtir. Bu anlamda Almanya'da Türk yazarlar tarafından oluştururlan çocuk edebiyatı yeni bir biçim kazanmaya başlamıştır.

Yücel Feyzioğlu Ve Masallar Alemine Yolculuk

Evliya Çelebi gibi diyar diyar dolaşıp Türklerin yaşadıkları coğrafyalarda bulunan masalları toplayarak yurtdışında Türk çocuklarına masal kültürünü anlattığı gibi , diğer kültürlerin çocuklarına da Türk insanını ve masallarını tanıtan Yücel Feyzioğlu 1946 yılında Kars'ta doğdu. Ailenin ilk çocuğu olan Yücel eğitimini Öğretmen okulunda aldı. Kendi söylediklerine göre Yücel Feyzioğlu edebi ortamda yetişti. Babasını soğuk kış akşamlarında onların evinde arkadaşları ile kitap okumaları, dede ve ninesinin daha çok küçük yaşlarından ona masallar anlatması gelecek hayatının yolunu çizmiştir. Daha küçük yaşlarından edebiyata olan hevesi ona küçük şeyler yazdırırdı. 1957 yılında sakladığı yazılarından birini yakalayan Faya öğretmeni Yücelin yazdığı küçük hikayeyi okur. "Bunu sen mi yazdın?" diye sorar. Çekingen bir sesle "evet" cevabını alan öğretmeni "sen çok güzel bir yazar olacaksın" sözleri Yücel'in gelecek hayatını şekillendirir. Yazar, 1965 yılında Kars Kazım Karabekir İlköğretmen Okulundan mezun olup Yozgat'ın Sorgun ilçesine bağlı Külhöyük İlkokuluna öğretmen olarak atanır.İki yıl bu okulda görev yaptıktan sonra askerlik görevini yerine getirmek üzere askere alınır. Acemi eğitimini Sivas'ta alan Feyzioğlu Ankara Etimesgut 28. Mekanize Tümeninde okuma yazma bilmeyenlere okuma öğretir, askerlik görevini Ardahan'da tamamlar.İlk olarak yerel 23 Şubat Gazetesi'nde makaleleri yayınlanan yazarın ulusal düzeyde Ulus, Akşam, Cumhuriyet gazetelerinde makaleleri ve sanat eklerinde öyküleri yayınlanır. 1971 yılına kadar Türkiye'de öğretmenlik yapabilen yazar, 1968 yılında yayımladığı "Sahipsizler" adlı hikâye kitabından dolayı Sıkıyönetim Mahkemesinde yargılanır, ceza alacağı anlaşılınca 1972 yılında

çok sevdiği vatanını terk ederek Almanya'ya yerleşir. Kendi ülkesinde kitaplar yazan, toplantılar yöneten yazar, Almanca bilmediği için kendi ifadesiyle birden sıfır yaşında bir bebeğe dönüşür. "1965 yılında Kars-Susuz-Kazım Karabekir İlköğretmen Okulunu bitirdim. Ancak 1971 yılına kadar öğretmenlik yapabildim. Yayımladığım ilk hikaye kitabımdan ve Arpaçay'da Türkiye Öğretmenler Sendikası kuruculuğu yapmamdan ötürü askeri yönetim beni görevden alıp sıkıyönetim mahkemesinde cezalandırdı. Ben de 1972 yılında bu yurdu terk edib Almanya'ya gitmek zorunda kaldım. Her melanette bir hayır olduğuna inanırım. İyi ki, ceza vermişler, diller öğrendim, masallara yönelme zorunluluğunu orada kavradım" (Feyzioğlu, 2013: 14)1973 yılında Adler firmasına ait bir fabrikada işçi olarak çalışan yazar, bu sairada Almanca Goethe Enstitüsünde dil eğitimi tamamlar ve 1974 yılında Almanya'da öğretmenliğe başlar. Yazar aynı zamanda Andersson Yazarlık Akademisini de bitirir. Bu akademinin onun yazarlaık hayatında önemli etkisi olur. 1979 yılında Türk öğrencilere yönelik Türkçe ders kitapları hazırlamada görev alır. 1985 yılına kadar Almanya Eğitim Bakanlığına bağlı olarak öğretmenlik mesleğini icra eden Yücel Feyzioğlu yayınladığı kitaplar ve yazarlık mesleği ile ilgili verdiği konferanslar ve görüşlerin sıklığı nedeniyle kendi isteğiyle öğretmenlikten ayrılır. Halan faal olarak çocuk edebiyatı alanınıda güzel eserler yazan yazar faaliyetini Almanya'nın Köln şeherinde devam ettiriyor.1974 yılından başlayarak tam kırk yıl boyunca masallar alemini, dünyanın neredeyse dört bir yanını seyahat ederek binlerce masal toplayan, onları tekrar değerlendirerek yeniden yazan Yücel Feyzioğlu masalların çocuk eğitimine ve güzel bir gençliğin yetişmesine önemli katkı sağladığını ve çokyönlü işlevini kısaca şöyle ifade eder: "İstiyorum ki, masalların neden gerekli olduğu anlaşılır olsun. Öğretmen ve anne babaların çalışmasını kolaylaştırsın, onların motivasyonunu artırsın, onların başarısına ufacık da olsa bir katkı sağlasın…" (Feyzioğlu, 2020: 15)Masalların her birinin farklı işlevinin olduğunu ileri süren Y.Feyzioğlu, bunun çocuğa sağlam bir kişilik ve kültürel kimlik kazandıracağını düşünür. Yazar yazdığı masallara göre Türkiye ve Avrupa'da bir çok ödüle layik görülmüştür. Yücel Feyzioğlu, eserleriyle birçok ödüle layık görülür. Bunlardan bazıları: 1979 yılında "Uğultu" ile Sanat Emeği roman ödülü, 1986-87 Gençlik çalışmasıyla "Yunus Nadi Röportaj Ödülü" ikinciliği, 1992 yılında "Kırmızı fare" öykü ödülü, 1997 yılında "Ömer Seyfettin" öykü özel ödülü, 2001 yılında "Göçün 40. Yılı" nedeniyle açılan yarışmada "Anadili Gerekli mi?" denemesiyle "Cumhuriyet Gazetesi" birincilik ödülü, 2003 yılında TRT İNT'in açtığı "AB/Türkiye ilişkileri" konulu yarışmada "Danışman" adlı öyküsü ile birincilik, TÜRKSAV tarafından "2011 yılı Türk Dünyasına Hizmet Ödülü", Elginkan Vakfı tarafından "2011 yılı Türk Kültürünü Araştırma Ödülü" ve 2012 yılında da "Halk Kültürü Araştırma Vakfı

Ödülü"dür. Eserleri 1987 Gladbeck Gülmece Ödülü seçkisine girer, 2002 yılında "Sihirli Limon" adlı kitabı NRW Eğitim ve Bilim Bakanlığının 20 kitaplık seçkisine alınarak bütün çocuklara, okullara ve ailelere tavsiye edilir. Son olarak Türkiye'de "Anarbay" adlı romanı ile "Tarih Boyunca Dünyayı Sarsan Doğal Felaketler" adlı iki kitabı; Bonn'da ise Free Pen Verlag tarafından "Sihirli Limon" adlı masalı iki dile çevrilerek yayımlanır (Karaman, 2018: 35).

Kültürel Değerler bağlamında masalların önemi

Yücel Feyzioğlu Almanya'daki çocukların Türkçe ve Almanca okuması, farklı kültürlerle bağ kurması amacıyla yazdığı kitaplar kısa sürede dikkat çekerek çeşitli dillere tercüme edilerek dünyanın bir çok yerinde yayınlandı. "Keloğlan"masal dizisi yine dünyanın bir çok yerinde büyük ilgiyle karşılandı. Radyo ve televizyon yayınlarında yer aldı. Farklı işlevlere sahip olan masallar çocuğun eğitiminde ve gelişiminde önemli yere sahiptir. Hayal ürünü olan masallar çocukları gerçek hayata hazırlar, yüksek ahlak değerleri, kültürel kimlik açısından olduğu gibi, çocuğun interkültürel bağlamda yetişmesinde de mühim rol oynar. Yücel Feyzioğlunun masalları bu bağlamda da önemlidir. Evliya Çelebi gibi diyar diyar gezip Türk kültürünün farklı boylarından aldığı renkli ilmeklerle sihirli bir masal halısı dokuyarak farklı kültürleri kaynaştırmaya çalışır. Bu farklılıkları bir araya getirirken çocukları bir birine tanıtarak yaşadıkları coğrafyayı, bulundukları toplumun tarihini ve kültürünü de aktarıyor. Masallarla çocukların hayal gücünü geliştiriyor, onları bir birine tanıtır, masallarla Türk dünyası çocuklarını buluştururken, farklı kültürleri tanımasına ve saygı duymasına olanak sağlıyor."Uygurların yaşadığı topraklar nere, Kars nere, Almanya nere? Ama bu iki masal birbirine o kadar benzer ki, iki halk arasında köprü oluşturur. Dört kafadan mı gitti Bremen Mızıkacıları'nı etkiledi, yoksa tersi mi oldu? Veya iki masal da birbirinden bağımsız mı yaratıldı, bilmiyoruz. Ama bu benzerlik iki ülke arasında bir köprü kuruyor. Bu köprü aracılığı ile iki halk birbirine yakınlık duyabiliyor, birbirine dost olması daha da kolaylaşıyor. Yeter ki bu kültürleri bilelim, kültürsüz köprü kurmak kolay değil." (Y.Feyzioğlu, 2020: 115)

Yücel Feyzioğlu'nun masalları Almanya'daki Türk çocuklarının kültürel kimliklerini tanıması ve bulundukları ülkelerde kültürel uyum sağlamaları açısından çok önemli. Nitekim masallar toplum bireylerin kültürel kimlik hakkında önemli bilgiler içerdiği için özellikle kimlik arayışı dönemlerinde çok önemlidir. Bunun yanında çocuklarda özgüven oluşmasına olanak sağlıyor. Çükü bir toplumda var olan değerler anlatılır ve tebliğ edilirse, diğer toplum bireyleri kültürel köklerini derinden tanımıyorsa büyük bir eksiklik yaşarlar. Fakat çocuklar masallarla kültürel bağlarını öğrenirse, yazarın deyimiyle "Onda varsa, bende de var" psikolojisiyle karşı tarafı da çok rahat anlar ve saygı duyar. Masallar derinden araştırılmasının bir toplumun estetik düşünce

tarzını, dünya görüşünü, kültürel kimliyini sahiplenmesi ve bir çok değerler bakımından ne kadar önemli ve etkili olduğunu görüyoruz. Masallar kültürel bağlamda değişir ve evrilir, bu da onların canlı ve esnek anlatılar olduğunu gösterir. Bu esneklik yazar tarafından mükemmel bir şekilde değerlendirilerek dönemin sosyal-kültürel ihtiyaçlarına ve topluma göre uygun bir hale getirilerek zaman içinde yeniden yazmıştır. Y.Feyzioğlu Almanya'da yaşayan çocukların anadilini öyrenmesine, zenginleştirmesinde masalların bir eğitim aracı olarak kullanılmasını bizzat kendisi pedogoji faaliyetinde tecrübe ederek faydalarını gözlemlemiştir. Çocukların masal kişileriyle kendilerini özedeşleştirerek; güzel davranışlar öğrenerek toplumsallaşma, sosyalleşme, kültürel bağlamda ulusal ve evrensel değerleri tanıma olanağı bulabilirler. Masalların çocukların çokyönlü eğitiminde en kolay, en hızlı ve en etkili yoldur.

Teknolojinin hızla geliştiği bir dönemde çocukların ve gençlerin zihni ve ruh gelişimi, dünyayı ve gerçekleri doğru yorumlaması yeniden yazılan masallarla mümkün olduğu pedagoglar ve araştırmacılar tarafından belirlenmiştir. Bu anlamda Yücel Feyzioğlu'nun yazdığı masal kitapları çok değerlidir.

Y.Feyzioğlu'nun yeni yaklaşımla yazdığı masalların eğitimsel işlevselliği

Yukarıda da belirttiğimiz üzere Masalların çocuk eğitiminde müstesna yere sahiptir. Yücel Feyzioğlu'nun masal kitaplarında yer alan etik, psikolojik etkiler belirgin şekilde dile getirilmiştir. Örneğin yalan söylemenin insanı nasıl kötü duruma düşürdüğünü, güvensizliğe sebep olduğunu "Kırk koyun"adlı masalında mükemmel bir şekilde vurgulamıştır. Masalda düştüğü durumdan kurtulmak isteyen kahramanın yalana el atmasıyla daha kötü duruma düşmesine sebep olmuştur. Kurnazlık yapıp yalan söyleyerek, insanları aldatmak güveni sarsar ve ilişkiler arasında samimiyetsizliğe yol açar. "Aldar Köse-Kazak Masalları"nda Aldar Köse'nin kurnazlıkla nasıl aldatıldığını, güveninin sarsılmasını açık bir dille anlatmıştır. Aynı konu "Yartı Kulak-Türkmen Masalları"nda da söz edilir.Dürüst olmak, yalan söylememek, güven vermek ve güvenmek gibi konular Y.Feyzioğlu'nun "Cırttan ile Çilbik-Azerbaycan ve Dağıstan Masalları" kitabında da vurgulandığı saptanır. Bu masallarda aynı zamanda haksızlık, özgüven ve cesaretli olma, zorluklar karşısında sabırla, yılmadan mücadele etmek çocuklarımıza örnek olabilecek niteliktedir."Murkumomo ile Çomotay-Özbek Masalları"nda doğruyu söyleyen kardeşlerin Hakan tarafından mükafatlandırıldığı anlatılır. Bu masallarla da Y.Feyzioğlu çocuklara "dürüst olan her zaman kazanır" mesajını verir. Dürüstük, yalan söylememe, cesur olma durumu toplumda adaletin de sağlanmasına yardım eder. Haksızlık karşısında durarak adaletin sağlanması bu masallarda ortaya konulur. "Dimirtaş ile Pıtıraş-Gagavuz Masalları"nda emanete sahıp çıkan çoban adaletli davranan keşiş tarafından

ödüllendirilir. Bununla birlikte bu masallarda yardımseverliğe de vurgu yapılmıştır. Bu masallarda çocuklar insan psikolojisi ile tanıştırılır. Nitekim yardımseverlikten bahseden bu kitaplarda her kese kendi değerini vermenin, gereksiz yere iyilik yapmanın da doğru olmadığını iletir.Y.Feyzioğlu yeniden yazdığı masallarda çalışkanlığı, alçakgönüllülüğü, cesareti, fedakarlığı, sabırlı ve azimli olmayı, insanlara karşı iyi niyetli olmanı, merhametli ve sorumluluk sahibi olmayı ve bu gibi bir çok insani değerleri çocuklara öğretiyor. Bu masallarda çocukların yaş grubuna göri daha iyi anlayabilmeleri için dil ve üslupla birlikte masal mitoloji terminlerini de başarıyla kullanmıştır.Y.Feyzioğlun'nun yeniden yazdığı masallarında kültürel bağlamda her kesi olduğu gibi kabul etmek, insanların mensubiyetine saygı duymak, merhametli ve tatlı dilli olmakla, çalışkan, mesuliyetli bir birey olarak dünya ile ilgili bilgi almak ve olaylardan ders çıkarmak gerektiğini ileti olarak vermiştir. Y.Feyzioğlu'nun masalları esas olarak sosyal ve kültürel değerler bakımından zengindir ve çocukların eğitiminde çok faydalıdır. Yücel Feyzioğlu'nun masalları değerler eğitimi açısından incelenirken başlıca değer olarak bilinen (adalet, dostluk, dürüstlük, öz denetim, sabır, saygı, sevgi, sorumluluk, vatanseverlik, yardımseverlik) sıklıkla ifade edildiği belirlenmiştir. Çocukların eğitiminde onlar yüksek değerlerin kazandırılmasında Yücel Feyzioğlu'nun masallarından faydalanılabilir.

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İKLİM DEĞİŞİKLİĞİNE UYUMDA İKLİM AKILLI TARIM SİGORTALARI: AKILLI SÖZLEŞMELER VE DLT'NİN ROLÜ

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Özet
İklim değişikliği, sıcaklık artışları, değişen yağış rejimleri ve aşırı hava olaylarının sıklığında artış gibi faktörlerle tarım sektörü üzerindeki baskıları artırmaktadır. Bu durum, tarım ürünlerinin verimliliğini düşürmekte ve küresel gıda güvenliğini riske atmaktadır. Bu zorluklarla mücadele etmek amacıyla, iklim akıllı tarım sigortaları, sektörün iklim değişikliğine uyumunu destekleyen stratejik çözümler arasında önemli bir yer tutmaktadır. Bu sigortaların uygulanmasında, akıllı sözleşmeler ve dağıtılmış defter teknolojisi (DLT), merkezi olmayan, şeffaf ve otomatize edilmiş bir çözüm sunarak dikkat çekmektedir. Akıllı sözleşmeler, sigorta poliçelerinin yönetimini otomatikleştirerek hızlı ve şeffaf tazminat süreçleri sağlarken, DLT tüm işlem geçmişini kaydederek veri bütünlüğü ve güvenilirliğini artırır. DLT, blockchain ve akıllı sözleşmeler, modern dijital işlemler ve otomasyonlar için hayati öneme sahip birbirleriyle bağlantılı teknolojilerdir. DLT, merkezi bir otorite gerektirmeksizin işlemlerin birden fazla konumda kaydedilmesi için bir yapı olarak temel oluştururken, blockchain ise işlemleri güvenli ve merkezi olmayan bir şekilde kaydeden bir DLT türüdür. Akıllı sözleşmeler ise, önceden belirlenmiş koşulların gerçekleşmesi halinde otomatik olarak yürütülen ve taraflar arasındaki anlaşmaları dijital olarak kodlayan sözleşmelerdir. Bu teknolojiler çeşitli sektörlerde şeffaflığı artırmakta, maliyetleri azaltmakta ve operasyonların verimliliğini iyileştirmektedir. Bununla beraber bu teknolojilerin uygulanması yanlış veya eksik veri girişinden kaynaklanan veri bütünlüğü sorunları, blockchain işlemlerinin yüksek enerji tüketimi ve sonuç olarak çevresel etki, mevzuattaki hızlı değişikliklere uyum sağlama zorlukları gibi riskleri beraberinde getirmektedir. Bu araştırma, iklim değişikliğine uyumda iklim akıllı tarım sigortalarının önemini vurgulamakta ve akıllı sözleşmeler ile DLT'nin bu alandaki rolünü detaylı bir şekilde incelemektedir.

Anahtar Kelimeler: İklim akıllı tarım sigortası, dağıtılmış defter teknolojisi (DLT), akıllı sözleşmeler, blockchain

ADAPTING TO CLIMATE CHANGE THROUGH CLIMATE-SMART AGRICULTURAL INSURANCE: THE ROLE OF SMART CONTRACTS AND DISTRIBUTED LEDGER TECHNOLOGY (DLT)

Abstract
Climate change, characterized by increasing temperatures, shifting precipitation patterns, and a rise in the frequency of extreme weather events, is exerting significant pressure on the agricultural sector. This challenge reduces agricultural productivity and jeopardizes global food security. To address these issues, climate-smart agricultural insurance emerges as a strategic solution, facilitating the sector's adaptation to climate change. The implementation of these insurances highlights the use of smart contracts and Distributed Ledger Technology (DLT), which provide decentralized, transparent, and automated solutions.Smart contracts automate the management of insurance policies, enabling swift and transparent compensation processes, while DLT enhances data integrity and reliability by documenting all transaction histories comprehensively.DLT, blockchain, and smart contracts are interconnected technologies crucial for modern digital transactions and automation. DLT provides a framework for recording transactions across multiple locations without requiring a central authority, blockchain records transactions in a secure and decentralized manner as a form of DLT, and smart contracts are self-executing contracts that activate automatically when predefined conditions are met, digitally encoding agreements between parties. These technologies enhance transparency, reduce costs, and improve operational efficiency across various sectors. However, their implementation also brings challenges, such as risks associated with data integrity issues due to incorrect or incomplete data entries, the high energy consumption of blockchain transactions contributing to environmental impacts, and difficulties in keeping pace with rapid legislative changes. This research emphasizes the significance of climate-smart agricultural insurance in climate change adaptation and provides a detailed examination of the roles of smart contracts and DLT in this context.
Keywords: Climate-smart agricultural insurance, Distributed Ledger Technology (DLT), smart contracts, blockchain

Giriş

İklim değişikliği, dünya genelinde tarımsal üretim sistemlerini ve gıda güvenliğini etkileyen en önemli çevresel sorunlardan biridir (Akalın, 2014). Artan sıcaklıklar, değişen yağış desenleri ve daha sık ve şiddetli hale gelen aşırı hava olayları tarım üzerindeki baskıyı artırmakta, ürün verimliliğini ve kalitesini olumsuz yönde etkilemektedir (Demirbaş, 2022). Bu durum, küresel gıda arzının sürdürülebilirliği konusunda ciddi endişelere yol açmakta ve tarım sektörünü iklim değişikliğine adaptasyon konusunda yenilikçi çözümler aramaya itmektedir. İklim değişikliğinin tarımsal üretim üzerindeki etkileri, küresel ölçekte farklılık göstermekle birlikte, özellikle gelişmekte olan ekonomilerdeki küçük ölçekli çiftçiler için önemli riskler oluşturmaktadır (Omar et al., 2023). Ekstrem hava olayları, çiftçilerin tarımsal üretimini doğrudan etkileyerek tarım tedarik zincirlerinin kırılganlığını artırmaktadır. İklimsel öngörülemezlik, hayvan ve bitki kayıplarına, açlığa ve göçe neden olmaktadır. Diğer taraftan tarımsal üretimdeki belirsizlikler, gıda fiyatlarında dalgalanmalara ve nihayetinde gıda güvenliğinin bozulmasına yol açabilmektedir. Bu bağlamda, küçük ölçekli çiftçiler, iklim değişikliğine karşı dirençlerini artırmak amacıyla çeşitli stratejilere başvurabilmekteler. Hükümetler arası İklim Değişikliği Paneli (IPCC), iklim değişkenliği ve değişikliğine karşı direnci, "bir sosyal veya ekolojik sistemin, temel yapısını ve işleyiş mekanizmalarını muhafaza ederken bozulmalara karşı direnç gösterebilme, kendini organize edebilme ve stresle veya değişimle başa çıkabilme kapasitesi" şeklinde tanımlamaktadır. Bu tanımdan yola çıkılarak, direncin esas niteliğinin, şok ve stres faktörlerine karşı dayanıklılık sergileme ve adaptasyon sürecinde gerekli dönüşümleri gerçekleştirme kapasitesi olduğu vurgulanmaktadır (Awazi et al., 2019).Literatürde, direnç oluşturma stratejileri maruziyeti azaltma, hassasiyeti azaltma ve uyum kapasitesini artırma olmak üzere üç ana başlık altında incelemiştir (Kangogo et al., 2020). Maruziyeti azaltma stratejisi, belirli bir riskin oluşma olasılığının ve şiddetinin azaltılması amacına yöneliktir. Bu stratejide, iklimsel ve iklimsel olmayan şoklar arasında bir ayrım yapılmaktadır; iklimsel olmayan şoklar için çiftlik düzeyinde olasılık ve şiddetin azaltılması mümkün olabilirken, iklimsel şoklar söz konusu olduğunda bu daha zor hale gelmektedir. Hassasiyeti azaltma stratejisi, çiftliklerin çeşitli şoklara karşı hassasiyetlerinin azaltılmasını hedeflemektedir. Bu süreçte, potansiyel risklerin tanımlanması ve bu risklerin etkilerini azaltacak yanıt mekanizmalarının geliştirilmesi gerekmektedir. Örneğin, kuraklığa daha dayanıklı tohum çeşitlerinin kullanımı, kuraklık gibi şoklara karşı hassasiyetin azaltılmasına katkıda bulunabilmektedir. Uyum kapasitesini artırma stratejisi ise, çiftçilerin iklim değişikliğinin etkilerine karşı hızlı ve etkili bir şekilde yanıt verebilme kapasitelerinin

geliştirilmesini ifade etmektedir. Bu bağlamda, yenilikçi yönetim uygulamalarının ve inovatif teknolojilerin benimsenmesi öne çıkmaktadır. Çiftçilerin uyum kapasitesinin artırılması, iklim değişikliğiyle başa çıkma stratejilerinin çeşitlendirilmesi ve belirsizlik altında karar alma süreçlerinin iyileştirilmesi ile ilişkilendirilmektedir. Bu bağlamda, değer zinciri iş birliği; hem diğer çiftçilerle yatay (çiftçi organizasyonları aracılığıyla) hem de ürün alıcılarıyla dikey (çiftçi-alıcı ilişkileri aracılığıyla) iş birlikleri yaparak, çiftçilerin uyum kapasitesini arttıran temel bir strateji olarak ön plana çıkmaktadır. Bu stratejiler arasında, tarımsal krediler ve genişletilmiş kredi erişimi aracılığıyla gelişmiş tarımsal üretim teknolojilerine yatırım yapmak da bulunmaktadır; bu yöntem, çiftçilerin iklim değişikliğine adaptasyon kapasitelerini önemli ölçüde güçlendiren bir yaklaşım olarak kabul edilmektedir (Kadanalı ve Kaya, 2021).Risk transfer aracı olarak tarım sigortası ise, iklim değişikliklerinin yol açtığı etkilerle mücadelede finansal direncin güçlendirilmesine önemli ölçüde katkıda bulunmaktadır. Bu katkı, kırılganlığın minimize edilmesi, risk ve belirsizliğin azaltılması ve üretken faaliyetlere yönelik yatırımların özendirilmesi şeklinde çok yönlü bir etki yaratmaktadır. Tarım sigortası, çiftçilere gelir güvencesi sağlamakta, ekipman yatırımlarını teşvik etmekte ve afet anında topluluklar ile hükümetler üzerindeki yükü hafifletmektedir (UNDP, 2023). Bu özellikleri ile tarım sigortası, çiftçilerin hem hassasiyetlerini azaltma hem de uyum kapasitelerini artırma yönünde önemli bir rol oynamaktadır. Sigorta, olumsuz hava koşulları gibi beklenmedik olaylardan kaynaklanan potansiyel zararları telafi ederek çiftçilerin zararlarını minimize etmektedir. Bu şekilde, çiftçilerin bu tür olaylara karşı daha az hassas hale gelmesini sağlamaktadır. Diğer taraftan sigorta, çiftçilere finansal güvence sağlayarak, onların iklim değişikliği ve diğer beklenmedik olaylar karşısında daha dirençli ve esnek olmalarını sağlamaktadır. Bu finansal güvence, çiftçilerin uzun vadeli planlama yapabilmelerine, yenilikçi tarım tekniklerine yatırım yapabilmelerine ve olası bir zarar durumunda toparlanabilmelerine olanak tanımaktadır.

Dünya genelinde çeşitli tarımsal sigorta ürünleri mevcuttur (Ghimire et al., 2016). Bu sigorta ürünleri, tazminat miktarlarının hesaplanma yöntemlerine göre üç ana kategoriye ayrılmaktadır (Çizelge 1).

Çizelge 1. Tarımsal Sigorta Ürünlerinin Sınıflandırılması

Tarımsal Sigorta Ürünü Türü	**Ödemeler**
a) Tazminat Temelli Tarımsal Sigorta (sigortalı birim seviyesindeki gerçek kayba dayalı tazminat ödemeleri)	
1. Belirli Riskler	Hasar Yüzdesi
2. Çoklu Riskler	Verim Kaybı
b) Endeks Bazlı Tarımsal Sigorta (sigorta ödemeleri bir endeks ölçümüne dayalı)	
3. Alan-Verim Endeksi	Alan-verim Kaybı
4. Tarımsal Hava Durumu Endeksi Sigortası	Hava Durumu Endeksi tazminat ölçeği
5. Normalleştirilmiş Fark Bitki Örtüsü Endeksi (NDVI) Sigortası	NDVI Endeksi Tazminat Ölçeği
6. Hayvan Ölüm Oranı Endeksi Sigortası	Hayvan Ölüm Oranı Endeksi Tazminat Ölçeği
7. Orman Yangını Endeksi Sigortası	Yangın Kaynağı ve Etkilenen Alan Tazminat Ölçeği
c) Ürün Geliri Sigortası (Verim ölçümü ve ürün fiyatlarına dayalı sigorta ödemeleri)	
8. Ürün Geliri Sigortası (CRI)	Verim ve Fiyat Kaybı

Kaynak: Ghimire et al., 2016

Tazminat temelli tarım sigortası ürünleri, hasar tazmin tutarını, sigortalı tarafından karşılaşılan gerçek zarara göre belirlenmektedir. Sigorta olayı gerçekleştiğinde, sigorta poliçesinde belirtilen teminatlar çerçevesinde hasar tespiti yapılmakta ve tazminat miktarı sigortalı düzeyinde saptanmaktadır. Endeks bazlı tarım sigortası ürünleri, hasar tespiti yerine, kayıplarla yüksek korelasyona sahip ve sigortalı tarafından etkilenmesi mümkün olmayan bir "endeks" değerine göre tazminat ödemektedir. Bu endeksler, yağış miktarı, sıcaklık, bölgesel verim gibi çeşitli faktörleri içermektedir. Ürün geliri sigortası, poliçe sahibine belirli bir gelir düzeyini garanti ederek hem verim düşüşlerine hem de olumsuz fiyat hareketlenmelerine karşı koruma sağlayan bir tarımsal sigorta türüdür. Bu sigortada, garanti edilen verim, üreticinin geçmiş dönem üretim verisinin bir yüzdesi olarak belirlenmektedir. Garanti edilen fiyat ise, hasat ayındaki ürünün gelecek vadeli piyasa fiyatı şeklinde belirlenebilmektedir. Hasat zamanında üreticinin elde ettiği gerçek gelir, gerçek verim ile hasat anındaki spot piyasa fiyatının çarpımı ile hesaplanmaktadır. Bu gerçek gelir, garanti edilen miktardan daha düşük ise, sigorta şirketi aradaki farkı tazmin olarak ödemektedir (Iturrioz, 2009).

Geleneksel tazminat temelli sigorta yöntemlerinin, iklim değişikliği kaynaklı olaylar sonucunda ortaya çıkan tarımsal zararların telafisinde önemli sınırlılıklar sergilediği gözlemlenmektedir. Bu yöntemlerin başlıca zaafları; hasar tespit ve tazminat süreçlerinin uzun sürmesi, dolandırıcılık riskinin bulunması ve risk modelleme zorluklarıdır (Sushchenko and Schwarze,

2021). Öncelikle, iklim kaynaklı felaketlerin neden olduğu hasarların kapsamını kesin olarak tahmin etmek güç olup, bu belirsizlik, zararların belirlenmesi ve tazminatların ödenmesi süreçlerinin aylar sürebilmesine ve bu süre zarfında hasarların daha da artmasına neden olabilmektedir. İkincil olarak, tarım sektöründe faaliyet gösteren firmalar ve çiftçiler, gerçekleşen zararları abartma eğiliminde olabilmekte, bu durum sigorta şirketlerinin tazminat yönetimi süreçlerini karmaşıklaştırmakta ve zararın doğrulanması ile uygun tazminat miktarının belirlenmesi için ek maliyet ve zaman gerektirmektedir. Nihayetinde, küresel ortalama sıcaklıkların beklenenden daha hızlı bir şekilde artması, risk modellemesini önemli ölçüde güçleştirmekte ve dolayısıyla geleneksel sigorta modellerinin bu yeni ve öngörülemeyen koşullara adapte olmasını engellemektedir. Bu bağlamda, geleneksel tazminat temelli sigorta tekniklerinin, iklim değişikliğinin yol açtığı zorluklar karşısında yetersiz kaldığı ve tarımsal risk yönetimi alanında yenilikçi yaklaşımların gerekliliği açıkça ortaya çıkmaktadır.Endeks bazlı sigorta kavramı ise, tazminat temelli sigortanın karşılaştığı eksikliklerin bir sonucu olarak geliştirilmiştir. Objektif ve bağımsız fiziksel bir göstergeye dayanarak, endeks bazlı sigorta, tarımsal sigortanın mevcut sorunlarının üstesinden gelmekte ve maliyetlerde tasarruf sağlamaktadır (Omar et al., 2023). Ancak bu avantajlar yanında dikkate alınması gereken bir dizi dezavantajı da beraberinde getirmektedir. Bu dezavantajlardan ilki, endeks ve bireysel tarla bazlı kayıplar arasında yaşanabilecek potansiyel uyumsuzluk olan "baz riski"dir. Bölgesel ortalama verim veya yağış gibi genel göstergeleri temsil eden endeksler, her bir poliçe sahibinin bireysel kayıplarını tam olarak yansıtamayabilir, bu durum bazı sigortalılar için ya tazminat eksikliğine ya da gereğinden fazla tazminat ödenmesine neden olabilmektedir (Lichtenberg and Martínez, 2022). Endeks bazlı tarım sigortasının başarısı, doğru ve güncel endeks verilerine olan erişimine bağlıdır; bu verilerin eksikliği veya düşük kalitesi, baz riskini artırabilmekte ve sigorta primlerinin yanlış fiyatlandırılmasına yol açabilmektedir (Steinmetz, 2024). Özellikle gelişmekte olan ülkelerde, veri altyapısının yetersizliği, önemli bir engel teşkil edebilmektedir. Endeks bazlı tarım sigortası sisteminin suistimal edilme riski de bulunmaktadır; sigortalıların, kasıtlı olarak ekim alanlarını azaltması veya düşük verim elde etmesi, tazminat talebinde bulunmalarına neden olabilmekte, bu da sigorta primlerinin artışına ve sigorta havuzunun dengesizliğine yol açabilmektedir (Omar et al., 2023). Endeks bazlı tarım sigortası, geleneksel sigorta modellerine kıyasla daha karmaşık bir yapıya sahip olduğundan, poliçe sahipleri ve diğer ilgili tarafların sistemi tam olarak kavraması zor olabilmekte; bu durum, sigortaya erişim ve katılımı engelleyebilmektedir. Ayrıca, endeks bazlı tarım sigortasının yaygınlaşması, sigortacılık sektörünün teknik ve finansal kapasitesine ek yükler getirebilmekte, sigorta

şirketlerinin karmaşık risk modelleme ve veri analizi gibi alanlarda yetkinliklerini geliştirmeleri gerekmektedir (Maize Index, 2011).Endeks bazlı tarım sigortasının etkin bir şekilde uygulanabilmesi için, endekslerin seçimi ve hesaplanması, sigorta sözleşmelerinin şartları ve sigortacılık sektörünün gözetimi ve denetimi gibi konuları kapsayan, uygun bir yasal ve düzenleyici çerçeveye ihtiyaç bulunmaktadır. Bu bağlamda, endeks bazlı tarım sigortası tarımsal üretimde risk yönetimi için önemli bir araç olarak kabul edilse de bu dezavantajların ele alınması ve sistemin etkin bir şekilde uygulanabilmesi için kamu ve özel sektör paydaşlarının ortak çabaları gerekmektedir. Tazminat ve endeks bazlı tarım sigortası sistemlerinin mevcut dezavantajlarını aşma gereksinimi, yeni nesil sigorta ürünlerinin geliştirilmesini zorunlu kılmaktadır. İklim akıllı tarım sigortaları, bu yeni nesil ürünler arasında yer almakta ve akıllı sözleşmeler ile DLT gibi yenilikçi teknolojileri kullanarak tarımsal üretimde karşılaşılan riskleri daha etkili bir biçimde yönetme imkanı sunmaktadır. Akıllı sözleşmeler, önceden belirlenmiş koşulların gerçekleşmesi halinde otomatik olarak yürütülen ve taraflar arasındaki anlaşmaları dijital olarak kodlayan sözleşmelerdir (Knezevic, 2018). DLT ise, işlemlerin güvenli, şeffaf ve değiştirilemez bir şekilde kaydedilmesini sağlayan bir veri yapısıdır. İklim akıllı tarım sigortalarında kullanıldığında, bu teknolojiler, hasar tespit ve tazminat ödeme süreçlerini otomatikleştirebilmekte, dolandırıcılığı azaltabilmekte ve sigorta hizmetlerinin şeffaflığını ve güvenilirliğini artırabilmektedir. Bu bağlamda çalışmanın amacı, iklim değişikliğinin giderek artan etkilerine karşı tarımsal faaliyetlerin korunması için geliştirilen iklim akıllı tarım sigortalarının önemini vurgulamak ve bu alandaki yenilikçi teknolojilerin, özellikle akıllı sözleşmeler ve DLT, uygulamalarını detaylı bir şekilde incelemektir. Araştırma, tarımsal risk yönetiminde bu teknolojilerin nasıl bir potansiyel taşıdığını ve iklim akıllı tarım sigortası ürünlerinin, tarım sektöründeki mevcut zorluklara yenilikçi çözümler sunma kapasitesini ortaya koymayı hedeflemektedir.

2. DLT ve Akıllı Sözleşmelerin İklim Akıllı Tarım Sigortalarındaki Rolü

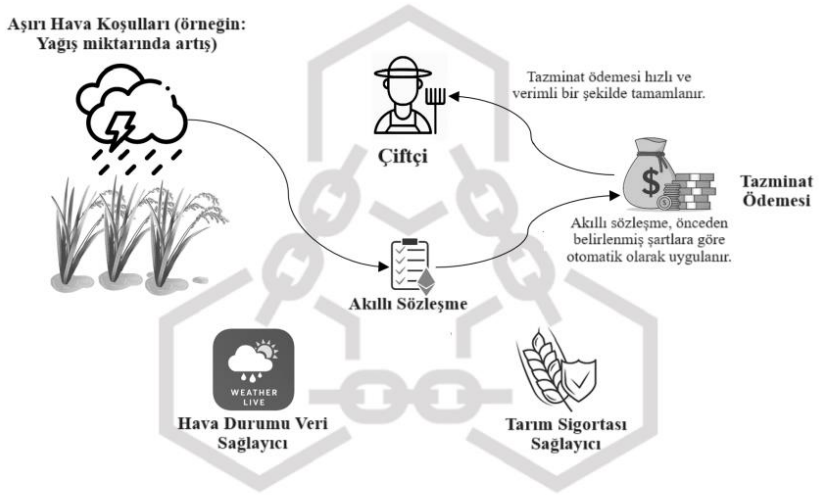
İklim akıllı tarım, iklim değişikliği bağlamında tarımsal faaliyetlerin yönetilmesine yönelik bir strateji olarak öne çıkmaktadır. Bu yaklaşım hem ulusal hem de uluslararası düzeylerde, tarımsal planlamada karşılaşılan zorlukların üstesinden gelmeyi amaçlamakta ve bu bağlamda giderek daha fazla önem kazanmaktadır (Lipper and Zilberman, 2018). İklim akıllı tarım, üç ana hedef doğrultusunda tanımlanmaktadır: tarımsal verimliliği sürdürülebilir bir şekilde artırarak gelirleri, gıda güvenliğini ve kalkınmayı desteklemek; çeşitli seviyelerde uyum kapasitesini geliştirmek ve sera gazı emisyonlarını azaltarak karbon yutaklarını çoğaltmak (Adegoke et al., 2024). İklim akıllı tarım kapsamında, gelişmiş su yönetimi teknolojileri, bitki

ıslahı, koruyucu tarım, üretim çeşitlendirilmesi, hava durumu endeksine dayalı sigorta, toprak verimliliği yönetiminin entegre uygulamaları gibi yenilikçi teknolojiler yer almaktadır (Zhao et al., 2023). Bu yaklaşımın bir bileşeni olarak tarım sigortası, iklim risklerine karşı stratejik bir tepki olarak işlev görmektedir. Çiftçilerin risk maruziyetini azaltarak, normalde aşırı riskli kabul edilebilecek yenilikçi tarımsal uygulamaların benimsenmesini teşvik etmektedir. Tarım Sigortası, iklim risklerini yönetmek ve iklim akıllı uygulamalarının daha geniş ölçekte benimsenmesini desteklemek için etkili bir araç olup; böylelikle iklim değişkenliği karşısında gıda üretimini güvence altına almaktadır (Falco et al., 2014). Diğer tarafta iklim değişikliği, küresel bir sorun olarak tanınmakta olup, çözümü için merkezi olmayan, çoklu paydaşlara dayalı ve alttan yukarıya yönelik bir yaklaşımın benimsenmesi gerekmektedir. Bu süreç, mevcut ve gelişmekte olan iklim eylem araçları için açık ve uluslararası bir platformun varlığını zorunlu kılmaktadır. Bunun yanı sıra, bu yaklaşımın yüksek seviyede ölçüm, raporlama ve doğrulama yeteneğine izin vermesi ve yüksek düzeyde güven ve şeffaflık gerektirmesi esastır. DLT, bu özelliklerle optimal bir uyum sağlayan teknolojidir (Born, 2018).DLT, blockchain ve akıllı sözleşmeler, modern dijital işlemler ve otomasyonlar için hayati öneme sahip birbirleriyle bağlantılı teknolojilerdir. DLT, merkezi bir otorite gerektirmeksizin işlemlerin birden fazla konumda kaydedilmesi için bir yapı olarak temel oluştururken, blockchain ise işlemleri güvenli ve merkezi olmayan bir şekilde kaydeden bir DLT türüdür (Connolly et al., 2017; Goodson, 2022). Blockchain platformlarında işleyen akıllı sözleşmeler ise, tüm katılımcıların aracı bir kurumun müdahalesi olmaksızın sonucundan hemen emin olabilmeleri için bir anlaşmanın yürütülmesini otomatikleştirmek amacıyla tasarlanmış protokollerdir (Omar et al., 2023). Bu teknolojiler birlikte, çeşitli sektörlerde şeffaflığı artırır, maliyetleri azaltır ve operasyonların verimliliğini iyileştirir.FAO, DLT'lerin ve akıllı sözleşmelerin tarım sektöründe değer ve bilgi alışverişini daha verimli, şeffaf ve izlenebilir hale getirme konusunda benzersiz fırsatlar sunduğunu belirtmektedir (Goodson, 2022). DLT ve akıllı sözleşmelerin entegrasyonu, işlemleri basitleştirmesi ve yenilikleri teşvik etmesi açısından iklim akıllı tarım sigortası için dönüştürücü bir potansiyele sahiptir. DLT, eski muhasebe sistemlerine kıyasla daha ucuz ve esnek olup, işlem parametrelerinin bağımsız doğrulanmasını sağlamaktadır (Connolly et al., 2017). Araştırmalar, DLT'nin indeks tabanlı sigorta ile birleştirilmesinin, AB'nin Ortak Tarım Politikası içindeki sorunları hafifletebileceğini ve iklim felaketlerinden etkilenen çiftçilere yapılan tazminat ödemelerindeki gecikmeleri azaltabileceğini göstermektedir (Schwarze and Sushchenko, 2022). Ayrıca, akıllı sözleşmeler, talep işleme ve ödemeler gibi sigorta süreçlerini basitleştirerek, tarım sigortasının verimliliğini artırmaktadır (Mainelli and Manson, 2017).

Günümüzdeki parametrik sigorta uygulamaları, teknolojik kısıtlar nedeniyle yeterli güvenilirlik ve verimliliğe sahip değildir. Blockchain teknolojisi, akıllı sözleşmeler ve IoT sensörleri kullanarak, şeffaflığı ve operasyonel verimliliği artırarak çiftçiler için daha etkili bir parametrik sigorta modeli oluşturma imkânı sunmaktadır. Bu teknoloji, çiftçi risk verileri ile iklim endekslerini bütünleştirerek tarımsal ürünlerin dalgalanmalarına ilişkin anlık bilgiler sunmakta ve böylece yağış miktarı gibi belirli parametrelere dayalı olarak akıllı sözleşmeler aracılığıyla tazminat işlemlerinin otomasyonunu sağlamaktadır (Mavilia and Pisani, 2019; UN, 2023).

Blockchain teknolojisi, belirli bir ağ üzerinde gerçekleşen tüm işlemleri değiştirilemez dijital defterlerde güvenli bir şekilde kaydetme kapasitesine sahiptir. Özellikle tarım sektöründe çiftliklerin durumu ve sözleşmelerle ilgili bilgilerin toplanması genellikle yüksek maliyetli bir süreçtir; bu bağlamda, blockchain güvenilir bir bilgi kaynağı olarak ön plana çıkmaktadır (Goodson, 2022). İlk büyük uygulama alanı Bitcoin adlı kripto para birimi olmakla birlikte, Bitcoin'in işlem sistemini destekleyen blockchain teknolojisi, bu kripto para biriminden çok daha geniş bir alana yayılmaktadır. Blockchain, aracılar olmaksızın işlem yapılmasını mümkün kılan, düşük maliyetli ve şeffaf bir mekanizma sunmaktadır; aynı zamanda karmaşık ağların üyeleri arasındaki işlemlerin doğruluğunu izlemeyi, raporlamayı ve doğrulamayı da sağlamaktadır. Bu özellik, veri kanallarında şeffaflık ve tutarlılık sağlar ki bu, afet yardımlarının ve tazminat ödemelerinin şeffaf bir şekilde raporlanmasında temel bir öneme sahiptir. (Nellore et al., 2022). Blockchainde her katılımcı bu veritabanının tam bir kopyasını bilgisayarında tutmakta, böylece merkezi bir kontrol mekanizması bulunmamaktadır. Blockchain, zaman damgalı ve geçerli girişler içeren bloklar şeklinde yapılandırılmış bir işlem defteridir. Her blok, önceki bloğun hash değerini içererek zincirleme bir bağlantı oluşturmakta ve bu, yapılan herhangi bir değişikliği tüm katılımcılara açık hale getirmektedir. Sonuç olarak, blockchain, değiştirilemez ve dağıtılmış bir kayıt sistemi olarak işlev görmektedir (Datoo, 2018)Blockchainde güven, aracı kurumlar olmaksızın işlemlerin geçerliliğinin kontrol edilmesi için dağıtılmış bir konsensus mekanizması kullanılarak sağlanmaktadır. Örneğin, Ethereum blockchain'inde İş Kanıtı (Proof of Work) kullanılmaktadır. Blockchain teknolojisi ile sigorta verileri, poliçeler, ödemeler, müşterini tanıma gibi bilgiler, düğümlerin dağılmış bir ağı üzerinde güvenli, bozulmaz dijital defterlere dijital olarak kaydedilebilmektedir. Ayrıca, veri transferi bağımsız ve otomatik olarak blok zinciri üzerinde gerçekleşmekte, böylece manuel, rutin ve kağıt temelli işlemleri ortadan kalkmaktadır (Nellore et al., 2022).Son zamanlarda, sigortacılar, çeşitli blockchainler kullanarak politika modelleri geliştirme ve deneme süreçleri yürütmektedirler. Akıllı sözleşme çözümleri sunan en yaygın blockchain platformu Ethereum

olup, NEO, NEM, EOS, Cardano, R3Corda ve Hyperledger gibi diğer platformlar da Bulunmaktadır (Nguyen et al., 2019). Sigorta sektöründeki en dikkate değer blockchain konsorsiyumu ise, izinli-özel bir blockchain olan R3 Corda'yı işleten Blockchain Endüstri Sigorta Girişimi (B3i)'dir. Öte yandan, AXA, izinsiz ve açık kaynaklı bir blockchain teknolojisi olan Hyperledger Fabric ile denemeler yapmaktadır. Farklı blockchainlerin kullanımı, InsurTech sektörünün henüz olgunlaşma aşamasında olduğunu ve pazarın konsolidasyon sürecinde olduğunu göstermektedir (Nellore et al., 2022).Şekil 1, blok zincir teknolojisinin küçük ölçekli çiftçilere yönelik ürün sigortası sağlama sürecinde nasıl işlev görebileceğini göstermektedir (Omar et al., 2023). Bu süreç içerisinde, çiftçiler, meteorolojik veri sağlayıcılar ve sigorta şirketleri gibi tüm ilgili taraflar, akıllı sözleşmelerle yönetilen bir blok zinciri ağı aracılığıyla entegre bir şekilde birbirine bağlıdır. Bu akıllı sözleşmeler, belirli ekstrem olaylar meydana geldiğinde otomatik olarak aktive olmakta ve çiftçilere yönelik tazminat ödemelerinin hızlanmasını sağlamaktadır. Söz konusu teknoloji, otomatik ödeme mekanizmaları içeren, işlem maliyetlerini azaltmayı ve talep süreçlerini kısaltmayı mümkün kılan kişiye özel sigorta ürünleri geliştirme olanağını sunmaktadır. Bu çerçevede, tazminat talebinde bulunan bireyler, sigorta şirketinin talepleri elle işlemesini beklemek zorunda kalmaz ve sözleşme şartları gerçekleştiğinde hemen ödeme alacaklarından emin olabilmekteler. Aynı zamanda, bu sistem sigorta şirketlerinin, bireysel çiftçilerin davranışlarında olası değişiklikleri doğru ve şeffaf bir şekilde belirten risk bilgilerine erişimini mümkün kılmaktadır. Sigorta şirketleri, çoğu çiftçinin kabul edeceği tutarların üzerinde prim yükü getirmeksizin risk temelli fiyatlandırmaya dayanarak prim belirleyebilmektedir (UN, 2023)



Şekil 1. Akıllı sözleşmeler kullanılarak entegre edilen blok zinciri tabanlı tarımsal endeks çözümü (Kaynak: Omar et al., 2023)

Çizelge 2'de, blockchain teknolojisinin tarım sigortası sistemlerine katkıları ve sağladığı avantajlar özetlenmiştir. Bu teknoloji, bilgi erişimini artırma, işlem güvenliğini sağlama ve sigorta işlemlerini otomatize etme gibi çeşitli yollarla tarım sigortası alanında önemli iyileştirmeler sunmaktadır.

Çizelge 2. Blockchain teknolojisinin tarım sigortası sistemine sağladığı avantajları

Yön	Fayda
Şeffaflık	- Bilgiye erişimi artırır ve şeffaflığı sağlar. - Sigorta sözleşmelerinin yönetiminde güvenlik, inanılırlık ve güveni artırır. - Bilgiye eşit erişim sağlayarak olumsuz seçim ve ahlaki tehlike gibi sorunları hafifletir (bilgi asimetrisini azaltır)
Verimlilik	Akıllı sözleşmeler, risk değerlendirmesi, prim hesaplamaları, izleme ve tazminat ödemeleri dahil olmak üzere pek çok sigorta sürecini otomatize eder. Bu, maliyetleri ve gecikmeleri azaltır.
Parametrik Sigorta	Blockchain, bireysel hasar değerlendirmeleri yerine parametrelere (örn., hava verileri) bağlı olarak otomatik olarak tetiklenen ödemeleri sağlayan güvenli, veriye dayalı endeks bazlı sigortayı mümkün kılar.
Kripto Para Potansiyeli	Dijital para birimleri kullanarak prim ve tazminat ödemeleri gibi işlemleri daha hızlı ve ucuz hale getirir.

Kaynak: Kosior, 2021 kullanılarak hazırlanmıştır

Blockchain teknolojisi, sigorta süreçlerinde çeşitli avantajlar sağlamakla birlikte, bu teknolojinin kullanımı belirli riskler ve zorluklar da içermektedir (Çizelge 3). Bu riskler, veri bütünlüğü, çevresel etkiler, mevzuattaki belirsizlikler, veri yönetimi, sosyo-ekonomik engeller ve iş modelindeki bozulmalar gibi kategoriler altında incelenmiştir. Bu risklerin detaylı bir şekilde değerlendirilmesi, Blockchain teknolojisinin tarım sigortası sistemlerinde etkin bir şekilde kullanılabilmesi için önem taşımaktadır.

Çizelge 3. Tarım sigortası sisteminde Blockchain teknolojisinin kullanımıyla ilişkili ana riskler

Kategori	Risk Açıklaması
Veri Bütünlüğü	Blockchain kaydedilen verilerin doğruluğunu garanti edemez. Yanlış veya düşük kaliteli veri girişi, kaydedildikten sonra verilerin değiştirilememesi nedeniyle sistemin güvenilirliğini tehlikeye atabilir.
Çevresel Etki	Özellikle kamu ağlarındaki blockchain, işlem doğrulaması için önemli güç gerektirir ve yenilenebilir olmayan enerji kullanımı nedeniyle CO2 emisyonlarının artmasına katkıda bulunur.
Mevzuatta Belirsizlik	Hızlı teknolojik gelişmeler, düzenlemelerin bu hıza ayak uydurmasını zorlaştırarak belirsizlik yaratır.
Veri Yönetimi	Blockchain'in değiştirilemez doğası, veri gizliliği düzenlemelerine uyum sağlamada zorluklar yaratır ve potansiyel hukuki çatışmalar oluşurabilir.
Sosyo-Ekonomik Engeller	Çiftçiler arasında düşük dijital okuryazarlık ve teknolojik değişime karşı direnç, Blockchain tabanlı dijital ürün ve hizmetlerin benimsenmesini ve ölçeklendirilmesini sınırlayabilir.
İş Modeli Bozulması	Akıllı sözleşmelerin ve Yapay Zekânın yaygın kullanımı, sigorta sektöründe iş modellerinde ve iş akışlarında değişiklikler gerektirebilir.

Kaynak: Kosior, 2021 kullanılarak hazırlanmıştır

3. Dünya'da Uygulama Örnekleri

Tarım sektöründe risk yönetimi, teknolojinin ilerlemesi ile birlikte yeni bir boyut kazanmıştır. InsurTech alanında, özellikle blockchain teknolojisinin entegrasyonu, dijital tarım sigortası uygulamalarını radikal bir şekilde dönüştürmekte ve geliştirmektedir. Bu teknolojiyi benimseyen şirketler, sigorta süreçlerini daha şeffaf, erişilebilir ve verimli hale getirmek için yenilikçi yollar aramaktadır. Bu bağlamda, özellikle Arbol platformu (ABD), Qoldau platformu (Kazakistan) ve Avrupa'da geliştirilen Beacon platformu gibi öncü girişimler, tarım sigortası alanında blockchain kullanımının öncü örnekleri olarak dikkat çekmektedir (Kosior, 2021).

Arbolmarket platformu (ABD): 2018 yılında Amerika Birleşik Devletleri'nde kurulan Arbol adılı start-up, tarım-gıda sektöründe faaliyet gösteren işletmeler başta olmak üzere çeşitli kuruluşlara yönelik hava durumu risklerine karşı sigorta erişimini geliştirmeyi amaçlamıştır. Arbol tarafından geliştirilen ArbolMarket platformu, hava koşullarından etkilenen tarımsal üreticiler ile sermaye sağlayıcıları—sigortacılar ve varlık yöneticileri (bankalar, hedge fonları, yatırımcılar ve hava türevlerinden kazanç sağlamak isteyen diğer taraflar) arasındaki işlemleri ve sözleşmeleri kolaylaştıran ve destekleyen çeşitli araçlara ve çözümlere erişim sunmaktadır. Bu platform, çiftçiler ve sigortacılar için bilgi asimetrisini azaltmayı ve sonuç olarak hava riski sigortası primlerini düşürmeyi hedeflemektedir.ArbolMarket platformunda sunulan ana ürün ve hizmet, tazminat ödemelerinin üretimdeki hasar ve kayıpların hesaplanmasına değil, belirli hava ve doğa olayları ile ilişkili kesin olarak tanımlanmış endekslere bağlı kılınan parametrik sigortadır. Arbol'un sağladığı sigorta, belirlenen endekslerin gerçekleşmesi durumunda otomatik tazminat ödemeleri yapılmasını sağlayan akıllı sözleşmeler şeklinde sunulmaktadır. Bu sözleşmeler, Ethereum ağı gibi, her bilgisayarın (düğüm) tüm sözleşmelerin bir kopyasını sakladığı ve tazminat ödemeleriyle ilgili işlemleri doğruladığı blockchain üzerinde doğrudan çalışan merkezi olmayan uygulamalar olarak işlev görmektedir.Şu anda, ArbolMarket platformu, çiftçilere ve sigorta piyasasına yatırım yapmak isteyen kuruluşlara, aşırı yağışlar, kar eksikliği, aşırı yüksek sıcaklıklar ve gübreleme işlemlerini engelleyen diğer hava olayları gibi çeşitli risklere karşı bir dizi parametrik sigorta ürünü sunmaktadır. Platform kurallarına göre, bir çiftçi sisteme giriş yaptıktan sonra, sigortalanacak risk türünü, koruma süresini, koruma altına alınacak alanları ve prim miktarını belirleyerek bir akıllı sözleşme oluşturma talebinde bulunabilir. Bu talep, sözleşmeyi kabul etme veya reddetme hakkına sahip yatırımcı sigortacılara raporlar aracılığıyla sunulur. İlgili bir yatırımcı ve çiftçi, akıllı sözleşmeye belirli bir miktar Ether kripto para birimi ödeyerek karşılığında sözleşme sertifikaları (imzalanan sözleşmenin belgeleri) alırlar. Bu sertifikalar, çiftçiye tazminat talep etme hakkı ve yatırımcıya

kar elde etme hakkı verir. Eğer sigorta olayı gerçekleşirse (kesin olarak tanımlanan bir parametrede açıklanmışsa), çiftçi akıllı sözleşmeye atanan tüm fonları otomatik olarak alır. Sözleşmede belirtilen parametrenin gerçekleşmediği durumda ise, veri analizleri bunu gösterir ve akıllı sözleşme yatırılan tüm Ether miktarı sigortacıya (yatırımcıya) tahsis edilir. Platformda, hava ile ilişkili olmayan parametrik ürünler de yer almaktadır. Bunlardan biri olan SmartYield Programı, tarım ekipmanlarındaki sensörlerden elde edilen verilere dayanan bir verim endeksini kullanmaktadır. Belirlenen bir sınırın altına düşmesi halinde, çiftçiler otomatik olarak tazminat almaktadırlar. Bu ürün için, hava sigortasında olduğu gibi, çiftçilerin tazminat talebinde bulunmaları gerekmemektedir. Ayrıca, tazminat miktarını önceden bilmektedirler.*AgriLedger:* Blockchain teknolojisini kullanarak sürdürülebilir tarım ve yerel ekonomi kooperatiflerinin kurulmasına odaklanmaktadır. Bu platform, vadeli işlem ödemelerinin şeffaf ve verimli bir şekilde yapılmasını kolaylaştırırken, tarım felaketlerine karşı akıllı sözleşme sigortaları sunmakta ve ayrıca hizmetlerden yeterince yararlanamayan topluluklar için mikro finansman fırsatları sağlamaktadır. AgriLedger, Kenya, Myanmar ve Papua Yeni Gine gibi yerlerde pilot programlar yürüterek ekonomik faaliyetleri artırmakta ve bölgesel olarak daha fazla değer elde edilmesini sağlamaktadır (Kim and Laskowski, 2017).*AgriOnBlock:* Tarım sektöründeki çeşitli sorunları ele almak için çiftçiler, perakendeciler ve sigorta şirketleri gibi paydaşları IoT cihazları ve Ethereum üzerindeki akıllı sözleşmeler aracılığıyla bir araya getirmektedir. Ürün sigortası da dahil olmak üzere, platform, şeffaflık, güvenlik ve değiştirilemezlik özelliklerini güçlendirerek finansal kayıp, ürün kontaminasyonu ve bozulması gibi problemleri çözmeyi amaçlamaktadır (Patel and Shrimali, 2021).

4. Sonuç ve Öneriler:

Bu çalışmada, iklim değişikliğine adaptasyon sürecinde iklim akıllı tarım sigortaları potansiyelini, bu süreçlerde akıllı sözleşmelerin ve DLT'nin rollerini incelemiştir. Bulgular, iklim akıllı tarım sigortaları, akıllı sözleşmeler ve DLT ile entegrasyonunun, geleneksel tarım sigortası modellerine kıyasla önemli avantajlar sunduğunu göstermektedir. Akıllı sözleşmeler, DLT destekli sensörlerden toplanan önceden belirlenmiş parametreler temelinde tazminat değerlendirmesi ve ödeme işlemlerini otomatize ederek, manuel süreçlerle ilişkili gecikmeleri ve olası anlaşmazlıkları ortadan kaldırmaktadır. Bu durum, çiftçilerin iklimle ilgili kayıplar sonrasında daha hızlı mali toparlanma imkânı sunmakta ve taraflar arasındaki güveni artırmaktadır. Ayrıca, DLT'nin sağladığı güvenli ve şeffaf veri toplama kapasitesi, hava durumu istasyonları ve uydu görüntüleri gibi çeşitli kaynaklardan elde edilen verileri kullanarak daha kesin ve yerelleştirilmiş risk modelleri geliştirmeyi mümkün kılmaktadır. Bu da daha adil

primlerle ve iklim hassasiyetlerine özel olarak tasarlanmış etkili sigorta ürünlerinin sunulmasına olanak tanımaktadır. DLT ayrıca, özellikle uzak bölgelerdeki küçük çiftçiler için geleneksel sigorta erişimindeki sınırlamaları aşarak sigortayı daha kapsayıcı ve finansal olarak uygulanabilir hale getirmektedir. Ancak, bu teknolojilerin uygulanmasının bazı zorlukları ve riskleri de bulunmaktadır. Özellikle, yanlış veya eksik veri girişi, yüksek enerji tüketimi ve mevzuatla uyum sağlama konularında karşılaşılan zorluklar dikkate alınmalıdır. Çiftçiler ve sigorta sağlayıcıları arasında yeni teknolojilere olan güveni artırmak için sürekli eğitim ve kapasite geliştirme çabaları gerekmektedir. Gelecek araştırmalar, iklim akıllı tarım sigortalarının DLT ile ölçeklendirilmesinin ekonomik uygulanabilirliğini ve bu yenilikçi yaklaşımı destekleyecek düzenleyici çerçeveler üzerine tasarlanabilmektedir.

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PRINCIPLES OF INTEGRATED PEST MANAGEMENT

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ABSTRACT
Integrated Pest Management (IPM) is a practical and eco-friendly method of controlling pests (including weeds, illnesses, and insects) that combines several useful strategies. Comprehensive, current data regarding pest life cycles and their interactions with the environment is used in IPM programs. To manage pest damage as cheaply and environmentally as possible, this information is used in conjunction with currently available pest management techniques. The IPM method can be used in non-agricultural settings like homes and offices, as well as agricultural ones like fields and gardens. IPM employs all suitable methods of controlling pests, which may involve the prudent application of pesticides (e.g., herbicides, fungicides, and insecticides). On the other hand, many of the same principles as IPM are used in organic food production; however, insecticides derived from natural sources rather than synthetic chemicals are used.
Keywords: Integrated Pest Management (IPM)

INRODUCTION

IPM is the application of a variety of techniques for pest management rather than a single approach to pest control. Based on the IPM, an action threshold is established. Not often does the presence of a single pest indicate the need for control (Deguine et al., 2021). Future pest control decisions must be based on how much of an economic danger pests pose (Dara, 2019). The classic Integrated Pest Management (IPM) model gives some consideration to the economics of pest management in relation to yield losses, but its primary goal is to maintain ecological balance in the cropping system. The new model, which covers the management, business, and sustainability elements of pest management and explains its many components (Figure 1). It is more thorough than the previous model (Dara, 2019). The new model defines IPM as a method for controlling pests in a way that is safe for the environment, socially and economically acceptable, and all three.



Figure 4. Modern IPM (Dara, 2019)

Not every insect, weed, and microbe needs to be controlled. Numerous creatures are benign; a few even have positive properties. To determine the best course of action and action thresholds, IPM systems seek to monitor pests and precisely identify them. Pesticides cannot be used improperly or when they are not truly needed because of this identification and monitoring (Singh et al., 2020). IPM programs aim to manage the crop, lawn, or enclosure as the initial stage in pest control to keep pests from posing a hazard. When it comes to an agricultural crop, this could entail applying cultural techniques like crop rotation, choosing pest-resistant cultivars, and planting pest-free rootstocks. These control techniques can be very efficient and cause little to no harm to the environment or people. IPM programs assess the best control strategy for both efficacy and risk when monitoring, identification, and action thresholds show that pest management is required, and preventative measures are either ineffective or unavailable (Flint & Van den Bosch, 2012). The least dangerous pest management methods are selected first, including weeding or pheromones that prevent pests from breeding. Additional pest control techniques, such as targeted pesticide spraying, will be employed if additional monitoring, identification, and action thresholds show that less risky measures are ineffective. Spraying non-specific pesticides widely is a last resort. The foundational idea of IPM is the link between economic damage and loss. In other words, no injury level below the damage cap justifies suppression, but injuries that are expected to cause financial harm certainly do.

PRINCIPLES OF IPM

One technique for managing pest issues while lowering hazards to people and the environment is IPM. All pests in urban, agricultural, wildland, and natural settings can be controlled with IPM. With a combination of tactics like biological control, habitat alteration, cultural practice modification, and the use of resistant cultivars, IPM is an ecosystem-based strategy that focuses on the long-term prevention of pests or their damage. In compliance with established guidelines, pesticides are only used when deemed essential, and treatments are only conducted to eradicate the intended organism. In order to reduce threats to the environment, beneficial and non-target creatures, and human health, pest control agents are carefully chosen and administered.Species classified as pests harm or impede the growth of plants that we find attractive in our landscapes, fields, orchards, or cause structural damage to houses or other buildings. Animal or human health-related organisms are also considered pests. In addition to causing pain, pests can spread illness. An invertebrate (an insect, tick, mite, or snail), a plant (weed), a disease-causing infection (a bacteria, virus, or fungus), or another type of animal or insect could be the pest.

These creatures are undesired and have the potential to damage the ecology, animal life, and water quality.

By controlling the ecosystem, IPM aims to prevent pests or the long-term harm they cause. By employing disease-resistant plants, applying sealant to cracks to keep mice and insects out of buildings, or cultivating a robust crop resistant to pest attacks, you can prevent pests from becoming a problem before they become one. By applying IPM, you will examine the environmental elements that impact the pest and its capacity to thrive, as opposed to just eliminating the pests you now observe. Now that you know this, you can make things difficult for the pest. Determining if management is required in IPM is facilitated by accurate pest identification and monitoring.In order to identify what pests are there, how many there are, and what kind of damage they are producing, you must monitor your field, landscape, forest, building, or other location. Gaining an accurate identification of the pest is essential to assessing its potential to cause issues and choosing the most effective control method. You can determine whether a pest can be tolerated or if it is a problem that needs to be controlled after keeping an eye on it and assessing its biology, surroundings, and other relevant elements. Should control be necessary, this data also aids in selecting the ideal time and most efficient management techniques. To be more effective, IPM programs integrate management techniques. Combining measures that complement each other rather than working alone is the most efficient, long-term approach to pest management. These are the broad categories into which pest management approaches fall. Utilizing viruses, competitors, parasites, and predators as natural enemies to manage pests and their damage is known as biological control. Many naturally occurring adversaries exist for vertebrates, nematodes, plant pathogens, weeds, and invertebrates. The establishment, growth, dispersal, and survival of pests are all decreased via cultural controls. By altering irrigation techniques, for instance, pest issues might be decreased while root illnesses and weed growth can be increased by excessive watering. In addition to preventing pests from existing, mechanical and physical controls can also alter the environment to make it less conducive to their presence. Mechanical controls include things like rodent traps. Physical controls include barriers like curtains to keep out birds and insects or mulches to control weeds and diseases. They can also involve steam sterilizing the soil. Pesticides are used for chemical control. To achieve more effective, long-term control, IPM uses pesticides sparingly and in concert with other methods. To reduce the risk of harm to people, non-target species, and the environment, pesticides are carefully chosen and used.The main goals of IPM are preventing pests, combining workable and practical methods, and using pesticides sparingly. Therefore,

compared to the traditional usage of soil pesticides, the IPM technique offers a more environmentally friendly and effective solution. All suitable pest management techniques, including the sparing application of pesticides, are employed in IPM programs. The risk of pesticide exposure may outweigh the advantages of control, particularly when nonchemical approaches yield equivalent results, therefore preventive pesticide application is restricted. IPM is an approach to pest management that integrates several strategies based on data gathered via inspection, monitoring, and reporting in the field (Bueno et al., 2021). Targets for preventing pests and requirements for condition removal inform the design of the IPM program (Karlsson Green et al., 2020). Identification and determination of harm thresholds of pest species is the first step for a successful IPM program.There are five strategic steps involved in all pest management decision-making. Each step provides an opportunity to thoroughly think through the pest control process and to reduce pesticide use (Figure 2).

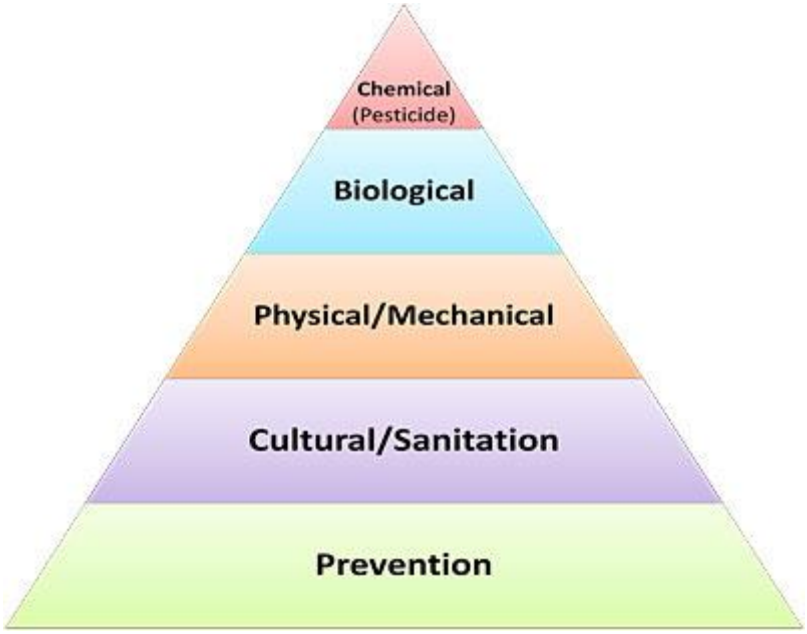


Figure 2. Five Steps of IPM (Stein, 2006)

Pest identification and observation are critical (Baker et al., 2020). Therefore, precautionary actions are done. Less insecticide is used needlessly. Correct identification also keeps beneficial organisms from being eliminated. When keeping an eye out for pests, documentation must be retained, and mapping must be completed if required. Records of monitoring outcomes and audit conclusions, along with recommendations, are required. There are numerous monitoring methods that can differ based on the type of pest. Pest populations must be regularly monitored, pest-prone areas must be identified, and effective prevention and control measures must then be put into place for IPM programs to be successful. The outcomes of monitoring should be

used to revise IPM plans. The pest population level at which its existence poses a risk to human health, the environment, and the economy is known as an action threshold. To help direct decisions about pest treatment, an action threshold must be set. An IPM plan's size, breadth, and intensity will be the main topics of a specified threshold. IPM concentrates on prevention by getting rid of things like food, water, and shelter that draw pests. One way to prevent pests from entering a space is to reduce clutter, close off areas where they might enter, remove trash and overgrown vegetation, maintain clean eating and food storage spaces, construct pest barriers, remove standing water, and educate people about IPM. In the event that action thresholds are crossed, pest management is needed(Hendrichs et al., 2021). Taking into consideration hazards to the practitioner, others, and the environment, IPM programs employ the most efficient, low-risk choices. Pests can be controlled by trapping them, applying heat or cold, physically removing them, and using pesticides. When assessing a pest management program's effectiveness, documentation is essential (Lesley, 2020). Every pest management treatment, including the use of pesticides, should be documented on the spot and kept in an accessible, well-organized system. Evidence of the consideration and application of non-chemical control techniques ought to be present. It is important to identify recommendations for averting future pest issues. The use of IPM—a clever, considerate, and environmentally friendly method of pest control—needs to be increased. IPM controls pests and lowers the amount of pests and pesticides that are exposed to the environment and humans, resulting in a safer, healthier ecosystem (Barzman et al., 2015). It makes sense because school buildings and gardens employ realistic measures to decrease supplies of food, water, and insect habitat. Because it is economically favorable and concentrates on pest prevention, it is sustainable (Luna & House, 2020). IPM offers a variety of techniques to decrease pest contact and pesticide exposure in an efficient and environmentally friendly manner. IPM is crucial because it stops or drastically lowers pollution brought on by the overuse of pesticides.

CONCLUSION

Integrated pest management (IPM), is not a novel idea; agricultural crops and orchards all over the world employ it. Special issues arise when applying it in both urban and rural settings, such as homes, buildings, workplaces, home gardens, landscapes, golf courses, meadow pasture areas, and woods. IPM is a field that is quickly growing in non-agricultural rural and urban locations. IPM, is a long-term approach to pest control that use a variety of techniques to bring insect populations down to manageable levels with the least amount of negative environmental effects and possible financial savings for the pest manager. IPM is another successful strategy

for maintaining public health.Prior to taking action, it is vital to identify pests and their hosts as well as beneficial organisms. For every sort of pest, there should be specific recommendations for monitoring. For the pest, an action threshold needs to be established. It is important to assess control strategies and put effective ones into practice. Outcomes must be tracked, assessed, and recorded. IPM is a tool that can be used to manage any kind of pest, including diseases, weeds, insects, and vertebrate pests. To prevent and reduce pests, prevention combines biological, chemical, mechanical, and/or physical pest control methods with cultural practices. IPM aims to successfully manage pests while minimizing the negative consequences of pest control on non-target organisms, the environment, and human health.As a result, IPM programs are made up of the integration of IPM methods and principles. While each circumstance is unique, all IPM programs share six essential elements. Dangerous is noted. It is done to keep an eye on the quantity and quality of pests. When management action is necessary, guidelines are prepared. It is regulated to prevent insect issues.
Tools for managing biological, cultural, physical/mechanical, and chemical aspects are combined. After taking action, the results of pest management are assessed.

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WEEDS FOR ECOLOGICAL RESTORATION

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ABSTRACT
Weed management for improving ecology emphasizes restoring or improving degraded ecosystem health. Ecological areas or agricultural areas may be destroyed because of natural disasters or human activities. It may even be necessary to transform some agricultural areas back to nature. Weeds can be used to improve ecologically appropriate natural or agricultural areas. In selecting the weed species to be used for this purpose, issues such as soil type, moisture levels, plant community structure and disturbance history are considered. Another issue to consider when choosing appropriate weed species is to prevent the spread of invasive species. Chemicals should not be used unless it is necessary to prioritize non-chemical methods such as cover crops, crop rotation and conservation tillage as components of the weed management program in reclaimed areas. The use of weeds in regulating ecology positively affects the environment and public health.
Keywords: Weed management, Chemicals, crop

INRODUCTION

Preventing, stopping, and undoing ecosystem degradation is the goal of ecological restoration (Gann et al., 2019) . Restoration of the plant community is challenging when natural or human-caused disturbances occur (Young & Hamerlynck, 2023). The biggest dangers to plant communities are the introduction of new invasive species or the rise of quickly spreading weeds that generate large amounts of biomass and seeds. Utilizing desirable weeds in ecological restoration can lead to improvements (Reid et al., 2009). It is possible to stop unwanted species from spreading and the soil from staying barren by regularly adding seeds or breeding materials derived from native plants that have weed-like traits (Pedrini et al., 2020; Uroy et al., 2022). It is possible to build desirable plant communities and enhance ecology by using weeds.Weeds take over the following essential ecological activities for improving the soil, swiftly covering the bare soil (Humphries et al., 2021). Natural or enhanced ecosystems benefit from the usage of weeds because they replenish organic matter, prevent soil erosion from wind and rain, aid in bioremediation, and foster the growth of soil microorganisms. Additionally, the allelopathic properties of weeds can be used to suppress undesirable species (Cummings et al., 2012).Humans and natural disasters have the power to ruin ecology (Radicetti & Mancinelli, 2021). Perennials, biennials, or summer or winter annual weeds can all be employed to repair the damaged environment. Certain weeds use their tap roots to hold the soil in place, while others use their hair roots (Figure 1). Because legume weeds increase the amount of organic matter in the soil and bind free nitrogen from the air to the soil, they are beneficial. By using the components of jade for photosynthesis, weeds purify the air. Through their roots, certain weeds provide a home for microbes that aid in the decomposition of harmful heavy metals in the soil. It keeps species that cover the soil surface from disappearing from the soil. Colorful flowering plants produce an eye-catching, lovely scene in the natural world. These explanations highlight the benefits that might arise from capacity of weeds to preserve and enhance ecology.

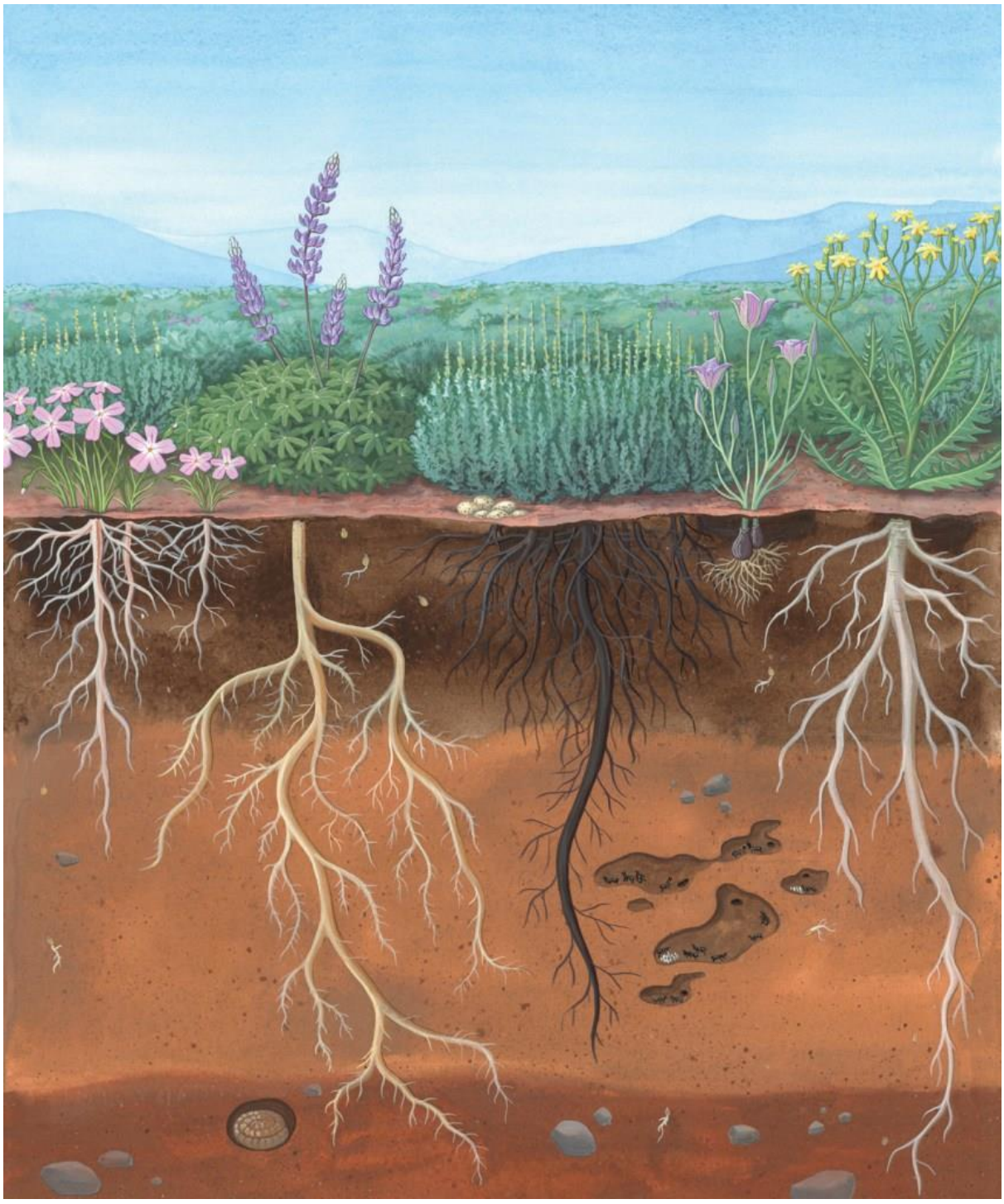


Figure 1. Weeds for ecosystem (Woolington, 2024)

ECOLOGICAL RESTORATION AND WEEDS

Successful weed control is essential to the preservation and restoration of natural plant populations, agricultural areas, and ecological restoration initiatives. It is important mapping and detecting troublesome species, such as noxious weeds that are designated by the state, and then offering suggestions for managing or eliminating those species (Khan et al., 2021). The

strategy is to reduce the long-term dependency on chemical herbicides by utilizing Integrated Weed Management approaches, which include mechanical, biological, cultural, and chemical control methods. Our ecological emphasis enables us to offer the most effective control strategy based on the distinctive qualities of each species.Creating an Integrated Weed Management Plan begins with mapping and inventorying noxious weeds. To identify and record the location and abundance of weed species of concern, we carry out thorough field survey. Locations are marked in the field using GPS units, and the data is subsequently entered into a GIS. The produced maps are used to support long-term monitoring programs and to identify and rank treatment locations for the management of noxious weeds.It is necessary to create weed management plans that include thorough implementation recommendations tailored to each project site, as well as maps and descriptions of the targeted species and regions of concern. Plans should concentrate on integrated weed management strategies, which combine mechanical, chemical, biological, and cultural control measures according to the distinct ecology of each weed, with the ultimate objective of lowering the long-term requirement for chemical herbicides.The dynamic process of managing weeds calls for close observation, advice, and supervision. Collaborating with various governmental or private organizations is crucial for executing Integrated Weed Management Plans. It is important to keep an eye on the applications' performance and to take appropriate action when needed.Long-term monitoring will be possible with the use of remote sensing or geographic information system-based weed mapping in conjunction with the establishment of quantitative vegetation monitoring transects to gather weed data from the weed management plan.

CONCLUSION

Numerous weeds play crucial roles in the restoration of ecosystems. The carbon cycle and the hydrological cycle are the two main ways that plants, including weeds, contribute to or mitigate climate change. Many studies on "invasive" weeds are notable for failing to take disturbance kind and frequency into account. People usually assume that the plant is the issue! This room contains an elephant.Weeds are known to play a part in soil regeneration. In general, annuals help to enhance the status of nutrients; tap-rooted weeds, such as dock and dandelions, also draw nutrients up from the soil's depths and allow water to reach the subsoil. They eventually die off, causing the soil to become more humus-rich and favorable to other plants. Nitrogen is added to the soil by legume plants like clover.Numerous aquatic weeds contribute significantly to the natural ecosystem by purifying water and removing excess nutrients from contaminated streams and wetlands, hence enhancing aquatic habitat in wetlands and streams. Similar to this,

native wetland species—such as *Typha* spp. and *Phragmites*—may be weeds even though they have been utilized to cure pollution and serve as markers of it. Therefore, it's critical to consider if these species are "invading" more nutrient-dense populations while developing rehabilitation measures. Microorganisms and other animals find refuge in weeds. Animals are adapting to coexist with weeds, and numerous endangered and unusual species now rely on them for nesting, food, and shelter. Surprisingly, non-native plants have several uses in restoration. The contribution of salt cedar to precipitation in a desert climate is described by Tao Orion. Plants also emit cloud-seeding microorganisms during transpiration. In comparison to its native neighbors that do not accumulate salt, salt cedar appears to harbor a greater variety and quantity of bacteria. When soil is exposed to disturbances such as fire, flood, landslide, cutting, clear tillage, or the application of herbicides, weeds naturally cover and improve the exposed soil. Species that can quickly cover bare soil and start to carry out one or more of the following essential ecological tasks for soil improvement are known as pioneer plants, or weeds.

It keeps the soil from being eroded by wind and rain, replenishes organic matter that supports the growth of soil microorganisms, collects, stores, and recycles soluble nutrients that seep into the soil, and strengthens the structure of the soil.

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TOHUM BANKALARI İLE İLGİLİ GENEL BİR DEĞERLENDİRME

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Özet
Günümüz dünyasında biyolojik çeşitliliğin azalması, ekonomik, ekolojik ve kültürel değerleri tehdit etmektedir. Ekonomik ve ekolojik kazançların tehlikeye altında olması ülkeler arasındaki çatışmaları tetiklemektedir. Bununla birlikte biyolojik unsurların kullanım alanlarının genişlemesi de biyolojik çeşitliliği önemli bir zorunluluk haline getirmiştir. İnsanlığın başına gelmekte olan doğal felaketlerde kaybolan bitki türlerinin devamlılığı için tohum bankaları büyük bir öneme sahip olacaktır. Bu bağlamda milli gen bankalarının oluşturulması ve sürekliliğinin sağlanması gerekmektedir. Bitki türleri bakımından yüksek endemizm oranına sahip olan ülkemizde biyolojik çeşitliliğin korunması ayrıcalıklı bir önem taşımaktadır. Ayrıca birçok bitkinin anavatan olması bakımından da Türkiye'de bulunan bitki türlerinin korunması oldukça önemlidir. Diğer taraftan kaçakçılık, bilgisizlik, biyoistila gibi nedenlerle bitki çeşitliliğinin yok olmasına yol açacak durumların önüne geçmek için gerekli politikaların oluşturulması ve uygulamalarda kararlığın sağlanması, biyolojik güvenliğimiz açısından elzemdir. Çeşitliliğin devamlılığının sağlanması açısından yerli tohumlarla üretimin sürdürülebilirliğinin sağlanması da gerekmektedir. Bu derlemede tohum bankalarının önemi ve tohum bankalarının Dünya'da ve Türkiye'deki durumuna değinilmiştir.
Anahtar Kelimeler: Yerli tohum, Sürdürülebilirlik, Tohum bankaları

A GENERAL ASSESSMENT OF SEED BANKS

Abstract
In today's world, the decrease in biological diversity threatens economic, ecological and cultural values. The fact that economic and ecological gains are at risk triggers conflicts between countries. However, the expansion of the usage areas of biological elements has made biodiversity an important necessity. Seed banks will be of great importance for the continuity of plant species lost in the natural disasters that occur to humanity. In this context, it is necessary to establish and maintain national gene banks. In our country, which has a high rate of endemism in terms of plant species, the protection of biological diversity is of special importance. In addition, it is very important to protect the plant species found in Turkey, as it is the homeland of many plants. On the other hand, it is essential for our biological security to establish the necessary policies and ensure consistency in practices in order to prevent situations that will lead to the extinction of plant diversity due to reasons such as smuggling, ignorance and bioinvasion. In order to ensure the continuity of diversity, it is also necessary to ensure the sustainability of production with local seeds. In this review, the importance of seed banks and the situation of seed banks in the world and in Türkiye are mentioned.
Keywords: Local seeds, Sustainability, Seed banks

Giriş

Kullanım alanı genişleyen biyolojik çeşitlilik unsurları, ilerleyen teknoloji ve bilim sayesinde geçmiş dönemlere kıyasla daha önemli hale gelmiştir. Türlerin azalması veya yok olması çevresel, sosyal ve ekonomik açıdan birçok sorunu da beraberinde getirmektedir. Bu bağlamda biyolojik çeşitlilikteki kayıplar önemli bir milli güvenlik sorunu olarak ortaya çıkmaktadır (Sümer, 2016). Bir ülkede var olan gen kaynaklarının muhafazası için bitkisel çeşitliliğin korunması gerekmektedir. Muhafazada temel amaç bitkilerin oluşturdukları genetik çeşitliliğin korunmasıdır. Bitkilerin sahip oldukları genetik çeşitlilik, bitkinin bir parçasının veya tüm bitkinin sağlıklı tutulması ile muhafaza edilebilir (Balkaya ve Yanmaz, 2001). Bitki çeşitliliğinin aşınmasının insanlığın ve gezegenimizin refahı üzerinde ciddi etkileri vardır. Bitkilerin ex situ korunması, hızla ilerleyen ve kolayca erişilebilen teknolojiler gerektirmektedir. Bitki habitatlarının endişe verici kaybı, tohum adaptasyonlarından faydalanarak kurutmayı sürdüren geleneksel dondurucu depolamaya veya geleneksel yöntemlere uygun olmayan genetik materyalin uzun süre hayatta kalmasını sağlayan kriyojenik platformlara odaklanan teknolojilere küresel yatırım yapılmasına yol açmıştır (Walters ve Pence, 2021).

Tohum Bankalarının Önemi

Biyoçeşitliliğin önem kazanması hem teknoloji ve bilim sayesinde hem de insanın doğaya bakışının değişim göstermesi sayesinde canlılar hakkında daha fazla bilgi elde edilmesi ile yakından ilgilidir. Teknoloji ve bilim ile canlılara verilen zararlar artarken, canlıların ekonomik değerleri ön plana çıkmaktadır. Bir taraftan çevresel kirlenmelerle canlı türleri yok olma sürecine girerken, diğer taraftan ekonomik değeri olan türlerin yok olma süreci hızlanmaktadır. Önümüzdeki süreçte küresel çevre güvenliğinin en ayırt edilen özelliği kaynak savaşları olacaktır. Gelecekteki kaynak savaşları ulus devletin yozlaşmış ya da zayıf olduğu, dış ve yerli aktörlerin iktidar olmak için yarışa girdiği ülkeler başta olmak üzere gelişmekte olan ülkeler içerisinde ortaya çıkacaktır. Tüm diğer işlevlerin yanı sıra türlerin ekonomik işlevlerinin olması bile sadece bir kaynak üzerinde çatışmalara sebep olabilecektir (Sümer, 2016). Gelecekteki sürdürülebilir bir dünya, bitki biyoçeşitliliğini korumaya yönelik ortak çabalar gerektirmektedir. Botanik bahçeleri, üniversiteler, devlet kurumları ve sivil toplum kuruluşları bütünleşik bir yaklaşım oluşturarak bu zorluğun üstesinden gelmeye çalışmaktadır. Bu bağlamda tohum bankacılığı güçlü ve etkili bir araç olmaya devam etmektedir. Aşırı kurumayı ve düşük sıcaklığı tolere edebilen tohumlar, ortak bir dondurucunun geleneksel koşulları kullanıldığında muhtemelen en az 100 yıl hayatta kalacaktır. Çeşitli taksonlar arasında

tohumların aşırı toleransı, küresel çapta tohum bankalarının sayısının şu anda 1.750'nin üzerine çıkmasına ve 50.000'den fazla türün korunmasına yol açmıştır (Walters ve Pence, 2021).Tohum bankaları metabolik olarak aktif olmayan bireylerin rezervuarlarıdır. Bu hareketsiz bireylerin genetik, fenotipik ve fonksiyonel çeşitliliği toplu olarak biyolojik sistemlerin davranışını önemli ve geniş kapsamlı şekillerde etkileyebilir. Hemen hemen tüm biyolojik varlıklar bir tohum bankası oluşturabilir, ancak belki de en ikonik ve iyi çalışılmış örnekler bitkilerden gelmektedir (Lennon ve ark., 2021). Binlerce yıl önce, insanların bitki tohumlarının çeşitliliğinden ve uzun ömürlülüğünden yararlanmaya başlamasıyla farklı kültür ve toplumlarda büyük dönüşümler ortaya çıkmıştır (Smith, 2001). O zamandan bu yana, zengin teorik, karşılaştırmalı ve deneysel çalışmalar, bitki popülasyonlarının ve topluluklarının çeşitliliği ve eko-evrimsel dinamikleri için tohum bankalarının dengeleyici rolüne ilişkin kritik bir anlayış sağlamıştır (Venable ve Lawlor, 1980; Ellner, 1985; Levin, 1990; Evans ve ark., 2007; Kortessis ve Chesson, 2019). Doğal sistemlerdeki gözlemlerden ilham alan tohum bankacılığı depoları, biyolojik çeşitliliğin korunmasına yardımcı olmak ve artan sıcaklıklar, hastalık salgınları, küresel ısınma ve diğer doğal afetler nedeniyle nesli tükenme tehlikesiyle karşı karşıya olan nadir bitki çeşitlerinin uzun süreli depolanması yoluyla gıda güvenliğini sağlamak amacıyla dünya çapında tasarlanmıştır (Peres, 2016; Lennon ve ark., 2021)Tohum bankaları biyolojik sistemlere dayanıklılık kazandıran önemli tamponlardır. Uyuşukluk, aksi takdirde bireyin kondisyonunu azaltacak uygun olmayan koşullardan koruma sağlar. Şanslıysanız, bu bireylerin en azından bir kısmı gelecekte çevrenin büyüme ve üreme için daha elverişli olduğu bir zamanda uyanacaktır. Evrim ve ekoloji üzerindeki sonuçları göz önüne alındığında, tohum bankası dinamiklerini kontrol eden mekanizmaların tanımlanmasına yönelik önemli çabalar sarf edilmiştir (Lennon ve ark., 2021).

Dünya'da ve Türkiye'de Tohum Bankalarının Durumu

İnsanlar tarıma başladığı ilk zamanlardan beridir doğadaki bitkisel kaynakları tüketme amaçlarına göre kültüre almış ve bugün itibariyle kullanılmakta olan türlere ait çeşitleri geliştirmiştir. Bitki türlerindeki genetik çeşitliliğin yoğun olduğu yöreler Bitki Gen Merkezi (Vavilov, 1926), gen merkezleri içinde çeşit zenginlini gösteren küçük alanlar da Mikro Gen Merkezi olarak tanımlanmıştır (Harlan, 1926). Bazı araştırıcılar yaptıkları çalmalarda, dünya üzerinde 12 farklı gen merkezi bulunduğunu belirtmişlerdir (Zhukovsky, 1975; Krusteva ve ark., 1995).Bitki biyoçeşitliliğinin tarımsal kullanımına ve tohum bankalarının malzeme sağlamadaki rolüne ilişkin vaka çalışmaları, mahsulleri ortaya çıkan hastalıklardan, değişen manzaralardan ve değişen hava koşullarından koruma ihtiyacı arttıkça her geçen gün

artmaktadır (Byrne ve ark., 2018; Greene ve ark., 2019; Khoury ve ark., 2019). Örneğin, USDA Ulusal Bitki Gen Plazma Sistemi her yıl dünyanın dört bir yanından yüz binlerce bilgi ve gen plazması talebi almakta ve çeşitli kullanımlar için yılda yaklaşık 250.000 katılım dağıtmaktadır. Geleneksel veya kriyojenik platformlar altında bitki gen plazması bankacılığına izin veren hızla gelişen teknolojiler, olasılıkları genişletmekte ve insanların Dünya'nın bitki çeşitliliği hazinesini koruyabileceği sözünü vermektedir. Ancak bu paha biçilmez kaynakları dondurucularda ve kriyovatlarda saklamak yeterli değildir. Unutulan veya ihmal edilen depolanan genetik materyal eninde sonunda ölecek ve koruma amacına hizmet etmeyecektir. Bu nedenle, koruma teknolojilerini botanik uzmanlığı ve restorasyon ekolojisinin yanı sıra kamu ve özel sektör kuruluşlarıyla birleştiren entegre yaklaşımlar, bitkileri korumak ve onların kendi varlığı için bitkilere dayanan bir dünyada bir yuva sahibi olmalarını sağlamak için esastır (Walters ve Pence, 2021). Genetik çeşitlilik erozyonuna yanıt olarak gelecekte küresel gıda güvenliğini tehdit edebilecek potansiyel durumlara karşı önlem almak için Kuzey Kutbu'nun Svalbard takımadasında dünyanın tüm tohum türlerini bir araya getirmeyi amaçlayan Svalbard Küresel Tohum Deposu bulunmaktadır. Kıyamet Ambarı (Doomsday Vault) adıyla da bilinen 2001'de Birleşmiş Milletler tarafından müzakere edilen "Uluslararası Tohum Anlaşması'nın" imzalanmasından sonra resmi olarak 2008 yılında açılan ve 4,5 milyon tohum kapasitesine sahip olan depoda 1,2 milyonun üzerinde tohum türü bulunmaktadır. Tohum deposu, -18°C'de sakladığı tohumlarla iklim değişikliği gibi küresel gıda güvenliğine yönelik tehditlere karşı geleceğin gıda tedarikçisi olarak görülmektedir. Svalbard Tohum Deposu'nda Afrika ve Asya'dan mısır, pirinç ve buğday gibi birçok temel besinin ender bulunan türlerinin yanı sıra Avrupa ve Güney Amerika'dan patlıcan, marul, patates gibi besinlerin tohumları da bulunmaktadır. Ülkemiz bitki genetik çeşitliliği olarak eşsiz bir konumda bulunmaktadır. Üç önemli floristik bölgenin kesişim noktasında bulunan ülkemiz topografik, jeomorfolojik ve iklimsel özellikleri ile oldukça farklı habitatlara ve buna bağlı olarak da zengin endemizm oranı ve bitki türlerine sahiptir. Ülkemizin tohumsuz ve tohumlu bitki taksonu sayısı 12.000 civarında olup bu sayının yaklaşık 4.000'i endemiktir. Özellikle tarımı yapılan türlere ait genetik kaynakların devamlılığının sağlanması, bitkisel üretimimizin sürdürülebilirliği açısından son derece önemlidir (Sarı ve ark., 2016). Bugün itibariyle ülkemizde 18 arazi gen bankası ve 2 tohum gen bankası bulunmaktadır. Tohum gen bankalarından birisi İzmir'de faaliyet vermektedir. Ege Tarımsal Araştırma Enstitüsü'nde hizmet veren bu banka 1964'ten bu yana hizmet vermekte olup 1974'ten beridir "Ulusal Gen Bankası" adıyla çalışmalarını sürdürmektedir. Ulusal Gen Bankası dünyadaki gen bankalarının ilk örnekleri arasında

sayılmaktadır. Bu bankada gelecek nesillere aktarılmak için yaklaşık 3 bin 500 endemik bitki türü ve 60 bin tohum örneği koruma altında tutulmaktadır.

Ülkemizdeki diğer tohum gen bankası ise Ankara'da bulunmaktadır. 1988'de tohum örneklerinin güvenlik yedeklemelerini yapmak amacıyla faaliyete geçirilen bu gen bankası Ankara Tarla Bitkileri Merkez Araştırma Enstitüsü bünyesinde çalışmalarına başlamıştır. "Türkiye Tohum Gen Bankası" adıyla bilinen bu banka 250 bin tohum saklama kapasitesine sahiptir. Dünyadaki en önemli 10 gen bankası arasında gösterilen Türkiye Tohum Gen Bankası'nda ağırlıklı olarak kültürü yapılan bitkiler ve yabani akrabaları olmak üzere birçok farklı bitki grubunda çalışmalar yürütülmektedir. Bölümün görev alanı ekonomik öneme sahip yabani bitkiler, ıslah edilmiş çeşitler, yerel çeşitler, bunların yabani akrabaları ve doğal florada mevcut diğer bitki türlerinin (özellikle endemik türler) kaybolma tehlikelerine karşı toplanması, uzun süreli muhafazası, toplanan materyalde karakterizasyon, yenileme/üretim çalışmaları ve bilgilerin dokümantasyonudur (Sarı ve ark., 2016).

Sonuç

Biyoçeşitlilik hem de sosyal ve ekonomik istikrar için hem de sağlıklı bir ekolojik işleyiş için ulusal düzeyde olduğu kadar uluslararası alanda da büyük önem taşımaktadır. Özellikle gelişmiş ülkelerde tohum bankalarının sürekli ve düzenli bir şekilde oluşturuluyor olması, biyoçeşitliliğin gelecekte çok daha önemli bir unsur olacağını işaret etmektedir. Bu bağlamda halkın ve bilhassa ilgili alanda uzmanlaşma yöneliminde olarak öğrenci ve araştırmacıların koruma bilincinin gelişmesine yönelik farkındalık ve eğitim çalışmaları yapılmalıdır. Ülkemizin genetik kaynaklarının gelecek nesiller için sürdürülebilir olmasını sağlamak adına yapılacak tüm çalışma içerikleri desteklenmelidir.

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Fusarium oxysprum'A KARŞI BAZI MONOTERPENLERİN İN SİLİCO ARAŞTIRILMASI

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Özet
Bu çalışmada, *Fusarium oxysporum* kutinazın kristal yapısı (5AJH) ile monoterpen bileşikleri olan alpha-pinene, beta-pinene ve beta-phellandrene'nin etkileşimini araştırmak için moleküler yerleştirme yöntemi kullanılmıştır. Bu amaçla, biyoaktif bileşiklerin kutinazın kristal yapısı ile etkileşimleri silikomoleküler bağlanma simülasyonları kullanılarak incelenmiştir. Yerleştirme işlemleri için Chimera programı kullanılmış ve hedef protein yapıları üretilmiştir. Çalışma sonucunda, alpha-pinene, beta-pinene ve beta-phellandrene için hesaplanan RMSD değerlerinin 2'nin altında olduğu tespit edilmiştir. Alpha-pinene'nin en yüksek kenetlenme puanına sahip olduğu ve -6.0'lık bir bağlanma puanı elde edildiği görülmüştür. Daha sonra beta-pinene (-5.8) ve beta-phellandrene (-5.4) sırasıyla izlemiştir. Bu sonuçlar, alpha-pinene molekülünün enzimin spesifik bağlanma ceplerine en sıkı şekilde bağlandığını göstermektedir. Bu bulgular, yeni antifungal bileşiklerin geliştirilmesi için potansiyel bir temel sağlamaktadır, ancak bu mekanizmanın daha derinlemesine anlaşılması için in vitro çalışmaların yapılması önerilmektedir.
Anahtar Kelimeler: Monoterpen bileşikler, *Fusarium oxysporum* kutinaz, Moleküler yerleştirme

IN SILICO INVESTIGATION OF SOME MONOTERPENES AGAINST *Fusarium oxysporum*

Abstract
In this study, molecular docking was employed to investigate the interaction between *Fusarium oxysporum* cutinase's crystal structure (5AJH) and monoterpen compounds, specifically alpha-pinene, beta-pinene, and beta-phellandrene. Bioactive compound interactions with the cutinase crystal structure were examined using silico-molecular binding simulations. Chimera software was utilized for the docking procedures and to generate target protein structures. The study found that the calculated RMSD values for alpha-pinene, beta-pinene, and beta-phellandrene were below 2. Alpha-pinene exhibited the highest binding affinity, with a binding score of -6.0. Subsequently, beta-pinene (-5.8) and beta-phellandrene (-5.4) followed in affinity ranking. These results indicate that alpha-pinene binds most tightly to the enzyme's specific binding pockets. These findings provide a potential basis for developing new antifungal compounds, although further in vitro studies are recommended for a deeper understanding of this mechanism.
Keywords: Monoterpen compounds, *Fusarium oxysporum* cutinase, Molecular docking

Giriş

Fusarium oxysporum olarak bilinen mantar toprak yoluyla bitkilere bulaşmaktadır (Gordon ve Martyn, 1997). Ayrıca *Fusarium oxysporum* bitki enfeksiyonlarını da içeren devasa bir tür kompleksidir. Bu patojenler, saldırılarını çok çeşitli türlere, konakçıya özgü bir şekilde hedeflemektedir (Fourie ve ark., 2011). Çok sayıda bitki türünde solgunluk veya çürümeye neden olabilen çok çeşitli suşları bulunabilmektedir (Dean ve ark., 2012). Ayrıca pamuk, patates ve süs bitkileri de dahil olmak üzere çok çeşitli bitkileri etkileyen hastalıktan *Fusarium oxysporum*'un sorumlu olduğuna dair kanıtlar vardır (Peters ve ark., 2008; Lecomte ve ark., 2016; Halpern ve ark., 2018). Araştırmacılar bitkilerden elde edilen uçucu yağların *Fusarium oxysporum* mantarına karşı etkilerini raporlamışlardır (Barrera-Necha ve ark., 2009; Sharma ve ark., 2017). Esansiyel yağların birincil bileşenlerinin hücre zarını kırabilmesi ve hücrenin geçirgenliğinde önemli bir değişiklik yaratabilmesi sayesinde, uçucu yağların Fusarium solgunluğu hastalığına karşı hem önleyici hem de tedavi edici kapasitede etkili olduğu gösterilmiştir (Gill ve Holley, 2006; Sharma ve ark., 2017). Alpha-pinene, beta-pinene, ve beta-phellandrene birçok bitkide doğal olarak bulunabilmektedir (Murakami ve ark., 2009; Singh Bisht ve ark., 2019; Herrera-Calderon ve ark., 2022). Bu bileşiklere sahip bitkilerin uçucu yağları *Fusarium oxysporum*'un etkilerini kontrol etmek için kullanılabileceği bildirilmiştir (Al-Naser ve Al-Abrass, 2014).Bu çalışmada alpha-pinene, beta-pinene, ve beta-phellandrene bileşiklerin moleküler yapılarıyla *Fusarium oxysporum* kutinazın kristal yapısının (5AJH) in silico modelleme ile bağlanma simülasyonunun incelenmesi amaçlanmıştır.

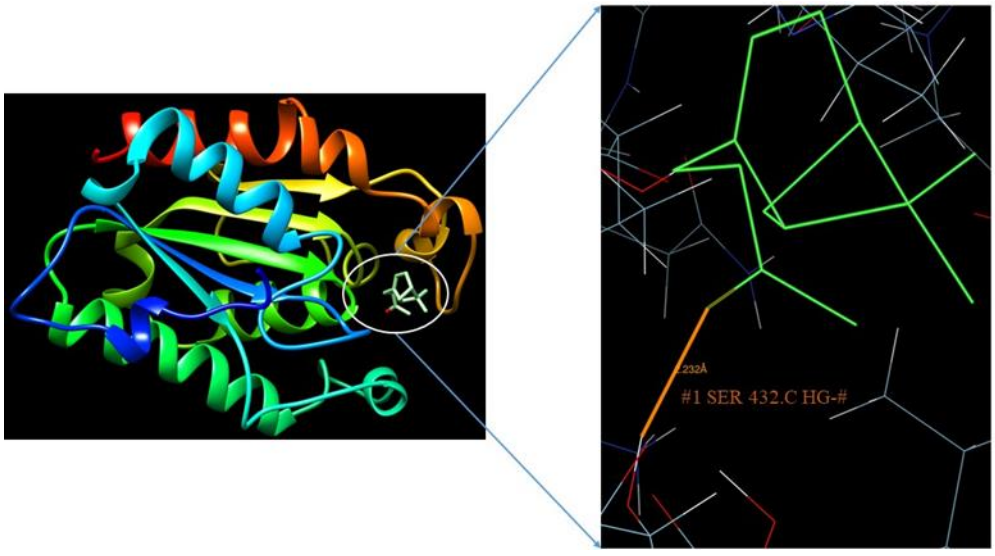
Materyal ve Yöntem

Monoterpen bileşikler olan alpha-pinene, beta-pinene, ve beta-phellandrene yapılarıyla *Fusarium oxysporum* kutinazın kristal yapısının (5AJH) etkileşime girip girmediğini araştırmak için moleküler yerleştirme yapılmıştır. Moleküler yerleştirme için biyoaktif bileşiklerin *Fusarium oxysporum* kutinazın kristal yapısı (https://www.rcsb.org/structure/5AJH) ile etkileşimi silikomoleküler bağlanma simülasyonları ile gerçekleştirilmiştir. Yerleştirme hedefleri olarak kullanıma hazır protein yapıları üretmek için Chimera (versiyon 1.16) programı kullanılmıştır.

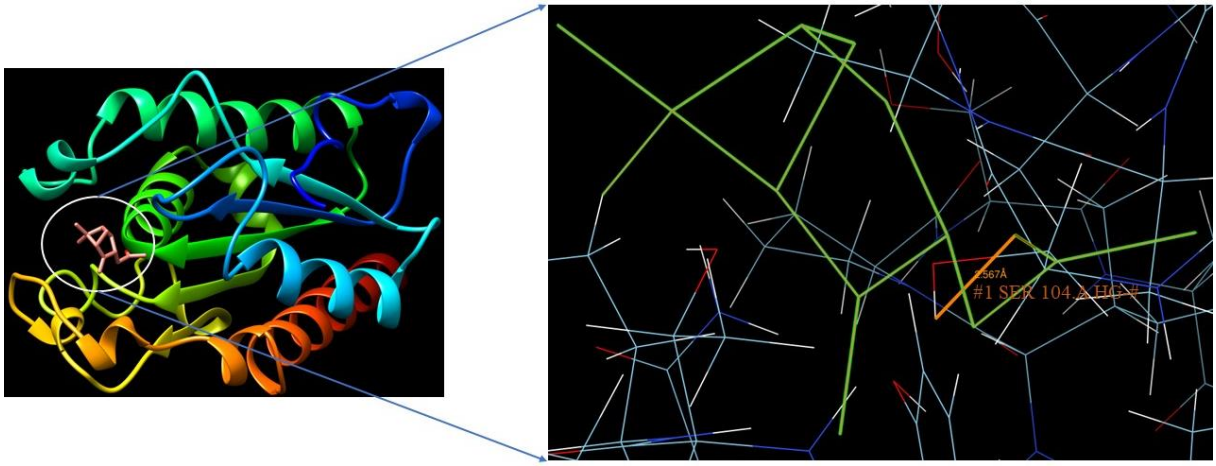
Bulgular ve Tartışma

Monoterpenler gibi bileşiklerin bakteri ve mantarlarla etkileşimini tahmin etmek amacıyla son yıllarda *in silico* araştırmalarının kullanımında önemli bir artış olmuştur (Jianu ve ark., 2021; Kundu ve ark., 2021; Santana de Oliveira ve ark., 2021). Bu çalışmada, bitkilerin uçucu yağlarında da doğal olarak bulunabilen alpha-pinene, beta-pinene, ve beta-phellandrene

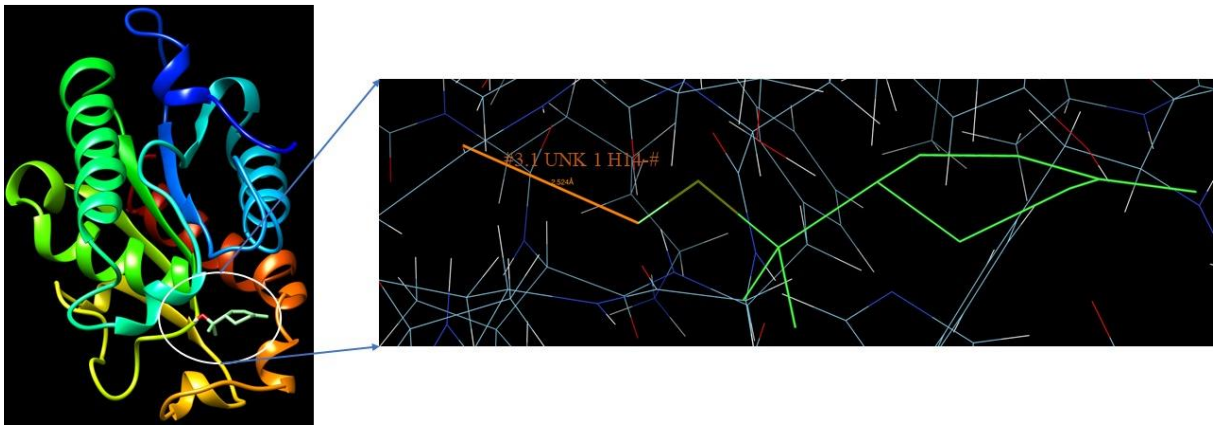
bileşenleri ile *Fusarium oxysporum* kutinazın yapısı arasındaki bağlantıyı araştırmak için *in silico* yöntemler kullanılmıştır. Bu önemli bileşiklerin, mantar zarlarını parçalamanın yanı sıra hücre zarlarının geçirgenliğinde önemli bir değişikliğe neden olabildikleri gösterilmiştir (Gill ve Holley, 2006; Sharma ve ark., 2017).*In silico* tahmini için Chimera yazılımı kullanılmıştır. Her bir yeniden kenetlenme duruşunun kalitesini değerlendirmek için hem kök ortalama kare sapma (RMSD) değerleri hem de kenetlenme puanları dikkate alınmıştır. Redocked protein ile kristalografik ligand arasındaki kök ortalama kare sapma (RMSD) değerlerinin 2Å'den (angström) daha az olması gerektiği bildirilmiştir (Silva ve ark., 2019). Bu çalışma sonucunda alpha-pinene, beta-pinene, ve beta-phellandrene için hesaplanan RMSD'nin 2'den düşük olduğu belirlenmiştir. Alpha-pinene'nin en yüksek kenetlenme puanına sahip olduğu bulunmuştur ve bu sonuç diğer üç bileşiğin öngörülen bağlanma puanıyla karşılaştırılmıştır. Alpha-pinene için -6.0'lık değer ile en yüksek değerde bağlanma puanı elde edilmiştir. Daha sonra sırasıyla beta-pinene (-5.8) ve beta-phellandrene (-5.4) bileşikleri izlemiştir. Stabil protein-ligand komplekslerinin oluşumu düşük yerleştirme puanlarıyla ölçülmektedir (Kundu ve ark., 2021). Bunun bir sonucu olarak, moleküler kenetlenmeyi içeren araştırmalar, alpha-pinene kenetlenme puanları açısından en üst konuma yerleştirmiştir. Şekil 1, alpha-pinene molekülünü, amino asit (Serin: SER) kalıntılarının enzimin spesifik bağlanma ceplerine yerleştirilmesini içeren optimal bağlanma pozisyonunda göstermektedir. Ayrıca beta-pinene, SER amino asidine bağlanırken beta-phellandrene, bilinmeyen amino aside bağlanmıştır.



Şekil 1. Alpha-pinene ve 5AJH'nin yerleştirme yapısı



Şekil 2. Beta-pinene ve 5AJH'nin yerleştirme yapısı



Şekil 3. Beta-phellandrene ve 5AJH'nin yerleştirme yapısı

Sonuç

Bu çalışmanın sonucunda, alpha-pinene, beta-pinene, ve beta-phellandrene ligandlarının ve hedef protein (5AJH) arasındaki ilişkilere ilişkin ayrıntılı bilgi tespit edilmiştir; spesifik olarak, üç bileşenin *Fusarium oxysporum* kutinaz sentazının enzimatik cebinin kalıntılarına sıkı bir şekilde bağlandığı keşfedilmiştir. Bu bileşiklerin etkilerinin ardındaki mekanizmanın daha iyi anlaşılması için *in vitro* çalışmalar yapılması önerilmektedir. Bu araştırmanın bulgularına dayanarak yeni antifungal bileşiklerin geliştirilmesine yönelik yeni yollar açılabilir.

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Özet
Artan nüfusun ihtiyaçlarını karşılamaya yetecek kadar gıda üretmek, dünya çapında gıda politikası uygulamalarının her zaman en büyük çabası olmuştur. Organik tarımın çevresel faydaları arasında biyolojik çeşitliliğin korunması, daha iyi toprak kalitesi, buharlaşmanın ve su kullanımının azaltılması, adaptasyon stratejilerinin güçlendirilmesi ve sera gazı emisyonlarının azaltılmasının yanı sıra enerji verimliliği de yer almaktadır. Karada bulunan bitkiler gibi deniz yosunu da fotosentetik pigmentler içermektedir. Deniz yosunları güneş ışığının ve deniz suyunda bulunan besinlerin yardımıyla fotosentez yapmaktadır. Deniz yosunu gübresinin farklı kültür bitkileri için uygulanması, ticari kimyasal gübrelerin yerini alması ve üretim maliyetini düşürmesi açısından büyük önem taşımaktadır. Deniz yosunlarından elde edilen gübrelerin, yüksek orandaki organik madde, mikro ve makro elementler, vitaminler ve yağ asitleri ile büyüme düzenleyiciler açısından da zengin olması nedeniyle bazı araştırmalarda kimyasal gübrelere göre daha üstün olduğu tespit edilmiştir. Organik tarıma artan ilgi göz önüne alındığında, bu derlemenin üreticilere yosun gübresinin faydalarını anlayabilmeleri açısından önemli bir kaynak oluşturacağı düşünülmektedir. Bu derlemede deniz yosununun organik tarımda değerlendirilmesi ile birlikte çevrenin korunması, çevresel değişikliklere karşı yüksek dayanıklılık, çiftçi gelirlerinin arttırılması, girdi maliyetlerinin azaltılması, toprak sağlığının korunması ve sağlıklı gıda ürünlerinin üretilmesine değinilmiştir.
Anahtar Kelimeler: Organik tarım, Yosun, Gübre, Yosun gübresi, Organik gübre

USE OF SEAWEED FERTILIZERS IN ORGANIC FARMING

Abstract
Producing enough food to meet the needs of a growing population has always been the greatest effort of food policy practices around the world. The environmental benefits of organic farming include preserving biodiversity, better soil quality, reducing evaporation and water use, strengthening adaptation strategies and reducing greenhouse gas emissions, as well as energy efficiency. Like land-based plants, seaweed contains photosynthetic pigments. Sea algae carry out photosynthesis with the help of sunlight and nutrients found in seawater. The application of seaweed fertilizer for different cultivated plants is of great importance in terms of replacing commercial chemical fertilizers and reducing the cost of production. Fertilizers obtained from seaweed have been found to be superior to chemical fertilizers in some studies, as they are rich in high amounts of organic matter, micro and macro elements, vitamins and fatty acids, and growth regulators. Considering the increasing interest in organic agriculture, it is thought that this review will be an important resource for producers to understand the benefits of seaweed fertilizer. In this review, the use of seaweed in organic agriculture and the protection of the environment, high resistance to environmental changes, increasing farmer incomes, reducing input costs, protecting soil health and producing healthy food products are discussed.
Keywords: Organic agriculture, Seaweed, Fertilizer, Seaweed fertilizer, Organic fertilizer

Giriş

Dünya çapında nüfus ve buna bağlı olarak tüketim artarken, gelecekte gıda, yem ve yakıta olan talepte artış olacaktır. Gelişmekte olan dünyada beslenme biçimleri değişmekte ve insanlar daha fazla gıda tükettikçe doğal kaynaklar üzerinde ekstra baskı oluşmaktadır (Godfray ve ark., 2010; Seufert ve ark., 2012). 2050 yılına gelindiğinde dünya nüfusunun 9 milyara ulaşması ve buna bağlı olarak tarım ürünlerine olan talebin yıllık %1,1 oranında artacağı tahmin edilmektedir (Alexandratos ve Bruinsma, 2012).Kimyasal gübrelerin aşırı bir şekilde kullanılması; toprağın tuzlanmasına, bitki besin maddelerinin dengesiz dağılmasına, ağır metal birikiminden dolayı toprak kirliliğine, mikroorganizma etkinliğinin azalmasına ve diğer çevre problemlerine sebep olmaktadır (Sönmez ve ark., 2008). Bununla birlikte kimyasal gübrelerdeki hızlı fiyat artışından dolayı üreticilerin organik gübrelere ilgisi daha da artmaktadır (Kara ve ark., 2013). Organik tarım, geleneksel tarım yöntemlerinden farklı olarak sentetik gübreler, pestisitler, genetik modifikasyonlar ve hormonlar gibi kimyasal girdilerin kullanılmadığı bir tarım uygulamasıdır. Bu yöntemde doğal ve organik kaynaklar kullanılarak ürünlerin yetiştirilmesi, böceklerle mücadele için zararsız yolların tercih edilmesi ve toprak verimliliğinin korunması hedeflenmektedir.Yosunlar, temel gıdanın bir bölümünü oluşturdukları Çin ve Japonya başta olmak üzere yüzyıllardır insan tarafından toplanmaktadır. Deniz yosunları; sığır yemi, insan tüketimine yönelik gıda olarak ve agar, alginik asit ve karragenan gibi fikokolloidlerin kaynağı olarak kullanılmaktadır (Chapman, 1970). Deniz yosunları sığ ve derin deniz alanlarında 180 m derinliğe kadar yetişmektedir. Deniz yosunları, normal bitkilerden tamamen farklıdır. Çünkü gerçek yaprakları, gövdeleri, kökleri ve özel organlara sahip damar sistemleri yoktur. Deniz yosunları, klorofil, karotenoidler ve fikobilinler gibi pigmentlerine göre yeşil (Chlorophyceae), kahverengi (Phaeophyceae), kırmızı (Rhodophyceae) olmak üzere üç gruba ayrılmaktadır. Granül ve toz gibi farklı formülasyonları piyasada mevcuttur. Dünyanın en önemli deniz kaynaklarından biri olup, insan gıdası, hayvan yemi ve birçok endüstrinin hammaddesi olarak kullanılmaktadır. Deniz yosunu ekstraktları, sitokininler (Durand ve ark. 2003), oksinler (Sahoo, 2000), gibberellinler (Strik ve Staden, 1997) gibi çoklu büyüme düzenleyicileri ve büyüme için gerekli çeşitli makro ve mikro besin maddelerini içerdikleri için sıvı gübre ve biyo-uyarıcı olarak pazarlanmaktadır. Yosun gübresi verimi, kaliteyi, tohum çimlenme hızını arttırmakla birlikte ve soğuğa (dona) dayanıklılığı, tuzluluk stresinin zararlarını azaltmayı, meyvenin daha uzun raf ömrüne sahip olmasını, mantar ve böcek saldırılarına karşı direnci artırmaktadır. (Erulan ve ark., 2009). Günümüzde yosun gübreleri birçok ülkede; gerek sıvı ekstrakt gerekse direk olarak toprağa karıştırılarak

uygulanmaktadır. Deniz yosunu gübresi uygulamadan birkaç saat sonra bitkiler tarafından absorbe edilebilmekte olup insan, hayvan ve çevre için güvenlidir (Sathya ve ark., 2010). Toprağa direk olarak uygulandıklarında; toprak yapısının düzeltilerek, toprak verimliliğinin uzun süre korunması amaçlanmaktadır. Deniz yosunu gübresi toprağın verimliliğini artırmanın yanı sıra nem tutma kapasitesini de arttırmaktadır (Dhargalkar ve Neelam Pereira, 2005).Uzun yıllardır denizlerde doğal olarak kıyıda bulunan bazı deniz yosunları tarlalarda gübre olarak kullanılmıştır (Güner ve Aysel, 1996). Yeni nesil doğal organik gübre olarak adlandırılan yosun gübreleri; tohum çimlenmesini, ürün veriminini, topraktan inorganik besin maddelerinin alınımını ve stres koşullarına direncin artması gibi alanlarda özellikle gelişmiş ülkelerde daha fazla değerlendirilmektedir (Blunden, 1991). Deniz yosunları kuvvetli kök gelişmesini sağlayarak, bitkilerin topraktan daha fazla bitki su ve besin maddesi almalarını, bitkilerin hastalık ve zararlılara ve çevresel streslere dayanımını, bitkilerde klorofil oluşumunu hızlandırarak yeşil aksamın artmasını sağlamaktadırlar. Makro ve mikro besin elementlerinin topraktan uzun süreli ve dengeli olarak alınmasını sağlayarak kalite ile birlikte ihracat ve pazar değerini arttırma ve genel verim kapasitelerini yükseltmektedirler (Blunden ve ark., 1992; Hong ve ark., 1995). Hem stresli hem de tuzlu koşullara dayanıklı olan Deniz yosunları Türkiye'de Karadeniz sahillerinde özellikle sığ ve kayalıklı alanlarda azot ve fosfor gibi elementlerin olduğu yerlerde yayılım göstermektedir (Pek, 2023). Son yıllarda organik gübreye artan ilgiyle beraber deniz yosunlarından elde edilen sıvı ekstrakt tarımsal amaçla çokça kullanılmaya başlanmıştır (Akyurt ve ark., 2011). Günümüzde geleneksel inorganik gübrelerin yerine doğal deniz yosunu ürünlerinin kullanılması önem kazanmıştır.

Deniz Yosunu Gübresi ile İlgili Yapılan Çalışmalar

Deniz yosunu gübrelerinin kırmızı pancar (Wilczek ve Ng, 1982), marul (Moller ve Smith, 1998) ve bakla (El-Sheekh ve El-Saled, 2000) gibi çeşitli türlerde olan bitki tohumlarının çimlenmesini iyileştirdiği rapor edilmişlerdir. Ek olarak başka araştırmacılarda düşük konsantrasyonda deniz yosunu ekstraktı kullanıldığında daha yüksek çimlenme yüzdesi olduğunu bildirmişlerdir. Layek ve ark. (2018), çeltik tohumlarının daha düşük konsantrasyonlarda deniz yosunu özütlerine batırıldığında çimlenme yüzdesinin, sürgün ve kök uzunluğunun yanı sıra fide canlılık endeksinin daha yüksek olduğu sonucuna varmışlardır.

Deniz yosunlarında yüksek düzeyde organik maddenin varlığı, köklerin kullanabileceği rizosferdeki nem ve minerallerin korunmasına yardımcı olmaktadır (Sivasankari ve ark. 2006). Zodape ve ark. (2008) Deniz yosunu ekstraktlarının yaprağa uygulanması nedeniyle farklı mahsullerin veriminde önemli bir artış gösterdiğini, Rathore ve ark. (2009) ise yosun gübresinin

yapraktan uygulanması ile soya fasulyesinin verimini arttırmada umut verici olduğu sonucuna varmışlardır.

Hannan ve Salem (2011), Deniz yosunu uygulaması ile ayçiçeği tohumunun yağ içeriğini, yağ verimini, K, Na ve ham proteinini önemli ölçüde arttırdığını, *Gracilaria dendroides* ve *Ulva lactuca* yosun gübrelerinin %0,6 konsantrasyonunun uygulanmasının ayçiçeğinde sırasıyla %34,05 ve %30,55 daha yüksek yağ içeriği kaydettiği rapor etmişlerdir. Kavipriya ve ark., (2011) Hindistanın Tamil Nadu eyaletinin Mandapam sahilinden toplanan *Ulva lactuca, Caulerpa scalpelliformis, Sargassum plagiophyllum, Turbinaria conoides, Padina tetrastromatica, Dictyota dichotama* deniz yosunlarının Maş Fasulyesinde tohumların çimlenmesini, sürgün ve köklerin yaş ağırlığını ve kuru ağırlığını arttırdığı sonucuna varmışlardır. Bir başka çalışmada ise Thevanathan ve ark. (2005) ve Lingakumar ve ark., (2002) siyah mercimek ve börülcede aynı sonuçları elde ettiklerini bildirmişlerdir.Raverkar ve ark., (2016) Deniz yosunu (Kappaphycus ve Gracilaria) ekstraktlarının Maş Fasulyesi (Vigna radiata)'nin gelişme, verimi ve beslenmesi üzerindeki etkinliğini değerlendirmek için tarla koşullarında çalışma yapmışlardır. Elde edilen sonuçlara göre Kappaphycus uygulamasında ürün verimi kontrole göre %29.32 ile 33.81, Gracilaria uygulamasında ise %25.74 ile 26.15 arasında artış göstermiştir. Kappaphycus'un yaprağa uygulanmasının çiçeklenme sırasındaki kök nodüllerinin sayısı ve kuru ağırlığı artmıştır. Ayrıca her iki deniz yosunu ekstraktının uygulanması bitkide protein, P ve K içeriği açısından ürünlerin kalitesini de arttırmıştır. Zodape ve ark., (2009) Deniz yosunu ekstraktının yapraktan uygulanmasının buğdayın verimini önemli ölçüde arttırdığı rapor etmiştir.Jebasingh ve ark. (2015) siyah mercimekte, 3 farklı (Laurencia pinnatifida, *Surgassum duplicatum* ve *Caulerpa scalpelliformis*) sıvı deniz yosunu ekstraktlarını 5 dozda (%5, 10, 20, 40, 60, 80 ve 100; v/v) uygulamış ve tohum çimlenmesi ile bitki büyüme parametrelerine etkisini incelemişlerdir. Uygulama toprağa ve yaprağa sprey şeklinde yapılmıştır. Tüm büyüme parametrelerinin %10 konsantrasyonlu sıvı deniz yosunu uygulamasında en yüksek olduğu sonucuna varmışlardır. Düşük seviyede sıvı deniz yosunu uygulamasının bitkide kontrole göre çimlenme yüzdesini ve etkili fide büyümesini, kök uzunluğunu, sürgün uzunluğunu ve yaprak sayısını da arttırmıştır.Rawhey ve ark. (2008), Deniz yosunu ekstraktlarının sıvı gübre olarak kullandıkları çalışmada bakla bitkisinin büyümesi, verimi ve biyokimyasal bileşenleri üzerindeki etkisi araştırmışlardır. Deniz yosunu gübresinin sprey olarak yaprağa uygulanması ile kök parametreleri (kuru kök ağırlığı, yaş kök ağırlığı, kök uzunluğu, nodül sayısı, kökün nitrojen enzim aktivitesi), sürgün parametreleri (sürgün yaş ağırlığı, sürgün kuru ağırlığı, sürgün uzunluğu), pigment içeriği, kardeş sayısı, bakla/bitki

sayısı, tane verimi, saman verimi ve tohum indeksi artmıştır. Ayrıca tohumların bazı biyokimyasal metabolitleri de (toplam karbonhidrat, toplam protein, N, P ve K yüzdesi) artmıştır. Shah ve ark. (2013) Deniz yosunu ekstraktının buğdayın (*Triticum aestivum* L.) büyümesi ve verimi üzerindeki faydalı etkilerini rapor etmişlerdir. *K. alvarezii* ve *G. edulis* özsuyunun %7,5 ve %5,0 konsantrasyonlarında uygulanmasıyla buğday veriminin kontrole göre sırasıyla %19,74 ve %13,16 oranında önemli oranda artış gösterdi sonucuna varmışlardır.

Sonuç

Günümüzde inorganik gübrelemenin çevreye, doğaya, toprağa ve yetiştirilen ürün kalitesine verilen zararları gün geçtikçe daha çok artmaktadır. Son yıllarda karşılaşılan bu sorunlara çözüm önerisi olarak alternatif yöntemlerin birisi de organik gübreleme kapsamında kullanılan yosun gübreleridir. Yosun gübreleri yapılarında içerdikleri sitokininler, oksinler, giberellinler, bitki büyüme düzenleyiciler ve makro-mikro besin maddeleri ile birlikte kültür bitkilerinin verimini, tohum çimlenme hızını, stres koşullarına karşı direncini arttırdığı için organik gübreler arasında önemli bir konuma sahiptir. Ayrıca insan gıdası, hayvan yemi ve birçok endüstrinin hammaddesi olarak kullanıldığından dolayı gelişmiş ülkeler yosun gübresinin önemini gün geçtikçe daha çok irdelemektedir. Dünyada çapında organik tarıma verilen önemin arttırılarak yosun gübreleri hakkında daha fazla araştırılma yapılması ve üreticiler ile etkileşim halinde olunup bilinçlendirilmesi gerekmektedir.

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TOHUMLARDA DORMANSİ VE DORMANSİ KIRMA YÖNTEMLERİ

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Özet
Dormansi, tohumun yaşamsal olaylarının minimum düzeye indiği veya tamamen durduğu bir dinlenme hali olarak tanımlanmaktadır. Bu çalışmada, dormansiyi daha iyi anlayabilmek ve dormansinin nasıl kırılabileceğine dair genel bir bilgi edinebilmek için dormansi olayı ve kırma yöntemleri tanımlanmıştır. Bazı bitkiler üzerinde yapılan çalışmalar ve sonuçları belirtilmiştir. Yapılan araştırmalar sonucu tespit edilen dormansiye etkili hormonlar, bu çalışmada yer yer gösterilmiştir. Genel olarak bu derlemede tohumda dormansi ve dormansi kırma yöntemleri hakkında değerlendirmelere yer verilmiştir.
Anahtar Kelimeler: Dormansi, Tohum, Dormansi kırma

DORMANCY IN SEEDS AND METHODS OF BREAKING DORMANCY

Abstract
Dormancy is defined as a state of rest in which the vital events of the seed are reduced to a minimum or completely stopped. In this study, dormancy and breaking methods are defined in order to better understand dormancy and gain general information on how dormancy can be broken. Studies conducted on some plants and their results are stated. Hormones effective on dormancy, identified as a result of research, are shown here and there in this study. In general, this review includes evaluations about seed dormancy and dormancy breaking methods.
Keywords: Dormancy, Seed, Dormancy breaking

Giriş

Tohumda dormansi ve dormansi kırma yöntemlerini tam anlamıyla kavrayabilmek için öncelikle çimlenme fizyolojisi ve biyolojisi konusunun bilinmesi gerekmektedir.Tohum bitkinin döllenme sonucu oluşmuş olan embriyo ve embriyo yedek besin maddesi taşıyan generatif üreme organı olarak tanımlanmaktadır (Çiftçi 2017). Çimlenme olayı bitki embriyosunda bulunan ve kökü meydana getiren radikula dediğimiz yapının, tohum kabuğu yani testadan ilk çıkış anıdır (Finkelstein ve ark. 2008). Dormansi olayı tohum ve belli bitki bölümlerinde büyüme, gelişme ve çimlenme gibi benzeri faaliyetlerin durup, gerileyerek istirahat dönemine geçilmesi olayı olarak tanımlanmaktadır. Çimlenme olayının gerçekleşmesi için mevcut ortamda yeterli düzeylerde ısı, su ve oksijen bulunması zorunlu olup, bazı durumlarda ortamda ışığın da mevcut bulunması gerekmektedir. Bunlara ek olarak engelleyici veya zararlı kimyasal varlığının olmaması gerekmektedir. Bu koşulların tümü mevcut olsa dahi tohumun çimlenme göstermeyebileceği savunulmaktadır (İskenderoğlu, 1993). Bu hadise bitkinin büyüme organlarında gerçekleşmektedir (Kocaçalışkan, 2002). Vandelook ve ark. (2007), 30 gün süresince çimlenme göstermeyen tohumu dormant olarak nitelendirmiştir. Viémont ve Crabbé, (2000) tarafından dormansinin bir düzenleme olduğu savunulmuştur. İç ve dış koşulların optimum düzeye gelmesi ve dışarıdan bir müdahale söz konusu olması durumunda dormansi olayının son bulması, dormansi kırılması veyahut kalkması olarak nitelendirilmiştir. Gerçekleşen dormansi evresi süresince bitkinin metabolik olayları ya durmuş ya da oldukça düşük düzeyde gerçekleşmektedir (Kocaçalışkan, 2002). Dormansi olarak tanımlanan bu olay uyku hali şeklinde de nitelendirebilmektedir. Dormansi devresince bitkinin yaşamsal olayları adeta saklı halde gerçekleşmektedir (Kadıoğlu, 1998).İki tür dormansi mevcut bulunduğu yapılan çalışmalar sonucunda belirtilmektedir (Kocaçalışkan, 2003):

1. Gerçek dormansi (uyku hali)
2. Yalancı dormansi (istirahat hali)

Gerçek dormansi, genlerin baskı altında bulunup enzim sentezinin engellenme hali olarak tanımlanmaktadır. Büyümeye uygun hale getirilen dış ortam şartlarına rağmen büyüme olayı görülmemektedir. Yalancı dormansi olayında gerçek dormansinin aksine genlerin baskı altında bulunmayıp, yalnızca dış ortam şartlarından dolayı dormansi olduğu savunulmaktadır (Kocaçalışkan, 2003). Dış ortamın elverişsizliğinden dolayı enzim aktivitesi ve büyüme olayı engellenmektedir.Dormant halde bulunan tohumun, durağan olmayan aynı zamanda çimlenme olayını tetikleyen özel bir çevresel etkiye ihtiyaç duyduğu belirtilmektedir. Bu haldeki tohumlar ekstrem etkilere tabii tutulmadıkça çimlenme potansiyeli göstermemektedirler (İskenderoğlu,

1993). Dormansi birbirinden farklı birçok uygulamayla kaldırılabilmektedir. Yaygın bir yöntem olarak soğuk uygulamasının gösterilebileceği araştırmacılar tarafından belirtilmiştir. Bunun dışında eter buharı, dikloretan, oksijenli su, sıcak su banyosu vs. uygulanabilmektedir (Akman, 1998). Bunlardan farklı olarak hormonal uygulamalar, stratifikasyon, tekrar eden değişik sıcaklık seviyeleri, mekanik parçalamalar, ışık ve gaz konsantrasyonlarının da dormansi kırma olayında nitelikli uygulamalar olduğu belirtilmektedir. Çimlenme ile fide oluşmasının sonraki evrelerinde ihtiyaç duyulan çevresel isteklerin, çimlenmenin başlaması için gerekli isteklerden farklı olduğu ve dormant halde bulunan tohumlarda bu çevresel ihtiyaçların oldukça özel oldukları belirtilmektedir (Jann, 1998). Tohumların dormansi halleri tür ve çeşitlere göre değişken olup 100 gün ya da daha çok sürebilmektedir (Onur, 1996).

Dormansi Kırma Yöntemleri

Dormansiyi kırmak için mevcut bulunan birçok değişik yöntem olduğu çeşitli çalışmalarla ortaya konulmuştur. Bunlar; testanın çizilmesi, değişik kimyasalların uygulanması, soğuk uygulaması (stratifikasyon), sıcak uygulaması, dalgalı sıcaklık muamelesi, ışık muamelesi ve elektrik akım muamelesi şeklinde nitelendirilmektedir (Güncan, 2002).

Doğada testa aşınmasının birtakım yolları olduğu çeşitli araştırmacılar tarafından belirtilmiştir (Güncan, 2002);

- Toprak içerisinde kimyasal tepkimelerle
- Mekanik yollarla
- Mikrobial parçalanma ile
- Hayvan sindirim sisteminden kaynaklı aşınma ile
- Ekstrem sıcaklık faktörleri ile

Testada mevcut geçirimsizlik olaylarını yok etmek ve çimlendirmeyi gerçekleştirebilmek adına;

- Mumsu tabakanın alkol vb. çözeltiler yardımıyla eritilmesinin sağlanması,
- Testada konsantre asit, alkol yardımıyla ya da sıcak su kullanılarak yıkanmayla geçirgenlik kazandırılması, (Alkol ile mumsu tabakanın eritilmesi mümkün olup, sıcak su ile testa yumuşatılması sağlanmaktadır. Alkol-asit tohumun sıcaklığa verdiği tepkileri değiştirip, çimlenme inhibitörlerinin parçalanmasına veyahut yıkanmasına olanak sağlamaktadır.)
- Testa embriyonun tam olarak karşı kısmından çizilmek veya kesilmek suretiyle geçirimliliği sağlanması,

- İç kısmı zımparayla örtülü kaplar içerisinde tohumlar döndürülmek suretiyle testanın aşındırılması (Güncan, 2002)
- Tohumların sıcak su da bekletilmesi (Pieterse, 2001), şeklinde sıralanabilmektedir.

Değişik kimyasal uygulamalar: Etilen, birtakım türlerde dormansi kırmada tesir edebilmektedir (Benech-Arnold, 2000). Söz konusu düzenleyicinin dormansi olayında oldukça önemli olduğu fakat ispatların tatmin edici düzeyde olmadığı belirtilmektedir. Etilenin depo halindeki yumrularda filizlenme sağlamasına karşılık yumrularda sentezlenen etilende filizlenmeye ihtiyaç ile kıyaslandığında oran oldukça alt seviyelerdedir ve bir başına etilenin patateste tomurcuk dormansisini ayarlamada tesirli olduğu savunulmaktadır (Tumbull, 1985). Dormanside devamlılığı sağlama açısından en tesirli hormonlardan birinin absisik asit olduğu belirtilmektedir. Dormant halde bulunan bitki dokularının içerisinde oldukça yüksek seviyelerde seyrettiği savunulmaktadır. Söz konusu hormonun salgısının durması halinde metabolik faaliyetler tekrar devam etmektedir. Absisik aside antagonist olarak giberellik asit hormonu bulunmaktadır. Yapılan araştırmalarda absisik asit salgılanması halinde çimlenme önlenerek dormansinin devam hali, giberellik asit uygulamasının ise çimlenmeye pozitif etki yaparak dormansiyi ortadan kaldırdığı kaydedilmiştir (Bidwell, 1979).

Soğuk uygulaması (stratifikasyon): Dormansiyi belirli olarak düzenleyen mühim dış etkenler olduğu ve bunların oksijen, sıcaklık, ışık ve rutubet etkenleri olduğu belirtilmektedir. Bu etkenlerin tümünün ayrı ayrı dormansi olayını oluşturan faktörlerle direkt olarak ilgi içinde olduğu belirtilmektedir. Soğuk muamelesi ardından tohumları kurutma olayı yapılırsa tohumun dormansiye döndüğü çeşitli araştırmacılar tarafından belirtilmiştir. Kurutulmadan direkt halde ekimi ise çimlenmeyi %80 oranından daha fazla artırmaktadır. Bu uygulama yönteminde kurutma olayına dikkat edilmelidir (Shen, 2001).

Sıcak uygulaması: Yüksek sıcaklık düzeyi bilindiği üzere kimi tohumlarda çimlenmeye hız verip artırmaktadır. Fakat bu dormansi kaldırma işlevi için, bilgilerin yeterli olmadığı belirtilmektedir. Yüksek sıcaklıkta bekletilen tohumlarda bir takım yapısal olaylar neticesi olarak kabuk geçirgenliği yükselmektedir (Güncan, 2002). Çimlenmeye engel oluşturan nedenler ortadan kalkmaktadır. Tohumun tabii tutulduğu sıcaklığın şiddeti ve tabii tutulma aralığının da çimlenmede tesirli olduğu savunulmaktadır. Çimlenmede sıcaklık tesiri kadar süresinin de önem teşkil ettiği belirtilmektedir (Susko, 2001).

Dalgalı sıcaklık muamelesi: Çoğu yabancı otta çimlenmenin gün bazlı ya da mevsimsel sıcaklık değişmelerinde pozitif yönde etkilendiği belirtilmektedir. Kimi çeşitlerde dormansi

sonlanması tohumların ancak dalgalı sıcaklık muamelesine tabii tutulmasıyla sağlanmaktadır (Benech, 2000).

Işık muamelesi: Çoğu çeşitte bulunan dormansi üzerinde ışık önemli miktarda uyarıcı olmaktadır (Benech, 2000). Bunun yanı sıra kimi yabancı otların türüne bağlı olarak inhibitör etki oluşturabilmektedir. Çünkü daha çok kırmızı ışınlar olmak üzere ışık faktörü türe bağlı olarak yabancı otlarda çimlenme engelleyicilerini parçalayıp, çimlenmeyi artırabilmektedir. Işık etkisiyle çimlenme gösteren kimi yabancı ot tohumunda testa tohum içerisine ışık girişini engellemekte, dolayısıyla çimlenmeye imkan vermemektedir. Ancak testa saf dışı bırakılarak tohum içerisine ışık girmesi mümkün kılınıp çimlenme oluşturulmaktadır. Bu şekilde ışık faktörünün çimlenmedeki olumlu veya olumsuz etkileri hem dalga boyu hem de ışığa maruz kalınan süre akabinde değişkenlik göstermektedir (Güncan, 2002).

Elektrik akım muamelesi: Kendince diğer yöntemlerden ayrı olan bu uygulama da dormansi sonlanması için uygulanan bir metot olarak belirtilmektedir. Örnek olarak patates bitkisinin yumrularındaki dormansi olayının bu muamele ile son bulduğu kaydedilmiştir. Yumrulardaki dormansi olayının giderilmesi hasat sonrası hastalık tayininin yapılması, sera-tarla alanlarından erkenci patates eldesi için elzem olduğu savunulmaktadır. Sebep olarak yumru yoluyla üretimin öne sürülebileceği belirtilmiştir. Yapılan araştırmalarda bu metodun öteki metotlardan çok bariz bir değişkenlik ortaya koymadığı diğer metotlara nazaran insan-çevre sağlığı açısından bir zarar göstermediği, pahada hafif bir metot olması itibariyle başvurulabileceği sonucu ortaya konulmuştur (Kocaçalışkan, 1989).

Yürütülen Bazı Çalışmalar

Liu ve ark. (2005), çalışmasında *Garciniacowa* Roxb. 'te dormansi kaldırılması ve germplasm muhafazasının mümkün olması için gerekli depolama şartları çalışmıştır. Dormansi sonlanması için yapılacak en tesirli metot olarak testanın tamamıyla uzaklaştırılıp kimyasal testayı yok etmesi saptanmıştır. Çetinbaş ve Koyuncu (2005), kuş kirazı (*Prunus avium* L.)'nda dormansi kırması sonrasında soğuk etkisiyle katlama ve testanın tesirlerini çalışmışlardır. 3 farklı zamanda katlama işlemi gören tohumlar kabukla ve kabuksuz şekilde çimlendirmeye alınmıştır. Her iki şekilde çimlenen tohumlarda katlama zamanları ve çimlenme oranında orantılı bir münasebet saptanmıştır. Kabuk bulunmayan tohumların çimlenmeleri kabuk bulunan tohuma göre hem daha hızlı hem de daha önce başladığı gözlenmiştir.

Tsuyuzaki (2006), *Rumex obtusifolius* L., *Polygonum longisetum Brujin* ve *Oenothera biennis* Walter bitkilerinde tohumların farklı derinliklerine ekimine bağlı olarak yaşanacak değişimleri çalışmışlardır. Değişik sıcaklık seviyelerinde çimlenme deneylerinin yapılmasıyla mevsime

bağlı değişikliklerin çimlenmedeki tesirleri çalışılmıştır. Walck ve ark. (2008), *Cyclospermum (Apium) leptophyllum* (Pers.) Sprague'de tohum dormansi kırma uygulaması ile çimlenme üzerine araştırma yapmışlardır. Taze tohumlar geniş olmayan sıcaklık düzeylerinde yüksekçe seviyelerde çimlenme gerçekleştirmişlerdir. Gerçekleşen olay şartlara endeksli fizyolojik dormansi halini açıkça ispatlamaktadır.

Nyachiro ve ark. (2002), 10 çeşit yaz buğdayı üzerinde çimlenmeye dair çeşitlilik ile tohumda meydana gelen dormansiyi açıklama adına çalışma yürütmek için değişik sıcaklıklar altında çimlenme denemeleri yürütmüşlerdir. Tohumda görülmekte olan dormansinin bitkide genetik ve çimlenme sıcaklığına endeksli bulunduğunu tespit etmişlerdir. Masaka ve Yamada (2009), *Robinia pseudoacacia* L. (Leguminosae) türünde bir başına ağaç düzeyinde karakter yönünden çimlenme değişikliğini araştırmışlardır. Tohum üzerinde testayı kaldırma, soğukta katlama, günlük termal rejim, ısı, çetin kış mevsimi koşullarında arındırma tipi yöntemler uygulamışlardır. Netice olarak 3 ayrı ağaç türünün tohumlarıyla çalışmış olan araştırmacılar tüm bireylerde ayrı ayrı dormansi düzeyleri saptamışlardır.

Sonuç

Daha önce yapılan çalışmalar ışığında dormansi kırma yöntemleri olarak; testanın çizilmesi, değişik kimyasalların uygulanması, soğuk uygulaması (stratifikasyon), sıcak uygulaması, dalgalı sıcaklık muamelesi, ışık muamelesi ve elektrik akım muamelesi gibi yöntemler tanımlanmaktadır. Dormant tohumlar üzerinde bu yöntemlerden biri veya birkaçının kombinasyon halinde uygulanması ile dormansi olayının kırılabileceği yapılan pek çok çalışma ile ıspatlanmıştır.

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WRKY TRANSKRİPSİYON FAKTÖRLERİNİN BİTKİLERİN KURAKLIK STRESİNE TOLERANSINDAKİ ROLÜ

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Özet
Küresel ısınmayla birlikte yağış rejiminde meydana gelen değişiklikler dayanıklı çeşit geliştirme çalışmalarını zorunlu kılmaktadır. Tarımsal üretimde verimliliğin düşmesine, ürün çeşitliliğin sınırlanmasına neden olan ve gelecekte gıda güvenliğinin sağlanmasını tehlikeye sokacak kuraklık stresi, abiyotik streslerin en yıkıcı olanıdır. Bu nedenlerle araştırmacılar çalışmalarında bitkilerin kuraklık stresinin üstesinden gelmek için geliştirdikleri stratejiler üzerine odaklanmıştır. Bu süreçte geleneksel ıslah yöntemlerinin uzun zaman alması, yoğun iş gücü ve büyük alanlara ihtiyaç duyulması nedeniyle ıslah sürecini hızlandıran moleküler yaklaşımlar umut vadedici olmuştur. Ayrıca son yıllarda biyoteknoloji alanında yeni nesil teknolojilerin kullanılmaya başlanması araştırmacıları genom boyutunda çalışmaya yöneltmiştir. Kuraklık stresi koşullarında bitkilerdeki dayanıklılığı arttırmak için tolerans mekanizmasında görev yapan genleri ve bu genlerin işlevlerinin tanımlanması kritiktir. Kuraklığa dayanıklı çeşit ıslahında önemli olan ve geniş bir transkripsiyon faktörleri (TF'ler) ailesine sahip olan WRKY genleri, bitkilerin fizyolojik süreçlerinde ve çevreye uyumunda hayati rollere sahiptir. WRKY proteini, çeşitli streslere (örneğin soğuk, sıcak, tuz, kuraklık, iyonlar, patojenler ve böcekler) karşı hücrelerde yanıt olarak üretilmektedir. Birçok WRKY geni, farklı biyotik ve abiyotik streslere karşı bitki tepkilerinde pozitif veya negatif düzenleyici rol oynamadığı tespit edilmiştir. İlk olarak tatlı patatesten klonlanan WRKY geninin, bitki türlerine göre gen aile üye sayıları değişim göstermektedir. WRKY proteinleri korunmuş WRKY bölgelerine ve çinko-parmak yapısına göre üç gruba ayrıldığı belirlenmiştir. Çoğu bitki türlerinde henüz WRKY genleri tanımlanmamıştır. Kuraklık stresine karşı dayanıklı çeşitlerin elde edilmesi için WRKY genlerinin dayanıklılık ıslahına entegre edilmesi ıslah başarısını arttıracaktır.
Anahtar Kelimeler: Genom çapında ilişkilendirme, WRKY gen ailesi, Kuraklık stresi**,** Gen İfadesi

THE ROLE OF WRKY TRANSCRIPTION FACTORS IN DROUGHT STRESS TOLERANCE OF PLANTS

Abstract
Changes in the precipitation regime with global warming necessitate the development of resistant varieties. Drought stress is the most destructive of abiotic stresses, causing a decrease in productivity in agricultural production, limiting product diversity and endangering food security in the future. For these reasons, researchers focused their studies on the strategies developed by plants to overcome drought stress. In this process, molecular approaches that accelerate the breeding process have been promising because traditional breeding methods take a long time, require intensive labor and large areas. In addition, the use of new generation technologies in the field of biotechnology in recent years has led researchers to work on the genome dimension. In order to increase the resilience of plants under drought stress conditions, it is critical to identify the genes that function in the tolerance mechanism and the functions of these genes. WRKY genes, which are important in breeding drought-resistant varieties and have a large family of transcription factors (TFs), have vital roles in the physiological processes and adaptation of plants to the environment. WRKY protein is produced in cells in response to various stresses (e.g. cold, heat, salt, drought, ions, pathogens and insects). Many WRKY genes have been found to play no positive or negative regulatory role in plant responses to different biotic and abiotic stresses. The number of gene family members of the WRKY gene, which was first cloned from sweet potato, varies depending on plant species. It has been determined that WRKY proteins are divided into three groups according to their conserved WRKY regions and zinc-finger structure. WRKY genes have not yet been identified in most plant species. Integrating WRKY genes into resistance breeding to obtain varieties resistant to drought stress will increase breeding success.
Keywords: Genom-wide identification, Wrky gen family, Drought stress, Gene Expression

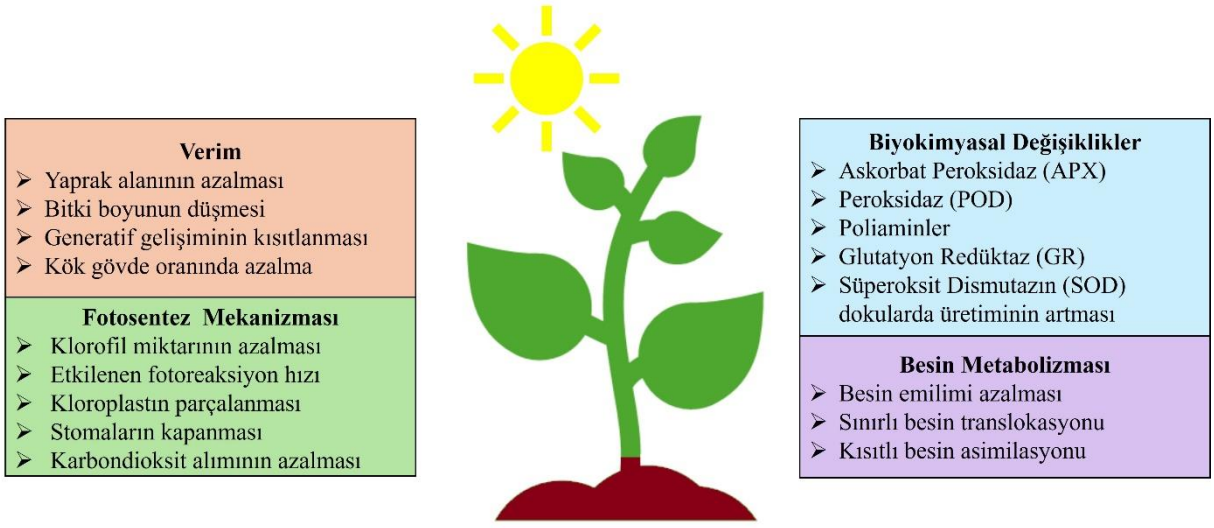
Giriş

Dünya çapında iklim koşullarındaki aşırı ve hızlı değişiklikler nedeniyle ortaya çıkan kuraklık, bitkilerin büyüme ve gelişme dönemlerinde karşılaştıkları abiyotik streslerden en yıkıcı olanıdır. Tarımsal üretimi ve ürün verimliliğini sınırlandıran bu çevresel stres faktörü gıda güvenliğini dünya çapında tehdit etmektedir (Iqbal ve ark., 2020). Özellikle kuraklık stresinin bitkinin hassas gelişme dönemlerine denk gelmesi, sıklığı, şiddeti ve süresi zararın boyutunu arttırmaktadır (Farooq ve ark., 2009). Kuraklık stresinin 2050 yılına kadar ekilebilir arazilerin %50'sinden fazlasında ciddi bitki büyüme sorunlarına neden olacağı tahmin edilmektedir (Gu ve ark., 2024). Kuraklık stresine maruz kalan bitkilerin %48'lik verim düşüşü yaşadığı ve bu kaybın diğer tüm abiyotik streslerin toplamından fazla olduğu tespit edilmiştir (Cohen ve ark., 2021). Üründe verim kayıpları bitkinin kuraklığa karşı verdiği tepkiye göre değişmektedir. Bitkilerin kuraklığa duyarlılığı karmaşık bir olgudur ve bitkinin büyüme aşaması, genetik potansiyeli, stresin süresi ve şiddeti gibi çok sayıda faktöre bağlıdır (Zu, 2002). Kuraklık, karbon asimilasyon hızı, turgorun azalması, oksidatif hasarın artması ve yaprak gazı değişimindeki değişiklikler gibi çeşitli bitki aktivitelerini bozarak bitkiler üzerinde birçok yıkıcı etkiye sahiptir ve bitkide verimin azalmasına neden olmaktadır (Nadeem ve ark., 2019). Bitkide meydana gelen morfolojik, fizyolojik ve biyokimyasal bu değişikliklerin ve kuraklık stresine karşı bitki reaksiyonlarının bilinmesi kuraklık stresine karşı dayanıklılığını arttırmak için önemlidir.

Kuraklık Stresinin Mahsul Büyümesi Üzerindeki Olumsuz Etkileri

Yaşamın en önemli bileşeni olan su, yokluğunda dünya çapında tarımsal ürün üretimini olumsuz yönde etkileyen başlıca abiyotik stres faktörlerinden biridir (Waraich ve ark., 2011). Su stresi koşulları altında, bitkilerde yaprak alanı azalmakta, büyüme ve gelişme sınırlanmakta, kök oranı artarken gövde oranı azalmakta ve yaşlanma hızlanmaktadır (Gu ve ark., 2024). Uzun süreli kuraklık, besin alımı ve asimilasyonu, fotosentez, protein sentezi ve reaktif oksijen türlerinin (ROS) birikimi dahil olmak üzere çok sayıda bitki hücresel fonksiyonunu olumsuz yönde etkilemektedir (Şekil 1). Kuraklık stresi, süperoksit anyonları ($O2^{-}$), hidrojen peroksit (H_2O_2) ve hidroksil radikalleri (OH) dahil olmak üzere aşırı reaktif oksijen türlerinin (ROS) oluşumunu arttırmaktadır. Aşırı miktarda ROS birikimi ise DNA veya RNA hasarına, enzim inaktivasyonuna, iyonik dengesizliklere ve protein denatürasyonuna neden olmaktadır (Hussain ve ark., 2018; Kang ve ark., 2022). Bitkiler genellikle kuraklık stresinin üstesinden gelmek için üç strateji benimser (Gupta ve ark., 2020; Fang ve Xiong, 2015);

1. Kaçış stratejisi (Vejetatif dönemden generatif döneme geçişi hızlandırmak veya yavaşlatmak)
2. Kök Sistemini Düzenleme Stratejisi (Kök uzamasının artması, absisik asit üretimi yapraktan K+ iyonlarının akışının artması, yaprak stomalarını daraltarak fotosentez aktivitesini düşmesiyle fotosentezin değiştirilmesi yoluyla stresin zararlı etkilerinden kaçınma)
3. Ozmotik ayarlamayı, Antioksidan savunma sistemlerinin aktivasyonunu ve fitohormonlara ve klorofil içeriğine verilen yanıtları içeren tolerans stratejisidir.



Şekil 1. Kuraklık stresinin bitki gelişimine etkileri

Günümüzde araştırmacılar bitkilerin kuraklık toleransını anlamak ve kuraklığa dayanıklılığı arttırmak için su eksikliği koşullarına yanıt olarak belirli genleri ve işlevlerini tanımlamaya odaklanmaktadır. Kuraklığa dayanıklı bitkilerdeki moleküler mekanizmaların bazıları;

- Transkripsiyonel aktivasyon ve düzenlemenin takip ettiği bir sinyal iletim sistemi,
- Geç embriyogenezde bol miktarda bulunan dehidrinler veya ısı şoku proteinleri, şaperonlar gibi birçok proteinin yardımıyla proteinlerin koruması,
- Mannitol, betain, prolin, trehaloz, miyo-inositol ve glisin dahil olmak üzere ozmolitlerin hücre içerisinde birikmesi,
- Glutatyon ve askorbik asit gibi kimyasal antioksidanların indüksiyonu,
- Süperoksit dismutaz ve glutatyon S-transferaz yoluyla reaktif oksijen türleri (ROS) toksisitesinin azaltılması sayılabilir (Sahabi et al. 2018).

Yapılan araştırmalar incelendiğinde *Dactylis glomerata* L. bitkisinde ARF, DREB, WRKY, NAC, TCP, MYB, GRAS gen aileleri, absisik asit, dehidrin genlerinin (Ji et al. 2018), *Glycine max* L.'da geç embriyogenez bol proteinlerinin (Kim et al. 2020), *Gossypium hirsutum*'da kuraklık stresine karşı toleransta TLP5, NSP2, DRE1D, NAC29 genleri tekrarlayan kuraklık koşulları altında yüksek transkript seviyelerinin tespit edildiği (Bano et al. 2022), *Medicago sativa*'da ise ROS temizleyici gen ailelerinin kuraklığa tepki olarak korunmuş dokuya özgü gen ekspresyonu modelleri oluşturduğu bildirilmiştir (Kang and Udvardi, 2012). Çalışmalar genlerin, transkripsiyon sonrası gen düzenlemesi, abiyotik streslere karşı tolerans ve reaktif oksijen türlerinin temizlenmesi yoluyla kuraklık toleransına nasıl katkıda bulunduğuna dair kapsamlı bir genel bakış sunmaktadır (Şimşek et al. 2024).

WRKY Transkripsiyon Faktörleri

Bitkilerdeki en büyük ailelerden biri olan WRKY transkripsiyon faktörleri ailesi, bitki gelişimi ve stres süreçlerinde önemli rol oynamaktadır (Nan et al. 2020). Bu gen ailesi temel olarak spesifik olarak ve çevresel faktörlere, biyolojik strese (bakteri, mantar, virüs ve diğer patojenler gibi) veya abiyotik strese (ekzojen hormonlar, yüksek sıcaklık, düşük sıcaklık, yüksek sıcaklık, tuz, mekanik yaralanma gibi) karşı hedef genlerin ekspresyonunu düzenlemektedir (Wu et al. 2024). Örneğin; Arabidopsis'in tohum kabuğu ve trichome gelişiminde (Johnson ve ark. 2002), çeltikte (*Oryza sativa*) alöron hücrelerindeki gibberellin sinyal yolu gibi çeşitli fizyolojik süreçlerde (Zhang ve ark. 2004) ve Arabidopsis'te yaprak yaşlanmasında görev almaktadır. (Miao ve ark. 2004). Ayrıca, ROS (reaktif oksijen türleri) ve hormon sinyal yolları gibi çeşitli biyolojik yollara katılarak, bitki enzim sistemlerini, stoma kapanmasını ve yaprak büzülmesinin fizyolojik tepkilerini daha da düzenleyerek bitkinin çeşitli ortamlara adaptasyonuna aracılık etmektedir (Wu et al. 2024). İlk WRKY geni tatlı patatesten klonlanmış ve daha sonra yabani yulaf (*Avena fatua* L.), maydanoz (*Petroselenium crispum* L.) ve *Arabidopsis thaliana* gibi diğer türlerden sürekli olarak klonlanma yapılmıştır (Javed and Gao, 2023; Goyal et al. 2023; Khoso et al. 2022). Bitkilerdeki WRKY genlerinin sayısı türler arasında değişim göstermektedir. Örneğin; *Gossypium hirsutum* bitkisinde 238 gen, *Cirus trifoliata* bitkisinde 55 gen, *Zea mays*'da 137 gen, *Oryza sativa* L. ssp indica ve L. ssp. japonica bitkisinde sırasıyla 102 ve 98, soyada *(Glycine max)* 296 ve fasulyede (*Phaseolus vulgaris* L.) ise 88 adet WRKY geni tanımlanmıştır (Wu et al. 2024; Ross et al. 2007; Wu et al. 2017). WRKY proteinleri üç gruba ayrılabilir. Grup I iki WRKY alanı ve iki çinko parmak motifi, grup II bir WRKY alanına ve bir çinko parmak motifine ve beş alt gruba ayrılır, grup III ise bir WRKY'ye sahiptir bir çinko parmak motifi içeren alanı bulunmaktadır (Wu et al. 2017). WRKY transkripsiyon

faktörü kuraklık stresinde önemli bir rol oynamakta ancak çoğu bitkide WRKY gen ailesinin özellikleri bilinmemektedir. Birçok çalışma WRKY genlerinin kuraklığa yanıt verdiğini göstermiştir. Örneğin, Arabidopsis'te AtWRKY25, AtWRKY33, AtWRKY46, AtWRKY57 ve AtWRKY63 kuraklık stresine verilen yanıtlarda anahtar rol oynamaktadır (Fu et al. 2010; Qiao et al. 2016; Wu et al. 2017).

Sonuç

Küresel iklim değişikliği ve su kıtlığı gibi sorunlar, tarımsal üretimde sürdürülebilirliğin önüne geçmektedir. Artan dünya nüfusuna karşı gıda arzını sağlamak için kuraklığa karşı dayanıklı çeşit sayısının arttırılması hayati önem taşımaktadır. Kuraklığa dayanıklı çeşitlerin geliştirilmesi ve ülke çapında dağıtılması uzun bir süreçtir. Bu sürecin kısalması için geleneksel ıslah metotlarının yanında, genetik ve moleküler tekniklerin (modern ıslah yöntemlerinin) multidisipliner yaklaşımla birleştirilmesi gerekmektedir. Genom düzenleme araçlarının dayanıklılık ıslahına entegre edilmesi tarımsal dayanıklılığın artırılması açısından kritik öneme sahiptir.

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RİBOZOMU İNAKTİVE EDEN PROTEİNLERİN (RIPs) TARIMDA KULLANIMI

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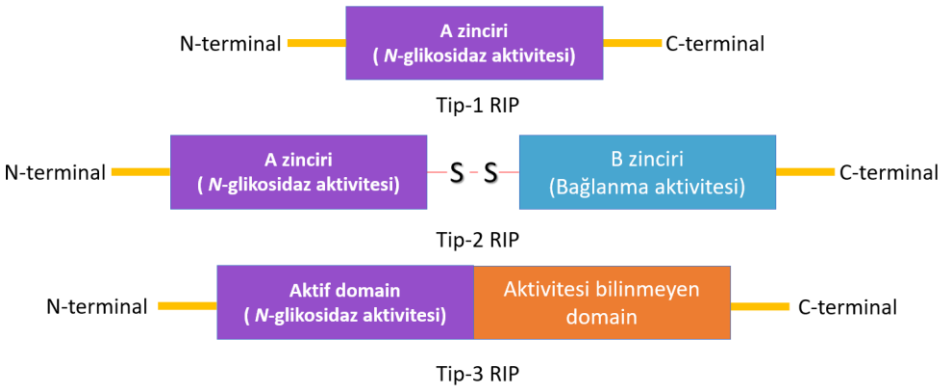
Özet
Ribozomu inaktive eden proteinler (RIP'ler), ökaryotik ve prokaryotik rRNA'ları depürine ederek protein translasyonu esnasında protein sentezini geri dönüşümsüz olarak durduran toksik N-glikosidazlardır. Araştırmalar RIP'lerin çoğunlukla bitkilerde fazlaca olmasının yanında farklı organizmalarda bulunduğunu göstermiştir. Ricin, abrin gibi RIP'lerin yüksek toksiteye sahip olmaları RIP'lerin tıp alanında kullanımı ile ilgili çalışmaların sayısında artış sağlamış olsada, tarım alanındaki potansiyel uygulamaları son yıllarda araştırmacıların ilgisini çekmiştir. Bu çalışma derleme niteliğinde olup RIP'lerin fitopatojenlere karşı anti-viral, anti-fungal, anti-bakteriyel ve böcek öldürücü aktiviteleri ele alınarak RIP'lerin tarımda potansiyel kullanımı değerlendirilmiştir.
Anahtar kelimeler: Ribozom inaktive eden protein, Fitopatojen, Bitki savunması

USE OF RIBOSOME-INACTIVATING PROTEINS (RIPs) IN AGRICULTURE

Abstract
Ribosome-inactivating proteins (RIPs) are extremely dangerous proteins that permanently stop protein synthesis by removing purine bases from eukaryotic and prokaryotic ribosomal RNAs (rRNAs) during translation. Studies have shown that ribosome-inactivating proteins (RIPs) are plentiful in plants and are also present in many species. The increased number of studies on the usage of highly toxic ribosome-inactivating proteins (RIPs) like ricin and abrin in medicine has caused interest among researchers in their possible uses in agriculture. This paper is an overview that evaluates the prospective application of RIPs in agriculture by examining their anti-viral, anti-fungal, anti-bacterial, and insecticidal actions against phytopathogens.
Keywords: Ribosome inactivating protein, Phytopathogen, Plant defense

Giriş

Ribozomu inaktive eden proteinler (RIP'ler), ribozomları etkisiz hale getiren ve protein sentezinin geri döndürülemez inhibisyonuna yol açan bir protein grubudur (Bolognesi ve diğerleri, 2016). Bu proteinlerin ribozom üzerindeki etkisi büyük ribozomal alt biriminin sarcin/ricin loop bölgesinde çoğunlukla korunmuş olan özel adenin kalıntılarının geri dönüşümsüz bir şekilde depürünasyonunu katalizleyerek ribozomu etkisiz hale getirmesidir.Dolaysıyla RIP'ler N-glikosidazlar olarak işlev görürler. Bu N-glikozidaz aktivitesi *E. coli* 23S rRNA'sında A2660 ve ökaryotik 28S rRNA'da A4324 üzerinden gerçekleşmektedir. Ribozomun bu şekilde inaktivasyonu uzama faktörü 2 (eF-2)'nin bağlanmasını engelleyerek protein sentezi inhibe olur ve sonuç olarak hücre ölümü gerçekleşir (Endo ve diğerleri, 1987). Rbozom inaktive eden protinler yapılarına göre 3 farklı sınıfa ayrılmıştır (Şekil 1). RIP'ler, yapılarına göre, enzimatik aktiviteye sahip bir polipeptit zincirinden oluşan tip 1 RIP'ler ve iki polipeptit zincirinden, enzimatik aktiviteye sahip bir A zinciri ve bağlanabilen lektin aktivitesine sahip bir B zincirinden oluşan tip 2 RIP'ler olarak sınıflandırılmıştır (Stripe 2013). Ayrıca, proteoliz ile aktive edilen jasmonatla indüklenen protein 60 (JIP60) ve mısır b-32 proteini gibi birkaç üyeyi içeren, tip 3 RIP'ler olarak adlandırılan üçüncü bir RIP sınıfı da tanımlanmıştır (Peumans ve diğerleri, 2001). Risin ve abrin gibi bazı tip 2 RIP'ler son derece toksik iken, diğer RIP sınıfı üyeleri ise düşük toksisiteye sahiptir (Stripe ve Battelli, 2006). Tip 1 RIP'lerin toksisitesi daha düşüktür, çünkü bunlar lektin kısmından yoksun olup, tip 2 RIP'lerin yaptığı gibi hücrelere bağlanamazlar.



Şekil 1. Ribozom inaktive eden proteinlerin yapısı (Demirel et al., 2022)

RIP genleri bakterilerde, mantarlarda ve hatta bazı böceklerde bulunsa da bu genlerin bitkilerde daha yaygın olduğu görülmektedir (Peumans ve Van Damme, 2010). RIP'ler ayrıca 17 farklı

bitki familyasında da bulunmaktadır (Girbes ve diğerleri, 2004, Stripe, 2004). RIP'lerin çoğu *Cucurbitaceae, Poaceae, Caryophyllaceae, Euphorbiaceae, Sambucaceae* ve *Phytolaccaceae* gibi familyalarda daha yaygındır (Girbes ve diğerleri, 2004; Domashevskiy ve Goss, 2015; Shang ve diğerleri, 2016). Bazı araştırmacılar, RIP'lerin *Hypsizigus marmoreus, Lyophyllum shimeji* ve *Volvariella volvacea* gibi mantar türlerinde de yaygın olarak bulunduğunu ortaya çıkarmıştır (Yao ve diğerleri, 1998; Lam ve Ng, 2001a; Lam ve Ng, 2001b). Liu ve diğerleri, (2002), *Laminaria japonica* A alglerinde RIP proteinlerinin varlığını ortaya koyarken, Lapadula ve Ayub (2017) ve Lapadula ve diğerleri, (2013), iki sivrisineğin genomunda farklı RIP genlerinin mevcut olduğunu göstermiştir. Ayrıca RIP'ler bitkilerde yaprak, çiçek, meyve, tohum kök, rizom, ağaç kabuğu ve lateks gibi farklı bitki kısımlarında bulunmaktadır (Schrot ve diğerleri, 2015; Kumar ve diğerleri, 2022)RIP'ler uzun yıllardan tıp başta olmak üzere farklı alanlarda pratik uygulamalar bulmuştur. RIP'lerin, özellikle PAP ve TC'ye ilişkin hayvan virüslerine karşı anti-viral aktivite, HIV ile enfekte hücrelerde etkisi ve bunların AIDS tedavisinde bir adjuvan olarak olası kullanımları umuduyla çok sayıda çalışma gerçekleştirilmiştir (McGrath ve diğerleri, 1989). RIP'lerin tümör hücrelerinde normal hücrelere göre daha toksik olmalarının bulunmasından sonra bunların immünotoksin potansiyeli, anti-viral ve anti-tümör özelliklerini değerlendiren çalışmalar mevcuttur (Sha ve diğerleri, 2013; Gilabert-Oriol ve diğerleri, 2014; Ajji ve diğerleri, 2016). RIP'lerin çoğu bitkilerde yapısal olarak sentezlenir ancak patojenlerin ve zararlıların saldırısı üzerine salınacak ve daha sonra aktif hale gelecek şekilde tecrit edilmiş bir formda tutulur (De Zaeytijd ve ark. 2019). RIP'ler, patojenin konakçı hücreye zarar vermesi üzerine salınması bilgisi araştırmacıları bitkilerde savunma sisteminde RIP'lerin rolünü araştırmaya sevk etmiştir. RIP'ların biyolojik rolleri tam olarak bilinmese de ve her geçen gün çalışmalar RIP'ların farklı rolleri olduğunu göstermektedir. Birçok çalışma RIP'ların anti-viral özelliklerine odaklansa da, tarımda RIP'ların anti-bakteriyel, anti-fungal ve insektisit aktivitelerinden yararlanmaya yönelik birçok girişim bulunmaktadır (Vargas ve Carlini, 2014). Bu çalışmada RIP'lerin tarımda kullanımları ile ilgili yönleri literatür taraması ile ele alınarak son yıllardaki gelişmeler araştırılarak elde edinilen bilgiler derleme olarak sunulmuştur.

Ribozom İnaktive Eden Proteinler ile Yapılan Çalışmalar

Pokeweed ekstraktlarının ilk kez bitkilerde viral enfeksiyonlara karşı inhibitör aktiviteye sahip olduğu gösterildiğinde RIP'ların bitki savunmasında yer aldığı düşünülmüştür. Bundan sonra RIP'ların anti-mikrobiyal aktivitesinden yararlanmak için çeşitli çalışmalar gerçekleştirilmiş ve anti-mikrobiyal ajanlar olarak etki gösterebildiği ortaya konmuştur (Girbes ve diğerleri, 2004).

İlk kez *Mirabilis expansa* köklerinden izole edilen ME1 ve ME2 isimli RIP'lerin bakterilere karşı anti-bakteriyel aktivite sergilediğini gösterilmiş ve o günden sonra bitkilerde patojen olan çeşitli bakteri türlerine karşı farklı RIP'lerin anti-bakteriyel etkileri ortaya konmuştur (Tablo 1).

Tablo 1. Fitopatojen bakterilere karşı anti-bakteriyel özellik gösteren RIP'ler

Ribozom inaktive eden protein	Bakteri	Kaynak
ME1 ve ME2	*Pseudomonas syringae, Agrobacterium tumefaciens, Agrobacterium radiobacter*	Vivanco ve diğerleri, 1999
TRIP	*Pseudomonas solanacearum, Erwinia amylovora, Shigella asonei, Salmonella typhimurium, Rhizobium leguminosarum*	Sharma ve diğerleri, 2004
Alpha-momorcharin (α-MMC	*Pseudomonas aeruginosa*	Wang ve diğerleri, 2012
Cucurbita moschata Tip-1 RIP	*E. amylovora ve P. solanacearum*	Barbieri ve diğerleri, 2006
MbRIP-1	*Escherichia coli*	Kushwaha ve diğerleri, 2012
M. jalapa RIP	*Propionibacterium acnes, Staphylococcus epidermidis*	Rumiyati ve diğerleri, 2014
balsamin	*Staphylococcus aureus, Salmonella enterica, Staphylococcus epidermidis, Escherichia coli*	Ajji ve diğerleri, 2016

Bazı peptit ve proteinler bitkilerin fungus istilasına ve hastalıklarla savaşmak için savunma mekanizmalarında kullanıldıkları anti-fungal özellikli önemli silahlardandır (Becker-Ritt ve Carlini, 2012). RIP'lerin funguslar da spor oluşumunu, hif oluşumunu azalttığı ve fungus büyümesini inhibe ettiğini gösteren birçok çalışma mevcuttur (Tablo 2).

Tablo 2. Fitopatojen funguslara karşı anti-fungal özellik gösteren RIP'ler

Ribozom inaktive eden protein	Fungus	Kaynak
Barley RIP30	*Botrytis cinerea, Fusarium sporotrichioides, Neurospora crassa , Rhizoctonia solani, Trichoderma reesei, Blumeria graminis*	Leah ve diğerleri, 1991 Roberts ve Selitrennikoff, 1986
TRIP	*C. heterostrophus, Cytospora* sp., *F. oxysporum, Pestalotia* sp., *Phoma* sp., *T. reesei*	Sharma ve diğerleri, 2004
EgRIP-1a and EgRIP-1b	*Ganoderma boninense*	Sargolzaei ve diğerleri, 2016
Maize b-32 (MOD1)	*Aspergillus flavus, A. nidulans, R. Solani, Fusarium culmorum, Fusarium fujikuroi*	Maddaloni ve diğerleri, 1997; Nielsen ve diğerleri, 2001; Balconi ve diğerleri, 2007; Lanzanova ve diğerleri, 2009
Dioicin 2	*P. digitatum*	Iglesias ve diğerleri, 2016
ME1 and ME2	*Alternaria solani, Fusarium oxysporum, F. proliferatum, Globisporangium irregulare, Phytophthora drechsleri, R. solani, Trichoderma harzianum, T. reesei, Verticillium dahliae*	Vivanco ve diğerleri, 1999; Park ve diğerleri, 2002
Alpha-momorcharin (α-MMC)	*A. flavus, A. niger, Cochliobolus heterostrophus, Fusarium graminearum, F. oxysporum, F. solani, Pyricularia oryzae, Sclerotinia sclerotiorum, Pyricularia grisea*	Zhu ve diğerleri, 2013; Qian ve diğerleri, 2014; Wang ve diğerleri, 2012; Nguyen ve Dang, 2023
Hispin	*Coprinus comatus, Didymella arachidicola, F. oxysporum, Physalospora pyricola*	Ng ve Parkash, 2022
Pebulin	*A. solani, F. oxysporum*	Rezaei-Moshaei ve diğerleri, 2021
MbRIP-1	*Aspergillus niger*	Kushwaha ve diğerleri, 2012
Curcin 2	*R. solani*	Huang ve diğerleri, 2008
PAPII	*R. solani, Clarireedia homoeocarpa*	Eang ve diğerleri, 1998; Dai ve diğerleri, 2003
TCS	*Pyricularia oryzae*	Yuan ve diğerleri, 2002
Hypsin	*Botrytis cinerea, Fusarium oxysporum, Mycosphaerella arachidicola, Physalospora piricola*	Lam ve Ng (2001a); Lam ve Ng (2001b)

Tip-1 RIP pokeweed antiviral proteininin (PAP) tobacco mosaic virüs enfeksiyonunu engellediğinin bilinmesinden beri, RIP'ler birçok hayvan, bitki ve insan virüsüne karşı güçlü anti-viral ajanlar olarak dikkat çekmişlerdir. Araştırmaların çoğunluğu insan ve hayvan virüslerine karşı RIP'lerin anti-viral aktivitesini değerlendirse de, ancak son zamanlarda tarımda dünya genelinde önemli kayıplara neden olan bitki virüslerine karşı anti-viral ajan olma potansiyellerini değerlendiren birçok çalışma mevcuttur ve bu çalışmaların sayısı giderek artmaktadır (Tablo 3).

Tablo 3. Fitopatojen virüslere karşı anti-viral özellik gösteren RIP'ler

Ribozom inaktive eden protein	Virüs	Kaynak
PAP (PAPI), PAPII ve PAPII	BMV, TMV, AMV, TBSV, SPMV, ZYMV, CMV, PVY, PVX, TEV, SBMV, AMCV	Vivanco ve Tumer, 2003; Di ve Tumer, 2015; Lodge ve diğerleri, 1993; Sipahioğlu ve diğerleri, 2017; Domashevskiy ve diğerleri, 2017; Wang ve diğerleri, 1998
BBAP1, BBP-24 ve BBP-28	TMV, SHMV	Narwal ve diğerleri, 2001a; Narwal ve diğerleri, 2001b; Choudhary ve diğerleri, 2008
SNAI' ve Nigrin b (SNAV)	TMV	Vandenbussche ve diğerleri, 2004; Chen ve diğerleri, 2002
ME1	TMV, BMV	Vivanco ve Tumer, 2003
Bouganin	ZYMV, AMCV	Bolognesi ve diğerleri, 1997; Güller ve diğerleri; 2018
MAP	TMV	Bolognesi ve diğerleri, 2002
PIP, Dioicin 2, PD-S2, PD-L1 ve PD-L4	TMV, CMV, PVY, PVX, PLRV, TNV	Bulgari ve diğerleri, 2020; Moon ve diğerleri, 1997; Iglesias ve diğerleri, 2016
CAP-I, CAP-II ve CAP30	TMV, SHMV	Dutt ve diğerleri, 2003; Park ve diğerleri, 2004
Trichosanthin	TuMV, CMV, TMV	Lam ve diğerleri, 1996; Krishnan ve diğerleri, 2002
α-Momorcharin	CMV, ChiVMV, TMV, TuMV	Zhu ve diğerleri, 2013; Yang ve diğerleri, 2016
Saporin	BMV, TMV, AMV	Vivanco ve Tumer, 2003
Amaranthin	TMV	Kwon ve diğerleri, 1997

Birçok çalışma, RIP'lerin Lepidoptera, Coleoptera ve Diptera gibi farklı böcekler üzerinde insektisidal aktiviteye sahip olduğunu ileri sürmektedir. Yapay diyet deneyleri çoğunlukla RIP'lerin böcek öldürücü aktivitesini incelemek için kullanılmıştır. Örneğin, *Sambucus nigr*a'dan elde edilen tip II RIP'nin farklı konsantrasyonlarıyla desteklenen yapay bir diyet, *Acyrthosiphon pisum*'un doğurganlığını ve hayatta kalma oranını azaltmıştır. (Shahidi-Noghabi ve diğerleri, 2008). Tablo 4 RIP'lerin bitkilerde zararlı böcek türlerine karşı insktidal etkisini ortaya koyan çalışmaları özetlemektedir.

Tablo 4. Fitopatojen böceklere karşı insektisit özellik gösteren RIP'ler

Ribozom inaktive eden protein	Böcek	Kaynak
Maize RIP	*Helicoverpa zea, Lasioderma serricorne*	Dowd ve diğerleri, 2003, 2006
Saporin, PAP-S, Lychnin, gelonin ve Momordin	*Anticarsia gemmatalis, Spodoptera frugiperda*	Bertholdo-Vargas ve diğerleri, 2009
Tip-1 Tip-2 RIP	*Acyrthosiphon pisum, Myzus persicae, Spodoptera exigua*	Hamshou ve diğerleri, 2016, 2017
MRIP	*Spodoptera frugiperda, Helicoverpa zea*	Dowd ve diğerleri, 2012
Cinnamomin	*Helicoverpa armigera, Culex pipiens Pallens, Bombyx mori*	Zhou ve diğerleri, 2000, Wei ve diğerleri, 2004
SNA-I	*Acyrthosiphon pisum, Myzus nicotianae*	Shahidi-Noghabi ve diğerleri, 2008

Sonuç

Günümüze kadar gerçekleştirilen çalışmalar RIP'lerin patojenlere karşı savunmada önemli rolü olduğunu ve çeşitli RIP'lerin anti-bakteriyel, anti-fungal, anti-viral ve böcek öldürücü aktivite dâhil olmak üzere benzersiz biyoaktif özellikler gösterdiğini ortaya koymuştur. Gelişen teknoloji ve özellikle CRISPR-Cas teknolojisi gibi biyoteknolojik yöntemler, RIP'lerin patojenlere karşı spesifik kullanımına yol açabileceği gibi endojen RIP aktivitesi olmayan bitkilerde RIP geninin ekpresyonuyla patojenlere ve zararlılara karşı koruma sağlamanın ve kimyasal pestisit uygulama ihtiyacını en aza indirmek adına ümit vadetmektedir.

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BİTKİ ISLAHINDA KLOROPLAST GENOMLARININ KULLANIMI

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Özet
Kloroplastlar yeryüzündeki yaşamın sürdürülmesinde çok önemli bir rol oynamaktadır. Çeşitli kara bitkilerinden 800'den fazla dizilenmiş kloroplast genomunun mevcudiyeti, kloroplast biyolojisi, hücre içi gen aktarımı, koruma, çeşitlilik ve kloroplast transgenlerinin bitki agronomik özelliklerini geliştirmek veya yüksek değerli tarımsal veya biyomedikal ürünler üretmek için tasarlanabileceği genetik temel hakkındaki anlayışımızı geliştirmiştir. Kloroplast genomu bitki ıslahında gen ekleme bölgesinin kontrolü, yüksek transgen ifadesi ve protein birikimi oranları, plastid genlerinin maternal olarak kalıtılması nedeniyle transgenin polen yoluyla aktarılmaması ve epigenetik etkilerin olmaması gibi avantajlar sağlar. Herbisit ve patojen direnci, kuraklığa karşı direnç, tuz toleransı ve fitoremediasyon potansiyeli gibi tarımsal özelliklerin iyileştirilmesi umut verici uygulamalardır. Kloroplast genomu uygulamaları mısır, domates, pamuk, patates, pirinç, tütün ve şeker pancarı gibi ürünlerde de başarılı bir şekilde gerçekleştirilmektedir. Moleküler ilaçlama, kloroplast mühendisliğinin yüksek potansiyele sahip bir başka alanıdır; aşı antijenleri, farmasötik proteinler (insan somatotropini, insan serum albümini, insan interferonu, monoklonal antikorlar) ve endüstriyel proteinler (avidin, beta kazein, sıvı kristal polimerler, ksilanaz, antranilat sentaz) gibi çok çeşitli ürünlerin üretimi, bakteri yetiştiriciliği veya hayvan hücre kültürlerine kıyasla ekonomik açıdan faydalıdır. Bu bildiride, kloroplast genom dizilerinin ekonomik açıdan önemli kültür türlerinin kökenlerinin ve domestikasyonu sırasında meydana gelen değişikliklerden bahsedilmiştir. Ayrıca kloroplast genomlarının potansiyel biyoteknolojik uygulamalarına da yer verilmiştir.
Anahtar Kelimeler: Kloroplast genomu, Bitki Islahı, Evcilleşme

USE OF CHLOROPLAST GENOMES IN PLANT BREEDING

Abstract
Chloroplasts play a very important role in sustaining life on earth. The availability of more than 800 sequenced chloroplast genomes from diverse land plants has improved our understanding of chloroplast biology, intracellular gene transfer, conservation, diversity, and the genetic basis on which chloroplast transgenes can be engineered to improve plant agronomic traits or produce high-value agricultural or biomedical products. The chloroplast genome provides advantages in plant breeding, such as control of the gene insertion site, high transgene expression and protein accumulation rates, lack of transgene transfer through pollen due to maternal inheritance of plastid genes, and absence of epigenetic effects. Improving agricultural traits such as herbicide and pathogen resistance, drought resistance, salt tolerance, and phytoremediation potential are promising applications. Chloroplast genome applications are also successfully carried out in products such as corn, tomato, cotton, potato, rice, tobacco and sugar beet. Molecular pesticides are another high-potential area of chloroplast engineering. The production of a wide variety of products such as vaccine antigens, pharmaceutical proteins (human somatotropin, human serum albumin, human interferon, monoclonal antibodies), and industrial proteins (avidin, beta-casein, liquid crystal polymers, xylanase, anthranilate synthase) is comparable to bacterial cultivation or animal cell cultures. It is economically beneficial. This paper mentions the origins of chloroplast genome sequences of economically important cultivars and the changes that occurred during domestication. Potential biotechnological applications of chloroplast genomes are also included.
Keywords: Chloroplast genome, Plant Breeding, Domestication

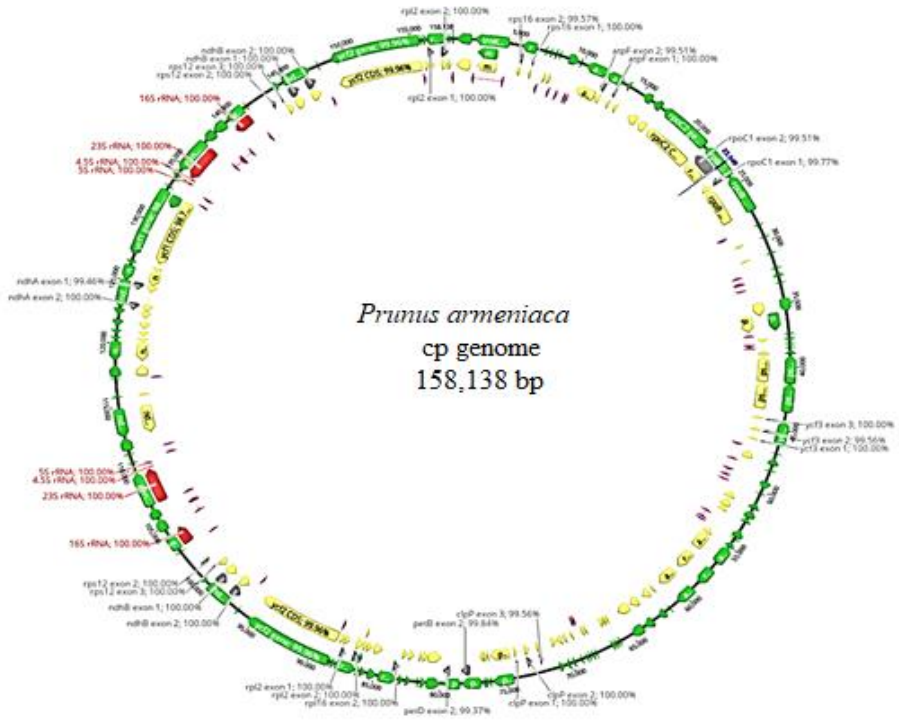
Giriş

Kloroplastlar, fotosentez ve oksijen salınımı yoluyla güneş enerjisini karbonhidratlara dönüştürerek yeryüzündeki yaşamı sürdüren aktif metabolik merkezlerdir. Fotosentez genellikle plastidlerin temel işlevi olarak kabul edilse de, amino asitlerin, nükleotidlerin, yağ asitlerinin, fitohormonların, vitaminlerin ve çok sayıda metabolitin sentezi ve kükürt ve azotun asimilasyonu dahil olmak üzere bitki fizyolojisi ve gelişiminin diğer yönlerinde de hayati roller oynarlar. Kloroplastlarda sentezlenen metabolitler, bitkilerin çevreleriyle etkileşimleri (ısı, kuraklık, tuz, ışık vb. tepkiler) ve istilacı patojenlere karşı savunmaları için önemlidir. Dolayısıyla, kloroplastlar sinyallere karşı hücresel reaksiyonlarda metabolik merkezler olarak görev yapar ve retrograd sinyalizasyon yoluyla yanıt verirler (Bobik ve ark. 2015; Daniell ve ark.2016). Kloroplast genomu, fotosentez ve diğer metabolik süreçlerde yer alan birçok anahtar proteini kodlamıştır.Yüksek verimli dizileme teknolojilerinin ortaya çıkışı, kloroplast genetiği ve genomik alanında hızlı ilerlemeyi kolaylaştırmıştır. Tütünden (*Nicotiana tabacum*) elde edilen ilk kloroplast genomunun 1986 yılında dizilenmesinden bu yana (Shinozaki ve ark.1986), National Center for Biotechnology Information (NCBI) organel genom veritabanında 300'ü bitki ve ağaç genomlarından olmak üzere 800'den fazla tam kloroplast genom dizisi kullanıma sunulmuştur. Tam kloroplast genom dizilerinden elde edilen bilgiler, bitki biyolojisi ve çeşitliliği anlayışımızı geliştirmiştir. Kloroplast genomları, çeşitli bitki ailelerinin filogenetik çalışmalarına ve filogenetik kümeler içindeki evrimsel ilişkilerin çözümlenmesine önemli katkılarda bulunmuştur. Buna ek olarak, kloroplast genom dizileri, hem dizi hem de yapısal varyasyon açısından bitki türleri içinde ve arasında önemli farklılıklar olduğunu ortaya koymuştur. Bu bilgiler, ekonomik açıdan önemli ürünlerin iklimsel adaptasyonunu anlamamız açısından özellikle değerli olmuş, yakın akraba türlerin ıslahını ve değerli özelliklerin tanımlanmasını ve korunmasını kolaylaştırmıştır (Wambugu ve ark.2015). Kloroplast genomik araştırmaları, bitki biyolojisi ve evrimi anlayışımızı geliştirmenin yanı sıra biyotik veya abiyotik strese karşı koruma sağlamak ve yenilebilir mahsul bitkilerinde aşı ve biyofarmasötiklerin geliştirilmesi gibi önemli uygulamalara da sahiptir. Yakın akraba bitki türlerinin kloroplast genomları arasında bile intergenik spacer bölgelerinin korunmaması ve düzenleyici dizilerin türe özgü olması, yabancı genlerin kloroplastlara entegrasyonu ve ifadesi için yüksek verimli transformasyon vektörlerinin geliştirilmesini kolaylaştırmıştır. Kloroplast genomu 120 ila 160 kb'lik bir moleküldür (Sugiura ve Takeda 2000). Hücre başına kopya sayısı hücre yaşına bağlı olarak 1000 ila 10 000 arasında değişir: tipik bir fotosentetik olarak aktif bitki hücresi yaklaşık 100 kloroplast içerir ve her kloroplast 100 kadar DNA kopyası içerir.

Bitki mitokondriyal genomları daha değişken büyüklüktedir ve yaklaşık 200 kb ila 2600 kb arasında değişir (Sugiura ve Takeda 2000). Bu genomlar çoklu alt genomik halkalar halinde bulunur; küçük halkalar çaprazlama yoluyla daha büyük olanlardan türetilir.Yirmi yıl önce kloroplastların başarılı bir şekilde transformasyonu (Svab ve ark. 1990), birçok açıdan sağladığı avantajlar nedeniyle nükleer gen transformasyonuna cazip bir alternatif sunmuştur. Tek bir plastid geni fotosentetik olarak aktif bir hücrede 10 000 kez temsil edilir; yüksek bitkilerin iki ters tekrar bölgesi dikkate alındığında, kopya sayısı 20 000'e kadar ulaşabilir. Bu da yüksek düzeyde transgen ekspresyonu ile sonuçlanır. Yabancı proteinlerin toplam yaprak çözünür proteininin (tsp) %46'sı kadar yüksek bir seviyede biriktiği gösterilmiştir (De Cosa ve ark. 2001) ve transkriptlerin birikimi kloroplastlarda nükleer transformasyondan sonraki bitkilerden 169 kat daha yüksektir (Lee ve ark. 2003). Kloroplastlar, kolera toksini B alt birimi, trehaloz veya ksilanaz gibi sitoplazmada zararlı olabilecek proteinleri veya bunların biyosentetik ürünlerini biriktirmek için ideal bir yerdir (Bogorad 2000). Bu trans-plastomik ifade, kloroplast biyoreaktörü kullanılarak rekombinant proteinlerin üretimi için en yaygın ve başarılı yöntemdir. Bu bildiri kloroplast biyolojisini daha iyi anlamamıza ek olarak, kloroplast genom dizilerinin hücre içi gen transferi, koruma, çeşitlilik ve kloroplast transgenlerinin bitki tarımsal özelliklerini geliştirmek veya yüksek değerli tarımsal veya biyomedikal ürünler üretmek için tasarlandığı genetik temel hakkındaki anlayışında gelişmesine yardımcı olacaktır.

Kloroplast Genom Yapısı

Kara bitkilerinin kloroplast genomları oldukça korunmuş yapılara ve içerik organizasyonuna sahiptir; büyük ve küçük tek kopya (LSC ve SSC) bölgelerini ayıran bir IR bölgesinin iki kopyasını içeren dörtlü bir yapıya sahip tek bir dairesel molekülden oluşurlar. Kloroplast genomu, öncelikle fotosentez, transkripsiyon ve translasyona katılan 120-130 gen içerir. Son zamanlarda yapılan çalışmalar, genellikle önemli düzenleyici dizileri içeren kodlamayan intergenik spacer bölgelerinde önemli çeşitlilik tespit etmiştir. Yapıdaki genel korunuma rağmen, kloroplast genom büyüklüğü 107 kb (*Cathaya argyrophylla*) ile 218 kb (*Pelargonium*) arasında değişen türler arasında farklılık gösterir ve nükleer genom büyüklüğünden bağımsızdır. Kara bitkisi kloroplast genomlarının belirli soyları da IR bölgelerinin veya tüm gen ailelerinin kaybına dair kanıtlarla birlikte önemli yapısal yeniden düzenlemeler göstermektedir (Daniell ve ark. 2006; Oldenburg ve ark. 2015).



Şekil.1. *Prunus armeniaca kloroplast genomunun genom haritası* (Turan et al.,2019)

Genler gibi, kara bitkileri kloroplast genomlarındaki intronlar da genellikle korunur, ancak protein kodlayan genler içindeki intronların kaybı arpa (*Hordeum vulgare*) (Saski ve ark.2007), bambu (*Bambusa sp*.) (Wu ve ark. 2009), manyok (*Manihot esculenta*) ve nohut (*Cicer arietinum*) (Jansen ve ark.2008) dahil olmak üzere birçok bitki türünde bildirilmiştir. İntron kaybının meydana geldiği bilinen genler tarafından kodlanan proteinlerin çeşitli işlevleri vardır; bunlar arasında bir ATP sentaz (atpF), bir Clp proteaz (clpP), bir RNA polimeraz (rpoC2) ve ribozomal proteinler (rpl2, rps12 ve rps16) bulunur (Jansen ark. 2007). Rapor edilen intron kayıplarının çoğu belirli bitki gruplarında veya türlerinde gözlemlenmiştir, ancak bazı intron kaybı örnekleri (clpP'de olduğu gibi) tek çenekliler (Poaceae), ödikotlar (Onagraceae ve Oleaceae) ve açık tohumlular (Pinus) dahil olmak üzere çeşitli bitki türlerinde görülmüştür.

Kloroplast Genom Dizileme Teknolojisindeki Gelişmeler

Kloroplast genomik alanının hızla ilerlemesindeki önemli faktörlerden biri de dizileme teknolojilerindeki gelişmedir. Yüksek verimli yöntemlerin bulunmasından önce yapılan çalışmalarda, izole edilmiş kloroplastlar tüm kloroplast genomunun amplifikasyonu için kullanılmıştır (Jansen ve ark. 2008; Bausher ve ark. 2006). Alternatif bir strateji, prob olarak kloroplast genom dizilerini kullanarak bakteriyel yapay kromozom (BAC) veya fosmid

kütüphanelerini taramaktır (Daniell ve ark.2006). Ancak bu yöntemlerle, iyi kalitede BAC veya fosmid kütüphaneleri oluşturmak çok sayıda PCR reaksiyonu ve diğer organellar DNA'dan kontaminasyon olasılığı gibi birçok zorluğa tabidir (Wu ve ark. 2012; Lin ve ark 2015). PCR yaklaşımının, kloroplast genomları dizilenmiş akrabaları olmayan veya yüksek oranda yeniden düzenlenmiş kloroplast genomlarına sahip türlere uygulanması da zordur. Yeni nesil dizileme (NGS) yöntemlerinin geliştirilmesi, bilim insanlarına kloroplast genomlarını dizilemek için daha hızlı ve daha ucuz yöntemler sağlamıştır. Kloroplast genom dizilimi için birden fazla NGS platformu mevcut olmasına rağmen (Wang ve Messing 2011), Illumina şu anda kloroplast genomları için kullanılan başlıca NGS platformudur çünkü rolling circle amplifikasyon ürünlerinin kullanımına izin vermektedir. Araştırmacılar daha sonra referans genom dizilerine ihtiyaç duymadan de novo birleştirme yapmak için biyoinformatik platformlarını kullanabilir; bu birleştirmelerden konsensüs kloroplast genom dizilerini tanımlamak mümkündür. Tek moleküllü gerçek zamanlı (SMRT) dizileme kullanan üçüncü nesil bir dizileme cihazı olan PacBio sistemi artık kloroplast genom dizilemesinde yaygın olarak kullanılmaktadır. PacBio platformu (English ve ark. 2012) tarafından üretilen uzun okumaların düşük doğruluğu (ham verilerin ~%85'i), en son kimya ile hiyerarşik bir genom birleştirme işlemi algoritması birleştirilerek düzeltilebilir; bu tür hata sonrası düzeltmelerden sonra %99,999'a kadar yüksek doğruluk oranları elde edilebilir (Chin ve ark. 2013).

Kloroplast Genomunun Islahta Yeri

Daha yüksek taksonomik seviyelerde (familya seviyesi), protein kodlama bölgeleri ve kloroplast genomunun korunmuş dizileri filogenetik analiz ve domestikasyon çalışmaları için kullanılabilir. Daha önceki filogenetik analizlerde kısmi kloroplast DNA dizileri kullanılmıştır. Değişken bölgelerin veya çoklu DNA parçalarının kullanımı bu analizlerin faydasını önemli ölçüde artırmıştır, ancak bu dizilerde, özellikle taksonomik ilişkileri belirsiz olan bazı tür içi taksonlar olmak üzere, yakın ilişkili taksonları ayırt etmek için gerekli yüksek çözünürlüğü sağlamak için yeterli bilgi yoktur. Tam kloroplast genom dizileri, yakın akraba taksonlar arasındaki filogenetik ilişkilerin deşifre edilmesi ve bitki türlerinin evrimine dair anlayışımızın geliştirilmesi açısından değerlidir.Kloroplast genomunun tarımdaki önemli bir uygulaması, ticari çeşitlerin tanımlanması ve saflıklarının belirlenmesidir. Kloroplast genomundan türetilen DNA barkodları, çeşitlerin tanımlanmasında ve ıslah kaynaklarının korunmasında kullanılabilir. Islahta başarı genetik uyumlulukla belirlenir ve kloroplast genomları, yakın akraba olması muhtemel ve dolayısıyla genetik olarak uyumlu bitkileri tanımlamak için değerli bir araç görevi görür. Kültür bitkileri ve yabani akrabaları arasındaki genetik ilişkilerin

anlaşılması, kültür bitkilerine belirli avantajlı özelliklerin kazandırılmasına yönelik çabalar hakkında bilgi verir.Orchidaceae, tüm angiospermlerin yaklaşık %6-11'ini kapsayan büyük bir familyadır ve çiçek yetiştiriciliğinde önemlidir (Pillon ve Chase 2007). Ticari açıdan önemli birçok orkide türü Epidendroideae alt familyasına aittir ve bu alt familyadan birkaç türün kloroplast genomları dizilenmiştir (Chang ve ark. 2006; Perini ve ark. 2015). Orkidelerde türler arası çaprazlama yapmak kolay olduğundan ve ıslah kayıtları bazen eksik olduğundan, ticari açıdan önemli çeşitlerin ebeveyn kökenini doğrulamak genellikle zordur. Düzeltilmiş ebeveyn bilgileri ıslah ve çeşit tanımlama için önemlidir. Epidendroideae içinde bir alt kabile olan Oncidiinae ile ilgili bir araştırmada, 15 ticari çeşitte sekiz korunmuş bölgeden elde edilen PCR ürünleri, tür düzeyinde filogenetik ilişkilerini çözmüş (Wu ve ark. 2010) ve ebeveyn kökenindeki varsayılan hataları çözmeye yardımcı olmuştur.Kloroplast DNA temelli filogenetik ağaç ile ebeveyn kayıtları arasındaki tutarsızlıkların olası bir nedeni kloroplast yakalamadır. Kloroplast yakalama, tür içi ve türler arası hibridizasyondan sonra kloroplastların bir türden diğerine geçmesidir (Tsitrone ve ark. 2003). Kloroplast genomları, yakın akraba taksonları içeren filogenetik analizler için yararlı bilgiler sağlasa da, hibridizasyon yoluyla kloroplast yakalama, yakalanan kloroplast genomları veya bunların içerdiği genler kullanılırsa filogenetik ilişkileri bozabildiği gözlemlenmiştir. Hem nükleer hem de kloroplast genomlarının kullanılması daha eksiksiz filogeniler sağlayabilir (Wambugu ve ark. 2015).Kloroplast genomları hakkındaki bilgiler, özellikle baklagiller olmak üzere çeşitli ürünlerin domestikasyonunu anlamak için yararlıdır. Baklagillerin kloroplast genom yapısı çok ilginçtir; büyük ters çevrilmiş segmentler ve ters çevrilmiş tekrarların kaybı dahil olmak üzere çok sayıda yeniden düzenleme içerir. Buna bir örnek, Papilionoideae alt familyasının çoğu üyesinde rapor edilmeden önce ilk olarak soya fasulyesi (*Glycine max*) kloroplast genom dizisinde (Saski ve ark. 2005) tanımlanan 51 kb'lık bir inversiyondur. Daha sonra Phaseolus ve Vigna kloroplast genomlarında 78 kb'lık bir tersinme doğrulanmıştır (Guo ve ark. 2007; Tangphatsornruang ve ark. 2010). Daha yakın zamanda, 51-kb inversiyonun içinde 36-kb (Martin ve ark. 2014) ve 5.6-kb (Kazakoff ve ark. 2012) inversiyonlar tanımlanmıştır. Bu ters bölgeler içinde birçok önemli gen vardır ancak hiçbir gen bozulmamış ve bitkinin hayatta kalması ve performansı etkilenmemiştir. Bu benzersiz özellikler sadece filogenetik çalışmalarda çok yararlı olmakla kalmaz (Schwarz ve ark. 2015), aynı zamanda baklagillerde kloroplast dönüşümü için de önemli bilgiler sağlar. Kloroplast yapısı, daha fazla domestikasyon ve filogenetik analiz için dizilerin amplifikasyonunda ihtiyaç duyulan primerlerin tasarımı için de önemlidir.Turunçgiller ticari açıdan en önemli meyve cinslerinden biridir. 2006 yılında, tatlı portakalın (Citrus ×

sinensis) ilk Citrus kloroplast genomu yayınlanmış (Bausher ve ark. 2006) ve sonraki çalışmalar için referans genom olarak kullanılmıştır. Citrus (28) ve Citrus ile ilişkili cinslerin (6) 34 kloroplast genomunun filogenetik analizi, turunçgillerin aynı ortak ataya sahip olduğunu göstermiştir (Carbonell ve ark.2015; Caspermeyer ve ark. 2015). Dört gende (matK, ndhF, ycf1 ve ccsA), tek nükleotid varyasyonları ve ekleme / silme frekansları ortalamadan açıkça daha yüksek olduğu ve bu genlerin pozitif olarak seçildiğini göstermiştir. MatK geni, tip II intronların eklenmesinde rol oynayan bir maturazı kodlar ve matK dizisi genellikle filogenetik ve evrimsel çalışmalarda kullanılır. MatK'nın pozitif seçilimi sadece turunçgillerde değil, diğer birçok bitki türünde de yaygın olarak görülmektedir. Aslında, 30'dan fazla bitki grubunun matK genlerinde pozitif seçilime uğradığı gösterilmiştir, bu da genin bir dizi farklı ekolojik seçici baskıya maruz kaldığını göstermektedir. ndhF geni, kloroplast NAD(P)H dehidrojenaz (NDH) kompleksinin bir alt birimini kodlar. Kloroplast NDH monomerleri yüksek ışık stresine duyarlıdır, bu da ndh genlerinin stres iklimlendirmesinde de rol oynayabileceğini düşündürmektedir. Bu çalışmalar, matK ve ndhF'nin Avustralya türlerinde pozitif seçilim gösterdiğini ve potansiyel olarak sıcak, kuru bir iklime adaptasyonlarına katkıda bulunduğunu göstermiştir.

Biyoteknolojik Uygulamalarda Kloroplast Genomunun Kullanımı

Son on yılda, kloroplast genomu öncelikle bitki koruma ve verim artışı için çok önemli olan biyotik stres toleransını artırma potansiyeline sahip hedef genlerin ekspresyonuna odaklanmıştır. Böcek zararlılarından kaynaklanan verim kaybı birçok ülkede çok ciddi boyutlarda olabilmektedir. Kloroplastlarda Bt proteininin hiper ekspresyonu ile sağlanan pamuk kurdu direncine ek olarak, geliştirilmiş biyotik stres toleransının yakın zamanda ortaya çıkan başka birçok çarpıcı örneği de bulunmaktadır (Lee ve ark. 2011). Retrosiklin-101 ve Protegrin-1, birçok kültür bitkisinde verim kaybına neden olan Erwinia yumuşak çürüklüğü ve tütün mozaik virüsüne (TMV) karşı koruma sağladığı ortaya çıkmıştır. *Pinellia ternata* aglutinin (PTA) geninin kloroplast genomunda ifade edilmesiyle yaprak bitlerine, beyaz sineklere, lepidopteran böceklere ve bakteriyel ve viral patojenlere karşı çoklu direnç elde edilmiştir. 40'tan fazla transgen kloroplast genomuna stabil bir şekilde entegre edilmiş ve kloroplast genomu içinde ifade edilmiş olup, yenilebilir ürünler olan lahana (*Brassica oleracea*) (Liu ve ark. 2007), soya fasulyesi (Dufourmantel ve ark. 2004,2005) ve patlıcanda (*Solanum melongena*) böcek direnci de dahil olmak üzere önemli agronomik özellikler kazandırmıştır.

Soya fasulyesi, kolza tohumu (*Brassica napus*) ve mısırdan elde edilenler gibi tohum yağları, E vitamininin başlıca diyet kaynağıdır. Ayçiçeği (*Helianthus annuus*) tohumu yağı gibi sadece

birkaç tohum yağı, önemli bir E vitamini öncüsü olan α-tokoferolü yüksek seviyelerde içerir. γ-Tokoferol, α-tokoferolün biyosentetik öncüsüdür ve γ-tokoferol metil transferaz (γ-TMT) tarafından katalize edilen α-tokoferol biyosentetik yolunun hız sınırlayıcı adım olduğunu düşündürmektedir. γ-tmt geninin kloroplast genomunda gerçekleştirilen biyoteknolojik uygulamalarla γ-TMT'nin aşırı ekspresyonu nedeniyle iç kloroplast zarfının çoklu oluşmuş ve tohumlarda γ-tokoferolün α-tokoferole dönüşümü yaklaşık on kat artmıştır. Benzer şekilde, likopen β-siklaz genlerinin domates plastid genomuna eklenmesi, likopenin provitamin A'ya (β-karoten) dönüşümünü belirgin fenotipik değişikliklerle artırmıştır (Kato ve ark. 2000).

Sonuç

Bitki hücresinin evrimi sırasında cpDNA önemli bir azalmaya uğramıştır. Atasal kloroplastların birçok geni cpDNA'dan hücre çekirdeğine aktarılmıştır. Kloroplast proteinlerinin çoğu çekirdek tarafından kodlanmıştır. Ancak kloroplast genomlarının yine de bitki türlerine bağlı olarak 50 ila 200 arasında temel proteini kodladığı belirlenmiştir. Yapılan araştırmalarda kloroplastların yarı bağımsız organeller olarak kabul edildiği ancak çekirdek ile sürekli yakın ilişki içinde olduğu belirlenmiştir. Özellikle yüksek bitkilerin kloroplastlarının, fotosentezi gerçekleştirerek Dünya'daki yaşamı sürdüren metabolik merkezler olduğu ortaya çıkmıştır. Bu süreçte bitkiler güneş enerjisini, suyu, mineral toprakları ve karbondioksiti kullanarak organik bileşikler sentezler. cpDNA, bitki türleri arasında hem boyut hem de alabilecekleri biçim açısından farklılık gösterir. Son cpDNA çalışmaları, bu moleküllerin hem çok dallı doğrusal hem de dairesel yapılar alabildiğini göstermektedir. Tüm bunlar bir araya geldiğinde, kloroplastların içinde meydana gelen çeşitli ve oldukça karmaşık bir genetik sistemin görüntüsünü vermektedir. Kloroplast genetik mekanizmasının anlaşılması, kloroplastların işleyişinin ve içlerinde meydana gelen süreçlerin tam olarak açıklanabilmesi için temel koşullardan biridir. Böylece evrimden domestikasyona kadar olan süreçte önemli bir destek olan kloroplast genomu bitki ıslahın da büyük gelişmelerin olmasına olanak sağlayacaktır.

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WHAT'S THAT SMELL? ALTERNATIVE FORAGE BASIL WITH REFERENCE OF PHARMACOLOGICAL ANIMAL STUDIES

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Abstract
Changing feed composition could achieve synchronization of energy and N supply to the rumen. The utilisation of distinct components could modify microbial or tissue metabolism for reasons other than dietary nutrient supply patterns. Advantages are due to the presence of individual species or the higher species diversity in the pasture mixture. Higher species diversity may enable particular advantages. The identification of the plants that contribute to the pasture seems to have a greater influence on the increase in pasture dry matter production than species diversification.
Keywords: Alternative forages, Ocimum basilicum, basil

Introduction

Over 40% of Earth's surface is covered by grasslands, with grazing areas accounting for the biggest portion of all land uses, covering over 40 million km^2. With livestock production making about 50% of the world's agricultural GDP, it is a significant economic activity. Since forage grasses are the most widely used animal feed worldwide, forages are particularly significant in livestock production systems. A variety of intensively managed monocultures with high stocking rates and high inputs (such as fossil fuels, fertiliser, and herbicides) that may be periodically replanted are examples of grazed ecosystems. Other examples include permanently managed grasslands, rangelands, and semi-arid savannas that serve as low-input ecosystems (Peters et al., 2013). Natural re-vegetation techniques, especially grazing management, have the potential to revitalise vigour and speed the spread of beneficial species. Due to low precipitation in arid and semiarid rangelands, where artificial re-vegetation would entail the establishment of suitable species either by seed or by transplanting seedlings, grazing management alone may not be able to speed the succession towards preferred species. The two primary methods used to replenish a depleted rangeland are restoration and rehabilitation. Rehabilitating or artificially establishing a new type of vegetation that differs from the pure native vegetation is known as artificial recovery, while restoration, also known as biological recovery, refers to returning the ecosystem to its original state (Le Houerou, 2000). Increases in biomass, plant cover, organic matter, soil micro- and macroorganisms, improved water intake and turnover, reduced evaporation, and runoff are examples of biological or artificial recovery. By preventing cattle and humans from entering the target region, biological recovery may be achieved. Rangelands may be restored for a variety of reasons, including erosion management, wind barriers, sand dune fixation, landscaping, and the production of fodder and timber (Le Houerou, 2000). The gradual decline in secondary productivity and diversity, together with the issue of how to handle these shifts, is a key problem for dry and semiarid regions. The task of maintaining and enhancing arid and semi-arid ranges is never easy. Many rangeland theoretical models have been established, and a small number of them are now being evaluated in various rangeland ecosystems across the globe (Ahmad and Islam, 2011).

Multispecies forages

Decoupling the increase of environmental contamination from productivity is one of the main goals in modern agricultural systems. Using varied (multispecies) pastures could help achieve this goal. It may be possible to improve the yearly herbage growth and N usage efficiency of intensively managed pastures by diversifying their species composition. The importance of

well-adapted plant functional types is emphasised by the finding that the presence of particular species in the sward has a greater bearing on herbage production and N dynamics than the number of species present in the sward. It has also been demonstrated that adding forbs to pastures, such as plantains and chicory, helps lower the nitrogen content of urine patches and lowers the possibility of nitrogen leakage from grazed pastures. The yields of herbage per year from varied blends are higher than those from simple combinations. Greater species diversity in pastures can increase plant N uptake (Vibart et al., 2016).Dairy farms are highly complex systems, with interactions among paddocks within the grazing rotation. The system as a whole may be affected by management choices made for a single paddock (Pembleton and Rawnsley, 2011). New fodder species have historically been incorporated into dairy systems using the distinct monoculture approach. The design and administration of two or more grazing platforms are necessary for this integration technique. Although there are effective examples of this technique in place, at least one of the monocultures frequently performs poorly overall due to the higher level of grazing management expertise and the periodic conflicts between the grazing requirements of each platform. This has hindered the species' ability to be widely adopted. A more effective way to increase pasture variety is to incorporate new species into the relatively basic grass-legume binary mixture that already exists. According to Pembleton et al. (2015), more species diversity should enable the use of particular advantages offered by other species without requiring more inputs or management. On the other hand, there is a worry that a sward's diversity will raise the management and inputs needed to achieve and sustain these benefits. Increasing the diversity of species in pastures enables each species to take advantage of niches. There are two types of niches: temporal (induced by seasonal weather patterns) and spatial (caused by variations in the soil). Niches can also happen when a species underutilizes a resource (such water or space), giving another species opportunity to take advantage of it (Sanderson et al., 2004). This particular form of niche exploitation may take several years to manifest (Tilman et al., 2001).During periods of soil moisture deficits, Sanderson et al. (2005) found that during a two-year grazing study, there was less herbage DM accumulation from a two-species (orchardgrass–white clover) mixture than from three species (orchardgrass, white clover, and chicory), six species (orchardgrass, tall fescue, perennial ryegrass, red clover, birdsfoot trefoil, and chicory), and nine species (the six-species mixture plus white clover, alfalfa, and Kentucky bluegrass Herbage accumulation was similar across all treatments during the second year. But during the third year of the trial, the majority of the combinations were going back to white clover–orchardgrass, and the variation between treatments was getting less.

Herbage accumulation is not always positively impacted when a sward's species diversity is increased (Sanderson et al., 2004). Whether the advantages are due to the presence of individual species or the higher species diversity in the pasture mixture has been a major open question in multi-species research. According to recent assessments (Pembleton et al., 2015; Vibart et al., 2016) of the effects of pasture species diversity on grazing systems, the presence of particular, well-adapted species was found to be more significant in driving herbage production and N dynamics than the total number of species. Increasing species richness in a system with limited resources might not increase herbage productivity; instead, it might only result in a more equitable distribution of these resources. It is proposed that functional diversity and the complementarity of niche-use among species in a sward can lead to transgressive overyielding (Cardinale et al., 2007).

Alternative species

The identification of the plants that contribute to the pasture seems to have a greater influence on the increase in pasture dry matter production than variety diversification. Reports from New Zealand pastures with perennial ryegrass, white clover, red clover, chicory, plantain (*Plantago lanceolata* L.), lucerne, and perennial ryegrass (Nobilly et al., 2013) as well as from south western Victorian pastures with tall fescue, cocksfoot, white clover, red clover, and chicory (Tharmaraj et al., 2014) corroborate this. In each case, the presence of heat- and drought-tolerant plants including plantains, lucerne, and chicory was linked to an increase in summertime dry matter production. Increasing species variety in a pasture can enhance the forage's nutritional qualities (Woodward et al., 2013), for example, by reducing concentrations of neutral detergent fibre (NDF). Additionally, species diversity might enhance the animal's food supply and, consequently, the digestive system's nutrient synchrony (Yang et al., 2010). But rather than being a result of the diversity of the pasture itself, this is probably mediated by the addition of species (such as legumes and forbs) that have lower NDF levels and digestibility parameters (Sanderson et al., 2006). In contrast to basic pastures, cows grazing 30 different types of pastures produced more milk in recent experiments (Totty et al., 2013). However, other studies found no overall improvement in milk production (Soder et al., 2006). Increases in milk yield have been noted in pastures with three species of perennial ryegrass, white clover, and plantain, or seven species (Pembleton et al., 2015): perennial ryegrass, white clover, tall fescue, prairie grass, chicory, plantain, and lucerne. Season to season variations exist in the correlation between increased diversity of sowed species and increased milk production. When there has been an increase in milk production, it usually results from a drop in the diet's NDF content

linked to an increase in the amounts of forbs (plantains and chicory) and legumes (red clover and lucerne) (Totty et al. 2013; Woodward et al., 2013).

The complementarity between grasses and legumes utilized in these swards are beneficial, since they can convert available resources to high quality forage. Commonly utilized forbs in multispecies swards have historically included ribgrass/ribwort plantain (*Plantago lanceolata* L.), chicory (*Cichorum intybus* L.), yarrow (*Achillea millefolium* L.), sheep's parsley (*Petroselinum crispum* Mill.) Fuss], burnet (*Sanguisorba minor* Scop.), cat's ear dandelion (*Hypochoeris radicata* L.), and caraway (*Carum carvi* L.) (Sanderson et al., 2003).

Condensed tannins (CT) were investigated in early animal research, and plants containing CT, including *lotus*, were used in grazing tests that decreased the amount of protein that degraded in sheep rumen (Barry and Manley, 1984). On order to evaluate the effects of CT on dairy cows, grazing tests with lotus seeded in a mixed pasture with ryegrass and forbs were conducted more recently. But other species outcompeted the lotus, and it never managed to establish (Totty et al., 2013). Multispecies swards that graze are generally thought to have higher DMI, though this hasn't always been seen. McCarthy et al. (2020) found no changes in overall DMI between multispecies and grass or grass-legume swards in their metanalysis comparison. In comparison to grass or grass-legume swards, multispecies swards often have lower NDF concentrations, which are thought to have an impact on DMI. Additionally, the milk yield in multispecies swards increased by 1,20 kg d^{-1} per cow, according to the researcher. For cows grazing multispecies swards, the analyses also revealed significant increases in milk component output, with increases in energy-corrected milk (ECM), fat, protein, and combined fat and protein. The variations in nutrient concentrations of multispecies swards are probably responsible for these variations in the composition of milk components.

When grazing cattle are fed chicory and plantain instead of ryegrass, it has also been demonstrated that the ruminative chews and rumination time are decreased (Gregorini et al., 2013). A decrease in ruminative chews may indicate increased breakdown of particles upon ingestion, which would lessen the need for ruminating and speed up the removal of digesta from the rumen. The rumen's digesta must be removed in order to make room for feeding, which increases intake overall. These effects are contingent upon the quantity chosen by the grazing animal as well as the pasture's overall proportion of fodder forbs (plantains or chicory). Increased selection for these species is probably going to have an impact on their persistence, which will reduce their prevalence in the pasture. Anti-quality factors have also been reported from multispecies swards, mainly as a contribution from the forb component (Jaramillo et al.,

2021). The nutritive value of pasture can be affected by plant secondary metabolites in both nutritional and anti-nutritional ways (Barry et al., 2002). One of the most researched plant secondary metabolites is condensed tannins, which have the potential to impact animal nutrition by shielding proteins from ruminal breakdown. Anthelmintic medications have traditionally been used to control gastrointestinal parasites; however, it has been noted that cattle, sheep, and goats have higher parasite resistance to standard anthelmintics (Min and Hart, 2003). Current studies are looking into alternate strategies for controlling gastrointestinal parasites. Evidence suggests that more diverse forage plants could prevent weeds from invading grassland ecosystems (Tracy and Sanderson, 2004). It is challenging to pinpoint the precise processes of suppression in multispecies swards because high productivity is frequently positively connected with increasing forage diversity. Nonetheless, it's been proposed that more soil cover increases resource efficiency and decreases the amount of area available for weeds to invade and establish themselves in the swards. It's crucial to remember that pasture productivity and fodder accumulation don't necessarily mean the same thing, particularly in situations where weed invasion could boost pasture biomass and the animals don't choose these species when grazing or in situations where weeds might be harmful (Jaramillo et al., 2021).In an effort to enhance animal performance, health, and product quality, aromatic herbs and their extracts have been added to animal diets as feed additives in recent years. The broad spectrum of antimicrobial antioxidants found in aromatic herbs, as well as their ability to stimulate digestion and appeal to the senses, are the reasons behind their use (Kosmidou et al., 2006).

Basil (*Ocimum basilicum*)

The herb basil, or *Ocimum basilicum* L., is native to South America, Africa, and Asia's subtropical zones. *O. basilicum* exhibited antibacterial activity against a number of isolates of *Vibrio* spp. The antibacterial action seen in *O. basilicum* essential oils may be attributed to chemical components such rosmarinic acid (Shabih et al., 2022). One of the most used herbs in cooking is basil. Sweet basil is one of the most widely utilised types of the more than 12 culinary basil herb kinds in cooking. Three primary components linalool, estragole, and eugenol were responsible for the scent of basil leaves and stems (Li and Chang, 2016). It is estimated that there are between 50 and 150 species of *Ocimum* in the world. Basil's water soluble extracts are a rich source of flavonol glycosides and phenolic acids, while its essential oil is a rich source of terpenoids. The beneficial properties of wild basil are most likely linked to the crop's significant flavonoid, alkaloids, tannin, saponin, and terpene content. In male Wistar rats with acetic acid-induced colitis, three products made from basil (1) linalool-rich essential oil, (2)

seed ethanolic extract, and (3) seed mucilage have demonstrated positive effects (do Nascimento et al., 2023).An erect branching herb, 0.6 to 0.9 m high, glabrous, more or less hispidly pubescent. Stems and branches are green or sometimes purplish. Leaves of *Ocimum basilicum* are simple, opposite, 2.5-5 cm or more long, ovate, acute, entire or more or less toothed or lobed with a cuneate and entire base. The petiole is 1.3-2.5 cm long. The leaves have numerous dont like oil glands which secrete strongly scented volatile oil. Whorls densely racemose, where the terminal receme is usually much longer than the lateral ones. The bracts are stalked, shorter than the calyx, ovate and acute. Calyx is five mm long, enlarging in fruit and very shortly pedicelled. Its lower lip with the two central teeth is longer than the rounded upper lip (Bilal et al., 2012).*Ocimum basilicum* was evaluated by Umar et al. (2012) in a rat model of hypertension, on the factors that cause the hypertension and its aftereffects (myocardial hypertrophy, renal function). *Ocimum basilicum* may reduce hypertension, according to the results. *Ocimum basilicum* showed no discernible dose dependence; the lowest dose produced the same results as the largest, four-fold larger dose. Additionally, *Ocimum basilicum* affects lipid metabolism and platelets. *Ocimum basilicum*, like all herbals, is undoubtedly composed of numerous ingredients. Further research is required to determine the constituents involved in the current impact and whether the substances responsible for *Ocimum basilicum*'s effect on platelets are the same or different.In a rat model of Alzheimer's disease, Gradinariu et al. (2015) examined the potential anxiolytic and antidepressant properties of inhaled basil essential oils derived from *Ocimum sanctum* L. and *Ocimum basilicum* L. The effects of inhaled basil essential oils were investigated, including their anxiolytic and depressive properties. In the forced swimming test, the rats treated with beta-amyloid showed the following: a reduction in exploratory activity (number of crossings), an increase in swimming time, and a decrease in immobility time. Consequently, the rats' behaviour greatly improved after being exposed to basil essential oils, indicating potential anxiolytic and antidepressant effects. The findings imply that several exposures to basil essential oils may be helpful in reducing anxiety and depression associated with Alzheimer's disease.According to the Harnafi et al. (2009) study, a high-fat diet heavy in cholesterol, lard, and cholic acid caused hyperlipemia. Animals were split into three groups at the start of the experiment: a normolipidemic control group (NCG), a hyperlipidemic control group (HCG), and a group that received basil treatment (BTG). Sweet basil significantly reduced liver and plasma total cholesterol and triglycerides after ten weeks of therapy. A comparable outcome was noted for the concentrations of LDL cholesterol in plasma. Additionally, there is a noteworthy

ameliorative effect of the basil extract on increased levels of the LDL/HDL-C ratio and the atherogenic index (AI). Researchers came to the conclusion that O. basilicum might be useful in treating hyperlipidemia and associated cardiovascular illnesses because it might contain polar compounds that can lower plasma lipid content.

Khaki et al. (2011) divided the thirty male Wistar rats (n = 10) into two treatment groups (n = 20) and a control group (n = 10). For 40 days, O. basilicum extract was given to the first treatment group at a dose of 1.5 g kg^{-1} body weight and to the second group at a dose of 3 g kg^{-1} body weight. Rat testes tissues were extracted from each group member at the end of the test period, and sperm was then extracted from the epididymis and ready for examination. When compared to the control group, the experimental group, which got the first treatment, had significantly higher levels of total testosterone serum, sperm concentration, sperm motility, and percentage of sperm viability. This implied that the extract from O. basilicum would be a potential therapy for improving the parameters of healthy sperm.In adult female cyclic Wistar rats, Bilal et al. (2013) examined the effects of a hydroalcoholic extract of *Ocimum basilicum* Linn. leaves on ovulation, implantation, and pregnancy maintenance. The antiovulatory, antiimplantation, and abortifacient properties of *Ocimum basilicum* leaf extract (364 mg kg^{-1} and 624 mg kg^{-1}) were investigated. Each day for the 15 days when the first experiment's rats were treated, the vaginal smears of the rats were observed. To verify its antiovulatory effect, the amount of cholesterol in ovarian tissue was estimated, and its histology was examined. The animals in the second and third trials were treated from the first to the seventh and from the eighth to the sixteenth day of pregnancy, respectively. In two studies, laparotomies were performed on the tenth and twentieth days of pregnancy, respectively, to measure the number of implantations and litter size. Pain control was examined between the treatment groups. There was a noteworthy ($P<0.001$) increase in the length of the diestrus phase and estrus cycle. Additionally, a noteworthy rise in the cholesterol content in ovarian tissue and a significant decrease in ovarian weight were noted ($P<0.001$). It was discovered that the treated group's uterus weighed less. A histological report revealed that the ovarian parenchyma had a sizable corpora lutea. In rats administered with both extract dosages, there was no discernible antiimplantation nor abortifacient impact. *Ocimum basilicum* hydroalcoholic extract prolongs the diestrus phase and throws off the estrus cycle, which in turn interferes with regular ovulation.Amrani et al. (2006) assessed the lipid-lowering potential of an aqueous extract of Ocimum basilicum in rats that had been hyperlipidaemic due to Triton WR-1339. Animals who received an intraperitoneal injection of Triton (200 mg kg^{-1}) developed hyperlipidemia.

Following the injection of Triton, the rats were split into three treatment groups: rats treated with fenofibrate, plant extract, or hyperlipidemia. Rats treated with *Ocimum basilicum* extract (0.5 g 100 g^{-1} body weight) had plasma cholesterol, triglycerides, and LDL-cholesterol levels that were, at 7 hours after the Triton injection, 50%, 83%, and 79% lower than those treated with Triton alone. In contrast, HDL-cholesterol was 129% higher. Total cholesterol, triglycerides, and LDL cholesterol dropped by 56%, 63%, and 68%, respectively, at 24 hours after *Ocimum basilicum* was administered, whereas HDL cholesterol did not significantly rise in comparison to the Triton treated group. The extract from *Ocimum basilicum* exhibited a much greater hypolipidemic impact than treatments with fenofibrate. Additionally, it was shown that the aqueous extract of *Ocimum basilicum* has a very strong antioxidant capacity. These findings suggest that *Ocimum basilicum* extract may include antioxidant and hypolipidaemic compounds, and that hyperlipidemic patients may benefit from using it as a treatment agent.

Certain scented plants may appeal to poultry. Essential oils and fragrant plant extracts are the foundation of aromatherapy (El Jeni et al., 2021). The choice of four distinct grown aromatic plants for free-range laying hens has been discovered by quantitative studies (Kosmidou et al., 2006). Twenty 50-week-old laying chickens were employed. Every day, they were allowed access to a specially designed pasture that was enhanced with *Anethum graveolens* (dill), *Petroselinum crispum* (parsley), *Origanum vulgare* (oregano), and *Ocimum basilicum* (basil). Each of the four aromatic plants was grown independently. Throughout the observation period (d 1 to 3), hens were consistently seen to visit the *Ocimum basilicum* region more frequently than the other plant locations. The average percentage of hens that visited the areas of *Anethum graveolens*, *Petroselinum crispum*, *Origanum vulgare*, *Ocimum basilicum*, and 8.4%, 6.1%, and 4.5%, respectively, were recorded on day 1. In contrast, the values on days 2 and 3 were 20.5%, 5.3%, 11.6%, and 5.3%, and 21.6%, 5.5%, 9.7%, and 5.0%, respectively. *Ocimum basilicum* was consistently and distinctly preferred (51% of the total number of chickens). Of the three fragrant plants, 24% of the chickens had a preference for *Petroselinum crispum*. This study suggests that although some aromatic plants may be preferred, hens can eat planted aromatic plants in the grazing area. Based on resemblance and distinctiveness, homoeopathy has the potential to be a useful nutritional approach for animals that can help lower the need for antibiotics (Doehring and Sundrum, 2016).

Conclusions

It may be beneficial to add basil in small amounts to the feed of animals raised in closed environments and under stress, in order to improve animal psychology without overdoing it. Excessive use may prevent pregnancy.

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HEMŞİRELERİN SAĞLIK TEKNOLOJİLERİNİ DEĞERLENDİRMESİ İLE YAPAY ZEKAYA YÖNELİK TUTUMU ARASINDAKİ İLİŞKİNİN BELİRLENMESİ

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ÖZET
Amaç: Bu araştırma hemşirelerin sağlık teknolojilerini değerlendirmesi ile yapay zekaya yönelik tutumu arasındaki ilişkinin belirlenmesi amacıyla yapıldı. Yöntem: Araştırmanın verileri, 15 Aralık 2023-15 Şubat 2024 tarihleri arasında toplandı. Bu araştırmanın evrenini bir devlet hastanesinde çalışan 404 hemşire oluşturdu. Verilerin toplanmasında tanıtıcı bilgi formu, sağlık personeli sağlık teknolojileri değerlendirme tutum ölçeği, yapay zekâya yönelik genel tutum ölçeği akademik okuryazarlık ölçeği kullanıldı. Bulgular: Çalışmaya katılan hemşirelerin %66.6'sının 18-30 yaş aralığında olduğu, % 60.9'unun kadın olduğu, %58.9'unun bekar olduğu, %70.3'ünün lisans mezunu olduğu, %53.2'inin çalışma yılının 4-6 yıllarında olduğu, %57.7'sinin vardiyalı çalıştığı, %40.6'sının diğer servislerde çalıştığı bulundu. Araştırma kapsamına alınan hemşirelerin Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği puan ortalaması 4.10±.552, Yapay Zekaya Yönelik Genel Tutum Ölçeği puan ortalaması 3.30±.539 olarak bulundu. Hemşirelerin Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği Puanları ile Yapay Zekaya Yönelik Genel Tutum Ölçeği puan ortalamaları arasında pozitif yönde orta düzeyde anlamlı bir ilişki bulundu ($p<0.001$). Sonuçlar: Hemşirelerinin sağlık teknolojilerini değerlendirme tutumu ile yapay zekaya yönelik tutumu arasında anlamlı ilişki olduğu saptandı.
Anahtar sözcükler: Hemşire, sağlık teknoloji, yapay zeka.

DETERMINING THE RELATIONSHIP BETWEEN NURSES' EVALUATION OF HEALTH TECHNOLOGIES AND THEIR ATTITUDES TOWARDS ARTIFICIAL INTELLIGENCE

ABSTRACT
Objective: This research was conducted to determine the relationship between nurses' evaluation of health technologies and their attitudes towards artificial intelligence. Method: The data of the study was collected between December 15, 2023 and February 15, 2024. The population of this research consisted of 404 nurses working in a public hospital. Introductory information form, healthcare personnel health technologies evaluation attitude scale, general attitude scale towards artificial intelligence, academic literacy scale were used to collect data. Results: 66.6% of the nurses participating in the study were between the ages of 18-30, 60.9% were women, 58.9% were single, 70.3% had a bachelor's degree, 53.2% were in the 4-6 years of their working years. It was found that 57.7% worked in shifts and 40.6% worked in other services. The mean score of the Health Technologies Evaluation Attitude Scale of the nurses included in the research was found to be 4.10±.552, and the mean score of the General Attitude Scale Towards Artificial Intelligence was 3.30±.539. A positive, moderately significant relationship was found between the Nurses' Health Technologies Evaluation Attitude Scale Scores and the General Attitude Scale Towards Artificial Intelligence score averages ($p<0.001$). Conclusion: It was determined that there was a significant relationship between nurses' attitudes towards evaluating health technologies and their attitudes towards artificial intelligence.
Keywords: Nurse, health technology, artificial intelligence.

GİRİŞ

"Yapay zeka" terimi ilk kez 1956 yılında Amerika Birleşik Devletleri'ndeki Dartmouth College'da düzenlenen bir konferansta tanıtıldı. O tarihten bu yana kavram ve kullanımı birçok değişikliğe uğradı (Russell S.J., Norvig P., Davis E. 2010). Başlangıçta yapay zeka yalnızca bilgisayar bilimi alanıyla ilişkilendiriliyordu (Schwab K. 2017). Ancak yavaş yavaş sağlık bilimlerine de yöneldi ve insanlar için sağlık hizmetlerinin ve sistemlerinin kalitesinin iyileştirilmesinin büyük önemi nedeniyle (World Health Organization, 2017) yapay zekanın hastalıkların tanı, bakım ve tedavisinde kullanılmasına önemli katkı sağladı (Liu X., Faes L., Kale A.U., et al. 2019).Yapay zeka kullanımı hemşirelerin iş yükünü de etkiliyor. Yapay zeka, yüksek riskli hastaların yaşamı tehdit eden durumlarını tahmin etmek ve uyarmak için halihazırda kullanılıyor (Mann S, Arora Y, Anand S. 2020). Ayrıca hemşirelere hastaların ihtiyaçlarını ve isteklerini anlamaları için daha fazla zaman tanımaktadır (Booth R.G. 2016). Yapay zekanın sağlık hizmetlerinde kullanılması olasılığı parlak ve umut vericidir ve kullanımı, sağlık çalışanları arasındaki hata ve ihmal olasılığını azaltma ve maliyet tasarrufu sağlama konusunda önemli bir etkiye sahip olabilir (Jones L.D., Golan D., Hanna S.A., Ramachandran M. 2018). Ancak yapay zekanın doğrudan hasta bakımında kullanılmasının hemşire-hasta iletişimini zayıflattığı yönünde endişeler bulunmaktadır (Cabitza F., Rasoini R., Gensini G.F. 2017; Karches KE. 2018). Bununla birlikte olası teknik hatalar ve teşhis modellerinde problem yaratabilir (Scott I.A., Carter S.M., Coiera E. 2021; Sunarti S., Fadzlul Rahman F., Naufal M., Risky M., Febriyanto K., Masnina R. 2021).Hemşireler tarafından tıbbi yapay zeka ile ilgili teknolojilerin benimsenmesi, onların bilgisi, kabulü ve tutumu gibi faktörlerle yakından ilişkili olabilir. Bu nedenle bu faktörlerin dikkate alınması ve ölçülmesi sağlık sistemleri ve yapay zeka geliştiricileri için gereklidir (Scheetz J., Rothschild P., McGuinness M., et al. 2021). Ayrıca yapay zekanın mevcut durumuna ve hemşireler arasındaki kabul oranına da dikkat etmek gerekir (Abuzaid M.M., Elshami W., Tekin H., Issa B. 2022).

Teknolojinin gelişmesi ve bilginin hızlı bir şekilde yayılması donanımlı bireylere olan ihtiyacı daha da artırmıştır. Çünkü günümüzde gerek özel işletmeler gerekse de kamu kurum ve kuruluşlarında, çağın gerekliliklerine uygun nitelikte bilgi ve teknolojik açıdan yeterli bireylerin istihdam edilmesi önemli görülmektedir (Kim, J.M., 2017; Sadoughi, F., et al. 2017). Teknolojik donanıma sahip olan bu bireyler kurumların amaçlarına ulaşması, sunduğu hizmetleri daha etkili ve verimli bir şekilde gerçekleştirebilmesi, hedef kitle ile sağlıklı bir iletişimin kurulabilmesi, örgütsel yapı içerisinde iş birliğinin ve organizasyon kültürünün

geliştirilmesi ve en önemlisi de rekabet düzeyinin artırılması gibi özellikler bakımından vazgeçilmez düzeyde önemlidir (Kuşcu, F.N., Yılmaz, F.Ö., & Karatepe, H. K. 2022).

Bu çalışma, hemşirelerin sağlık teknolojilerini değerlendirmesi ile yapay zekaya yönelik tutumu arasındaki ilişkinin belirlenmesi amacıyla yapılmaktadır. Yapılan literatür taramasında hemşirelerin sağlık teknolojilerini değerlendirmesi ile yapay zekaya yönelik tutumu arasındaki ilişkinin belirlenmesi konusunda sınırlı sayıda araştırmaya rastlandı. Bu nedenle bu araştırmanın literatüre önemli bir katkı sağlayacağı düşünülmektedir. Bu amaç doğrultusunda bu çalışmanın araştırma soruları şunlardır:

1. Hemşirelerin sağlık teknolojilerini değerlendirme düzeyleri nedir?
2. Hemşirelerin yapay zekaya yönelik tutum düzeyleri nedir?
3. Hemşirelerin sağlık teknolojilerini değerlendirme düzeyleri ile yapay zekaya yönelik tutum düzeyleri arasında bir ilişki var mı?

MATERYAL VE METOT

Araştırmanın Amacı

Araştırmada hemşirelerin sağlık teknolojilerini değerlendirme düzeyleri ile yapay zekaya yönelik tutum düzeyleri arasındaki ilişkinin belirlenmesi amacıyla nicel araştırma yöntemlerinden ilişkisel tarama modeli kullanıldı.

Araştırmanın Yapıldığı Yer ve Zaman

Araştırma 15 Aralık 2023-15 Şubat 2024 tarihleri arasında bir devlet hastanesinde gerçekleştirildi.

Araştırmanın Evren ve Örneklemi

Araştırmanın evrenini araştırmanın yürütüldüğü tarihler arasında bir devlet hastanesinde çalışan tüm hemşireler oluşturdu. Örneklemini ise 15 Aralık 2023-15 Şubat 2024 tarihleri arasında çalışmaya dahil olmayı kabul edenler oluşturdu.

Veri Toplama Araçları

Kişisel Bilgi Formu: Formda yaş, cinsiyet, medeni durumu, eğitim durumu, çalışma yılı, çalışma şekli, çalıştığı klinik gibi tanımlayıcı özelliklerini belirlemeye yönelik toplam yedi sorudan oluşmaktadır.

Sağlık personeli sağlık teknolojileri değerlendirme tutum ölçeği (SPSTDTÖ)

Kuşcu, Yılmaz ve Kuşcu Karatepe (2022) tarafından geliştirilen SPSTDTÖ 23 sorudan ve 3 boyuttan oluşmakta olup; 1.-4. sorular ölçeğin kapsam boyutunu, 5.-11. sorular farkındalık boyutunu, 12.-23. sorular fayda boyutunu oluşturmaktadır. Ölçekte ters kodlama bulunmamaktadır. 5‟li Likert tipinde hazırlanan ölçek “1-Kesinlikle katılmıyorum, 2-

Katılmıyorum, 3-Kararsızım, 4-Katılıyorum, 5- Kesinlikle katılıyorum" şeklinde derecelendirilmektedir. 1"e yaklaştıkça Sağlık Teknolojisi Değerlendirmenin düşük puana sahip olduğu, 5"e yaklaştıkça ise yüksek puana sahip olduğu çıkarımında bulunulabilir. Kuşcu vd. (2022) tarafından yapılan çalışmada ölçeğin Cronbach Alpha değerinin 0,959 olduğu belirtilmiştir. Bu çalışmada ise Cronbach Alpha değeri 0,948 olduğu tespit edilmiştir. Bu değer de SPSTDTÖ"nün yüksek derecede güvenilir olduğunu göstermektedir (Kalaycı, 2017; Uzunsakal ve Yıldız, 2018).

Yapay Zekâya Yönelik Genel Tutum Ölçeği (GAAIS)

Bu ölçek Schepman ve Rodway (2020) tarafından geliştirilmiştir. Bireylerin yapay zekaya yönelik genel tutumlarını ölçmek amacıyla ölçekte 12'si olumlu ve 8 madde olumsuz olmak üzere toplam 20 madde bulunmaktadır. Öğeler beşli Likert tipi (1 = Kesinlikle katılmıyorum, 5=Kesinlikle katılmıyorum) olarak puanlanmıştır. Doğrulama araştırmasında iki faktörün Cronbach alfa değerleri olumlu genel tutumlar için 0,88 ve olumsuz genel tutumlar için 0,82 iken, olumlu alt ölçekler için 0,84 ve olumsuz alt ölçekler için 0,80 olarak hesaplanmıştır ve her ikisi de iyi bir iç tutarlılığı temsil etmektedir. Kaya ve ark. (2022) Türkçe geçerlik ve güvenilirlik araştırmasında Faktör yapısı aynı zamanda Schepman ve Rodway tarafından yapılan doğrulama araştırmasıyla da benzer sonuçları ortaya çıkardı; çünkü KMO 0,90 ve Bartlett testi anlamlıydı.

Verilen toplanması: Veriler toplanmadan önce araştırmanın amacı ifade edildikten sonra araştırmaya dahil olmayı kabul eden hemşirelerin yazılı onamları alındı ve soru formları araştırmacı tarafından uygulandı. Verilerin toplanması işlemi yaklaşık 15-20 dakika sürdü. Veriler, Google Forms aracılığı ile toplandı.

Verilerin Analizi: Verilerin analizinde SPSS (Statistical Package For Social Sciences) 22.0 paket programı kullanıldı. Tanımlayıcı verilerin analizinde sayı, ortalama, yüzdelik dağılımlar, standart sapma kullanıldı. Ölçeklerin güvenirlik katsayıların hesaplanmasında Cronbach alfa katsayısı ve ölçekler arasındaki ilişkiyi saptamak için Pearson Korelasyon analizi kullanıldı. Ölçekler arası korelasyon katsayıları; çok zayıf (0.00-0.25), zayıf (0.26-0.49), orta (0.50-0.69), güçlü (0.70-0.89) ve çok güçlü (0.90- 1.00) olarak sınıflandırıldı.

Araştırmanın Etik Yönü: Araştırmanın yapılabilmesi için bir üniversitenin bilimsel araştırma ve yayın etik kurulundan ve araştırmanın yürütüleceği hastaneden gerekli yazılı izinler alındı. Veriler toplanmadan önce hemşirelere araştırmanın amacı, elde edilecek sonuçların ne amaçlarla kullanılacağı açıklandı. Bununla birlikte araştırmaya dahil olup olmamasının isteğine bağlı olmasını ifade edilerek "Özerkliğe Saygı" ilkesi, araştırmaya katılan hemşirelerin

bilgilerinin gizli tutulacağı belirtilerek "Gizlilik ve Gizliliğin Korunması" ilkesi yerine getirildi. Araştırmada İnsan Hakları Helsinki Deklerasyonu'na sadık kalındı.

Araştırmanın sınırlılıkları ve genellebilirliği: Araştırma anket yöntemi ile veriler elde edildiğinden bu tür araştırmaların taşıdığı sınırlılıklar bu araştırmada da geçerlidir ve bulgular araştırmaya katılan hemşirelere genellenebilir.

BULGULAR

Tablo 1. Hemşirelerin Sosyo-demografik Özelliklerine Göre Dağılımı(n=404)

Yaş	**Sayı**	**%**
18-30	269	66.6
30-45	113	28
45 ve üzeri	22	5.4
Cinsiyet		
Kadın	246	60.9
Erkek	158	39.1
Medeni Durumu		
Bekar	238	58.9
Evli	166	41.1
Eğitim Düzeyi		
Lise	21	5.2
Ön Lisans	55	13.6
Lisans	284	70.3
Lisans üstü	44	10.9
Çalışma Yılı		
0-3 yıl	37	9.2
4-6 yıl	215	53.2
7-9 yıl	82	20.3
10 yıl ve üzeri	70	17.3
Çalışma Şekli		
Vardiya	233	57.7
Gündüz	171	42.3
Çalıştığı Klinik		
Dahili servisleri	59	14.6
Cerrahi servisleri	50	12.4
Acil servisi	67	16.6
Yoğun bakım servisleri	64	15.8
Diğer servisler	164	40.6

Çalışmaya katılan hemşirelerin %66.6'sının 18-30 yaş aralığında olduğu, % 60.9'unun kadın olduğu, %58.9'unun bekar olduğu, %70.3'ünün lisans mezunu olduğu, %53.2'inin çalışma yılının 4-6 yıllarında olduğu, %57.7'sinin vardiyalı çalıştığı, %40.6'sının diğer servislerde çalıştığı bulundu (Tablo 1).

Tablo 2. Hemşirelerin Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği ve Yapay Zekaya Yönelik Genel Tutum Ölçeği Puan Ortalamaları (N=404)

Ölçekler ve Alt Boyutları	x̄ ± SD	Min	Max
Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği	4.10±.552	1.95	5.00
Kapsam boyutu	4.07±.693	1.50	5
Farkındalık boyutu	4.29±.610	1.86	5
Fayda boyutu	4.01±.590	2	5
Yapay Zekaya Yönelik Genel Tutum Ölçeği	3.30±.539	1.60	4.94
Yapay Zekaya Yönelik Negatif Tutum	3.61±.757	1	5
Yapay Zekaya Yönelik Pozitif Tutum	2.85±.835	1	5

Araştırma kapsamına alınan hemşirelerin Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği puan ortalaması 4.10±.552, Yapay Zekaya Yönelik Genel Tutum Ölçeği puan ortalaması 3.30±.539 olarak bulundu (Tablo 2).

Tablo 3. Hemşirelerin Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği Puanları ile Yapay Zekaya Yönelik Genel Tutum Ölçeği Puan Ortalamaları Arasındaki İlişki

Ölçekler		**Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği**	**Yapay Zekaya Yönelik Genel Tutum Ölçeği**
Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği	R	1	.377**
	P		,000
Yapay Zekaya Yönelik Genel Tutum Ölçeği	R	, 377**	1
	P	,000	

**. Correlation is significant at the 0.01 level (2-tailed).

Hemşirelerin Sağlık Teknolojilerini Değerlendirme Tutum Ölçeği Puanları ile Yapay Zekaya Yönelik Genel Tutum Ölçeği puan ortalamaları arasında pozitif yönde orta düzeyde anlamlı bir ilişki bulundu ($p<0.001$) (Tablo 3).

SONUÇ VE ÖNERİLER

Hemşirelerinin sağlık teknolojilerini değerlendirme tutumu ile yapay zekaya yönelik tutumu arasında anlamlı ilişki olduğu saptandı. Araştırmanın sonucunda sağlık teknolojilerini değerlendirme tutumu ile yapay zekaya yönelik tutumu arasında arasında orta düzeyde pozitif yönlü bir ilişki olduğu belirlendiğinden hemşirelerinin sağlık teknolojilerini değerlendirme tutumu ile yapay zekaya yönelik tutumu bir bütün olarak incelenmesinin önemli olduğu düşünülmektedir. Bu doğrultuda hemşirelere yönelik sağlık teknolojileri ve yapay zeka hakkında eğitim programları düzenlenmelidir. Bu programlar, hemşirelerin teknolojiyi kullanımını teşvik etmeli ve teknolojiye olan güvenlerini artırmalıdır. Sağlık teknolojileri firmaları, hemşirelerin ihtiyaçlarına uygun ürünler geliştirirken onların geri bildirimlerini dikkate almalı ve ürün geliştirme süreçlerine dahil etmelidir. Hemşireler, teknoloji firmalarıyla iş birliği yaparak yapay zeka uygulamalarının kullanımını optimize etmek için danışmanlık yapabilirler.

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PEYZAJ MİMARLIĞI PERSPEKTİFİNDEN KÜRESEL GÖÇÜN KENTSEL KİMLİK ÜZERİNDEKİ ETKİLERİ

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Özet
Tarihsel süreç içerisinde, özellikle yabani hayvanlardan ve doğa olaylarından korunma amacıyla ortaya çıkan topluluk halinde yaşama fikri, başta insanların küçük yerleşim birimleri oluşturmalarını sağlamıştır. Bu yaşam tarzı zamanla gelişmiş ve nüfus artışı, teknolojinin ilerlemesi, buluşların artması gibi sebepler yerleşim birimlerinin büyümesine sebep olmuş, sonuç olarak da bugün adına kent denilen yaşam alanlarını ortaya çıkarmıştır. Kentler, doğal ve yapılı çevrenin sentezlenmesiyle oluşan mekanlardır. Kuruldukları yere ait doğal özelliklerin yanı sıra, insan eliyle oluşturulmuş tarihi, kültürel, mimari vb özelliklerin etkisiyle birlikte her geçen gün değişmekte ve şekillenmektedir. Bir kentin sahip olduğu ayırıcı özellikler ve faktörler, onun diğer kentlerden farklılaşmasını ve adına "kentsel kimlik" denilen bir kimlik kazanmasını sağlamaktadır. Göç, günümüzde küresel ölçekte önemli bir fenomen haline gelmiştir ve kentler, göçün en yoğun yaşandığı ve etkilerinin en belirgin hissedildiği yerlerdir. Göç kavramı, Türk Dil Kurumu (TDK) sözlüğünde; "*Ekonomik, toplumsal ve siyasi sebeplerle bireylerin veya toplulukların bir ülkeden başka bir ülkeye, bir yerleşim yerinden başka bir yerleşim yerine gitme işi, taşınma, hicret, muhaceret"*, olarak tanımlanmaktadır. Uluslararası Göç Örgütü (IOM) tarafından hazırlanan göç terimler sözlüğüne bakıldığında ise; "*İnsanların grup halinde veya bireysel olarak uluslararası bir sınırı geçmeleri veya bir devlet içinde yer değiştirmeleri, kısaca süresi, yapısı ve nedeni ne olursa olsun insanların yer değiştirdiği nüfus hareketleri"* olarak tanımlandığı görülmektedir. Göçün kentlerdeki sosyal, ekonomik ve kültürel yapıları nasıl şekillendirdiği ve kent kimliği üzerindeki etkileri, araştırmacılar ve planlamacılar arasında büyük bir ilgi konusudur. Bu çalışma, küresel göçün kentsel kimlik üzerindeki etkilerini peyzaj mimarlığı perspektifinden inceleyerek, kent peyzajının ve çevresel düzenlemelerin göçmenlerin kimlikleri ve kent kimliği arasındaki etkileşimde nasıl bir rol oynadığını anlamayı amaçlamaktadır.
Anahtar Kelimeler: Göç, Kentsel Kimlik, Peyzaj Mimarlığı

THE EFFECTS OF GLOBAL MIGRATION ON URBAN IDENTITY FROM THE PERSPECTIVE OF LANDSCAPE ARCHITECTURE

Abstract
The concept of residing in communities, which developed over time, primarily for the purpose of safeguarding against wildlife and natural occurrences, allowed individuals to establish small settlements. This way of life has evolved gradually, with factors such as population growth, technological advancements, and the rise of inventions contributing to the expansion of settlements. As a result, urban areas known as cities have emerged in the present day. Cities are created by combining the natural and constructed environment. Apart from the inherent natural characteristics of their surroundings, cities undergo constant transformation and development, shaped by the influence of human-made elements such as history, culture, architecture, and more. The unique characteristics and factors of a city allow it to distinguish itself from other cities and acquire an identity known as "urban identity". Migration has emerged as a significant global phenomenon in contemporary times, with cities serving as the primary focal points where migration takes place intensely, and its impacts are profoundly felt. The Turkish Language Association (TDK) dictionary defines the concept of migration as "*the act of individuals or groups moving from one country to another, or from one settlement to another, for economic, social, and political reasons, encompassing both emigration and immigration*". According to the migration terminology dictionary compiled by the International Organization for Migration (IOM), migration is defined as "*the movement of individuals or groups across an international border or their displacement within a state. In essence, it refers to population movements involving the relocation of people, irrespective of their duration, composition, or reasons*." The impact of migration on the social, economic, and cultural fabric of cities, as well as its influence on urban identity, is a subject of significant interest for researchers and planners alike. The objective of this study is to explore the influence of urban landscapes and environmental regulations on the interplay between immigrant identities and urban identity. By examining the impacts of global migration on urban identity through the lens of landscape architecture, we seek to gain a deeper understanding of this dynamic relationship.
Keywords: Migration, Urban Identity, Landscape Architecture

INTRODUCTION

Migration has been an existing phenomenon since the beginning of human history. It is possible to explain the concept of migration in various ways: Migration is a population movement that involves geographical displacement, affecting the economic, cultural, social, and political aspects of society (Özer, 2004). Migration primarily refers to changing one's location. Individuals move from one region to another for various reasons. This situation can be either permanent or temporary. It is noted that migration can also include movements related to education, work, short-term stays, and the possibility of returning to the original location (Sağlam, 2006). The person who carries out the migration process is referred to as a "migrant" or "refugee" (Koçak and Terzi, 2012).Throughout human history, migrations have occurred due to various factors. These factors include the desire to benefit from unevenly distributed economic opportunities, as well as ecological pressures and forced displacements caused by social authorities such as states, settlements, and wars (Kaygalak, 2009). Migration is not specific to any one place; it is inevitable wherever humans exist. The underlying causes of migration are similar across most countries worldwide (Koçak and Terzi, 2012).Migration directly impacts urbanization and often has negative effects. Intense migration movements in cities lead to problems such as unplanned urbanization, increased crime rates, infrastructure and transportation issues, and unemployment (Bozkurt and Ayfer, 2018). Additionally, migrants facing adaptation challenges in cities, poorly executed migration movements, and the resulting rapid urbanization can lead to changes or even deterioration of urban identity.

THE PHENOMENON OF MIGRATION

Throughout history, people have constantly moved from one place to another to find shelter and create new living spaces. Sometimes, they are forced to migrate away from their habitats due to unfavorable climate conditions, wars, diseases, and pressures (Güreşçi, 2011). In modern times, numerous scientific research studies and definitions have been conducted regarding migration. According to Yalçın (2004), migration is "a geographic and social displacement movement from one place to another, driven by economic, political, ecological, or individual reasons, aiming for short, medium, or long-term return or permanent settlement." Another definition describes migration as the process of individuals relocating from one settlement area (village, city, town) to another in order to continue a part or the entirety of their lives (Üner, 1972). Migration involves moving individuals from one spatial area to another, carrying their unique problems with them (Bozkurt and Ayfer, 2018).

Although the phenomenon of migration varies in each country, it is evaluated in a similar manner. Place, time, and space are important concepts in migration. Migration can be divided into two categories: internal and international migration. Internal migration includes seasonal, voluntary, compulsory, labor, and permanent migrations, while international migration is classified as brain drain, exchange, and labor migrations (Bozkurt and Ayfer, 2018).

International migration refers to the movement of people from one country to another. These migrations can be voluntary or forced. With the increase in transportation and communication facilities, migrations between countries have also increased. Additionally, reasons such as war, famine, natural disasters, and terrorism lead to forced international migrations, while the desire for a better quality of life can lead to voluntary international migrations (Şahin, 2010; Koçak and Terzi, 2012). These global-scale migrations, especially mass-scale international migrations, cause various changes in the country and city that is being migrated to. Alongside the physical and social changes in the city's structures, changes in the identity of the migrated city are often observed.

URBAN, URBANIZATION, URBAN IDENTITY AND MIGRATION

The dominant form of settlement in our era, the city, represents a new dimension of the reflection of interpersonal relationships and physical space throughout human history. The emergence of neighborhoods and spaces in cities, as well as their demographic and economic structures, differentiate one city from another. The city not only signifies a new economic organization and a changed physical environment but also represents a new social order that influences human behavior and thoughts (Es and Ateş, 2010).In its broadest sense, the city is a complex and dynamic mechanism where non-agricultural and agricultural production is controlled, distribution is coordinated, and non-agricultural production is based on supporting it. It is a place where technological changes have brought about organization, specialization, and division of labor to the highest level, where a large population size and density are required due to the demands of various functions. The city is characterized by increased social heterogeneity, integration, and the continuous operation of this complex mechanism. With all these characteristics, the city is a product of the post-Industrial Revolution era (Es and Ateş, 2010).Urbanization refers to the process of population accumulation that is accompanied by increasing levels of organization, division of labor, and specialization, resulting in changes in human behavior related to cities. It is also indicative of the increase in the population living in cities and the number of cities. Urbanization began with the Industrial Revolution and is a social

phenomenon that emerged with modernization. Alongside various impacts of the Industrial Revolution, there are three significant outcomes: differentiation in social structure, innovation in production, and rapid population mobility (urbanization) (Kaya et al., 2008).

In Turkey, urbanization developed in parallel with industrialization in the 1950s. With industrialization, the number of factories in cities increased. As the number of factories grew, people who became unemployed in rural areas started coming to cities in search of work. As a result, rural-to-urban migration occurred, initiating the process of urbanization (Koçak and Terzi, 2012).In the process of social change, urbanization, which is both a dependent and independent variable, exhibits a complex characteristic in terms of its causes and consequences. Urbanization, defined as "changes that affect the private lives, economic, social, and political behaviors of people living in them, and require certain activities of the state" due to the accumulation of population in cities and the increase in the number of cities resulting from the high distribution rate and settlement of these excesses in areas outside the city, which enables the rapid growth of production, trade, and services through industrialization, is a social dimension of a transformation process that requires planned and programmed intervention because it gives rise to many social problems (Es and Ateş, 2010).In general, the concept of identity can be defined as distinctive characteristics that differentiate living beings or objects. At the same time, the concept of identity brings about comparison among similarities and reveals the distinctive features possessed in comparison to others. In terms of cities and architectural products, the notion of identity and urban image encompasses a broad definition primarily highlighted by its visual dimension, as well as encompassing natural, geographical, cultural products, and social life norms. Urban identity and related urban images are formed within the urban space over a long period of time and sometimes consist of very different components. Urban images create shared values that people living in the city can sacrifice for and these values persist between generations (Ulu and Karakoç, 2004).Cities symbolize the product of a social group (Laborit, 1990). In this regard, cities are identity-bearing structures with their unique identity, personality, image, and way of life (Alver, 2017). Identity requires the identification of an object, its differentiation from other things, and its acceptance as an entity, which expresses the singularity and uniqueness of identity (Lynch, 2018). In the identity of each city, the distinctive characteristics that have been sustained over time are preserved (Keleş, 2005). In this context, urban identity reflects the unique character and differences of the city and consists of the interactions of identity elements that give the city its distinctiveness (Ertin, Zülfikar and Atik, 2015; Oktay, 2011). The identities of cities are accumulations of

slowly growing, changing, and having a long historical past (Tekeli, 1991). Cities do not emerge suddenly but are formed over time, gaining their personality and identity, and encompassing differences and uniqueness (Aliağaoğlu, 2018). Urban identity, being the differentiation of cities in terms of their inherent characteristics, is a reflection of the culture inherent to the city. Identities in urban space are constructed through urban culture and continue to exist with this culture. Cities manifest as spaces where different cultures encounter, intertwine, or conflict (Özbey, 2022).The physical changes observed in neighborhoods where migrants predominantly settle have the potential to alter both the lifestyle patterns of the migrants and the overall urban aesthetics. While the encounter of different cultures allows for cultural exchange and enhances cultural richness, it also leads to cultural shifts within society. These daily life differences are evident within buildings, their immediate surroundings, streets, neighborhoods, and eventually throughout the entire city, leaving traces of the migrant community. This situation particularly affects historically significant cities and urban areas, causing them to lose their values, eroding their identities, and damaging the connection between the urban population and their city. The sense of belonging of the local population to the city is shaken. To prevent this situation, it is crucial for local governments to actively participate in the process and ensure that urbanization and urban development movements are carried out in a way that does not lead to cultural shifts (Çetinkaya Karafakı, 2023). Potential cultural shifts can disrupt the urban identity and put cities at risk of losing their identity.

CONCLUSION

The structure of urban identities is shaped by different migration patterns. Internal and external migrations, individual and mass migrations, temporary and permanent migrations, forced and voluntary migrations, skilled and unskilled migrations, and regular and irregular migrations all play a significant role in the formation of urban identities. With these migrations, the identities of cities are being reshaped (Özbey, 2022).Migrations play an important role in the spread of urban identities because they are not just spatial movements but also social and cultural movements (Yalçın, 2004; Canatan, 2013). Migrants carry their values, traditions, relationship patterns, and essentially their identities to the places they migrate to, and they interactively reconstruct their identities in the migrated space. Migrants become part of the migrated society and continue to maintain their connection with their place of origin, reconstructing their identities. With migrations, the identities of migrants also spread to a wider area. This phenomenon, often observed in rural-to-urban migrations, is also seen in migrations between

cities. Urban identities spread to a broader space with migrations. They encompass their new spaces, influence them, and mutually transform each other (Özbey, 2022).Migration creates cultural diversity through interactions on urban identity. The demographic changes in the city contribute to the formation of cultural diversity, as migrants from different cultures affect the social and cultural fabric. Additionally, migrations bring about transformations in the physical environment of the city. Generally, migrants in newly settled urban areas establish new residential areas where they can maintain their own cultures and lifestyles. This also alters the fabric of the city. The natural and cultural heritage that reflects a part of the city's urban identity can change and transform with migrations, allowing for the emergence of new heritages. What is important here is the preparedness of the city to adapt to the new order in the most suitable and fastest way possible as a result of migration movements.

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PEYZAJ MİMARLIĞINDA YAPAY ZEKA DESTEKLİ TASARIM VE PLANLAMALAR ÜZERİNE BİR DEĞERLENDİRME: TRENDLER VE UYGULAMALAR

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Özet
Günümüzün en önemli kavramlarından biri olan teknoloji, yaşamın her alanında varolan ve kullanılan bir olgudur. Teknoloji sayesinde, bilgi üretmek, işlemek, planlamak, tasarlamak, paylaşmak, iletişim kurmak vb kolay ve pratik bir şekilde gerçekleşmektedir. Bunun yanı sıra yapılması amaçlanan işin teknolojik araçlarla daha kısa sürede gerçekleştirilmesi de zaman tasarrufu sağlamaktadır. Teknolojinin insanoğluna sunduğu en önemli gelişmelerden biri de yapay zeka kavramıdır. Yapay zeka kavramı genel olarak makinenin akıllı davranışlar sergileyebilmesidir. Akıllı davranışsa sırasıyla algılama, akıl yürütme, öğrenme, iletişim kurma, karışık ortamlarda hareket etmeyi kapsamaktadır. Uzun vadede yapay zekanın hedefi insanların yapabileceği şeyleri en az onlar kadar hatta onlardan daha iyisini yapabilen makineler geliştirmektir (Nilsson, 1998). Diğer bir tanımda ise Luger ve Stubblefield (1998), yapay zekayı "akıllı davranışın otomasyonu ile ilgilenen bilgisayar biliminin dalı" olarak tanımlamaktadır (Karabulut, 2021). Günümüzde, peyzaj mimarlığı disiplini giderek daha fazla yapay zeka teknolojilerinin etkisi altında gelişmekte ve dönüşmektedir. Yapay zeka, peyzaj tasarımı ve planlaması süreçlerinde yaratıcı ve yenilikçi çözümler üretmek, sürdürülebilirlik hedeflerini desteklemek ve kullanıcıların ihtiyaçlarını en iyi şekilde karşılamak için bir araç olarak kullanılmaktadır. Yapay zekanın diğer meslek disiplinlerine olduğu gibi peyzaj mimarlığı açısından da çok önemli olduğu ve gelecekte yapay zeka destekli çalışmaların artacağı, yapay zeka destekli tasarım ve planlamaların gelecekte önemli bir trend haline geleceği yadsınamaz bir gerçektir. Bu çalışmada yapay zekanın peyzaj mimarlığı çalışmaları açısından kullanım örnekleri üzerinden birtakım değerlendirmeler yapılmıştır.
Anahtar Kelimeler: Yapay Zeka, Tasarım, Planlama, Peyzaj Mimarlığı

AN EVALUATION ON ARTIFICIAL INTELLIGENCE SUPPORTED DESIGN AND PLANNING IN LANDSCAPE ARCHITECTURE: TRENDS AND APPLICATIONS

Abstract
Technology, a pivotal concept of our time, permeates and finds application in every facet of life. Thanks to technology, tasks such as producing, processing, planning, designing, sharing, communicating, and more can be carried out with ease and practicality. Moreover, the utilization of technological tools allows for the accomplishment of tasks in a shorter timeframe, thereby saving valuable time. One of the significant advancements bestowed upon humanity by technology is the concept of artificial intelligence. The general notion of artificial intelligence entails the capacity of machines to demonstrate intelligent behavior. Intelligent behavior encompasses the abilities of perceiving, reasoning, learning, communicating, and acting within intricate environments. In the long run, the objective of artificial intelligence is to create machines capable of performing tasks at least as well as, if not better than, humans (Nilsson, 1998). In an alternate definition, Luger and Stubblefield (1998) define artificial intelligence as "the field of computer science concerned with automating intelligent behavior" (Karabulut, 2021). Today, the field of landscape architecture is undergoing a progressive evolution and transformation, driven by the impact of artificial intelligence technologies. Artificial intelligence serves as a valuable tool in generating imaginative and inventive solutions within landscape design and planning processes. Its application aids in advancing sustainability objectives and effectively catering to the requirements of users. Undoubtedly, artificial intelligence holds immense significance not only in landscape architecture but also in various other professional fields. It is evident that AI-supported studies will continue to grow in the future, with AI-backed design and planning emerging as a significant trend in the times to come. Within this study, several evaluations were conducted, focusing on the practical applications of artificial intelligence in the context of landscape architecture studies.
Keywords: Artificial Intelligence, Design, Planning, Landscape Architecture

INTRODUCTION

Artificial intelligence is a branch of science that deals with the simulation of intelligent behavior in computers. When this concept emerged with the aim of mimicking human intelligence, McCarthy and his colleagues (1955) interpreted it as the ability to define any characteristic of human intelligence, such as learning, precisely, implying that its simulation could be achieved. According to Jack Copeland, who works in this field and has written various books on artificial intelligence (2000), human intelligence consists of a series of separate components rather than a single ability or cognitive process. Nowadays, artificial intelligence encompasses various subfields, ranging from general areas such as perception and reasoning to specific tasks such as diagnosing diseases, playing chess, writing poetry, and proving mathematical theorems (Russel & Norvig, 2002; Üstün, 2020). Additionally, artificial intelligence technology can be encountered in different fields such as facial recognition, voice recognition, medical diagnosis, language translation, and credit application evaluation (Bentley, 2019; Yıldırım and Demirarslan, 2020). In the fields of architecture and engineering, various artificial intelligence tools are predominantly used to investigate design processes (Brown, 2005; Üstün, 2020).

Today, it is possible to come across developments related to artificial intelligence in every aspect of life. To briefly mention these developments, patent applications for designs generated by artificial intelligence (URL-1, 2024), granting citizenship to a robot by Saudi Arabia (URL-2, 2024), organizing exhibitions for artworks created by robots (URL-3, 2024), the establishment of a mega city in Saudi Arabia where the number of robots is said to surpass the number of humans (URL-5, 2024), and the efforts by Neuralink company to merge human intelligence and artificial intelligence (URL-6, 2024) can be given as examples (Yıldırım and Demirarslan, 2020). Today, the use of artificial intelligence in designs is inevitable, as it is already being utilized in various fields.

DESIGN, DESIGNING, AND ARTIFICIAL INTELLIGENCE

Design can be defined as the form that something planned to be created takes in the human mind through various actions. Although the concept of design encompasses meanings such as designing, planning, shaping, and conceptualizing, it is difficult to provide a complete definition of its content. However, in various studies, design is described as a solution plan for any problem, as an idea (Demirarslan, 2006). As emphasized by many designers, the built environment that emerges as a result of the design process is shaped as a repetition of a series

of events in a chronological order, and although the products may be different, the process itself contains various patterns (Baran Ergül et al., 2022).

The concept of artificial intelligence refers to systems that mimic human intelligence, gradually educating themselves based on the information they are given or collect from the environment, and producing outputs based on the knowledge they acquire. Nowadays, artificial intelligence-based decision support systems receive intense interest from researchers, and the number of studies in this field is increasing day by day. These types of artificial intelligence-based decision support systems are used in many disciplines with the general aim of assisting experts in their respective fields, increasing the accuracy of decisions, reducing human errors, and making life easier (Baran Ergül et al., 2022).The use of artificial intelligence in solving design problems and enabling more informed, objective decisions about the resulting products began with the use of computer models in architectural design decision support mechanisms. In addition to traditional systems in architecture, these models, when used with algorithm-based methods in well-defined problems, can provide appropriate solutions (Baran Ergül et al., 2022).The development of technology over time has provided designers with various means of spatial transfer. The primary tool used in these transfers is computers. According to Görgül (2001), when the designer transforms their sketches, ideas, and preliminary designs - which they produce by using the representation tools in their "database" such as plans, geometry, and three-dimensionality - by blending them with numerous factors such as accumulated knowledge, intuition, and perception, computers come into play. With the integration of computers into human life, advancements have been made in the fields of Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) (Yıldırım and Demirarslan, 2021).Today, hand drawing continues depending on the designer's approach, especially during the study/sketch phase. However, the advantages provided by technology, such as efficiency, speed, flexibility, ability to make changes, and present proposals to clients, are utilized, and the working process is supported. Another advantage of digital platforms is their ability to provide a means of expression for individuals with limited technical drawing knowledge (Yıldırım and Demirarslan, 2021). Artificial intelligence applications and/or different artificial intelligence-supported software are used in design disciplines. Landscape architecture is one of these disciplines.

ARTIFICIAL INTELLIGENCE APPLICATIONS IN LANDSCAPE ARCHITECTURE

Artificial intelligence applications in landscape architecture vary in the forms of genetic algorithms, machine learning, data analytics, remote sensing, and geographic information systems. Genetic algorithms are used as a method for optimizing design parameters, image processing and modeling techniques, simulation generation, and making design decisions.

Machine learning algorithms are particularly used in analyzing large datasets and optimizing design decisions. These algorithms provide support in various aspects, from color selection to material choice.Data analytics, remote sensing, and geographic information systems are commonly preferred in landscape planning studies. These software types are utilized for conducting terrain analysis, revealing the current state of the land, or creating accurate projections. Some artificial intelligence-supported programs used by landscape architects include:

- Autodesk Autocad:

It is a software used for both two-dimensional and three-dimensional designs. It is also preferred by landscape architects, just like in other professional disciplines (Figure 1).

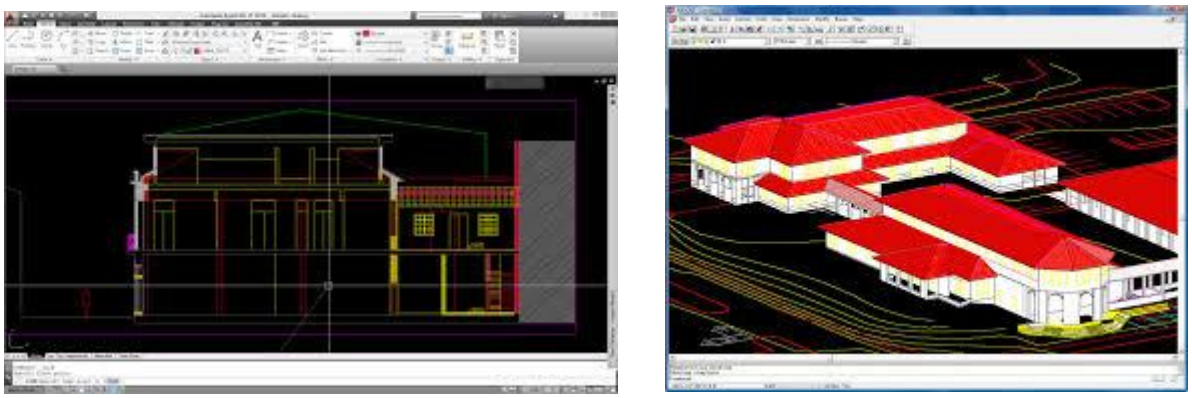


Figure 1. Autodesk AutoCAD image (URL-7, 2024)

- Google SketchUp:

SketchUp is a user-friendly software used for three-dimensional modeling. It is one of the fastest methods for elevating landscape designs to the third dimension (Figure 2).



Figure 2. Google SketchUp image (URL-8, 2024)

- Lumion:

Lumion is a software that is widely preferred today and allows for the creation of highly realistic visualizations and animations. It is particularly one of the most used tools by landscape architects for outdoor design projects (Figure 3).



Figure 3. Lumion image (URL-9, 2024)

- GIS Software:

In landscape planning studies, terrain analysis, creating base maps, spatial analysis applications, and other purposes, the most preferred software within geographic information systems is ArcGIS (Figure 4).



Figure 4. ArcGIS image (URL-10,2024)

- Vectorworks Landmark:

Another software that provides support to landscape architects in design and project processes (Figure 5).



Figure 5. Vectorworks Landmark image (URL-11, 2024)

- DynaSCAPE:

It is a supportive software, particularly used in landscape designs and the preparation of presentation drawings (Figure 6).

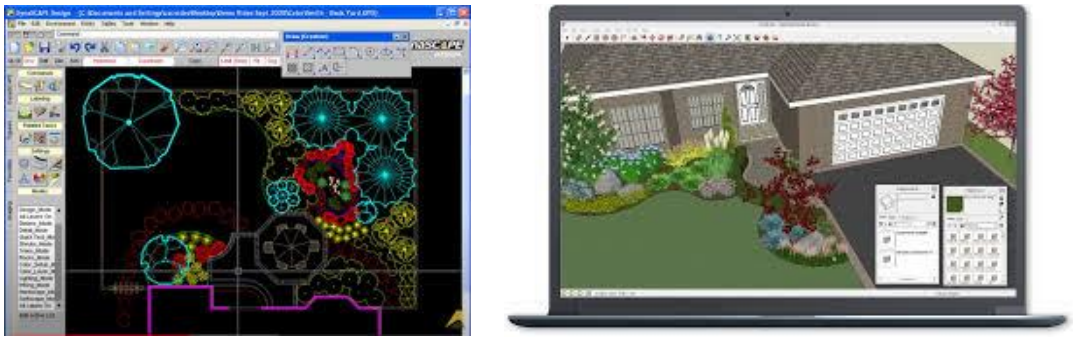


Figure 6. DynaSCAPE image (URL-12, 2024)

- Land F/X:

Another software specifically designed for landscape architects is Land F/X (Figure 7). With Land F/X, designers can create irrigation systems in landscape areas and select project elements using the libraries of palettes available in the software.



Figure 7. Land F/X image (URL-13, 2024)

In addition to the software programs mentioned above, there are also many other software programs used. This study has provided examples of a few for reference purposes.

CONCLUSION

The advancement of technology has accelerated and facilitated access to information in today's world. Human beings, who need to keep up with the fast-paced lifestyle, have focused on computer technologies to spend their time efficiently and effectively, discovering and continuing to explore innovations that make life easier in this field. Among these discoveries, artificial intelligence stands out. Nowadays, time can be saved with software integrated with artificial intelligence. Artificial intelligence-supported software is used in the field of landscape architecture, just like in other professional disciplines.While it is entirely possible for artificial intelligence to be present in architectural applications, in some cases, its implementation depends on the designer's initiative. When the accuracy of the project data is known and accepted with certainty, artificial intelligence inference may not require the involvement of designers. However, in cases where inferences vary depending on various parameters, the need for designers persists alongside artificial intelligence systems (Barın Ekin and Benli Yıldız, 2023).

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URL 8: https://l24.im/qjgPZ5b

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ÇİNKONUN MALATYA KİLİ İLE ADSORPSİYON KİNETİĞİNİN PSEUDO-SECOND KİNETİC ORDER MODELDEN TÜRETİLMİŞ DOĞRUSAL MODELLERLE ANALİZİ

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Özet
Çinko elementi endüstride yaygın kullanıma sahip bir metaldir. Diğer ağır metallerle beraber çevre ve sağlık sorunlarına neden olmaktadır. Çinkonun sulu çözeltiden gideriminde adsorpsiyon alternatif bir yoldur. Yalancı-ikinci dereceli kinetik model, adsorpsiyon kinetiğine ait modeller içerisinde en çok başvurulan ve özellikle divalent metallerde deneysel verilere en uygun olan modeldir. Esasen non-lineer olan modelden literatürde 6 adet doğrusal denklem türetilmiştir. Dal ve Onursal'ın 2023'te bu modelden türettikleri 2 doğrusal modelin de literatüre eklenmesi ile modele ait doğrusal tip denklemlerin sayısı 8'e yükselmiştir. Bu çalışmada bu yeni modellerden Tip 7 için çinko elementi kullanılmış olup, deneysel verilerden sekiz adet grafik elde edilmiştir. Analiz sonucuna göre; kinetik verilerin uyum derecesi sırasıyla tip 6 > tip 1= tip 7 > tip 2 = tip 5 > tip 3 = tip 4 şeklindedir. Regresyon analizi ise R^2 değerlerine göre yapılmış olup R^2= 0,9910 olarak bulunmuştur.
Anahtar Kelimeler: Adsorpsiyon kinetiği, Yalancı-İkinci Dereceli Kinetik model, Doğrusal Regresyon, Çinko, Kil

ANALYSIS OF ADSORPTION KINETICS OF ZINC WITH MALATYA KILO WITH LINEAR MODELS DERIVED FROM PSEUDO-SECOND KINETIC ORDER MODEL

Abstract
The element zinc is a metal widely used in industry. Together with other heavy metals, it causes environmental and health problems. Adsorption is an alternative way to remove zinc from aqueous solution. The pseudo-second order kinetic model is the most commonly used model of adsorption kinetics and is the most suitable model for experimental data, especially for divalent metals. Six linear equations have been derived from the essentially non-linear model in the literature. With the addition of 2 linear models derived from this model by Dal and Onursal to the literature in 2023, the number of linear type equations of the model increased to 8. In this study, zinc element was used for Type 7, one of these new models, and eight graphs were obtained from experimental data.According to the analysis result; The degree of fit of the kinetic data is respectively type 6 > type 1 = type 7 > type 2 = type 5 > type 3 = type 4. Regression analysis was performed according to R2 values and R2 was found to be = 0.9910.
Keywords: Adsorption kinetics, Pseudo-Second Order Kinetic model, Linear Regression, Zinc, Clay

Giriş

Sanayinin gelişimine bağlı olarak üretimin artması daha fazla ağır metal kullanımını beraberinde getirmektedir. Doğal olarak buda kirlilik ve sağlık problemlerine yol açmaktadır. Nüfuslar artmakta ve buna paralel olarak teknoloji ye olan talepte artmaktadır (Onursal, et al., 2019), (Canpolat & Altunkaynak, 2022). Artan ağır metal kirliliği hava, su ve toprağı kirletmekte ve besin zinciri aracılığı ile tüm canlıları olumsuz etkilemektedir (Wang & Guo , 2020). Bu da insanoğlunu soruna çözüm bulmak için çeşitli araştırmalara sevk etmektedir. Özellikle canlıları kanserojen etkiye sahip olan bu toksik maddelerden koruma yolları araştırılmaktadır. (Onursal, et al., 2020),. Bu çözüm yöntemlerden ucuz maliyetli, yaygın ve kolay uygulanabilir olan adsorpsiyon ile atık sulardan ağır metallerin giderimidir. Şayet sorpsiyon süreci iyi tasarlanırsa yüksek verim elde etmek mümkün olmaktadır (Dal, et al., 2021). Adsorpsiyon, sıvı veya gazdan kütle transferi aracılığı ile katının yüzeyinde maddenin birikmesi olayıdır (Altunkaynak, et al., 2021). Adsorpsiyon kinetiği ise adsorplayıcı ile adsorplanan arasındaki temas süresinin nasıl ve hangi aşamalarda gerçekleştiğini bulmamıza yardımcı olmaktadır (Altunkaynak, 2022). Bunun dışında adsorpsiyonun doğasını, afinitesini, mekanizmasını ve aktivasyon enerjisini anlamamızı sağlamaktadır. Adsorpsiyon kinetiği tüm Dünya'da çalışılmakta ve geliştirilerek deneysel veriler modellenmektedir. Bunlardan en önde geleni yalancı-ikinci dereceli kinetik modeldir:

1.1. Yalancı-İkinci Dereceli Kinetik Model

Ho ve McKay tarafından 1998 yılında öne sürülen model, non-lineer yapıda olup eşitlik.1'deki gibi ifade edilmektedir: (Ho & McKay, 1998 b).

$$q_t = \frac{q_e^2 k_2 t}{1+q_e k_2 t} \qquad (1)$$

Burada;

qt; t anında, adsorplayıcı tarafından gram başına adsorplanan madde miktarı (mgg^{-1})

qe; dengeye gelindiğinde adsorplayıcı tarafından gram başına adsorplanan madde miktarı (mgg^{-1})

t; temas süresidir. (min).

k_2; adsorpsiyona ait hız sabiti (min^{-1}) ni temsil etmektedir (Dal & Onursal, 2023).

Zaman içerisinde modele ait lineer denklemler de geliştirilmiştir Ho, Lagergren'in 'ikinci dereceli eşitliği'nin lineer formunu türetmiştir ve karıştırılmasınlar diye, eşitlik 1998'den beri ikinci dereceli kinetik model 'pseudo-second-rate order' olarak anılmaktadır (Ho, 2005).

Bu denklemler Tablo.1'de verilmiştir.

Type 1 $\frac{1}{q_e - q_t} = \frac{1}{q_e} + k_2 t$ (1)

Type 2: $\frac{1}{q_t} = \frac{1}{q_e} + \frac{1}{K_2 q_e^2}\frac{1}{t}$ (2)

Type 3: $q_t = q_e - \frac{1}{K_2 q_e}\frac{q_t}{t}$ (3)

Type 4: $\frac{q_t}{t} = k_2 q_e^2 - k_2 q_e q_t$ (4)

Type 5: $\frac{1}{t} = -k_2 q_e + k_2 q_e^2 \frac{1}{q_t}$ (5)

Type 6: $\frac{t}{q_t} = \frac{1}{K_2 q_e^2} + \frac{1}{q_e} t$ (6)

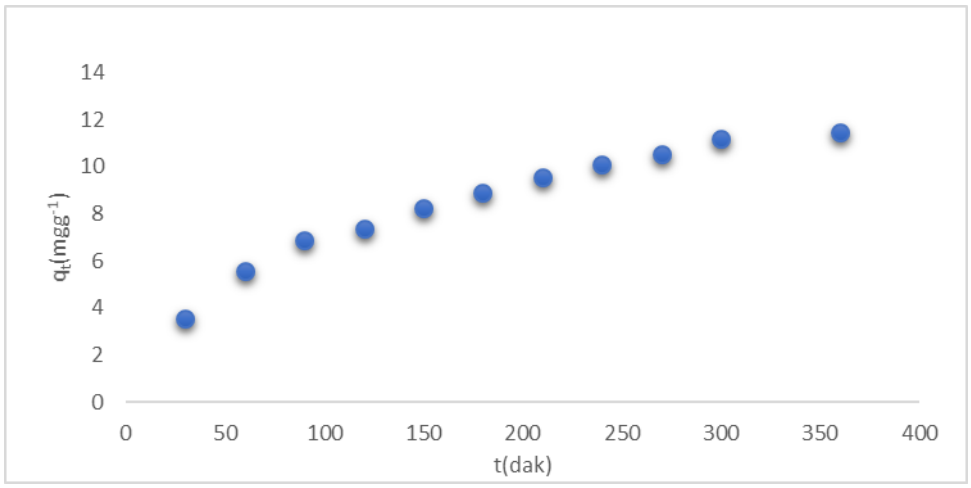
Tip 7: $t = \frac{1}{k_2}\frac{1}{q_e - q_t} - \frac{1}{k_2 q_e}$ (7)

2. Materyal ve Metod

Bu çalışmada kullanılan kil Malatya ilinden temin edilmiştir.Tüm kimyasallar Sigma firmasından alınmıştır. Zn $(NO_3)_2$. $3H_20$ adsorbat olarak kullanıldı. Deney 308 K'de gerçekleştirildi. Yalancı ikinci dereceden denklemin sekiz farklı doğrusallaştırılmış versiyonu için Malatya kili (MK) yüzeyine adsorbe edilen Zn^{2+} ile deneysel veriler elde edilmiştir. Hesaplamalar microsoft@excel 2010 program ile yapılmıştır. Modele ait 8 doğrusal tipe ait grafikten elde edilen denklemlerden R^2, q_t ve k_2 sabitleri bulunmuştur. En küçük kareler yöntemi Regresyon analizi için kullanılmış ve lineer denklemin uygunluk derecesi araştırılmıştır.

BULGULAR

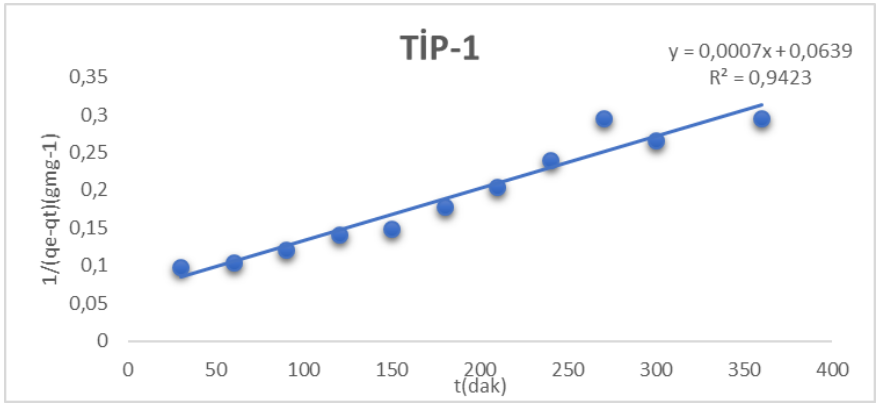
Zn(II) iyonunun MK ile adsorpsiyon kinetiğinde zamana karşı ölçülen anlık değişimlerinden hesaplama yolu ile edilen q_t değerleri arasındaki ilişkiyi gösteren kinetic çalışma grafiği şekil 1'de gösterilmiştir.



Şekil 1. 308 K sıcaklığındaki MK'nin çalışma grafiği

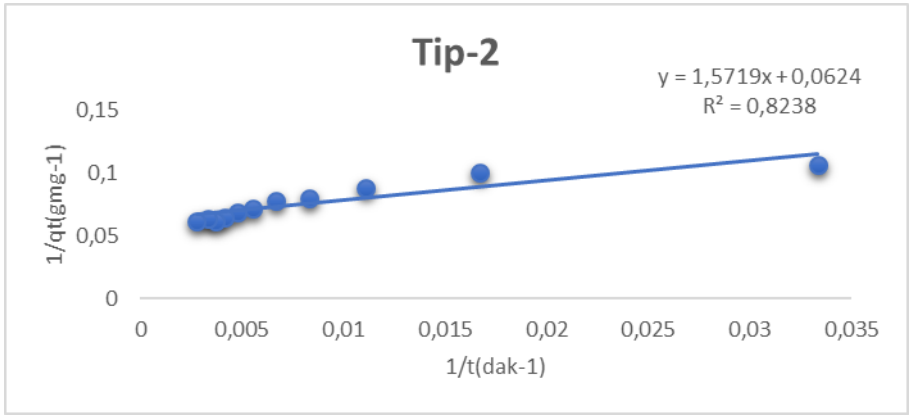
Yukarıdaki deneysel verilerin Tablo.1'de gösterilen lineer tiplere uygulanması ile şekil 2-8'de gösterilen grafikler elde edilmiştir:

Tip-1



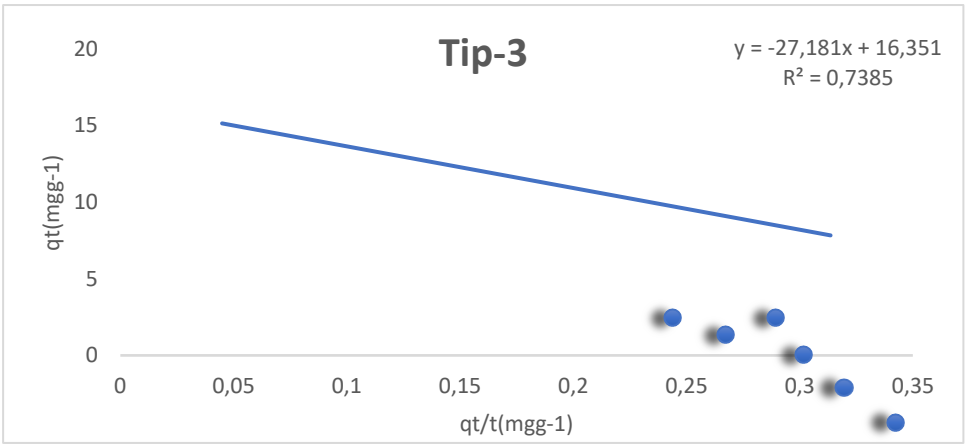
Şekil 2. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 1 grafiği.

Tip-2



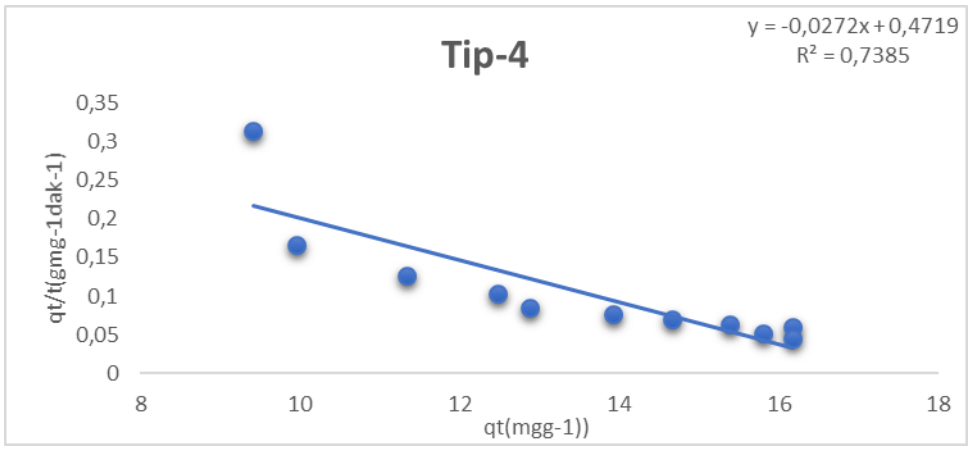
Şekil 3. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 2 grafiği.

Tip-3



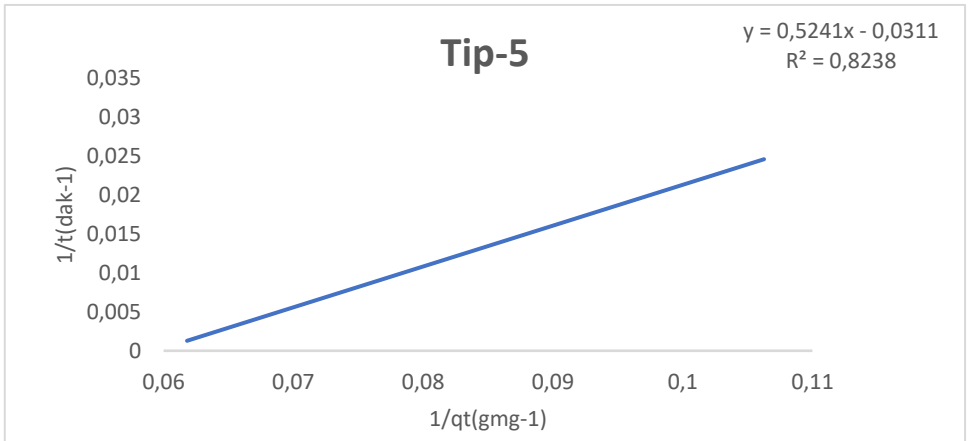
Şekil 4. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 3 grafiği.

Tip-4



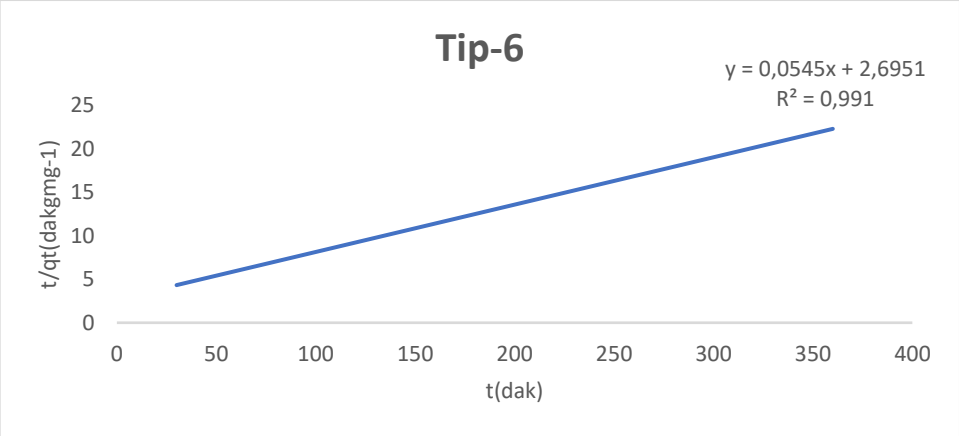
Şekil 5. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 4 grafiği.

Tip-5



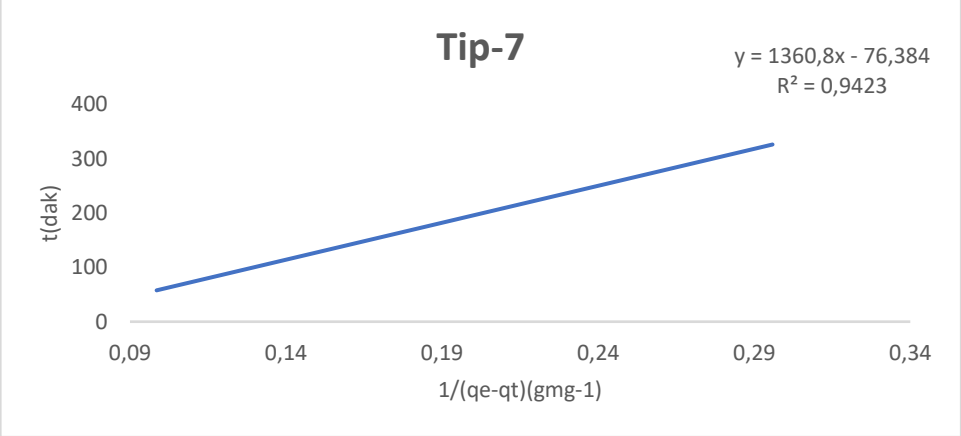
Şekil 6. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 5 grafiği.

Tip-6



Şekil 7. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 6 grafiği.

Tip-7



Şekil 8. 308 K sıcaklığındaki MK üzerine Zn^{2+}ait Tip 7 grafiği.

Hesaplamalar sonucu elde edilen sabitler Tablo.2'de verilmiştir:

Tablo.2. Yalancı-ikinci dereceli kinetik modelin 7 doğrusal tipine ait sabitler

Lineer Tip	K_2 ($gmg^{-1}min^{-1}$)	q_e (mgg^{-1})	R^2
Tip 1	0,0007	15,65	0,9423
Tip 2	0,0025	16,03	0,8238
Tip 3	0,0023	16,35	0,7385
Tip 4	0,0016	17,35	0,7385
Tip 5	0,0018	16,85	0,8238
Tip 6	0,0011	18,35	0,9910
Tip 7	0,0007	17,82	0,9423

Sonuç

Çinko elementi endüstride yaygın kullanım alanı olan bir metaldir. Kullanım miktarı ile paralel olarak çevre ile kontamine olan metalin sudan giderilmesi için adsorpsiyon kolay, ucuz ve etkili bir yöntem olarak diğer yöntemlere alternatiftir (Onursal, et al., 2019). Adsorpsiyon kinetiği adsorpsiyon çalışmlara içinde özel bir yer alır. Adsorpsiyon kinetiği için en yaygın ve özellikle metaller için deneysel verilere en uygun model,yalancı-ikinci dereceli kinetik modeldir. Dal ve Onursal'ın literatüre iki yeni tip sunması ile literatürdeki Yalancı-ikinci dereceli kinetik modelden türetilen model sayısı sekizi bulmuştur.

Bu çalışmada Malatya kilinin (MK) adsorplayıcı olarak adsorplayıcı olarak kullanıldığı çalışma 308 K sıcaklığında gerçekleştirilmiştir. Kinetik veriler Yalancı- İkinci dereceli kinetik modelin 7 doğrusal tipine uygulanmıştır. Oluşturulan grafiklerden elde edilen sabitler tablolaştırılmıştır. q_e miktarları ise 15,65 < 16,03 < 16,35 < 16,85 < 17,35 < 17,82 < 18,35 olup en yüksek q_e değeri 18,35 mgg^{-1} değeri ile 6 tipine aittir. K_2 sabitleri ise 0,0025<0,0023 < 0,0018 < 0,0016 <0,0011 < 0,0007 = 0,0007 şeklinde sıralanmaktadır. . Regresyon analizi en küçük kareler yöntemi ile yapılmıştır. Buna göre modele ait doğrusal tiplerin uygunluk derecesi 0,9910 < 0,9423 = 0,9423 < 0,8238 = 0,8238 < 0,7385 = 0,7385 tür. Tip 6'nın, 0,991 gibi yüksek R^2 değeri ile deneysel verilere en uygun tip olduğu görülmüştür.

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KOBALT (II)'NİN KARIŞIK TİPTEKİ SİVAS/YILDIZELİ KİLİ İLE SULU ÇÖZELTİDEN GİDERİLMESİNİN İZOTERM VE KİNETİK BAKIMDAN İRDELENMESİ

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ÖZET
Kobalt elementi çeşitli amaçlarla sanayide kullanılan, kanserojen bir ağır metaldir. Killer, ağır metallerin sulu çözeltiden gideriminde adsorplayıcı olarak yaygın biçimde kullanılmaktadırlar. Bu çalışmada Co (II)'nin sulu çözeltiden giderilmesi için adsorplayıcı olarak kullanılan kil (SK), Sivas Yıldızeli yöresinden alınmıştır. Adsorpsiyon çalışması çalkalamalı su banyosunda 298 K sıcaklığında yapılmıştır. Deneysel veriler Langmuir, Freundlich , Temkin, Elovich, H-J ve HJOD izoterm modellerine uygulanmıştır. Aynı sıcaklıkta gerçekleştirilen kinetik çalışmada ise veriler PFO, PSO, Weber-Morris ve Elovich kinetik modellerine uygulanmıştır. En küçük kareler yöntemine göre yapılan regresyon analizi sonucu izotermlerin deneysel verilere uygunluk derecesi Langmuir> HJOD > Temkin > Freundlich > Elovich > H-J olarak tespit edilmiştir. En yüksek R^2 değeri 0,985 olarak bulunmuştur. Kinetik çalışmalarda ise Elovich > Weber- Morris > PFO > PSO olarak bulunmuştur. q_m= 188.68 mgg^{-1} ve q_e= 111g olarak bulunmuştur. Her ne kadar kinetik çalışmaya 270 dakikaya kadar devam edilmişse de 90. Dakikada kinetiğin % 90'ın üzerinde denge noktasına yaklaştığı görülmüştür. Dolayısıyla SK kilinin hem adsorplama kapasitesi hem de adsorplama hızı ile Co (II) adsorpsiyonu için ucuz, seri ve etkili bir adsorplayıcı olarak uygun olduğu görüşüne varılmıştır.

EXAMINATION OF THE REMOVAL OF COBALT (II) FROM AQUEOUS SOLUTION BY MIXED TYPE SIVAS/YILDIZELI CLAY IN TERMS OF ISOTHERM AND KINETIC

ABSTRACT

Cobalt element is a carcinogenic heavy metal used in industry for various purposes. Clays are widely used as adsorbents in the removal of heavy metals from aqueous solution. In this study, clay (SK) used as adsorbent to remove Co (II) from aqueous solution was taken from Sivas Yıldızeli region. Adsorption study was carried out in a shaking water bath at 298 K temperature. Experimental data, were applied to Langmuir, Freundlich, Temkin, Elovich, H-J and HJOD isotherm models. In the kinetic study carried out at the same temperature, the data were applied to PFO, PSO, Weber-Morris and Elovich kinetic models. As a result of the regression analysis performed according to the least squares method, the degree of conformity of the isotherms to the experimental data was determined as Langmuir > HJOD > Temkin > Freundlich > Elovich > H-J. The highest R2 value was found to be 0.985. In kinetic studies, it was found as Elovich > Weber-Morris > PFO > PSO and qm= 188.68 mgg^{-1} and qe= 111g. Although the kinetic study was continued up to 270 minutes, it was observed that the kinetics approached the equilibrium point by over 90% at the 90th minute. Therefore, it was concluded that SK clay is suitable as a cheap, rapid and effective adsorbent for Co (II) adsorption with both its adsorption capacity and adsorption rate.

GİRİŞ

Bulunduğumuz yüz yıl teknoloji çağı ve nüfusun kontrolsüz bir şekilde artması ile birçok sorunu beraberinde getirmektedir. Çünkü git gide artan tüketim alışkanlıklarının değişimi sonucu kaoslar yaşanabilmektedir. (Çokadar, İleri, Ateş, & İzgi, 2003). Bunun temel nedenlerinden birisi insanın ihtiyaçlarını karşılamak adına Dünyada az gelişmiş, gelişmekte olan ya da gelişmiş ülke olsun tümünde endüstriyel faaliyetlerin artması ve buna bağlı olarak atıkların oluşmasıdır (Dal M. C., Onursal, Arıca, & Yavuz, 2021). Bu atıkların uygunsuz şekilde bertaraf edilmeleri birçok soruna neden olmakta ve toksik etkiyi arttırmaktadır.

Buna bağlı olarak, bu toksik maddelerin besin zinciri aracılığıyla tüm canlı organizmaları da tehdit ediyor olmasıdır (Dal & Onursal, Two new linearized equations derived from a pseudo-second-order kinetic model., 2023). Özellikle 1970 yıllardan beri kullanılan, son kullanma tarihi geçmiş olan pestisitler sorununa da çözüm bulunamamıştır. Bunlar insan vücudunda birikebilen tehlikeli atıklardır. Dahası bunlar genellikle kanserojen ve mutajenik bileşiklerdir (Piekarski, Ignatowicz, & Dąbrowski, 2022). Bu toksik maddeler su kütlelerinde çok düşük konsantrasyonlarda dahi oldukça ciddi sağlık ve çevre sorunları oluşturmaktadır. Özellikle madencilik, dericilik, tekstil, ilaç, gübre, metal kaplama gibi faaliyetler sonucu su kirliliği artmakta ve ölümcül salgınlara neden olmaktadır (Mustapha, et al., 2019), (Altunkayna, Canpolat , & Yavuz , 2021). Su yaşam için neredeyse hava kadar gerekli temel maddelerden birisidir. Besin maddesi olduğu gibi bünyesinde barındırdığı mineraller ve bileşikler ile canlıların biyokimyasal reaksiyonunun oluşumunun en önemli unsurları arasındadır. Suyun görevleri arasında vücudun pH dengesini korumak, gıda ve kalıntı maddeleri uygun yerlere taşımak ta bulunmaktadır (Buldağ, 2018). Bunların dışında ağır metaller de son yüzyılda aşırı kullanılmaya başlanmış bertaraf edilmesi sıkıntı oluşturmaya başlamıştır. Toprağa ve suya sızan ağır metal atıklarının bertarafı için çok yoğun araştırmalar yapılmakta ve çeşitli yöntemler geliştirilmektedir. Bu yöntemlerden en çok tercih edileni ise adsorpsiyondur.

Ağır Metaller

Ağır metal tanımlanacak olunursa, fiziksel yönden yoğunluğu 5 g/cm3 den büyük olan açık renkli ve metalik özellikleri bulunan elementlere denmektedir. Bu grupta ki element sayısı altmıştan fazladır. Bunlar içerisinde Çinko, bakır, mangan, kobalt, kadmiyum, kurşun, cıva ve nikel sayılabilir (Demir & Yalçın, 2014). Bazı ağır metallerin düşük geri dönüşümü, sınırlı miktarda rezervinin olması ve tedarik etme riski ile benzersiz özelliklerinin olması, onların stratejik metaller olarak ifade edilmesini sağlamıştır. Kobaltta bunlardan biridir (Conte, Díez, Brigitte, Gómez , & Rodríguez , 2023).

Kobalt

Her türlü elektronik cihaz için şarj edilebilir iyon-lityum pillerin üretilmesi için gerekli olan katot malzemesinin kullanımı yönünden kobalt, en önemli stratejik metallerden biri olarak kabul görmektedir (Conte, Díez, Brigitte, Gómez , & Rodríguez , 2023). Bunun yanı sıra çalışmalar endüstrilerdeki düzensiz uygulamalar ve kaynak dağıtımındaki aşırı dengesizlik nedeniyle mevcut kobalt madenciliği uygulamalarını ve tedarik zincirinin hem sürdürülemez hem de çevreye zararlı olduğunu göstermektedir (Amoo , et al., 2023).

Kil Mineralleri

Tanecik boyutu 2µm' den daha küçük olan kayaç malzemelere kil; tanecik boyutu 2µm ' nin altında olan tabakalı silikatlara ise kil minerali denmektedir. Birçok çeşidi vardır. Kaolinit, illit, smektit ve vermikülit, montmorillonit bunlardan bazılarıdır. Genel formülleri ise;

$[Si_{3-4}Al_{0-1}O_{10}]$ (Al, Mg, Fe)$_{2-3}$ (Ca, Mg, Na, K) $(OH)_{2-8}$ .nH_2O olarak verilmektedir (Demir & Yalçın, 2014).

Materyal ve Metod

Bu çalışmada Sivas ili Yıldızeli ilçesinden temin edilen kil kullanılmıştır. 100 °C' de kurutulup Retsch Marka bilyalı öğütücüde öğütülmüştür. Kilin karakterizasyonu XRF, SEM, EDAX, BET (Quantachrome Nova Win)markalı cihazda yaptırılmıştır. Sivas kilinin (SK) analiz sonuçları aşağıda verilmiştir. Adsorpsiyon çalışmaları Memmert Marka çalkalyıcılı banyoda 298 K sıcakılığında gerçekleştirilmiştir. Adsorpsiyon deneyleri denge ve kinetik çalışmalar diye iki grupta ele alınmıştır. Çözelti konsantrasyonları Unicam 929 model AAS cihazı ile ölçülmüştür. Elde edilen ham veriler Microsoft excell®2010 programı ile hesaplanmıştır. Bu veriler ışığında oluşturulan grafiklerden elde edilen sabitler tablolaştırılmıştır.

XRF analizi

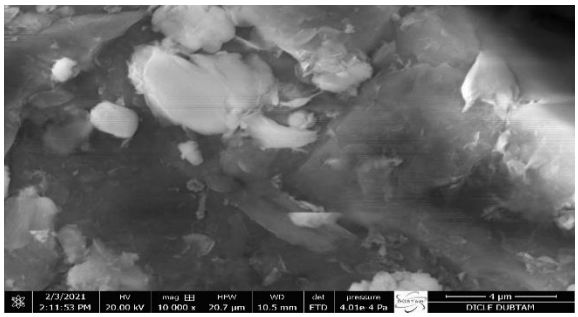
Kilin XRF analizi yaptırılmış ve sonuçlar aşağıdaki tabloda verilmiştir.

Tablo 1. Sivas/Yıldızeli Kilinin XRF analizi Sonucu

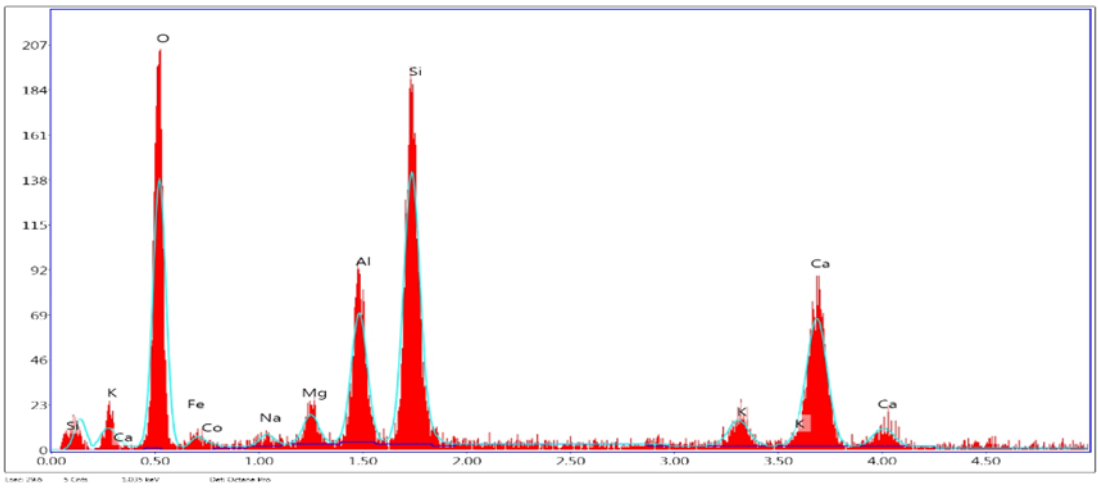
Numune İşareti	LOI %	Al2O3 %	CaO %	Fe2O3 %	K2O %	MgO %	MnO %	Na2O %	P2O5 %	SiO2 %	TiO2 %
Sivas Kili	10.50	14.7	3.7	7.5	1.0	4.3	0.1	0.1	<0.1	57.1	0.6

Şekil 2 ve tablo1 verileri incelendiği zaman SEM-EDX ve XRF sonuçları ile mikroskobik ve makroskobik veriler arasında bir tutarlılık olduğu ve birbirlerini desteklediği görülmektedir.

SEM-EDAX Analizi



Şekil.1. SK Kilinin Co (II) ile işlem görmüş SEM görüntüsü



Element	Wt %	Atomic %	Error %	Net Int.	Net Error %	K Ratio	Z	R	A	F
O K	51.40	68.45	11.12	72.08	2.80	0.1391	1.0622	0.9647	0.2547	1.0000
Na K	1.40	1.30	56.38	3.12	45.70	0.0041	0.9663	0.9914	0.3045	1.0044
Mg K	2.07	1.81	22.96	8.74	16.52	0.0092	0.9831	0.9992	0.4487	1.0076
Al K	7.82	6.18	9.87	41.67	4.73	0.0436	0.9471	1.0066	0.5821	1.0098
Si K	15.40	11.68	7.49	90.68	3.01	0.0971	0.9681	1.0135	0.6469	1.0066
K K	2.04	1.11	20.07	10.38	18.03	0.0179	0.8985	1.0427	0.9253	1.0540
Ca K	12.72	6.76	6.58	54.20	4.87	0.1126	0.9150	1.0475	0.9456	1.0235
Fe K	5.99	2.29	17.99	12.64	16.29	0.0518	0.8165	1.0688	0.9930	1.0649
Co K	1.16	0.42	61.86	2.09	60.09	0.0099	0.7976	1.0706	0.9969	1.0779

Şekil 2. Kilin metal ile etkileşimi sonucu elde edilen EDX diyagramı.

Bu tablodaki veriler ile şekil 2'deki diyagram incelendiğinde, SK tarafından kobalt'ın adsorplandığı anlaşılmaktadır.

BET analizi

BET (Braun Emmet Teller) analizinde numuneye 105 °C sıcaklıkta 20 saat boyunca vakum işlemi uygulanmış olup, yüzey alanı 153,364 m2/g olarak ölçülmüştür.

Adsorpsiyon Kinetik Modelleri

Kinetik çalışmalar

Adsorpsiyon prosesi zamana bağlı olarak gelişmektedir. Adsorpsiyon kinetiği ise,adsorplayıcı ile adsorplanan arasındaki denge temas süresini ifade etmektedir. Yani adsorplanan ile adsorplayıcının doyuma ulaşıncaya dek geçen süredir. Bunun yanı sıra adsorpsiyonun hangi mekanizma ile gerçekleştiğini tespit eden pek çok kinetik model mevcuttur. Bunlardan en çok tanınan ve kullanılanlar arasında PFO (Pseudo- first-order model), PSO (Pseudo-second-order model), Elovich model ve Weber and Morris (W&M) model) olduğu söylenebilir (Altunkaynak , Canpolat, & Yavuz, 2023).

$$\ln(q_e - q_t) = lnq_e - k_1 t \quad (1)$$

-PSO modeli aslında adsorpsiyon hızı ve aktif yüzey mevkiilerinin sayısı ile doğru orantılı olduğundan, bir anlamda Langmuir modelini takip etmektedir. 1999 yılında Ho- Mckay bu eşitliği aşağıdaki biçimde oluşturmuşlardır (Ho & McKay, 1999b).

$$\frac{t}{q_t} = \left(\frac{1}{k_2 q_e^2}\right) + \left(\frac{1}{q_e}\right) t \quad (2)$$

-Elovich modeli ampirik bir modeldir ve en önemli iki varsayımı ise, adsorpsiyon süresine bağlı olarak artan aktivasyon enerjisi ile adsorbanın yüzeyinin heterojen olması şeklindedir. Elovich denklemi ise;

$$qt = (1 /\beta) \ln(\alpha . \beta) + (1 /\beta) \ln t \quad (3)$$

şeklindedir. Burada;

β, yüzeye ait aktivasyon enerjisi (Ea) ile ilişkili desorpsiyon sabitini (gmg^{-1})

α, başlangıçtaki adsorpsiyon oranını ($mg\ (g\ dk)^{-1}$

q_t , t zamanda adsorplanan madde miktarını ifade etmektedir. (Kanmaz, 2022).

- Weber and Morris, kendi adlarıyla yayımlanan bu modeli, parçacık içi difüzyon sürecini tanımlamak için geliştirmişlerdir. Bu model aşağıdaki bağıntıda verildiği gibidir; (Wang & Guo, 2020).

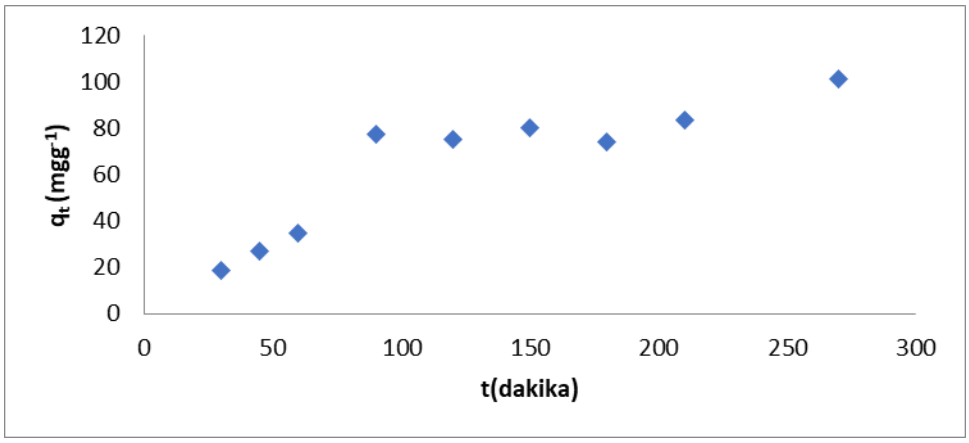
$$q_t = k_{W\&M} t^{\frac{1}{2}} , \quad (4)$$

Burada $k_{w\&M}$, Weber-Morris sabitidir.

Bulgular

Bu çalışmada 298 K sıcaklığında çalışılan SK kilinin yüzeyine adsorbe edilen $Co2^{+}$ için deneysel veriler kinetik modellerden PFO, PSO, Elovich ve Weber-Morris modellerine uygulanmış, konsantrasyon izotermleri ise; Langmuir, Freundlich, Harkins-Jura ve HJOD modellerine uygulanmış olup elde edilen grafik ve tablolar aşağıda verilmiştir. Co(II) iyonunun

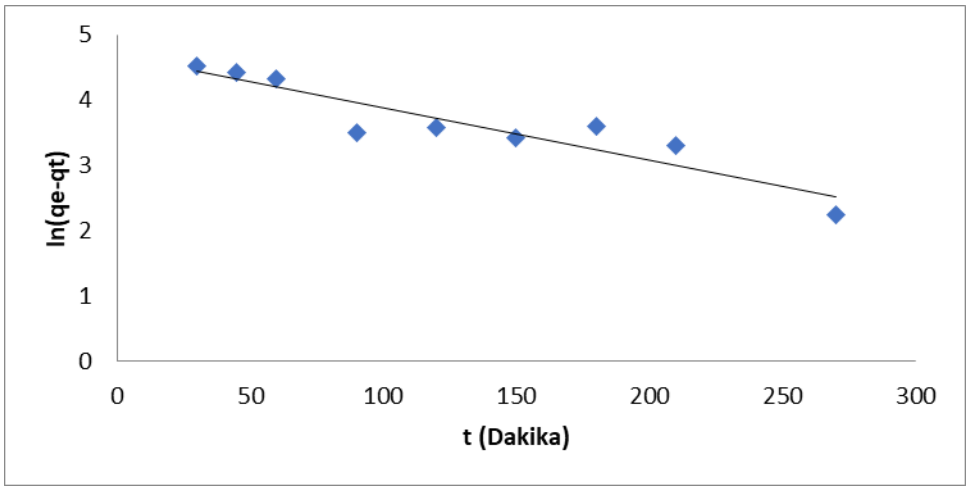
SK ile adsorpsiyon kinetiğinde zamana karşı anlık ölçülen derişimlerinin hesaplanması suretiyle elde edilmiş olan q_t değerleri arasındaki ilişkiyi veren grafik şekil 1.de verilmiştir.



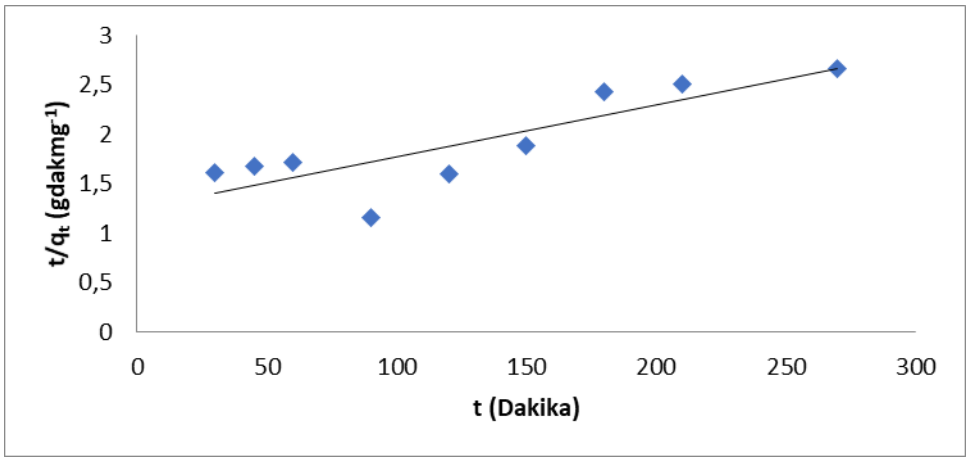
Şekil 1. Co^{2+}'nin SK ile adsorpsiyon kinetiğinde q_t-t ilişkisi grafiği.

Grafikten de anlaşıldığı üzere artan zamana bağlı olarak, doyma durumuna göre qt'deki artış hızı yavaşlama eğilimindedir. Eğri, sonsuz zaman dilimine doğru gittikçe q_t değerine yakınsamaktadır. Deneylerden elde edilen verilerin uygulandığı kinetik modeller şekil 2 ile şekil 5 aralığında gösterilmiştir.

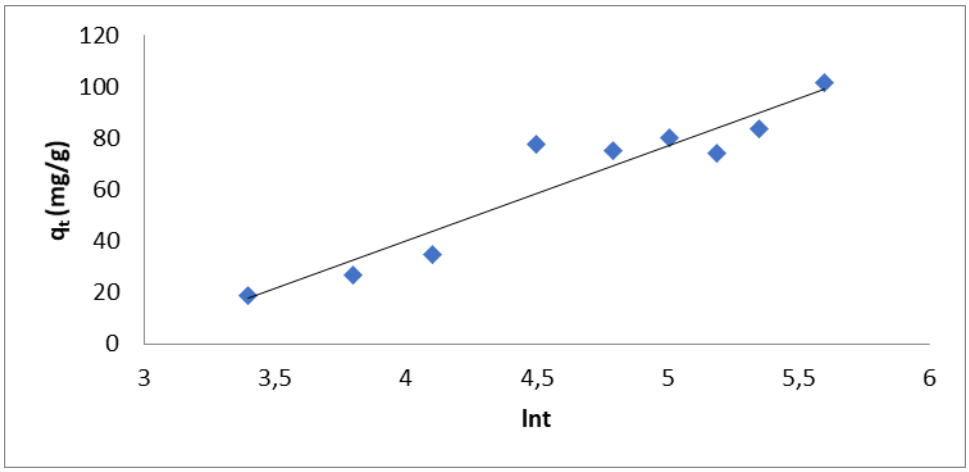
Kinetik Çalışmalar



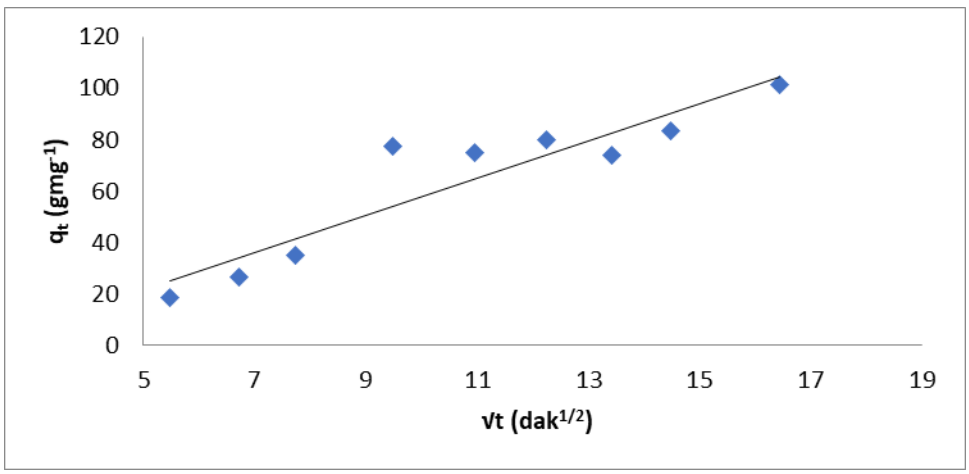
Şekil 2. 298 K sıcaklığındaki Co^{2+}'nin PFO grafiği.



Şekil 3. 298 K sıcaklığındaki Co^{2+}'nin PSO grafiği.



Şekil 4. 298 K sıcaklığındaki Co^{2+}'nin Elovich grafiği.



Şekil 5. 298 K sıcaklığındaki Co^{2+}'nin Weber-Morris grafiği.

Grafiklerden elde edilen sabitler ise tablo 2'de verilmiştir.

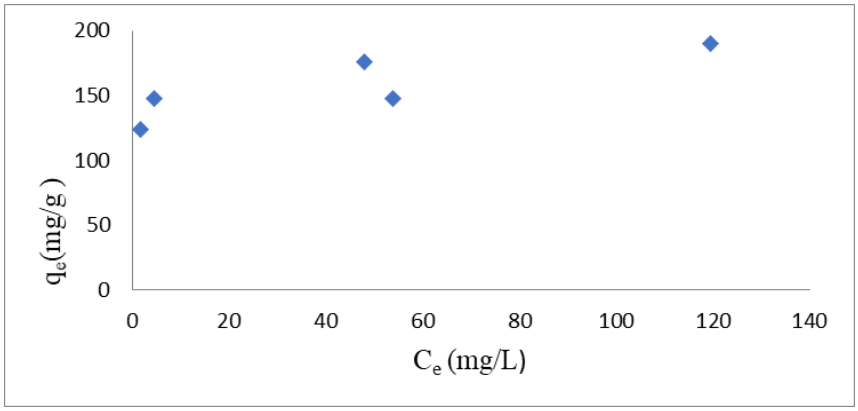
Tablo.2. Co (II)'nin SK kili adsorpsiyonuna ait kinetik veri sonuçları

Sıcaklık	Pseudo First Order			Pseudo Second Order		
(K)	k_1 (dak^{-1})	q_t (mgg^{-1})	R^2	k_2 ($gmg^{-1}dak^{-1}$)	q_{max} (mgg^{-1})	R^2
298	0.008	109,49	0.8579	2.1710^{-5}	192.31	0.7058
	Elovich			Weber-Morris		
	α ($mgg^{-1}dak^{-1}$)	B (gmg^{-1})	R^2	$k_{W\&M}$ ($mgg^{-1}min^{-1/2}$)	C (mgg^{-1})	R^2
298	1.997	0.027	0.9021	7.2355	-14.409	0.8587

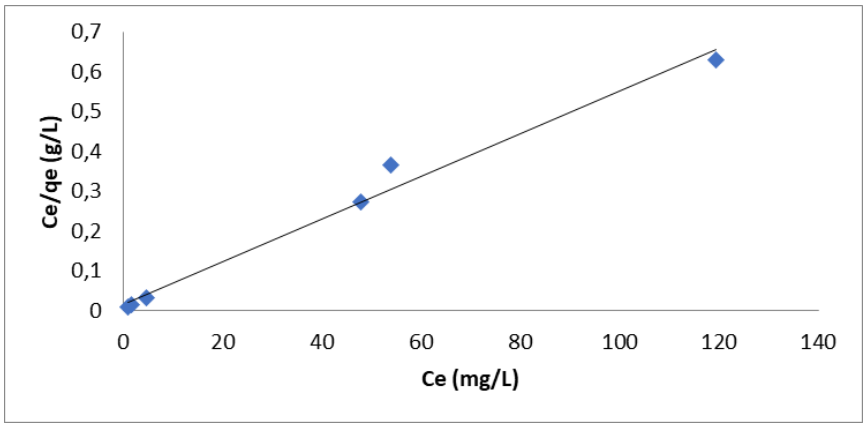
İzoterm modelleri olan angmuir, Freundlich, Harkins-Jura ve HarkinsJura-OnursalDal (HJOD)' a deneysel veriler uygulanmış ve elde edilen grafik ve tablolar aşağıda verilmiştir.

İzoterm Çalışmaları

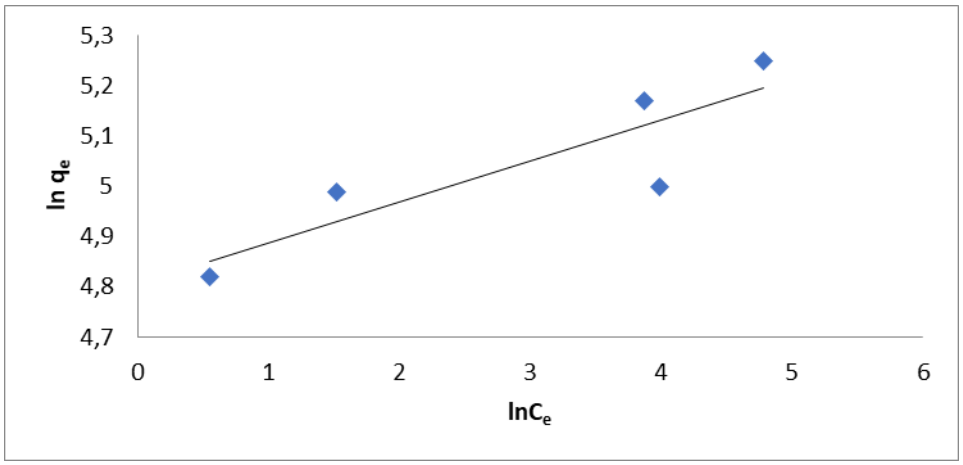
İzoterm eğrileri, çözeltinin içerisinde kalan madde ile adsorplanan madde miktarına karşı çizilerek elde edilmektedir. Genellikle artan sıcaklığa bağlı olarak adsorpsiyonunda arttığı gözlemlenir. Bu çalışmanın verileri Langmuir, Freundlich, HJ ve HJOD'a uygulanarak aşağıdaki grafikler elde edilmiştir.



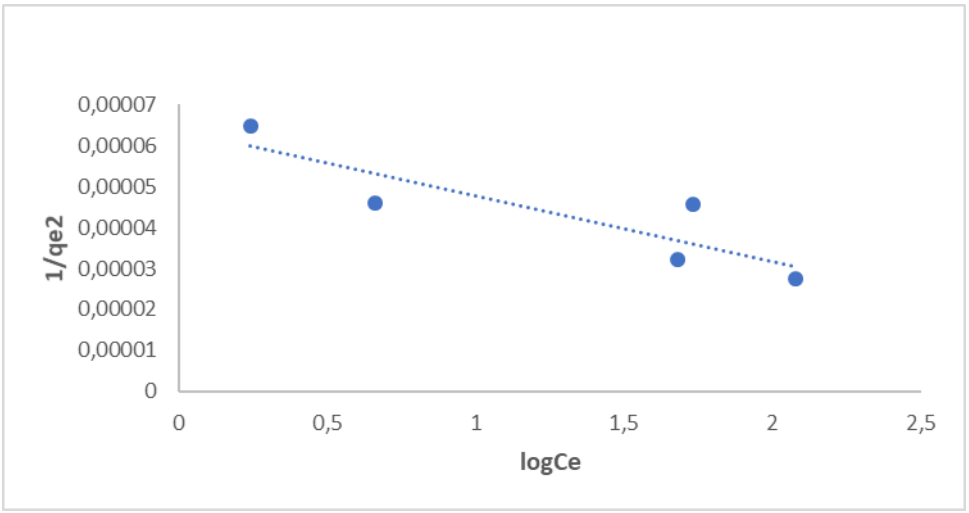
Şekil 6. 298 K sıcaklığındaki Co^{2+}'nin q_e-Ce ilişkisi grafiği.



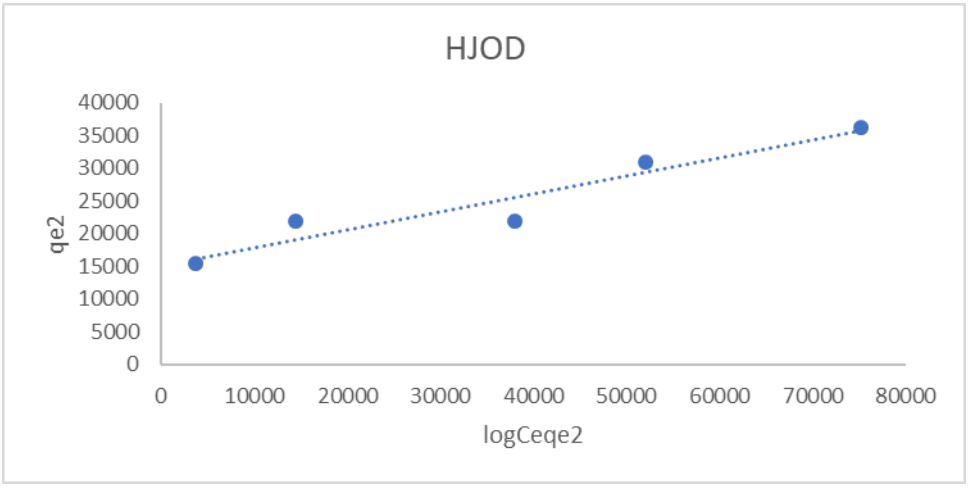
Şekil 7. 298 K sıcaklığındaki Co^{2+}'nin Langmuir grafiği.



Şekil 8. 298 K sıcaklığındaki Co^{2+}'nin Freundlich grafiği.



Şekil 9. 298 K sıcaklığındaki Co^{2+}'nin HJ grafiği.



Şekil 10. 298 K sıcaklığındaki Co^{2+}'nin HJOD grafiği.

Bu grafiklerden elde edilen verilerle izoterm sabitleri hesaplanmış ve bulunan sonuçlar tablo 2'de gösterilmiştir.

Tablo 2. İzoterm çalışmalarına ait sabitler

Sıcaklık	Langmuir İzotermi			Freundlich İzotermi		
(K)	K_L (Lmg^{-1})	q_{max} (mgg^{-1})	R^2	K_F	n	R^2
298	0.325	188.68	0.985	122.376	12.315	0.7609
	Harkins-Jura İzotermi (H-J)			Harkins-Jura-Onursal-Dal (HJOD)		
	A	B	R^2	A	B	R^2
298	10000	3.00	0.7928	19642	2.46	0.9124

Sonuç

Ağır metallerin canlı ve özellikle insan sağlığına olumsuz etkileri bilinmekte ve bu etkiler araştırılmaktadır. Kritik hammadde olarak tanımlanan kobalt metali diğer taraftan ağır toksik etkisi ve kanserojen olması nedeni ile çevreden uzak tutulması gereken bir elementtir. Adsorpsiyon kobaltın giderimi için alternatf bir yöntemdir. Bu çalışmada adsorplayıcı olarak seçilen Sivas kili (SK) ile 298 K sıcaklığında çalkalayıcılı su banyosu ile Co(II) iyonunun adsorpsiyonu çalışmaları kapsamında izoterm ve kinetik çalışması yapılmıştır. İzoterm çalışmaları sonucu elde edilen hamveriler Langmuir, Freundlich, Elovich, H-J ve HJOD izoterm modellerine uygulanmıştır. Kinetik çalışmalardan elde edilen veriler ise Pseudo- First Kinetic Order Model (PFO), Pseudo- Second Kinetik Order Model (PSO), Intra Particle Diffusion Model (Weber-Morris) ve Elovich kinetik modellerine uygulanmıştır. En küçük kareler yöntemine göre yapılan regresyon analizi sonucu izotermlerin deneysel verilere uygunluk derecesi Langmuir> HJOD > Temkin > Freundlich > Elovich > H-J olarak tespit edilmiştir. En yüksek R^2 değeri 0,985 olarak bulunmuştur. Kinetik çalışma için yapılan regresyon analizi modellerin deneysel veriye uygunluk derecelerinin Elovich > Weber- Morris > PFO > PSO olarak bulunmuştur. İzotermlerde qm= 188.68 g ve kinetik çalışmada qe= 111g olarak bulunmuştur. 90 dakikada denge noktasına % 90 yaklaşıldığı tespit edilmiştir. Sonuç olarak SK kilinin Co (II)'nin adsorpsiyonu için uygun bir adsorplayıcı olduğu kanaatine varılmıştır.

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ÇOCUKLARA YÖNELİK HAZIRLANAN DENEYSEL ETKİNLİK ÖRNEKLERİNİN ÖĞRENMEYE KATKISI

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ÖZET
Günümüz eğitiminde etkin olan kullanılan yapılandırmacı yaklaşım, bilginin aktif katılımını ve bireysel olarak yapılandırıldığını ortaya koymaktadır. Çocuk gelişiminde bireysel farklılıklar söz konusu olduğunda her çocuğa öğrenme şansı verilmesi, aktif uyarıcılarla karşı karşıya olması, öğretimde kullanılan yöntem, teknik ve materyallerin çeşitliliği ve ulaşılabilirliği aynı oranda değildir. Bu yüzden çocukların etkin öğrenme süreçlerinde yaş ve gelişim düzeylerine uygun etkinliklerin planlanarak, çeşitli konularda bilgi ve beceri edinmeleri, yeni kazanımlar elde etmeleri sağlanmalıdır. Bu noktada çocuklar için bilimsel bilginin verimli şekilde öğrenilip, kavram yanılgılarını ve oluşabilecek mantıksal boşlukları en aza indirebilecek yöntem ve yaklaşımların kullanılması son derece elzemdir. Yaparak yaşayarak öğrenme sürecinin desteklenmesi, bilimsel bilginin gelişmesi ve uygulanmasında yeni modellere ve öğrenme stratejilerine yer verilmesi, öğrenmenin gerçekleşmesi sürecinde çocuğu desteklemektedir. Deneyler her yaş grubu çocuk için eğlenceli, somut, geleneksel yöntemlerin aksine keşif temelli bir öğrenme sunar. Her yaş grubu çocuk için fen ve doğa etkinliklerin planlanması, bilginin doğrudan aktarılarak değil buluş yoluyla deneyimlenmesine izin vererek, çocukların farklı konularda yeni kazanımlar elde edilmesine de olanak sağlar. Ezberci yöntemlerin aksine bu tür etkinlikler; çocuğun araştırması, inceleme ve gözlem yapabilmesi noktasında bilimsel bir temel oluşturmanın yanında bu tür iç içelik çocuğun gelişim alanlarına olumlu yönde katkı sağlar. Sonuç olarak derleme niteliğindeki bu çalışmada erken çocukluk döneminde ki çocukların bilgiyi somut hale getirerek aktif deneyimleme fırsatı yakalayacakları farklı (buharlaşma, süblimleşme, tek hücreli canlı deneyleri vb.) konulara ilişkin deneysel örneklere yer verilmiştir.
Anahtar Kelimeler: Çocuk gelişimi, Deney, Fen ve Doğa

CONTRIBUTION OF EXPERIMENTAL ACTIVITY EXAMPLES PREPARED FOR CHILDREN TO LEARNING

ABSTRACT
The constructivist approach used in today's education reveals the active participation of knowledge and its individual configuration. When it comes to individual differences in child development, each child is given a chance to learn, faces active stimuli, methods used in teaching, variety of techniques and materials and their availability are not at the same rate. Therefore, it should be ensured that children acquire knowledge and skills in various subjects by planning activities suitable for age and development levels in effective learning processes and to obtain new achievements. At this point, it is extremely important for children to learn scientific knowledge efficiently and to use methods and approaches that can minimize misconceptions and logical gaps. Supporting the process of living learning by doing, introducing new models and learning strategies in the development and application of scientific knowledge supports the child in the process of learning. Experiments offer exploration-based learning unlike traditional, concrete methods that are fun for all age group children. The planning of science and nature activities for each age group child allows children to experience new achievements in different subjects, not through direct transfer of knowledge, but through invention. Unlike ezberci methods, such activities; in addition to creating a scientific basis for the child to research, examine and observe, this kind of inner steel contributes positively to the development areas of the child. As a result, in this compiled study, children in early childhood will have the opportunity to materialize information and experience it actively (evaporation, sublimation, single-celled live experiments, etc.) Experimental examples of subjects are given.
Keywords: Child development, Experimentation, Science and Nature

GİRİŞ

Çocuklar çevresinde olup bitenleri gözlemleyerek dış dünyayı araştırır ve çevresinde olup biten pek çok şeyi algılamaya çalışır. Farklı zamanlarda algıladığı bilgilerin birbirleri ile bağlantısını ya da farklılıklarını anlamaya çabalar ve gelişim alanlarını şekillendirir. Çevresinde gördüğü nesneleri, olayları merak eder ve bu merakını giderebilmek için neden-sonuç ilişkisi kurmaya çalışır. Kimi zaman "Rüzgârın nasıl oluştuğunu, kuşların nasıl uçtuğunu ya da yağmurun nasıl yağdığını gözlemler, bu durumlara dair sorular sorar, gözlem, keşif ve deneysel etkinlikler yapar. Merak ettikleri konular olduğunu çevresindekilere de gösterir. Doğası gereği doğuştan meraklı ve keşfetmeye istekli olan çocuk bu özelliği sayesinde, matematik, fen ve benzeri pek çok alanlara ilişkin bilimsel kavramları da zamanla keşfetmeye başlar. Bu keşif arzusu, onların bilimsel düşünmeyi ve problem çözme becerilerini geliştirmelerine yardımcı olur. Hayal güçlerini serbest bırakmalarına ve farklı çözüm yolları düşünmelerine olanak tanıyan deneysel çalışmalarla günlük hayatta iç içe olmaları çocukların yaşamlarında bu yönüyle önemli bir role sahiptir (Çetin Çetin, T., Yavuz, S., Tokgöz, B., Güven, G. (2012), Can Yaşar, M. ve Aral, N. (2010). Bu keşif sürecinde deneysel etkinliklere yer vermek; çocukların ilgi duydukları alanlara odaklanmalarına dahası bilim dünyasına olan ilgilerini artırmalarına da yardımcı olur. Yaşamın erken dönemlerinden başlayarak bilimsel uygulamaların bir parçası olmak, çocuğu merak ve sorgulamaya teşvik eder. Böylece ileri ki yaşlarda derinlemesine bilimsel çalışmalara yönelmeleri de sağlanabilir. Bilimsel düşünmeyi ve problem çözme becerilerini başarıyla kullanmalarına yardımcı olacak uygulamalar çocukların bilimsel süreç becerilerini kazanmaları için önemlidir (Çetin T. ve ark.,2012, Akman, Üstün ve Güler, 2003). Çocukların olayları tek bir bakış açısıyla değerlendirmelerini sınırlandırmak, aynı olay veya nesne için farklı bakış açılarının olabileceğini göstermek, kavramların somut hale getirilmesi sağlamak için deneysel çalışmalardan faydalanmak bu sayede nesnenin farklı özelliklerini keşfetmeleri için fırsatlar sunmak çocuk gelişimi için destekleyicidir.Bu gerekçeler ışığında çocukların, duyularını kullanarak gözlem yapma, tahminde bulunma, tahminlerini arkadaşları ile paylaşma, tahminlerini araştırma ya da deneylerle test etme çalışmaları ile fen-doğa uygulamalarına aktif katılımlarını sağlayacakları etkinlikleri deneyimlemeleri gelişimleri açısından elzemdir. Başka bir ifade ile bilimsel süreç becerilerini geliştirirken, çocukların olayların neden-sonuç ilişkilerini anlamalarına ve farklı olayları birbiriyle ilişkilendirmelerine yardımcı olacak eğitim uygulamalarında deneysel çalışmalara yer vermek önemlidir. Kısacası deneyler günlük hayatın bir parçasıdır. İnsan, yaşamın her aşamasında bir doğa olayı ile karşılaşma ve karşılaştığı bu yeni olayı da temelde merak duygusu ile birlikte öğrenme isteğini geliştirmek çocuğun dünyayı

daha derinlemesine anlamasına yardımcı olur (Güler ve Bıkmaz, 2002; Karamustafaoğlu, 2006).

Deneysel Çalışmaların Çocuklara Katkıları Nelerdir?

Dünyayı anlamak ve keşfetmek için bir araç olarak kullanılan bilim çocuğun içinde yaşadığı doğayı ve evreni, bilinen somut ve tarafsız unsurlar aracılığıyla anlamasını kolaylaştırır (Çapan, 2019). Deney değişkenleri değiştirme ve kontrol etme sürecidir. Bu süreç diğer tüm süreçlerle birleşerek, gerekli birçok araç gereci beceriyle kullanarak uygun bir düzenek kurmayı, değişkenleri değiştirip kontrol ederek veriler elde etmeyi, bu verileri kaydedip değerlendirerek model oluşturmayı, verileri yorumlamayı, sonuca varmayı ve yapılanları raporlaştırmayı içeren bir süreç olarak ifade edilir (Tan ve Temiz, 2003).Çocuğun karşı karşıya kaldığı olayları, durumları gözlemlemesi, araştırması ve sonuçlara varmasını sağlayan bu süreç çocukların merak duygularından yola çıkarak olayları ve nesneleri tanımalarını sağlayarak günlük yaşamlarında gerekli olan çeşitli becerileri kazanmalarına da katkı sağlar. Yaratıcı düşünme yeteneğinin gelişmesi için temel basamak nitelikte olan deneysel etkinlikler aynı zamanda düşüncelerini ifade etmelerini de sağlar. Olay ve durumlara ilişkin yorumlama becerini kullanan çocuk; deneme-keşfetme ve araştırma yoluyla bilişsel olarak kendisini de destekler. Aşağıda alan yazında yer alan deneysel çalışmalarının çocuklar üzerindeki etkilerindeki olumlu etkilerini ortaya koyan bazı çalışmalara yer verilmiştir. Dejonckheere ve arkadaşları tarafından (2016) yapılan çalışmada; dört okul öncesi (4-6 yaş) sınıfı karşılaştırılmıştır. Çocuklara toplamda 15 deneysel etkinlik yaptırılarak sınıflar arasında farklı bilimsel olguları keşfetmeye çalışmışlardır. Örneğin ağırlığın ve pozisyonun denge üzerindeki etkisini keşfetmek için çeşitli boyutlardaki bardaklara su doldurulmuş ya da sesin etkisi farklı deneylerle keşfedilmeye çalışılmıştır. Çalışma sonunda deneylerin derinlemesine öğrenmede teşvik edici olduğu, çocukların daha sonra ne olacağına veya başka bir şey olursa ne yapılabileceğine dair tahminlerde bulunabildikleri belirtilmiştir.Civelek ve Akamca (2018) tarafından yapılan araştırmada ise 6 yaş toplam 14 çocuk çalışma grubunu oluşturmaktadır. Çalışma kapsamında, araştırmacı tarafından bilimsel süreç becerilerinin beş alt becerisine (gözlem yapma, sınıflama, tahmin etme, ölçme ve sonuç çıkarma) ait etkinlikleri içeren açık alan eğitim modülü hazırlanmış 8 hafta deney grubuna uygulanmıştır. Sonuç olarak açık alan etkinliklerinin; çocukların gözlem yapma, sınıflama ve ölçme becerilerini geliştirmede sınıf içi etkinliklerden daha etkili olduğu görülürken, açık alan etkinliklerinin çocukların tahmin etme ve sonuç çıkarma becerilerini geliştirmede sınıf içi etkinliklerden daha etkili olmadığı sonucuna ulaşılmıştır.

Ünal ve Aksüt (2021) tarafından yapılan "4-6 yaş çocuklarına etkinlik temelli STEM eğitiminin bilimsel süreç becerilerine etkisinin incelenmesi" adlı çalışma toplamda 48 çocukla (19 deney, 29 kontrol) gerçekleştirilmiştir. Etkinlik Temelli STEM Eğitimi Uygulamalarının çocukların bilimsel süreç becerilerini olumlu yönde desteklediği sonucuna ulaşılmıştır.

SONUÇ

Kısacası deneyler çocukların doğaya olan merakını ve ilgisini teşvik ederek dünyayı anlama, keşfetme ve sorgulama yeteneklerini geliştirmelerine yardımcı olur. Ancak, bu süreçte bilinçli ve gelişimsel olarak uygun seçimler yapmak önemlidir. Çocuklar sadece bilim bilgisi edinmekle kalmaz, aynı zamanda dünyayı anlama sürecini somutlaştırır. Belirli bir planlama yapmanın yanında, benzer özellikler yönünden ayırım yapmayı da öğrenir. Örneğin bir cevizi insan beyni ile bir mantarı insan kulağına benzeterek basit analoglar oluşturur. Deneyler yoluyla kavramlar ve kavramlar arasındaki aşamaları belirler bunları farklı nesnelerle ilişkilendirir. Örneğin bir ipeğin oluşum süresince koza, ipek ve kumaş ilişkisini kurar. Çocuğa ebeveynleri ve eğitimcileri tarafından yeterli ve teşvik edici ortamların sunulması, olumlu bir bakış açısına sahip olmaları deneysel çalışmalara ilgi duymaları açısından önemlidir. Çocuklar profesyonel olarak deneysel çalışmalara yetkin olmasalar da zihinsel olarak merak ettikleri sorulara yanıt bulabilir deneysel çalışmalar yoluyla meraklarını giderebilirler. Bilgiye ulaşmanın kolaylaşmasının yanında bilgi kirliliğinin fazlalaştığı bir çağda doğru bilgiye ulaşmak için gerekli eleştirel ve bilimsel düşünme becerilerine sahip bireyler yetiştirmesi için yaparak-yaşayarak öğrenme fırsatı için deneysel uygulamalardan yararlanılması çocuklar için gereklidir.

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SELÜLOZ NANOFİBRİLLERDEN KOMPOZİT FİLM ELDESİ

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ÖZET
Günümüzde doğal kaynakların azalması ve enerji tüketiminin artması sebebiyle yenilenebilir ve çevre dostu doğal malzemeler üzerine yapılan araştırmalar giderek artmaktadır. Endüstriyel alandaki gelişmelerin artmasıyla birlikte petrol bazlı plastiklerin üretimi de artmaktadır. Biyolojik olarak doğada bozunmayan bu plastiklerin artması, çevre kirliliğine yol açmakta ve insan sağlığı açısından da risk oluşturmaktadır. Çevre dostu, biyo bazlı ve yüksek performanslı kompozit malzemelerin üretimi ve geliştirilmesi de giderek önem kazanmaktadır. Son yıllarda kompozit malzeme üretiminde ve plastiklere alternatif olarak kullanılan selüloz kaynaklı malzemelerin üretimi ve geliştirilmesi için çeşitli çalışmalar yapılmaktadır. Selüloz, bitkisel ve hayvansal kaynakların yanı sıra bakterilerden de kolaylıkla temin edilebilen, ucuz, yenilenebilir, biyobozunur, biyouyumlu ve doğada en bol bulunan doğal bir polimerdir. Selüloz, yüksek fiziksel ve mekanik özellikleri, kolay ulaşılabilirliği ve çevre dostu olması gibi avantajlarından dolayı biyo bazlı malzeme üretiminde giderek daha fazla tercih edilmektedir. Selüloz kullanılarak elde edilen biyolojik malzemelerden biri ise selüloz nanofibrillerdir (NFC). NFC'ler, 10-100 nm arasında değişen selüloz moleküllerinin çok ince uzun lifler halinde düzenlenmesiyle elde edilen nano boyutlu malzemelerdir. NFC'lerin içerisindeki fibriller, kristalin ya da amorf yapıda olabilmektedir. NFC'ler, selüloz liflerinden mekanik, kimyasal, asit veya enzimatik ön işlemlerle üretilen, yüksek özgül dayanıma ve sertliğe, düşük termal genleşmeye ve yoğunluğa sahip olan ve çeşitli alanlarda kullanılabilen biyo-esaslı nanomalzemelerdir. NFC'ler tarım ve gıda atıklarının yapısında bulunan selülozdan da üretilebilmekte ve böylece bu ürünlerin ekonomik değeri daha yüksek ürünlere dönüştürülmesine katkı sağlanmaktadır. Bu çalışmada da çeşitli tarımsal ve gıda atıklarından elde edilen NFC'lerin kompozit film üretiminde kullanılma potansiyeli araştırılacaktır.
Anahtar Kelimeler: Selüloz, selüloz nanofibril, kompozit film, nanomalzeme

COMPOSITE FILM PRODUCTION FROM CELLULOSE NANOFIBRILS

ABSTRACT

Nowadays, research on renewable and environmentally friendly natural materials is increasing due to the decrease in natural resources and the increase in energy consumption. With the increasing developments in the industrial field, the production of petroleum-based plastics is also increasing. The increase in these plastics, which do not biodegrade in nature, causes environmental pollution and poses a risk to human health. The production and development of environmentally friendly, bio-based, and high-performance composite materials are becoming increasingly significant. In recent years, various studies have been carried out for the production and development of cellulose-based materials used in the production of composite materials and as an alternative to plastics. Cellulose is an inexpensive, renewable, biodegradable, biocompatible, and the most abundant natural polymer in nature, easily sourced from plant, and animal sources as well as bacteria. Cellulose is increasingly preferred in the production of bio-based materials due to its advantages such as high physical and mechanical properties, easy accessibility, and environmental friendliness. One of the biological materials obtained using cellulose is cellulose nanofibrils (NFC). NFCs are nano-sized materials obtained by arranging cellulose molecules ranging from 10-100 nm into very thin long fibers. The fibrils in NFCs can be crystalline or amorphous. NFCs are bio-based nanomaterials that are obtained from cellulose fibers through mechanical, chemical, acid, or enzymatic pretreatments, have high specific strength and stiffness, low thermal expansion and density, and can be used in various fields. NFCs can also be produced from the cellulose in the structure of agricultural and food wastes and thus contribute to the transformation of these products into products with higher economic value. In this study, the potential of using NFCs from various agricultural and food wastes in composite film production will be investigated.

Keywords: Cellulose, cellulose nanofibril, composite film, nanomaterial

1. GİRİŞ

Petrol kaynaklı doğada bozunmayan plastikler çevre kirliliğine sebep olduğu için, son zamanlarda biyo bazlı kaynaklardan, yenilenebilir, biyobozunur, çevre dostu ve düşük maliyetli alternatif malzemeler geliştirmek için yoğun çaba sarf edilmektedir (Xiao et al., 2015). Biyobozunur, yenilenebilir, düşük maliyet ve toksik olmama gibi üstün özelliklere sahip dünyada en çok bulunan biyo bazlı hammaddelerden biri de selüloz polimeridir (Bastante et al., 2021). Selüloz, çeşitli arıtma yöntemleriyle nanoselüloza (NC) dönüştürülebilmektedir. NC'ler, farklı yöntemlerle selüloz nanofibril (NFC), bakteriyel nanoselüloz (BNC) ve selüloz nanokristal (CNC) olmak üzere üç faklı türde sentezlenebilmektedir (Silva et al., 2020).

Nanofibriller, çeşitli işlemlerle (fiziksel, kimyasal ve diğer işlemler) amorf bölgeler boyunca enlemesine bölünerek elde edilen, hemiselülozik matrise bağlanan sert selülozik mikrofibrillerdir. Nanofibriller, yüksek en boy oranına, yüksek spesifik yüzey alanına sahip, düşük maliyetli, toksik olmayan takviye malzemelerdir (do Lago et al., 2020). Nano boyuttaki selüloz liflerinden meydana gelen NFC'ler ise selüloz liflerinin çapının nano boyuta getirilerek küçültülmesiyle üretilmektedir. Mekanik arıtmanın yanı sıra NFC, bazı kimyasal ve enzimatik işlemler kullanılarak da üretilebilmektedir. NFC'lerin elde edilmesinden sonra çeşitli işlemlerle (kimyasal aşılama ve adsorpsiyon gibi) özellikleri değiştirilerek uyumlulukları arttırılmakta ve davranışları değiştirilebilmektedir. Örneğin adsorpsiyon veya kimyasal aşılama ile hidrofilikliği azaltılabilmekte, yeni özellikler kazandırılmakta ve böylece uygulama alanı genişletilebilmektedir (Rol et al., 2019). NFC'ler, yüksek mekanik özelliklere ve bası ütün özleliklere (biyobozunurluk, düşük maliyet, yenilenebilirlik, yüksek mukavemet ve düşük termal genleşme gibi) sahip olduğundan termoplastik matris malzemelerde dolgu maddesi olarak kullanılabilmektedir. Bu özellikler NFC'lerin kompozit malzemeler için iyi bir takviye dolgu maddesi olmasına imkan sağlamaktadır. NFC'lerin kullanıldığı alanlardan birisi de nanokompozit film üretimleridir. Selüloz nanofibrillerin, nanokompozit üretiminde takviye olarak kullanıldığı pek çok çalışma mevcuttur (LakshmiBalasubramaniam et al., 2022; Oun & Rhim, 2015; Qing et al., 2015). Selüloz nanofibriller farklı alanlarda kullanılmakla birlikte yüksek hidrofillik özellikleri ve jel benzeri davranış göstermeleri kullanımlarını sınırlamaktadır (Rol et al., 2019).

NFC'ler filmlere dönüştürülebilmekte ve doğada bozunmayan ve çevre kirliliğine yol açan plastik ambalajların yerine alternatif olarak kullanılabilmektedir. Geleneksel olarak NFC filmler, vakumlu filtreleme, döküm, daldırmalı kaplama, döndürerek kaplama, sürekli kaplama gibi farklı yöntemler kullanılarak üretilebilmektedir. Ancak kullanılan bu yöntemlerin bazı

kısıtlamaları olduğundan geniş ölçekte uygulanamamaktadır. Film üretimlerinde filmlerin homojen olmaması, kaplama işleminden sonra filmlerin filtreden ayrılması gibi bazı sorunlar yaşanmaktadır (Nadeem et al., 2022).

Selülozik nanofibriller, genel olarak katma değeri düşük olan ve çevre sorunu yaratan tarımsal sanayi yan ürünlerinden ve atıklardan elde edilebilmektedir. Dünya çapında yaygın olan tarım ve ormancılık faaliyetlerinden elde edilen bu yan ürünler, kolay bulunabilirlikleri göz önüne alındığında mükemmel sürdürülebilir ve yenilenebilir selüloz kaynaklarıdır (do Lago et al., 2020). Bu çalışmanın amacı çeşitli tarımsal ve gıda atıklarından elde edilen NFC'ler kullanılarak hazırlanan kompozit film üretimlerini incelemektir.

2. SELÜLOZ

Selüloz dünyada en yaygın ve en bol bulunan polimerlerden biridir. Keten, kenevir, pamuk, jüt, yüksek miktarda selüloz içeriğine sahip bitkilerden sadece birkaçıdır. Selüloz, bakteriler ve omurgasız deniz canlıları (*tunicates*) tarafından da sentezlenebilmektedir. Selüloz bir karbonhidrat olarak sınıflandırılmasına rağmen, monosakkaritlerden sentezlenebilmesi veya hidrolize edilebilmesi sebebiyle diğer organik bileşiklerden farklı olduğu vurgulanmaktadır (Verma et al., 2024).

Selüloz, birçok biyolojik atıkta lignin ve hemiselülozdan meydana gelen bir matris ile çevrelenen fibriller halinde bulunmaktadır. Bu atıklardan selülozun ayrıştırılması için bazı yöntemler kullanılmaktadır (buhar patlatma, klor içermeyen yöntem, Organosolv yöntemi ve iyonik sıvılar yöntemi gibi). Fakat bu yöntemlerin, selüloz eldesinde düşük verim ve yüksek maliyet gibi bazı sınırlamaları bulunmaktadır (Zainal et al., 2021).

2.1. Nanoselüloz

Nanoselüloz (NC), son yıllarda çeşitli endüstriyel uygulamalar için dikkat çeken benzersiz özelliklere sahip bir biyomateryal olarak kapsamlı şekilde araştırılmaktadır. NC, doğada bol miktarda bulunan bir polimer olan selülozdan üretilmektedir. Üstün özellikleri arasında yüksek en-boy oranı ve yüksek yüzey alanı, iyi mekanik, mukavemet ve biyouyumluluk özellikleri bulunmaktadır (Leong et al., 2023). Uygulanan ön işleme bağlı olarak, çeşitli bitkisel kaynaklardan ekstrakte edilen iki çeşit nanoselüloz bulunmaktadır: bunlardan biri selüloz nanokristalleri (CNC)'ler diğeri nanofibrillenmiş selüloz (NFC) veya mikrofibrillenmiş selüloz (MFC) olarak da adlandırılan selüloz nanofibrilleri (CNF'ler)'dir. CNC'ler selülozun amorf bölgelerinin kimyasal hidrolizi ile elde edilirken, NFC'ler selüloz süspansiyonunun mekanik bir işleme tabi tutulmasıyla elde edilmektedir. Bakteriyel selüloz çok saf olan ve esas olarak α-selülozdan oluşan ve değiştirilmesini kolaylaştıran üçüncü bir nanoselüloz türünü

oluşturmaktadır. Bu üçüncü tip nanoselüloz, karakteristik şerit benzeri nanofibriller oluşturan bakteriler tarafından üretilir ve bunları elde etmek için mekanik işlemlere gerek yoktur (Rol et al., 2019). NC'ler ham maddelerden enzimatik hidroliz, asit hidrolizi ve mekanik işlemler olmak üzere çeşitli yöntemlerle elde edilebilmektedir. Bu yöntemler ile NC'ler pektin, hemiselüloz veya lignin zincirlerinden ayrılmaktadır. NC eldesinde iki farklı yaklaşım kullanılmaktadır: lignoselülozik biyokütlenin fiziksel veya kimyasal olarak parçalanmasını içeren yukarıdan aşağıya yaklaşım ve oksidasyon fermantasyonu yoluyla bakteriyel selülozu esas alan aşağıdan yukarıya yaklaşımdır. Belirtilen yaklaşımlar NFC'ler, CNC'ler ve BNC gibi farklı nanoselüloz çeşitlerinin elde edilmesine imkan sağlamaktadır (Leong et al., 2023).

2.1.1 Bakteriyel Nanoselüloz (BNC)

Bakteriyel nanoselüloz (BNC), iyi bir esnekliğe, yüksek en-boy oranına, gerilme mukavemetine, yüksek su tutma kapasitesine ve benzersiz özelliklere sahip, oldukça kristalli, yüksek polimerize yapıda bir nanomalzemedir. Yüksek saflıkta selüloz, büyüme ortamına ve fermantasyon işlemlerine bağlı olarak çeşitli fiziksel ve kimyasal özelliklere sahip olarak üretilebilmektedir. Genel olarak güvenli biyomalzemelerden biri olarak kabul edilen BNC, çok çeşitli biyomedikal uygulamalarda kullanılmaktadır (Zhou et al., 2023).

BNC'ler, üstün özelliklere sahiptir ve bitkisel kaynaklardan üretilen nanoselülozdan farklı olarak, lignin ve hemiselülozun uzaklaştırılması için ön işleme gerek olmamaktadır, çünkü ultra ince ağ yapısına sahip saf selüloz ve 20-100'lük karakteristik şerit benzeri mikrofibriller olarak sentezlenmektedir. Daha yüksek su tutma kapasitesi ve hidrofiliklik gibi geliştirilmiş mekanik özelliklere sahip BNC'lerin, bitkiden elde edilenlerle karşılaştırıldığında özellikle farmokoloji, biyoteknoloji, medikal ve gıda endüstrisi, gibi daha geniş alanlarda uygulanması imkanı bulunmaktadır (Fey et al., 2020; Jeremic et al., 2019; Khan et al., 2023; Ullah et al., 2024; Zhou et al., 2023).

2.1.2 Selüloz Nanokristalleri (CNC)

CNC'ler, selülozun amorf kısımlarının kimyasal, fiziksel ve biyolojik işlemlerle ayrıştırılmasıyla üretilen yüksek kristalli çubuk şeklinde nanomalzemelerdir (Zheng et al., 2024). CNC'ler, geleneksel nanomalzemelerle karşılaştırıldığında, iyi biyobozunurluk, yenilenebilir kaynaklardan mükemmel kullanım özellikleri ve çok miktardaki hidroksil gruplarının varlığı sayesinde kolay kimyasal modifikasyon gibi avantajlara sahiptir. Ayrıca selüloz ve türevleriyle iyi bir uyumluluk göstermesi ve yüksek gerilme mukavemeti (10 GPa), yüksek elastik modül (150 GPa) ve yüksek kristallik (%60-%90) gibi yüksek mekanik özelliklere sahip olması sebebiyle CNC'lerin önemi giderek

artmaktadır (Hu et al., 2024). Yüksek lif içeren çeşitli tarımsal ve gıda atıkları CNC üretimi için potansiyel malzemelerdir (Zheng et al., 2024). Domates posası (Moradi & Fathi, 2023), fındık kabukları (Ebrahimi et al., 2024), liçi kabuğu (Ma et al., 2023) gibi bazı gıda atıklarının selüloz nanokristal üretiminde kullanılabileceği bildirilmiştir.

2.1.3 Selüloz Nanofibriller (NFC)

Yeşil ve sürdürülebilir ambalaj malzemelerinin üretilmesinde ilgi çeken malzemelerden biri olan NFC'ler yüzeyindeki çok sayıda hidroksil grubunun varlığı, modifikasyon imkanı ve farklı polimerlerle (örneğin, karboksimetil selüloz (CMC), polivinil alkol (PVA), kitosan gibi) çapraz bağlanarak ilave edildiği kompozit ambalajın mekanik, antioksidan, antimikrobiyal, UV koruyucu, termomekanik ve reolojik özelliklerini geliştirebilmektedir. Gelişmiş biyokütle malzemelerinden biri olan NFC'ler, selüloz liflerinden izole edilebilir ve nano boyutlara (bir mikronun birkaç yüzde biri ve hatta daha küçük) kadar rafine edilebilmektedir. NFC'ler, yüksek basınçlı homojenizasyon, rafinasyon, yüksek yoğunluklu ultrasonikasyon, bilyalı öğütme ve çift vidalı ekstrüzyon dahil olmak üzere farklı mekanik tekniklerle üretilebilmektedir (Lu et al., 2024). NFC'ler, yaklaşık olarak 3 nm çapında hem amorf hem de kristal yapılarda mikro ölçekli uzunluklara sahip, esnek ve uzun liflerden meydana gelen birbirine bağlanmış bir ağdan oluşmaktadır. NFC'ler geniş yüzey alanı, kolay üretim süreci, yüksek en boy oranı, çevreye olan faydaları, yüksek mekanik ve mukavemet özellikleri, düşük maliyet ve sıcaklık stabilizasyonu gibi birçok işlevsel özelliklere sahip nanomalzemelerdir. Bu özellikleri NFC'leri sentetik polimerler için uygun bir alternatif haline getirmektedir (Saberi Riseh et al., 2023). NFC'ler otomobil parçaları, ambalaj ve inşaat malzemeleri gibi alanlar dahil olmak üzere farklı endüstrilerde kullanılmaktadır. NFC'ler kimyasal kaynaklı materyallere olan ihtiyacı en aza indirerek malzemelerin çevreye daha az zarar vermesini sağlamaktadır. NFC'ler ilaç sektöründe, yara iyileşmesinde, doku mühendisliğinde ve biyosensör alanlarında da kullanılmaktadır ve bu alanlarda ileriye dönük çalışmalar yapılmaktadır. Elektriksel iletkenlikleri ve yüksek yüzey alanları nedeniyle NFC'ler, süper lityum iyon piller ve süper kapasitör gibi enerji depolamaya yarayan cihazlarda elektrot olarak kullanılabilmektedirler. İnce gözenek yapıları ve yüksek en-boy oranı sayesinde NFC'ler hava su ve filtreleme sistemlerinde kullanılabilmektedir. Selüloz nanofibriller alanındaki araştırmalar ilerlemeye devam ettikçe, farklı endüstrilerde potansiyel uygulamaları da umut verici olmaktadır (Prasad et al., 2024).

3. NFC ELDE ETME YÖNTEMLERİ

Selüloz polimeri çeşitli kaynaklardan elde edilmektedir. Selüloz kaynakları, doğadaki kökenine göre bitkisel, hayvansal veya bakteriyel olsa da çevre açısından, hammadde seçimini değerlendirmek önemlidir (García et al., 2016). Selüloz polimeri, odun veya bitkilerde lignin ve hemiselülozun kombinasyonu şeklinde bulunmaktadır Selüloz yüksek işlevsellik özellikleri sayesinde birçok endüstriyel alanda kullanılmaktadır. Selülozun kullanımı, nanoselüloza (NC) ve selüloz nanometaryallerine dönüştürüldüğünde daha da genişletilebilmektedir. Rafine etme, homojenleştirme (homojenleştiriciler ve mikroakışkanlaştırıcılar kullanılarak) ve öğütme NFC'lerin üretimi için en yaygın yöntem olarak kabul edilse de üretimlerinde daha faydalı çözümler bulmak için başka yöntemler üzerinde de çalışılmaktadır (Nechyporchuk et al., 2016). Mekanik fibrilasyon NFC'leri selülozik mikrofibrillerden izole etmek için kullanılmaktadır. Homojenleştirme, rafine etme, mikro akışkanlaştırma ve mikro öğütme gibi işlemler selülozik elyafların defibrilasyonu için uygulanan diğer mekanik yöntemlerdir. Mekanik işlemlerde uygulanan kuvvetler NFC'in boyutları ve özelliklerine etki etmektedir. Buhar patlaması, yüksek yoğunluklu ultrasonikasyon, kriyo-ezme ve yüksek hızlı harmanlama da kullanılan mekanik yöntemlerdir. Mekanik işlemler sırasında yüksek enerji tüketimi meydana gelmektedir. Çeşitli kimyasal, fiziksel veya enzimatik ön işlemlerle enerji tüketimi azaltılabilmektedir (Nadeem et al., 2022).

Kullanılan Bazı Yöntemler:

Yüksek Basınçlı Homojenizasyon: Yüksek basınçlı homojenizasyon, en uzun ve en yaygın kullanılan NFC hazırlama yöntemidir. Bu yöntemin prensibi, selüloz dispersiyonunun yüksek basınç koşullarında (>150 MPa) homojenizasyon valfinin küçük akış kanalından tekrar tekrar geçirilmesidir. Bu işlemden elde edilen NFC'lerin büyük boyutta olması nedeniyle tek başına NFC'lerin hazırlanmasında kullanımını kısıtlamaktadır.

Mikro Jet: Yüksek basınçlı homojenleştirme yöntemine benzeyen mikro jet teknolojisinde selüloz dispersiyonu N şekilli veya Y şekilli bir kanaldan ultra yüksek basınç (>300 MPa) kullanılarak birkaç mach hızında geçirilerek NFC'ler üretilmektedir.

Öğütme (Milling): Milling (öğütme) yönteminde esas olarak, elyaf parçacık boyutunu azaltmak amacıyla selüloz elyafını kesmek ve ovalamak için bir taşlama diskinin veya bir planeter bilyenin (gezegen bilyeli değirmen) mekanik kuvveti ve sabit bir yivli diski kullanılır. Öğütme yöntemiyle hazırlanan nanoselülozun parçacık boyutu esas olarak öğütme diskleri arasındaki mesafeye bağlıdır.

Ultrasonik Uygulama: Ultrasonik işlemle NFC'lerin hazırlanması esas olarak sıvıdaki (selüloz dispersiyonu) yüksek enerjili, akustik dalgalar ve yüksek ve düşük frekansların sürekli etkisi altında ses akışı iletimi tarafından oluşturulan bir dizi sürekli büyüyen ve kopan akış alanı kabarcıklarının (kavitasyon) ortak hareketine dayanır. Ultrasonik işlemle elde edilen lifin boyutu ve verimi ultrasonik zamanla ultrasonik güç arasındaki güçlü bir ilişkiye dayanmaktadır.

Düşük Sıcaklıkta Presleme: Düşük sıcaklıkta presleme yöntemi, su veya alkali ile şişirilmiş selüloz dispersiyon sıvısının sıvı nitrojen kullanılarak düşük sıcaklıkta dondurmak, selüloz hücrelerinin içinde buz kristalleri oluşturmak ve ardından yeniden dondurma sisteminde güçlü bir kesme ve darbe uygulanması esasına dayanır. Selülozik hücreler tarafından oluşturulan buz kristalleri kırılgan hale gelir, böylece hücreler kırılır ve nanoselüloz serbest bırakılır ve ayrışır.

Buhar Patlaması: Buhar patlaması yöntemi, selülozun iç yapısını içten dışa doğru yok etmek için içine nüfuz eden yüksek basınçlı buharın hızlı salınımının kullanılması esasına dayanır. Bu yöntem çoğunlukla endüstride bitkilerden selülozu saflaştırmak için kullanılır.

Elektrospinning (Electrospinning): Bu yöntem, selülozun bir çözelti haline getirilmesini gerektirir, ardından güçlü bir elektrik alan ortamı altında iğne şeklindeki enjeksiyon portundan küçük bir selüloz jeti çıkarılarak bir Taylor konisi oluşturulur ve ardından çözelti buharlaştıkça nanoselüloz oluşur. Bu yöntemin en büyük avantajı farklı parçacık boyutlarında ve tekdüze boyutlara sahip nanoselüloz elde edilmesidir.

Çözücü Yöntemi: Çözücü yöntemi elektrospinning yöntemine benzerlik göstermektedir. İlk olarak, selüloz spesifik bir çözücü ile şişirilir ve dağıtılır. Daha sonra selülozu fibrilleştirmek için ultrasonik olarak dağıtılır veya kuvvetlice karıştırılır. Ayrıca, çözünme sistemine çözücü olmayan bir faz eklenmesi selüloz fibrilasyon oranını artırabilir.

İyonik Sıvı Metodu: İyonik sıvı yönteminde ahşap selülozu çözmek ve ayırmak için organik katyonlar veya inorganik/organik anyonlar kullanılır. İmidazol iyonik sıvılar ahşap selülozunun işlenmesinde en yaygın kullanılan iyonik sıvılardır ve selülozun ayrıştırılması için yaygın olarak kullanılırlar. Çözünmeden sonra, selüloz iyon çözeltisi sistemi, selülozun hızla çökelmesini sağlamak ve nanoselülozu hazırlamak için elektrospinning veya püskürtme ile selülozu yeniden çökeltmek için koşulları değiştirir. Bununla birlikte, genellikle, iyonik çözeltisinin oda sıcaklığındaki reaksiyonu yüksek viskozite, düşük katı-sıvı oranı, yüksek fiyat ve toksisite gibi dezavantajlara sahip olduğundan nadiren kullanılmaktadır (Yi et al., 2020).

NFC'nin mekanik işlemlerle üretimi sırasında yüksek enerji tüketimi, NFC'yi enerji verimli yöntemlerle üretmeye odaklanılmasını sağlamaktadır. Kimyasal ön arıtma yoluyla NFC üretimi düşük enerji tüketimi ve fibrilasyonun verimliliğini artıran bir yöntemdir. TEMPO yoluyla

oksidasyon, asetilasyon, karboksimetilasyon ve periodat-klorit oksidasyonu NFC elde etmek için uygulanan kimyasal arıtma yöntemleridir. NFC eldesi sırasında enerji tüketimini azaltmak için kimyasal ön işlemler mekanik işlemden önce uygulanmaktadır (Nadeem et al., 2022).

Enerji talebini azaltmak ve katyonizasyon, karboksimetilasyon ve TEMPO aracılı oksidasyon dahil olmak üzere mekanik etkiyi kolaylaştırmak için izole edilmiş selüloza çeşitli kimyasal işlemler uygulanabilmesi ve giderek daha verimli olmasına rağmen, bu kimyasalların CNF üretimi için kullanılmasıyla ilgili önemli çevresel sorunlara neden olduğu bildirilmektedir. Selüloz fibrilasyonunu mekanik yöntemlerle kolaylaştırmada kullanılan yeni bir yaklaşım olarak enzimatik işlemlerin kullanılabileceği ifade edilmektedir (Rossi et al., 2021). Bu yaklaşım, enzimlerin yüksek substrat özgüllüğü nedeniyle, fibrilasyon için enerji tüketiminin azaltılmasına ve bunun çevre dostu yönlerine bağlı olarak giderek daha fazla ilgi görmektedir. Enzimatik işlemlerle NFC üretim yöntemi, zehirli ve toksik kimyasallar kullanılmadan NFC üretiminde alternatif bir yöntem olarak kullanılmaktadır. Enzimatik işlem, mekanik arıtmadan önce bir ön arıtma yöntemi olarak uygulanmaktadır. Enzim dozajına ve işlem süresine bağlı olarak fibrilasyonun NFC üretimindeki etkinliği değişmektedir. Bu yöntemle daha ince NFC üretilebilmekte fakat liflerin en boy oranının daha düşük olabileceği dikkate alınmalıdır (Nadeem et al., 2022).

Gıda endüstrisinde kullanılan ambalajların, gıdaları dış etkilerden korumasının yanı sıra bir diğer işlevi de içerisindeki içeriğin görülebilmesini sağlayan yüksek şeffaflıkta olmasıdır. Ambalajın geçirgenlik ve bariyer özellikleri, ambalajlanan gıdanın su buharı ve oksijen teması ile bozulmasını engellemede önemli bir konudur (Nguyen et al., 2021).

Günümüzde plastikten üretilen ambalajlar ciddi anlamda çevre kirliliğine neden olmaktadır. NFC'den üretilen filmler petrol bazlı doğada çözünmeyen ambalajlara karşı güvenilir ve çevre dostu birer alternatif olarak görünmektedir. NFC'ler çeşitli yöntemler kullanılarak biyo bazlı filmlere dönüştürülebilmektedir. Bu filmlerin üretiminde kullanılan yöntemlerden bazıları döküm, vakumlu filtreleme, püskürtme, döndürerek kaplama, sürekli kaplama, daldırmalı kaplama gibi uygulamalardır (Nadeem et al., 2022).

4. NFC KOMPOZİT FİLM UYGULAMALARI

NFC'ler yüksek mukavemet, ısı direnci, kolay bozunma ve diğer avantajları ile benzersiz özelliklere sahip doğal selüloz ve nanomalzemelerin optimal kombinasyonu sayesinde plastiklerin yerini almada daha çok tercih edilmektedir. NFC filmler ambalajlama, takviye bileşen olarak ve esnek elektronik cihazlar gibi çeşitli uygulamalarda kısmen plastik filmlerin yerini almaktadır (Shi et al., 2022). NFC takviyeli PVA esaslı kompozit filmlerin şeffaf, hafif,

esnek, doğada parçalanabilir ve şekillenmesi kolay özelliklere sahip olması NFC'yi takviye bileşeni olarak birçok uygulamada (ambalaj malzemelerinin, hassas optik cihazların, otomobil camlarının ve esnek ekranların üretiminde) mükemmel bir aday haline getirmektedir (Xiao et al., 2015).

Yer fıstığı kabuğundan izole edilen selüloz nanoliflerinin biyokompozit elde etmek amacıyla takviye malzemesi olarak kullanıldığı bir çalışmada, yer fıstığı kabuğu kimyasal-mekanik işlemlerden sonra vakumlu emdirim (impregnation) yöntemiyle elde edilmiş selüloz nanoliflerinin 15-20 nm aralığında düzgün çapta olduğu ve biyokompozitlerin ince bir ağ yapısında olmalarını sağladığı bildirilmiştir. FESEM görüntüleri ile lifli parçaların oldukça düzgün yapıya sahip olduğu ve PVA'nın şeffaflığını sağladığı gözlemlenmiştir. Elde edilen kompozit filmlerin optik olarak esnek ve şeffaf olduğu ve NFC'lerle birleştirildikten sonra yüksek termal ve mekanik özellikler gösterdiği anlaşılmıştır. Hazırlanan nanokompozitlerin modül ve çekme mukavameti saf PVA'ya göre 0,6 GPa'dan 6,0 GPa'ya ve 31 MPa'dan 125 MPa'ya kadar yükseldiği ve fiber oranının %80'e kadar arttığı tespit edilmiştir. Işık geçirgenliğinin ise %7 oranında azaldığı ifade edilmiştir. Elde edilen sonuçlara göre elektro-optik ve tıbbi cihaz uygulamalarında kullanılan PVA kompozitlerinde selüloz nanolif takviyesinin yüksek verimlilik özellikleri sağladığı anlaşılmıştır (Wang & Li, 2015).

Selüloz kaynağı olarak atık hindistan cevizi kabuğunun kullanıldığı çalışmada çeşitli kimyasal ön işlemler, hafif TEMPO aracalı oksidasyon (TEMPO/NaClO/$NaClO_2$, pH = 4,8) ve arka arkaya ultrasonik ayırma uygulanarak yüksek katma değerli hindistan cevizi selüloz nanofibrilleri elde edilmiştir. Selüloz nanofibrillerinin kristallikleri, fonksiyonel grupları, termal stabiliteleri ve morfolojileri açısından detaylı bir şekilde karakterize edilmiştir. Dolgu maddesi olarak hindistan cevizi selüloz nanofibrillerinin (CNFC), biyobozunur PVA bazlı filmler için potansiyel takviyesi araştırılmış ve CNFC/PVA kompozit filmlerin kopma uzaması, çekme mukavemeti ve termal stabilitesi gibi özelliklerinin özellikle %3 CNFC uygulandığında önemli derecede arttığı görülmüştür. Ortalama 5,6-1,5 nm çapa sahip hindistan cevizi NFC'lerin yüksek zeta potansiyeli sayesinde sulu ortamda yüksek oranda dağılabildiği ve uygun konsantrasyonda PVA filminin temel özelliklerini güçlendirilebileceği vurgulanmıştır (Wu et al., 2019).

Muz kabuğundan elde edilen selüloz nanoliflerinin (NFC) nanokompozit filmlerde takviye maddesi olarak kullanıldığı çalışmada, NFC'ler muz kabuğundan enzimatik hidroliz yoluyla ayrıştırılmış ve çözücü döküm yöntemi ile NFC'ler hazırlanmıştır. NFC'lerin nanokompozit film özellikleri ve hücre canlılığı üzerindeki etkisi incelenmiştir. NFC'lerin ilave edilmesiyle

hazırlanan kompozit filmlerin topografyası ve pürüzlülüğü, taramalı elektron mikroskobu (SEM) ve atomik kuvvet mikroskobu (AFM) teknikleriyle analiz edilmiş ve filmlerinin mikro yapısını önemli ölçüde değiştiği gözlemlenmiştir. CNF'lerin nişasta matrisine eklenmesinin, muz nişastası filmlerinin su bariyerini ve mekanik direncini arttırmada etkili olduğu ancak nanokompozit filmlerin yüksek opaklık ve düşük parlaklık sergilediği ortaya konulmuştur. Bu sonuçlara göre olgunlaşmamış muz kabuğu, biyobozunur filmlerde matris ve takviye malzemesi olarak kullanılabilecek potansiyel bir NFC kaynağı olarak görülmüş ve gıda ambalaj olarak kullanılabileceği belirtilmiştir (Tibolla et al., 2019)

Mısır samanı çekirdeğine (CSC) NFC ilave edilerek iyi mekanik özelliklere, etkili su buharı bariyeri, yüksek UV bariyeri ve yeterli düzeyde bakteri engelleme özelliklerine sahip nanokompozit filmlerin geliştirildiği bir çalışmada, NFC/CSC filmlerinin yapıları ve CSC ve NFC arasında oluşan reaksiyon FTIR, XRD, SEM, TG VE DMA ile analiz edilmiştir. Analizler sonucunda nanokompozit filmin gerilme ve yırtılma mukavemetinin iyileştiği, su buharı bariyer özelliğinin arttığı, yüksek UV bariyer ve antibakteriyel özellik kazandığı görülmüştür. CNF/CSC filmleri kullanılarak paketlenen sarımsak ve sütün daha az ağırlık kaybettiği, şeklini ve rengini daha iyi koruduğu belirlenmiştir. Ayrıca CNF/CSC filmleriyle paketlenen sarımsak ve sütün CNF filmi kullanılarak paketlenenlere kıyasla daha uzun süre bozulmadan kaldığı ve çeşitli dış faktörlerin (mikroorganizmalar, nem vb.) etkilerinin azaltıldığı tespit edilmiştir. Bu araştırma ile elde edilen NFC/CSC nanokompozit filmin potansiyel gıda ambalaj malzemesi olarak kullanılabileceği bildirilmiştir (Li et al., 2023).

Jackfruit (*Artocarpus heterophyllus*) meyvesinin kabuğuna mum alma, orta dereceli alkali delignifikasyonve hidrojen peroksit ile ağartma gibi ön işlemlerden sonra organik-inorganik karışım asit hidrolizi ve homojenizasyon işlemleri kullanılarak seloloz nanofibrillerin (NFC) ekstrakte edilerek NFC'lerin elde edildiği bir çalışmada NFC'ler TEM, PXRD, TGA/DTA DLS, XRD-EDX ve FTIR ile karakterize edilmiş ve NFC'lerin ortalama çapı 28 nm, kristallik indeksi %87,36 ve kristal boyutu 3.38 nm olarak ölçülmüştür. Elemental analiz sonucunda NFC'lerin %48,02 karbon ve %51,98 oksijen içerdiği ve mükemmel saflıkta olduğu bildirilmiştir. Jackfruit meyve kabuğundan ekstrakte edilen NFC'lerin organik/inorganik nanokompozitlerin sentezinde kullanılabileceği vurgulanmıştır (Rubiyah et al., 2023).

Başka bir çalışmada ise selüloz, mısır sapı, yaprağı ve koçanından oluşan mısır atığından (corn stover) alkali ve delignifikasyon işlemleri ile %93'ün üzerinde saflıkta ekstrakte edilmiştir. Elde edilen selülozun boyutu yüksek basınçlı homojenizasyon yöntemiyle mekanik kesmeyle azaltılmış, homojenizatörden otuz kez geçirilerek selüloz nanofibriller üretilmiştir. Üretilen

NFC'nin uzunlukları mikron olarak ölçülmüş çapları ise 5-50 nm aralığında belirlenmiştir. Mısır atığı selülozundan yüksek basınçlı kesmeyle ve kesmeden üretilen filmlerin mekanik özellikleri karşılaştırılmıştır. Kesilmeden yapılan filmlerin düşük mekanik özellikler sergilediği, selülozdan kesilerek NFC ile üretilen filmlerin ise daha yüksek mekanik özellikler gösterdiği belirlenmiştir (Xu et al., 2018).

Meyan kökü kalıntılarından, soda-antrakinon hamurlaştırma ve ardından peroksiasetik asit ağartma ile enzimatik ön işlem ve yüksek basınçlı homojenizasyondan oluşan bir kombine işlemler neticesinde NFC'nin hazırlandığı bir çalışmada, enzimatik ön işlemlerin meyan kökü hamurundan hazırlanan selüloz nanofibrilleri (ETNFC) üzerindeki etkileri incelenmiş ve ETNFC'lerin net bir nanofibril yapıda olduğu ve yüksek koloidal stabilite gösterdiği anlaşılmıştır. ETNFC filmlerine kitosan nanofibril (CHN) ve lignin nanopartikülleri (LNP'ler) eklenmiş ve CHN veya LNP'lerle birleştirilmiş selüloz kompozit filmlerin iyi termal stabilite ve hidrofobiklik özellikleri gösterdiği belirlenmiştir. ETNFC filmiyle kıyaslandığında, ETNFC@LNPs-%5 filmi daha yüksek UV bariyer yeteneği ve termal stabilite gösterdiği fakat ışık geçirgenliğinin ise azaldığı belirlenmiştir. ETNFC@CHN-%5 filminin de gelişmiş mekanik özellikler ve benzer ışık geçirgenliği gösterdiği bildirilmiştir. Sonuç olarak meyan kökünden elde edilen kompozit filmlerin ambalaj endüstrisinde potansiyel materyaller olarak kullanılabileceği bildirilmiştir (S. Wang et al., 2020).

Pirinç samanından elde edilen NFC'lerin, polikaprolaktonun (PCL) yapısını güçlendirmek için kullanıldığı bir çalışmada, filmler eriyik harmanlama yöntemi ile hazırlanmış ve NFC/PCL kompozit filmlerin yapı ve özellikleri çeşitli yöntemlerle analiz edilmiştir. PCL matrisine az miktarda NFC ilave edildiğinde NFC'nin homojen şekilde dağıldığı, ancak NFC içeriği %5'e ulaştığında ise NFC'lerin kısmen topaklaştığı belirlenmiştir. NFC'lerin eklenmesiyle PCL'nin kristal yapısı ve erime sıcaklığının neredeyse değişmediği ancak NFC/PCL kompozitleri için kristalleşme sıcaklığının ve su absorpsiyonunun arttığı, termal stabilitenin ise azaldığı bildirilmiştir. Kompozit filmlerdeki NFC içeriğinin %10'u geçmesi durumunda gerilme mukavemetinde düşüş olduğu ve yüksek miktarlarda NFC eklemenin ise filmlerde termal stabilite ve hidrofobiklik özelliklerinde olumsuz etkiye neden olduğu tespit edilmiştir. Bu çalışma ile pirinç samanından elde edilen NFC ile takviyelendirilmiş PCL filmlerin çeşitli ambalaj ve biyomedikal alanlarda kullanılabileceği bildirilmiştir (Qiao et al., 2022).

Yulaf samanından NaOH ile alkali muamele ve mekanik defibrilatörden ardışık beş geçiş sonrasında nanofibrillerin elde edildiği çalışmada, işlemler sonunda nanofibrillerin çapında daha fazla azalma meydana geldiği, topaklanmanın azaldığı ve yüksek verimle malzeme elde

edildiği bildirilmiştir. Farklı yüzdelerdeki yulaf samanı nanofibrilleri döküm yöntemiyle hazırlanmış ve manyok nişastası bazlı biyonanokompozitler elde edilmiştir. Bu nanokompozitlerin bariyer özellikleri (su buharı geçirgenliği, temas açısı ve çözünürlük), mekanik özellikleri (young modülü, kopma uzaması, gerilme mukavemeti ve delme kuvveti), renk, opaklık ve morfoloji özellikleri çeşitli analiz yöntemleriyle incelenmiştir. Yulaf samanı NFC'leri, ilave edilmiş filmlerin sertliğinde artış ve buna bağlı olarak esnekliğinde azalma meydana gelmiştir. Yulaf samanı nanofibrilleri ilavesinin artışıyla nanokompozit filmlerin sudaki çözünürlüğü ve su buharı geçirgenliğinin azaldığı belirlenmiştir. Belirlenen etkilerin genellikle NFC ilavesinin %30'dan yüksek olduğu durumlarda görüldüğü ifade edilmiştir. %30-50 oranında NFC ilavesinin bu nanokompozit filmlerin mekanik ve bariyer özelliklerinde iyileşme sağladığı tespit edilmiştir. Yapılan çalışmanın geleneksel polimer malzemelere sürdürülebilir yeni alternatifler kazandırmada önemli olduğu sonucuna ulaşılmıştır (do Lago et al., 2020).

5. SONUÇ

Çalışmanın amacı tarımsal ve gıda atıkları kullanılarak elde edilen NFC'lerin kompozit filmlerin üretiminde kullanılma potansiyelini ortaya koymaktır. Doğada bozunmayan plastik bazlı malzemeler giderek daha ciddi çevresel sorunlara yol açmakta ve bu malzemelere alternatif kullanılabilecek malzeme arayışları devam etmektedir. Plastik bazlı malzemelere alternatif olarak kullanılabilecek biyo esaslı malzemelerin önemi her geçen gün daha iyi anlaşılmaktadır. Doğa dostu, biyouyumlu, biyobozunur özelliklere sahip selüloz esaslı nanomateryallerin kompozit film üretiminde kullanılması ve alternatiflerine kıyasla üstün mekanik, kimyasal ve fiziksel özelliklere sahip olması petrol bazlı malzemelerin yerine kullanılabilecek iyi bir alternatif olduğunu göstermektedir. Bu alternatif biyomalzemelerden birisi de tarımsal ve gıda atıklarından üretilebilen selülozik nanomateryallerdir (CNC, NFC ve BNC). Ancak selülozik nanomateryallerden biri olan NFC'lerin plastik malzemelere alternatif olarak kullanılabilmesi ve yaygınlaşabilmesi için bu konuda daha fazla araştırmaya ihtiyaç duyulmaktadır. Bununla birlikte sürdürülebilir çevre, kaynakların verimli kullanılması ve atıkların katma değerli ürünlere dönüştürülebilmesi açısından tarımsal ve gıda atıklarından NFC'lerin üretilmesinin önemli olduğu sonucuna varılmıştır.

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INSULIN RESISTANCE AND IRON METABOLISM IN DIABETES

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ABSTRACT
Iron is an important trace element for living organisms as it participates in a range of metabolic processes, such as oxygen transport, energy metabolism, nucleotide synthesis, and electron transport, Although vital, excessive amounts of iron can be toxic, therefore, its concentration needs to be maintained within an ideal range. Iron homeostasis is regulated and maintained by iron metabolism. Thus, iron metabolic homeostasis is required for the optimal functioning of fundamental physiological processes. Iron homeostasis in humans is regulated by balancing iron uptake with intracellular utilization and storage. Dietary iron is absorbed by duodenal enterocytes and binds to transferrin in the plasma. Transferrin limits the production of toxic free radicals and is responsible for ferric-ion delivery into cells. The iron homeostasis system maintains transferrin saturation at physiological levels.
Keywords: Diabetes, Insulin resistance, Iron metabolism

The maintenance of iron homeostasis is essential for proper endocrine function. A growing body of evidence suggests that iron imbalance is a key factor in the development of several endocrine diseases. Nowadays, ferroptosis, an iron-dependent form of regulated cell death, has become increasingly recognized as an important process to mediate the pathogenesis and progression of type 2 diabetes mellitus (T2DM). It has been shown that ferroptosis in pancreas β cells leads to decreased insulin secretion; and ferroptosis in the liver, fat, and muscle induces insulin resistance. Understanding the mechanisms concerning the regulation of iron metabolism and ferroptosis in T2DM may lead to improved disease management (Gao H, Jin Z, Bandyopadhyay G, Wang.,2022).

Iron is an important trace element for living organisms as it participates in a range of metabolic processes, such as oxygen transport, energy metabolism, nucleotide synthesis, and electron transport , Although vital, excessive amounts of iron can be toxic, therefore, its concentration needs to be maintained within an ideal range. Iron homeostasis is regulated and maintained by iron metabolism (Kərimova R.C.,Ağayeva A.H.,Quliyeva N.T.,İsmayılova K.İ.,2023).

Thus, iron metabolic homeostasis is required for the optimal functioning of fundamental physiological processes . Iron homeostasis in humans is regulated by balancing iron uptake with intracellular utilization and storage. Dietary iron is absorbed by duodenal enterocytes and binds to transferrin in the plasma. Transferrin limits the production of toxic free radicals and is responsible for ferric-ion delivery into cells (Krümmel B, von Hanstein AS, Plötz T, Lenzen S.,2022).

The iron homeostasis system maintains transferrin saturation at physiological levels. During iron metabolism, less than 10% of the iron demand is met by intestinal absorption, and the remaining iron is exported by ferroportin . Ferroportin is regulated by hepcidin, which is a peptide hormone and is often secreted by hepatocytes . Abnormal iron metabolism mainly presents as iron deficiency or overload , which triggers multiple pathological changes such as ferroptosis. Ferroptosis is an iron-dependent form of non-apoptotic cell death , characterized by iron overload and lipid hydroperoxides accumulation (Santos M, Anderson CP, Neschen S.,2020).

With the continuous development of this research, Dixon et al. first proposed the concept of ferroptosis, based on its distinct morphological characteristics and function in 2012. Ferroptosis was defined as an iron-dependent form of regulated cell death that involves the iron-catalyzed accumulation of lethal lipid peroxides. Under physiological and pathological conditions, cell death is an inevitable and important function in biological processes and marks the end of cell

life. Cells undergoing ferroptosis have different morphological and metabolic characteristics from other known forms of cell death (such as apoptosis, necrotizing apoptosis, and pyroptosis) . Morphologically, ferroptosis mainly occurs in cells, presented as decreased mitochondrial volume, decreased or no mitochondrial cristae, and increased bilayer membrane density; however, the nuclear size remains unchanged . Ferroptosis is regulated by many aspects of iron metabolism, including iron absorption, transport, storage, and utilization (Marku A, Galli A, Marciani P, Dule N.,2021).

In addition, ferroptosis-inducing factors can affect different pathways of glutathione peroxidase directly or indirectly , resulting in a decreased capacity of antioxidants and accumulation of lipid reactive oxygen species (ROS) in cells, culminating in oxidative cell death. Thus, ferrotropis regulation is closely related to the metabolism of iron, lipids, amino acids, and glutathione. Evidence shows that Abnormal ferroptosis is closely related to the occurrence and progression of various diseases, including metabolic diseases, such as T2DM (Gao H, Jin Z, Bandyopadhyay G, Wang G.,2022).

Iron plays an important role in insulin secretion function in pancreas β cells. Tf-Fe^{3+} is absorbed into pancreas β cells through DMT-1 . The pancreas β cells strictly control iron homeostasis, to avoid excessive harmful free iron. Consequently, Fe^{2+} is reserved in the labile iron pool (LIP), where iron is sequestered by ferritin (a unique cytoplasmic iron storage protein) . Fe^{2+} is bound in ferritin for the synthesis of iron-dependent proteins in the cytoplasm or mitochondria . In extracellular, the pancreas β cells release hepcidin, which binds transferrin and induces their internalized (Kim JD, Lim DM, Park KY.,2020).

Studies have shown that transferrin mediates a positive feedback mechanism for iron regulation in the process of glucose-stimulated insulin secretion . Fe^{2+} in the Labile iron pool (LIP) is involved in insulin secretion, via three pathways. Although iron can be found in almost all intracellular organelles, iron is predominantly consumed by mitochondria which is the primary source of cellular iron metabolism. Synthesis of heme and Fe-S clusters, used for electron transport proteins, occurs in the mitochondria. Under high-glucose stimulation, glucose enters the pancreas β cells via glucose transporter 2 (GLUT-2) and undergoes glycolysis before entering the mitochondria, which leads to increased ATP production (Santos M, Anderson CP, Neschen S.,2020).

Numerous studies have shown that ferroptosis plays an important role in the development and progression of type 2 diabetes mellitus (T2DM) and complications (Krümmel B, von Hanstein AS, Plötz T, Lenzen S.,2022).

T2DM is a serious global health concern. Physical inactivity and an unhealthy diet are the major T2DM risk factors, and an increasing disease prevalence is observed in children and younger adults . High levels of ferroptosis, mediated by multiple metabolic pathways and signals, can lead to insulin resistance (IR), abnormal metabolism in the liver and fat, and neurological and vascular diseases. Human blood glucose homeostasis is primarily regulated by insulin and glucagon, which promote glycogen synthesis and breakdown, respectively. It has been shown that iron metabolism is involved in different processes of human glucose metabolism such as insulin secretion , liver metabolism , and fat metabolism , and maintains blood glucose homeostasis in multiple organs and tissues (Gao H, Jin Z, Bandyopadhyay G, Wang G.,2022). The relationships among iron metabolism, T2DM, liver function, and liver injury are complex (Gong Z, Qin Y, Wang Y, Liu X.,2022).

Hepatocytes play a dual role in iron metabolism: they serve as the main site of iron storage and regulate blood iron content by secreting regulatory hormones, such as hepcidin , which controls plasma iron content by binding to transferrin in intestinal epithelial cells and iron circulating macrophages. The binding of transferrin to hepcidin triggers transferrin degradation, thereby reducing transferrin levels. Hepcidin expression is primarily regulated by the BMP-SMAD signaling pathway . In addition, hepatocyte metabolism is regulated by iron. Studies have shown that the iron-sequestering ferritin H chain (FTH) is synthesized in hepatocytes to limit iron-induced hepatic glucose-6-phosphatase (G6Pase) expression and oxidative inhibition. FTH maintains endogenous glucose production, through hepatic gluconeogenesis, which is necessary for hypoglycemic prevention (Tang W, Li Y, He S, Jiang T, Wang N, Du M, et al.,2022).

In multiple models of IR, researchers have found that iron overload leads to the development IR. It was shown that hepatic gluconeogenesis is increased in mouse models of hereditary haemochromatosis . In db/db mice, iron overload aggravates IR and increases hepatic gluconeogenesis . In hypoxia and iron deficiency mouse models, iron restriction caused hypoglycemic, in part due to reduced hepatic gluconeogenesis, possibly due to the activation of the hypoxia-sensing pathway . In the context of the functional interplay between iron metabolism and liver gluconeogenesis, studies have shown that iron can alter the circadian rhythm of hepatic glucose production and affects liver gluconeogenesis(Kərimova R.C.,Hüseynzadə X.R.,2023).

Inappropriate hepcidin synthesis has been shown to play a role in the pathogenesis of T2DM and its complications. Insufficient hepcidin expression results in iron overload, which triggers

ROS synthesis which in turn plays a major role in the pathogenesis of β cell exhaustion and IR-mediated T2DM. Increased hepcidin expression leads to increased intracellular iron sequestration and is associated with T2DM complications (Marku A, Galli A, Marciani P, Dule N.,2021).

A growing number of evidence supports the role of ferroptosis in the initiation and progression of various metabolic diseases such as T2DM. However, several questions need to be addressed before the therapeutic potential of ferroptosis-targeted agents can be clinically evaluated. Plasma ferritin concentration is currently used as a ferroptosis biomarker in preclinical studies. However, it is non-specific and is present in other types of cell death and several pathological conditions. The lack of ferroptosis-specific biomarkers has been a long-standing bottleneck,limiting the development of ferroptosis-targeted clinical applications. To date, no clinical trials have investigated ferroptosis-specific inhibitors for metabolic disease treatment. Most of the research uses selective inhibition of ferroptosis, which has been shown to substantially improve pancreatic β cells function in various animal models. Large population-based datasets are urgently needed to determine whether selectively blocking ferroptosis can improve T2DM and its complications (Tang W, Li Y, He S, Jiang T, Wang N, Du M, et al.,2022).

The relationship between iron metabolism and glucose homeostasis is now widely recognized. Iron has been shown to affect glucose homeostasis in organs and cells, such as pancreas β cells, hepatocytes, and adipose tissue. In addition, iron metabolism is related to the brain-gut axis and circadian rhythm. Iron metabolism disorders result in insufficient insulin secretion and IR; however, the relationship between iron metabolism and T2DM and its complications was unclear until the discovery of ferroptosis. Excess levels of free reactive iron cause tissue damage and oxidative cell death. Different drugs and compounds for lipid peroxidation have been widely studied for the treatment of T2DM induced by iron overload. However, there is a lack of clinical research at this stage and preclinical research is paving the way for the development of effective ferroptosis-specific antagonists for the clinical treatment of T2DM (Gao H, Jin Z, Bandyopadhyay G, Wang.,2022).

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CHARACTERIZATION AND DIAGNOSTIC DETERMINATION OF PHYSIOLOGICAL CHANGES OF PERSISTENT HYPERPLASIA OF THE THYMUS GLAND

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ABSTRACT
Thymic hyperplasia could be true thymic or lymphoid hyperplasia. It is usually found incidentally or could present with compressive symptoms or systemic symptoms due to autoimmune disease like myasthenia gravis. The diagnosis is made through a chest CT or MRI. Treatment for symptomatic patients is mostly thymectomy. This activity describes pathophysiology, evaluation, and management of thymic hyperplasia and highlights the role of the interprofessional team in the evaluation and treatment of patients with thymic hyperplasia. The production of functional T-cell is choreographed by thymic epithelial cells that guide them in proliferation, maturation, and survival. The thymic epithelial cells are compartmentalized into two main populations medullary thymic epithelial cells and cortical thymic epithelial cells. These populations are further segregated into distinct subpopulations having specific molecular and functional roles. There are two major etiologies of thymic hyperplasia. It could be congenital or acquired. The congenital thymic hyperplasia can be hypo functioning or hyperfunctioning and is found to be the result of neuroendocrine disturbances, usually within the hypothalamic-hypophyseal system. Thymic hyperplasia with hypo functioning thymus would lead to immune deficiency. Hyperfunctioning thymic hyperplasia could lead to autoimmune diseases, most commonly myasthenia gravis, but the relationship has also been found with graves' disease and collagen vascular disorders. Acquired thymic hyperplasia can also result in hypo functioning or hyperfunctioning thymus.
Keywords: Thymus gland,Persistent hyperplasia, Physiological changes, Diagnosis

Thymic hyperplasia could be true thymic or lymphoid hyperplasia. It is usually found incidentally or could present with compressive symptoms or systemic symptoms due to autoimmune disease like myasthenia gravis. The diagnosis is made through a chest CT or MRI. Treatment for symptomatic patients is mostly thymectomy. This activity describes pathophysiology, evaluation, and management of thymic hyperplasia and highlights the role of the interprofessional team in the evaluation and treatment of patients with thymic hyperplasia (Jinguji M, Nakajo M, Nakajo M, et al.,2017).

The thymus got its role in T-cell differentiation discovered a few decades ago before the 1960s it was considered vestigial. Though largely known as a lymphoid organ and for its role in T-cell differentiation, thymus also has an endocrine role that includes manufacturing thymosin that regulates T-cell differentiation and other humoral factors that regulate cell growth, maturation and guide the process of mineralization. The thymus is the principal location for T-cell lymphopoiesis (Zhao M, Xing J, Tang X.,2022).

The production of functional T-cell is choreographed by thymic epithelial cells that guide them in proliferation, maturation, and survival. The thymic epithelial cells are compartmentalized into two main populations medullary thymic epithelial cells and cortical thymic epithelial cells. These populations are further segregated into distinct subpopulations having specific molecular and functional roles (Haider U, Richards P, Gianoukakis AG.,2017).

Thymic hyperplasia alludes to an increase in the size of thymus due to an increase in the number of cells. Thymus achieves its peak size around puberty and then atrophies slowly. Thymic hyperplasia is not always pathological, but the growth of the thymus to a certain degree not anticipated for a patient’s age raises the alarm and should lead to further investigation (Kadouri N, Nevo S, Goldfarb Y.,2020).

There are two major etiologies of thymic hyperplasia. It could be congenital or acquired. The congenital thymic hyperplasia can be hypo functioning or hyperfunctioning and is found to be the result of neuroendocrine disturbances, usually within the hypothalamic-hypophyseal system. Thymic hyperplasia with hypo functioning thymus would lead to immune deficiency. Hyperfunctioning thymic hyperplasia could lead to autoimmune diseases, most commonly myasthenia gravis, but the relationship has also been found with graves' disease and collagen vascular disorders. Acquired thymic hyperplasia can also result in hypo functioning or hyperfunctioning thymus (.Priola AM, Priola SM.,2014).

Acquired thymic hyperplasia is usually a rebound phenomenon in patients who have undergone chemotherapy,have had thermal burns, cardiac surgery,or after discontinuation of oral steroids

as the thymus is susceptible to fluctuations in corticosteroids (Kərimova RC.,Ağayeva A,H.,Quliyeva.,2023).

Thymic masses are the most common abnormal growths in the anterior mediastinum. Among the pediatric population, thymic hyperplasia is the most common benign tumor of the anterior mediastinum. In adults, the incidence is increased between the ‘40s and ‘50s; it is similar in men and women. An increased incidence among Asians has been reported compared to other races. Thymic hyperplasia is mostly discovered incidentally in about 50% to 70% of patients with myasthenia gravis. 75% of the patients with myasthenia gravis have thymic disease. Out of 75 %, 85% have thymic hyperplasia, and 10% to 15% have thymoma (Jinguji M, Nakajo M, Nakajo M, et al.,2017).

There are two morphological forms of thymic hyperplasia: It is characterized by an increase in the size and weight of thymus due to an increase in the number of thymic epithelial cells. The normal histology of the thymic cells is preserved. This form of thymic hyperplasia is more prevalent among children and young male patients. It is not associated with autoimmune diseases. The most common presentation of this type is usually respiratory distress or peripheral blood lymphocytosis (Zhao M, Xing J, Tang X.,2022).

Lymphofollicular hyperplasia: It is caused due to hyperplastic lymph follicles within the thymus. The follicles stem in the medulla and interlobular septal space that shifts the parenchyma of the thymus.[These reactive lymphoid follicles are similar to normal follicles. Histologically these lymphoid follicles have numerous diverse lymphoid cells supplemented with germinal center cells of different sizes and macrophages containing cellular debris. Thus, the main characteristic of lymphofollicular thymic hyperplasia is the development of ectopic germinal centers and neo-angiogenesis. This form of thymic hyperplasia is associated with autoimmune diseases like myasthenia gravis or graves' disease (Zhao M, Xing J, Tang X, Sheng X.,2022).

A comprehensive history and a detailed physical examination are necessary to evaluate patients with thymic hyperplasia, focusing on its signs and symptoms. Thymic hyperplasia is usually discovered incidentally after imaging is performed for an unrelated chest complaint. The thymus is located in the anterior mediastinum closely related to airways and major blood vessels. Thymic hyperplasia can compress these structures, causing the following symptoms: Shortness of breath,Dysphagia,Cough,Loss of appetite (Radojevic N, Medenica S.,2017).

The thymus is located near the superior vena cava, and a massive true thymic hyperplasia could compress it, leading to superior vena cava syndrome. The superior vena cava syndrome would present as: Swelling of face, neck, and upper chest,Cyanosis,Headaches,Dizziness.

The lymphofollicular thymic hyperplasia is associated with autoimmune diseases like myasthenia gravis, Graves disease, or collagen vascular disorders. Patients with these autoimmune disorders can present with varying signs and symptoms depending upon the underlying disorder (Farmakidis C, Pasnoor M, Dimachkie MM.,2018).

Myasthenia gravis: It is a neurological autoimmune disease caused by autoimmunity against the acetylcholine receptor component of the neuromuscular junction.
The lymphofollicular form of thymic hyperplasia is evidently involved in the pathogenesis of myasthenia gravis with anti-acetylcholine receptor antibodies.It is characterized by a fluctuating degree and varying amalgamation of weakness in an ocular, bulbar, limb, and respiratory muscles. T-cell dependent autoantibodies attack the acetylcholine receptors on the postsynaptic membrane leading to muscular weakness (Kadouri N, Nevo S, Goldfarb Y.,2020).

Graves disease: The relation between thymic hyperplasia and Graves' disease was first described in 1912. Patients with Graves' disease should undergo a thorough evaluation of thymus. There seems to be a complex hormonal and immunological mechanism involved, but the exact pathogenesis is unclear. Most patients with Graves disease can be diagnosed with thymic hyperplasia by undergoing clinical evaluation and radiological studies. The treatment of hyperthyroidism due to Graves disease leads to the rapid resolution of thymic hyperplasia (Radojevic N, Medenica S.,2017).

Laboratory studies: Acetylcholine receptor antibodies may be positive in some patients with thymic hyperplasia, pointing towards the presence of myasthenia gravis.

Imaging: The thymic hyperplasia is usually discovered incidentally on radiographical imaging for pre-op of some elective surgery or unrelated chest complaints. The findings of a chest radiograph can range from subtle mediastinal findings to large mass or widened mediastinum.

Chest X-Ray: A frontal chest X-ray of infants and young children show a strikingly large thymus and a sail sign can be seen. The thymus normally remains visible on the radiograph till the age of 3 years. On conventional radiography, thymic hyperplasia usually appears normal (Zhao M, Xing J, Tang X, Sheng X.,2022).

Chest CT-scan: Contrast-enhanced computed tomography is typically used for thymic abnormalities not detected on conventional radiography. In most cases, chest CT-scan is diagnostic. Chest CT-scan can provide comprehensive information about mediastinal

abnormality, inclusive of its location, size, relation to surrounding structures, and it can also give you information about the presence of fluid, fat, or calcifications within the tissue. CT-scan of a hyperplastic thymus exhibits diffuse enlargement, preserved contour, normal blood vessels, and a mixture of lymphoid tissue and fat. This precise information is important, especially involvement or compression of related structures in order to plan treatment or resection in severe cases (Budavari AI, Whitaker MD.,2002).

PET-CT: A hyperplastic thymus demonstrates only mild uptake of fluorodeoxyglucose as compared to marked uptake in case of malignancy.

Chest MRI: Chemical shift MRI usually demonstrates chemical shift artifact between in-phase and out of phase images and can help differentiate thymic hyperplasia from thymic neoplasia. It can be challenging to differentiate between normal and hyperplastic thymus; so following guidelines should be used to identify a normal thymus:

Massive thymic hyperplasia: Asymptomatic patients with diffusely enlarged thymus glands can be followed up expectantly because they have a negligible incidence of significant thymic disease. The major treatment of massive thymic hyperplasia is surgical resection (Haider U, Richards P, Gianoukakis AG.,2017).

Lymphofollicular hyperplasia: The management of lymphofollicular type of thymic hyperplasia depends on how it manifests. Depending upon the signs and symptoms, it could have the following approaches towards treatment (Yang J, Liu C, Li T, Li C.,2017).

Myasthenia gravis: Acetylcholinesterase inhibitors such as physostigmine or pyridostigmine could be used for the symptomatic treatment of myasthenia gravis resulting from thymic hyperplasia. These agents act by inhibiting hydrolysis of acetylcholine in synaptic cleft leading to the availability of more acetylcholine to interact with remaining acetylcholine receptors not yet effected by autoantibodies. Corticosteroids can help improve the symptoms of myasthenia gravis, especially in the case of myasthenic crisis. However, the exact mechanism by which steroids act to help with symptoms has not been well understood. Plasma exchange therapy could also help improve symptoms of myasthenia gravis, and it is relatively less costly. Thymectomy is the surgical removal of the thymus gland. There is evidence that thymectomy leads to remission and decreased drug dependency (Kərimova RC.,Ağayeva A,H.,Quliyeva.,2023).

Graves disease: Thymic hyperplasia due to Graves' disease usually resolves as the hyperthyroidism is treated and is under control. Patients with thymic hyperplasia can present differently. The patient could present with compressive symptoms such as dyspnea, dysphagia,

cough, horner syndrome, superior vena cava syndrome, or systemic symptoms like weakness and blurry vision due to autoimmune disease like myasthenia gravis. But usually, the thymic hyperplasia is an incidental finding. The newly diagnosed patient should be given emotional support and detailed information about the condition, its treatment, prognosis, and effects on everyday life (Budavari AI, Whitaker MD.,2002).

Asymptomatic patient: If the thymic hyperplasia is asymptomatic, the patient should be guided about follow up, and observation until the condition remains asymptomatic and steps that will be taken if somehow the condition starts showing symptoms in the future (.Priola AM, Priola SM.,2014).

Compressive symptoms: The patients presenting with compressive symptoms should be informed about the cause of symptoms and the possibility of surgery, i.e., thymectomy, to relieve the symptoms (Farmakidis C, Pasnoor M, Dimachkie MM.,2018).

Myasthenia gravis: Myasthenia gravis patients should be informed about possible associated between thymic hyperplasia and their condition and the possible need for surgery, i.e., thymectomy in the future to improve their symptoms if the medications and plasma exchange therapy fail to improve the symptoms.

Thymic hyperplasia and Graves disease: In the case of thymic hyperplasia associated with hyperthyroidism due to grave disease, the patient should be guided that the hyperplasia will subside if hyperthyroidism is controlled (Zhao M, Xing J, Tang X.,2022).

The patient should be provided with educational material about the disease. Flow charts, diagrams, and videos should be used to explain each and every aspect of the disease, treatment, and lifestyle changes. Until the patient fully understands everything and is satisfied with the provision of care (Yang J, Liu C, Li T, Li C.,2017).

It is the responsibility of healthcare professionals that the patient has a good understanding of the disease and the appropriate treatment available for the disease. Thymic hyperplasia is usually an incidental finding and can cause significant anxiety among patients. It is vital for healthcare providers to provide emotional support to the newly diagnosed patient. The approach to hyperplastic thymus should be multidisciplinary, including primary care physician, physician assistant, nurse practitioner, radiologist, pathologist, thoracic surgeon, neurologist, and an endocrinologist in order to establish a definitive diagnosis and provide appropriate treatment (Zhao M, Xing J, Tang X, Sheng X.,2022).

If the diagnosis of thymic mass is an incidental finding, a biopsy should be performed to differentiate thymic hyperplasia from thymoma or other malignancies and make a definitive

diagnosis. Patients who are asymptomatic and have no local or systemic manifestations can be closely monitored by primary care providers. Patients with serious manifestations such as superior vena cava syndrome or myasthenia gravis should be referred to a thoracic surgeon for thymectomy (Kadouri N, Nevo S, Goldfarb Y.,2020).

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PATHOPHYSIOLOGY, CLINICAL MANIFESTATIONS AND ADIPOSE TISSUE DYSFUNCTION OF METABOLIC COMPLICATIONS ASSOCIATED WITH ADIPOSOGENITAL OBESITY

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ABSTRACT

Obesity is a critical risk factor for the development of type 2 diabetes (T2D), and its prevalence is rising worldwide. White adipose tissue (WAT) has a crucial role in regulating systemic energy homeostasis. Adipose tissue expands by a combination of an increase in adipocyte size (hypertrophy) and number (hyperplasia). The recruitment and differentiation of adipose precursor cells in the subcutaneous adipose tissue (SAT), rather than merely inflating the cells, would be protective from the obesity-associated metabolic complications. In metabolically unhealthy obesity, the storage capacity of SAT, the largest WAT depot, is limited, and further caloric overload leads to the fat accumulation in ectopic tissues (e.g., liver, skeletal muscle, and heart) and in the visceral adipose depots, an event commonly defined as lipotoxicity. Excessive ectopic lipid accumulation leads to local inflammation and insulin resistance (IR). Indeed, overnutrition triggers uncontrolled inflammatory responses in WAT, leading to chronic low-grade inflammation, therefore fostering the progression of IR. Severe obesity is associated with elevated risks of adverse health consequences. The prevalence of obesity is rising worldwide, and if the trend continues, global prevalence will reach 18% in men and 21% in women by 2025 . A positive energy balance between energy intake and energy expenditure results in weight gain and obesity . Many factors, including genetics, epigenetics, and lifestyle factors, have been

implicated in obesity pathogenesis. In most cases, no single factor is exclusively responsible for the development of obesity.

Keywords: Adipozogenital obesity, Metabolic complications, Pathophysiology, Clinical manifestations, Adipose tissue

Obesity is a critical risk factor for the development of type 2 diabetes (T2D), and its prevalence is rising worldwide. White adipose tissue (WAT) has a crucial role in regulating systemic energy homeostasis. Adipose tissue expands by a combination of an increase in adipocyte size (hypertrophy) and number (hyperplasia). The recruitment and differentiation of adipose precursor cells in the subcutaneous adipose tissue (SAT), rather than merely inflating the cells, would be protective from the obesity-associated metabolic complications. In metabolically unhealthy obesity, the storage capacity of SAT, the largest WAT depot, is limited, and further caloric overload leads to the fat accumulation in ectopic tissues (e.g., liver, skeletal muscle, and heart) and in the visceral adipose depots, an event commonly defined as lipotoxicity (Kərimova R.C.,Ağayeva A.H.,Abıyev H.Ə., **Cəfərova Z.İ.**, Məmmədov Ş.Ə.,2023).

Excessive ectopic lipid accumulation leads to local inflammation and insulin resistance (IR). Indeed, overnutrition triggers uncontrolled inflammatory responses in WAT, leading to chronic low-grade inflammation, therefore fostering the progression of IR. This review summarizes the current knowledge on WAT dysfunction in obesity and its associated metabolic abnormalities, such as IR. A better understanding of the mechanisms regulating adipose tissue expansion in obesity is required for the development of future therapeutic approaches in obesity-associated metabolic complications (Biondi, G.; Marrano, N.; Borrelli, A.; Rella, M.;2022).

Severe obesity is associated with elevated risks of adverse health consequences. The prevalence of obesity is rising worldwide, and if the trend continues, global prevalence will reach 18% in men and 21% in women by 2025 . A positive energy balance between energy intake and energy expenditure results in weight gain and obesity . Many factors, including genetics, epigenetics, and lifestyle factors, have been implicated in obesity pathogenesis . In most cases, no single factor is exclusively responsible for the development of obesity. Rather, obesity results from the interaction of these factors and these combinations can vary over time and between individuals . Dietary and lifestyle interventions can be adequate to treat obesity and prevent metabolic alterations. Moderate and progressive weight loss improves metabolic function in different tissues and contributes to dose-dependent changes in the main adipose tissue biological pathways. Nevertheless, these approaches are difficult to maintain in the long term (Porro, S.; Genchi, V.A.; Cignarelli, A.; Natalicchio.,2020).

The primary cause of T2D is obesity-driven insulin resistance (IR) in white adipose tissue (WAT), liver, and skeletal muscle, combined with impaired secretion of insulin by pancreatic β-cells to overcome this resistance . Obesity-induced IR is also linked to a wide cluster of obesity-associated metabolic abnormalities, such as dyslipidemia, non-alcoholic fatty liver disease (NAFLD),

hypertension , coronary heart disease, and stroke (Genchi, V.A.; D'Oria, R.; Palma, G.; Caccioppoli.,2021).

Insulin reduces blood glucose by inducing glucose uptake in insulin-sensitive tissues (skeletal muscle, adipose tissue, and liver) and by inhibiting glucose production in liver. IR occurs when the insulin-sensitive tissues lose insulin response. In this scenario, insulin-mediated glucose uptake is impaired in the insulin target tissues. This failure is a result of the insulin signaling pathway inhibition . Nonetheless, an overall paradigm has been strengthened by many studies over several decades in which overnutrition in predisposed individuals leads to IR in peripheral tissues. This effect increases blood glucose levels, which in turn stimulates the β-cell insulin secretion (Biondi, G.; Marrano, N.; Borrelli, A.; Rella, M.;2022).

There are several hypotheses to explain the mechanisms responsible for IR in obese subjects. These mechanisms include adipose tissue dysfunction/lipotoxicity, inflammation, mitochondrial dysfunction, hyperinsulinemia, and endoplasmic reticulum (ER) stress. Although there is no theory for a unifying mechanism, most of these factors are typically and concomitantly associated with obesity. Here, we review the current knowledge of WAT dysfunction in obesity and its associated metabolic abnormalities (Kaare, M.; Mikheim, K.; Lilleväli, K.; Kilk, K.,2021).

WAT is a complex organ and has primary roles in energy homeostasis control. Adipocytes not only act as a reservoir for energy storage and utilization, but also sense energy demands and secrete paracrine factors to regulate other metabolic tissues. In a high energy state, for example, leptin is secreted from adipocytes to reduce food intake centrally and increase energy expenditure . However, in obesity, WAT may become severely dysfunctional and not expand properly to store the energy excess. This induces ectopic fat deposition in other tissues that regulates glucose homeostasis, an event commonly defined as "lipotoxicity". This mechanism leads to systemic IR and an increased risk of T2D (Porro, S.; Genchi, V.A.; Cignarelli, A.; Natalicchio.,2020).

Numerous deleterious effects have been associated with the unhealthy expansion of the WAT, including inflammation, fibrosis, hypoxia, altered adipokines secretion, and mitochondrial dysfunction, each of which could represent a new therapeutic target in the obesity treatment . In prolonged positive energy balance conditions, adipocytes expand cell size and number to compensate the need for increased lipid storage. These cells inevitably reach a limit at which additional anabolic pressure cannot be accommodated, due to cell and tissue expansion limitations. Reaching this threshold causes stress in adipocytes and initiates an inflammatory program in response to this stress (Genchi, V.A.; D'Oria, R.; Palma, G.; Caccioppoli.,2021).

In obesity, “healthy” WAT expansion is achieved by recruiting and differentiating adipose precursor cells rather than infiltrating fat into mature adipocytes. Alterations in the precursor cell commitment and subcutaneous adipose tissue (SAT) adipogenesis are associated with the metabolic complications of obesity. When the storage capacity of SAT, the largest adipose tissue depot, is exceeded, further caloric overload leads to the fat accumulation in ectopic tissues (liver, skeletal muscle, and heart) as well as in the visceral depots (Fernandes Negris Lima, T.; Nackeeran, S.;2020).

It has been largely demonstrated that excessive lipid accumulation in ectopic tissues leads to local inflammation and IR . The ectopic fat accumulation in the pancreas, for example, contributes to β-cell dysfunction, and recent studies in human have proved that the bariatric surgery can improve β-cell function by decreasing pancreatic fat accumulation . A marker of ectopic fat accumulation in human is the increased visceral/intra-abdominal fat accumulation, associated with abdominal obesity . Independently of body mass index (BMI), adipose tissue dysfunction, increased visceral and ectopic fat accumulation, and inflammation may contribute to unhealthy obesity and associated IR (Kaare, M.; Mikheim, K.; Lilleväli, K.; Kilk, K.,2021).

To review the adipose tissue remodeling in obesity and associated metabolic comorbidities, it is essential to examine how the morphology can change depending on the adipose tissue location. The adipose tissue is classified, according to the regional distribution, as SAT (located under the skin) and visceral adipose tissue (VAT; associated with internal organs), and it is diffused throughout the entire human body . The sites of adipose tissue accumulation are strictly conserved across several species . The development and formation of these two adipose tissue types are different, and even in adult life, they show different functions and structures . Adiposity is a polygenic trait; several genes control phenotypic variability , and multiple pathways regulate its development (Kərimova R.C.,Ağayeva A.H.,Abıyev H.Ə., Cəfərova Z.İ., Məmmədov Ş.Ə.,2023).

Different studies report that fat distribution is strongly associated with IR, the main risk factor for T2D and cardiovascular disease (CVD) . A systematic review and meta-analysis of observational studies by Zhang et al. demonstrates that the accumulation of VAT is the strongest predictor of IR.Nevertheless, obesity indices (total fat mass, BMI, and waist circumference) and adipose tissue depots (intra-abdominal and total abdominal fat) are significantly correlated with IR . Other human studies have also shown that the accumulation of lipids in the abdominal SAT correlates with the onset of IR and T2D. Central adiposity rather than peripheral adiposity is an important risk factor in establishing metabolic diseases (Yu, S.Y.; Choi, Y.; Kwon, Y.I.; Lee, O.-H.; 2021).

In response to a positive energy balance, dynamic mechanisms reorganize the adipose tissue by changing the number and size of mature adipocytes. In the meantime, the precursor cells of the stromal vascular fraction begin to be recruited and committed towards the adipocyte lineage. Hypertrophic adipocytes secrete paracrine factors (hormones and cytokines), which facilitate preadipocytes recruitment and promote their differentiation into mature adipocytes . These events are generally defined as adipose tissue remodeling. In obesity, alteration in adipose tissue remodeling may induce the dysregulation of adipose tissue secreted cytokines, leading to local and systemic inflammation and impaired adipogenesis of precursor cells, as further discussed later in this review (Perrini,S.;Cignarelli,A.;Quaranta,V.N.; Falcone.,2017).

In addition to the regional distribution of fat, the adipocyte morphology (hypertrophy vs. hyperplasia) contributes to the obesity-associated metabolic abnormalities. In a chronic state of positive energy balance, the adipocyte size reaches a critical threshold before recruiting precursor cells to increase the adipocytes number. Spalding et al. demonstrated that the adipocyte number is tightly regulated and determined during childhood, suggesting that the increase in cell size is the main plasticity mechanism in response to an energy imbalance . Adipose tissue hyperplasia is considered as a “recovery mechanism” to overnutrition . The adipocytes that reach the critical cell size become lipid-overloaded and insulin-resistant, and adipose tissue hyperplasia attempts to repair metabolic alterations (Yu, S.Y.; Choi, Y.; Kwon, Y.I.; Lee, O.-H.; 2021).

Pluripotent mesenchymal stem cells (MSCs) can develop into several cell types, including adipocytes, myocytes, chondrocytes, and osteocytes. These stem cells are located in the vascular stroma of adipose tissue as well as in the bone marrow ; indeed, bone marrow-derived cells account for approximately 10% of the SAT cell population and are therefore increased by up to 25% in obese people.MSCs, when appropriately stimulated, undergo a multistep process of commitment in which the progenitor cells become restricted to the adipocyte lineage. Accordingly, adipogenesis can be divided into two phases: commitment (or determination) and terminal differentiation. Determination results in the conversion of the stem cell into a preadipocyte, which cannot be distinguished morphologically from its precursor cell but has lost the potential to differentiate into other cell types. In the second phase, the terminal differentiation, the preadipocyte takes on the characteristics of the mature adipocyte that acquires the necessary machinery for lipid transport and synthesis, insulin sensitivity, and the secretion of adipocyte-specific proteins. All of these steps are controlled by a network of interacting transcription factors operating to coordinate the expression of many hundreds of proteins responsible for establishing the mature fat cell phenotype (Perrini, S.; Cignarelli, A.; Quaranta, V.N.; Falcone.,2017).

For a long time, the role of adipose tissue has been underestimated, and it has been considered a merely storage organ. The obesity pandemic has put a spotlight on adipocyte function, and we now recognize it as an endocrine organ essential in regulating systemic energy homeostasis. Obesity and the associated metabolic diseases are rapidly increasing and, in our opinion, the dysfunction of adipose tissue is the central mechanism for the development of these complications (Fernandes Negris Lima, T.; Nackeeran, S.;2020).

A deep understanding of the molecular mechanisms responsible for adipose tissue dysfunction is needed. Impaired adipose tissue plasticity also synergizes with age-related metabolic defects to exacerbate metabolic disorders. Understanding the molecular alterations that regulate defective adipose tissue plasticity may identify therapeutic targets to enhance the expandability and function of adipose tissue. Lifestyle interventions as exercise and diet are effective in promoting a healthy adipose tissue expansion, although these approaches are difficult to maintain in the long term. Recently, adipogenesis has emerged as a possible therapeutic target to enhance adipose tissue health. Increasing adipogenesis during weight gain can counteract the negative metabolic consequences of obesity. However, a remaining issue is to address these mechanisms in human (Biondi, G.; Marrano, N.; Borrelli, A.; Rella, M.;2022).

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PHYSIOLOGICAL STUDY OF ADRENAL CORTEX DRUG DEFICIENCY

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ABSTRACT
The role of the adrenal glands in your body is to release certain hormones directly into the bloodstream. Many of these hormones have to do with how the body responds to stress, and some are vital to existence. Both parts of the adrenal glands the adrenal cortex and the adrenal medulla perform distinct and separate functions. Cortisol is a glucocorticoid hormone produced by the zona fasciculata that plays several important roles in the body. It helps control the body's use of fats, proteins and carbohydrates; suppresses inflammation; regulates blood pressure; increases blood sugar; and can also decrease bone formation. This hormone also controls the sleep/wake cycle. It is released during times of stress to help your body get an energy boost and better handle an emergency situation. Adrenal glands produce hormones in response to signals from the pituitary gland in the brain, which reacts to signaling from the hypothalamus, also located in the brain. This is referred to as the hypothalamic pituitary adrenal axis. As an example, for the adrenal gland to produce cortisol, the following occurs: The hypothalamus produces corticotropin-releasing hormone (CRH) that stimulates the pituitary gland to secrete adrenocorticotropin hormone (ACTH). ACTH then stimulates the adrenal glands to make and release cortisol hormones into the blood. Normally, both the hypothalamus and the pituitary gland can sense whether the blood has the appropriate amount of cortisol circulating. If there is too much or too little cortisol, these glands respectively change the amount of CRH and ACTH that gets released. This is referred to as a negative feedback loop. Excess cortisol production can occur from nodules in the adrenal gland or excess production of ACTH from a tumor in the pituitary gland or other source.
Keywords: Adrenal gland, Shell layer, Medicinal failure

An adrenal gland is made of two main parts: The adrenal cortex is the outer region and also the largest part of an adrenal gland. It is divided into three separate zones: zona glomerulosa, zona fasciculata and zona reticularis. Each zone is responsible for producing specific hormones.The adrenal medulla is located inside the adrenal cortex in the center of an adrenal gland. It produces stress hormones,including adrenaline.The adrenal cortex and adrenal medulla are enveloped in an adipose capsule that forms a protective layer around an adrenal gland (Kərimova R.C.,Huseynova G.A.,Nəcəfova T.M.,Abıyev H.Ə.,2023).

The role of the adrenal glands in your body is to release certain hormones directly into the bloodstream. Many of these hormones have to do with how the body responds to stress, and some are vital to existence. Both parts of the adrenal glands the adrenal cortex and the adrenal medulla perform distinct and separate functions.Each zone of the adrenal cortex secretes a specific hormone. The key hormones produced by the adrenal cortex include: Cortisol is a glucocorticoid hormone produced by the zona fasciculata that plays several important roles in the body. It helps control the body's use of fats, proteins and carbohydrates; suppresses inflammation; regulates blood pressure; increases blood sugar; and can also decrease bone formation.This hormone also controls the sleep/wake cycle. It is released during times of stress to help your body get an energy boost and better handle an emergency situation (Kərimova R.C.,Abıyev H.Ə.,Hüseynova G.A.,2023).

Adrenal glands produce hormones in response to signals from the pituitary gland in the brain, which reacts to signaling from the hypothalamus, also located in the brain. This is referred to as the hypothalamic pituitary adrenal axis. As an example, for the adrenal gland to produce cortisol, the following occurs: The hypothalamus produces corticotropin-releasing hormone (CRH) that stimulates the pituitary gland to secrete adrenocorticotropin hormone (ACTH). ACTH then stimulates the adrenal glands to make and release cortisol hormones into the blood (Shaffer ML, Baud O, Lacaze-Masmonteil T.,2019).

Normally, both the hypothalamus and the pituitary gland can sense whether the blood has the appropriate amount of cortisol circulating. If there is too much or too little cortisol, these glands respectively change the amount of CRH and ACTH that gets released. This is referred to as a negative feedback loop.Excess cortisol production can occur from nodules in the adrenal gland or excess production of ACTH from a tumor in the pituitary gland or other source.This mineralocorticoid hormone produced by the zona glomerulosa plays a central role in regulating blood pressure and certain electrolytes (sodium and potassium). Aldosterone sends signals to the kidneys, resulting in the kidneys absorbing more sodium into the bloodstream and releasing

potassium into the urine. This means that aldosterone also helps regulate the blood pH by controlling the levels of electrolytes in the blood (Kang TS, Choi HY, Park SH.,2018).

These hormones produced by the zona reticularis are weak male hormones. They are precursor hormones that are converted in the ovaries into female hormones (estrogens) and in the testes into male hormones (androgens). However, estrogens and androgens are produced in much larger amounts by the ovaries and testes. The adrenal medulla, the inner part of an adrenal gland, controls hormones that initiate the flight or fight response. The main hormones secreted by the adrenal medulla include epinephrine (adrenaline) and norepinephrine (noradrenaline), which have similar functions (Alexandraki KI, Grossman A.,2019).

Among other things, these hormones are capable of increasing the heart rate and force of heart contractions, increasing blood flow to the muscles and brain, relaxing airway smooth muscles, and assisting in glucose (sugar) metabolism. They also control the squeezing of the blood vessels (vasoconstriction), helping maintain blood pressure and increasing it in response to stress (Shaffer ML, Baud O, Lacaze-Masmonteil T.,2019).

Like several other hormones produced by the adrenal glands, epinephrine and norepinephrine are often activated in physically and emotionally stressful situations when your body needs additional resources and energy to endure unusual strain. The two common ways in which adrenal glands cause health issues are by producing too little or too much of certain hormones, which leads to hormonal imbalances. These abnormalities of the adrenal function can be caused by various diseases of the adrenal glands or the pituitary gland (Shaffer ML, Baud O, Lacaze-Masmonteil T.,2019).

Adrenal insufficiency is a rare disorder. It may be caused by disease of the adrenal glands (primary adrenal insufficiency, Addison's disease) or by diseases in the hypothalamus or the pituitary (secondary adrenal insufficiency). It is the opposite of Cushing syndrome and is characterized by low levels of adrenal hormones. The symptoms include weight loss, poor appetite, nausea and vomiting, fatigue, darkening of skin (only in primary adrenal insufficiency), abdominal pain, among other.The causes of primary adrenal insufficiency may include autoimmune disorders, fungal and other infections, cancer (rarely), and genetic factors (Paragliola RM, Corsello SM.,2019).

Although adrenal insufficiency usually develops over time, it can also appear suddenly as an acute adrenal failure (adrenal crisis). It has similar symptoms, but the consequences are more serious, including life-threatening shock, seizures, and coma. These may develop if the condition is left untreated. Adrenal insufficiency can also result from a genetic disorder called

congenital adrenal hyperplasia. Children who are born with this disorder are missing an essential enzyme necessary to produce cortisol, aldosterone or both. At the same time, they often experience excess of androgen, which may lead to male characteristics in girls and **precocious puberty** in boys (Paragliola RM, Corsello SM.,2019).

Congenital adrenal hyperplasia can remain undiagnosed for years depending on the severity of the enzyme deficiency. In more severe cases, infants may suffer from ambiguous genitalia, dehydration, vomiting and failure to thrive. Sometimes, adrenal glands may develop nodules that produce too much of certain hormones. Nodules 4 centimeters or larger and nodules that show certain features on imaging increase suspicion for malignancy. Both benign and cancerous nodules may produce excessive amounts of certain hormones, which is referred to as a functional nodule. Functional tumors, malignant tumors or nodules greater than 4 centimeters are recommended to be referred for surgical evaluation(Shaffer ML,Baud O, Lacaze-Masmonteil T.,2019).

Cushing syndrome results from excessive production of cortisol from the adrenal glands. The symptoms may include weight gain and fatty deposits in certain areas of the body, such as the face, below the back of the neck called a buffalo hump and in the abdomen; thinning arms and legs; purple stretch marks on the abdomen; facial hair; fatigue; muscle weakness; easily bruised skin; high blood pressure; diabetes; and other health issues (Alexandraki KI, Grossman A.,2019).

Excess cortisol production can also be triggered by overproduction of ACTH by a benign tumor in the pituitary gland or tumor elsewhere in the body. This is known as Cushing Disease. Another common cause of Cushing syndrome is excessive and prolonged consumption of external steroids, such as prednisone or dexamethasone, which are prescribed to treat many autoimmune or inflammatory diseases (e.g., lupus, rheumatoid arthritis, asthma, inflammatory bowel disease, multiple sclerosis, etc.) (Kang TS, Choi HY, Park SH.,2018).

Hyperaldosteronism results from overproduction of aldosterone from one or both adrenal glands. This is characterized by increase in blood pressure that often requires many medications to control. Some people can develop low potassium levels in the blood, which can cause muscle aches, weakness and spasms. When the cause is adrenal oversecretion, the disease is called Conn syndrome (Martin-Grace J, Dineen R, Sherlock M.,2020).

Pheochromocytoma is a tumor that results in excess production of adrenaline or noradrenaline by the adrenal medulla that often happens in bursts. Occasionally, neural crest tissue, which has similar tissue to the adrenal medulla, may be the cause of overproduction of these hormones.

This known as a paraganglioma (Kərimova R.C.,Huseynova G.A.,Nəcəfova T.M.,Abıyev H.Ə.,2023).

Pheochromocytomas may cause persistent or sporadic high blood pressure that may be difficult to control with regular medications. Other symptoms include headaches, sweating, tremors, anxiety and rapid heartbeat. Some people are genetically predisposed to developing this type of tumor. Malignant adrenal tumors (adrenal cancer), such as adrenocortical carcinoma, are rare and often have spread to other organs and tissues by the time they are diagnosed. These tumors tend to grow fairly large and can reach several inches in diameter (Shaffer ML,Baud O,Lacaze-Masmonteil T.,2019).

Cancerous adrenal tumors can be functional and release excess of one or more hormones accompanied by corresponding symptoms, as listed above. Patients may also experience abdominal pain, flank pain or a feeling of abdominal fullness, especially when the adrenal tumor gets very large. Not all cancers found in adrenal glands originate from the gland itself. The majority of adrenal tumors are metastasis, or cancer spread, from another primary tumor elsewhere in the body (Martin-Grace J, Dineen R, Sherlock M.,2020).

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STRESS-INDUCED DISRUPTION OF THE ADRENAL GLANDS, ONE OF THE MOST IMPORTANT ORGANS FOR PREGNANCY

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ABSTRACT
The Hypothalamic-pituitary-adrenal (HPA) axis is comprised of the hypothalamus, pituitary gland, and adrenal glands. It regulates the body's adaptive response to stress. Stress is a huge factor as it can mess up every single hormone. In particular progesterone, one of the most important hormones for fertility and pregnancy, is not only produced by the corpus luteum of the ovary, but is also produced by the adrenal glands. This means that if you are under a lot of stress then your adrenal glands may have shut down your production of progesterone in favour of stress hormones such as cortisol and adrenaline. I really believe this was a huge factor in my fertility journey and is likely to be a major factor with a lot of women in this day and age. When we are under stress our body tends to shut down our reproductive hormones as getting pregnant is not essential for our survival. The stress response serves to prioritise survival over less essential physiological functions, inclusion growth, and reproduction.
Keywords: Pregnancy, Adrenal glands, Stress, Pathology

The Hypothalamic-pituitary-adrenal (HPA) axis is comprised of the hypothalamus, pituitary gland, and adrenal glands. It regulates the body's adaptive response to stress. Adrenal fatigue, or HPA Axis dysfunction which is otherwise known, is when our adrenal glands function below normal levels, usually as a result of prolonged, chronic stress. The adrenal glands are situated on top of the kidneys and regulate our stress response by producing stress hormones such as cortisol and adrenaline in response to stress. Long term stress can lead to the depletion of the adrenal glands and can result in imbalances in the production of cortisol. When the body is in a long-term stress state, non-essential functions that are not important for immediate survival such as the digestive system, reproduction system, and thyroid start to slow down or switch off altogether (Bernard, V.; Young, J.; Binart, N.,2019).

The hypothalamic - pituitary - adrenal (HPA) axis, when activated by stress, exerts an inhibitory effect on the female reproductive system. Corticotrophin-releasing hormone (CRH) inhibits hypothalamic gonadotropin-releasing hormone (GnRH) and glucocorticoids inhibit pituitary luteinizing hormone and ovarian estrogen and progesterone secretion (Studerus, E.; Ittig, S.; Beck, K.,2021).

The inhibition of luteinizing hormone (LH) can have a negative effect on follicular development and oocyte quality, so if high AMH and low egg quality is an issue for you then it is essential that stress is addressed as HPA Axis dysfunction is connected to poor egg quality. Follicular fluid from follicles whose oocytes were not fertilised had levels of cortisol significantly higher than levels in follicular fluid from follicles containing successfully fertilised oocytes. This suggests that high levels of glucocorticolds negatively influences the ability of an oocyte to become fertilised (Collée, J.; Mawet, M.; Tebache, L.,2021).

Here are some of the most common symptoms of adrenal fatigue or HPA Axis dysfunction: Exhaustion, fatigue,Waking up unrefreshed after a long sleep,3 pm energy crash,Craving sugar, coffee, or salt ,Tired in evenings but gets second wind after 10 pm and stays up late,Hormone imbalances, low progesterone, low thyroid.Infertility and recurring miscarriage .Weight gain, Blood sugar issues (Ibáñez, L.; Oberfield, S.E.,2017).

Without a healthy balance of hormones, getting pregnant or staying pregnant can be a challenge. It is also very hard for anyone to have a healthy hormone balance unless your life is in balance. For optimal hormonal health, we need to balance all areas of our lives, whether physical and emotional. These include:Work and a sense of purpose,Family and relationships,Exercise - not too much or not too little,Diet,Sleep, relaxation, and me-time .Having fun,Gut health, allergies,

and infections,Nutritional deficiencies,Physical alignment and pain (Pandey, A.K.; Gupta, A.; Tiwari.,2018).

Stress is a huge factor as it can mess up every single hormone. In particular progesterone, one of the most important hormones for fertility and pregnancy, is not only produced by the corpus luteum of the ovary, but is also produced by the adrenal glands. This means that if you are under a lot of stress then your adrenal glands may have shut down your production of progesterone in favour of stress hormones such as cortisol and adrenaline. I really believe this was a huge factor in my fertility journey and is likely to be a major factor with a lot of women in this day and age. When we are under stress our body tends to shut down our reproductive hormones as getting pregnant is not essential for our survival. The stress response serves to prioritise survival over less essential physiological functions, inclusion growth, and reproduction (Bernard, V.; Young, J.; Binart, N.,2019).

Stress also leads to an increase in the production of cortisol (a stress hormone) from the adrenal glands, which inhibits the body's main sex hormones GnRH (gonadotropin-releasing hormone) and subsequently suppresses ovulation (by inhibiting the release of LH and FSH). In men, stress can have a negative effect on sperm health. Stress hormones affect the hypothalamus, pituitary glands, and reproductive organs. Chronic stress can lead to adrenal issues, which can downregulate your thyroid gland and lead to an underactive thyroid, which can contribute to fertility issues and affect your energy levels and sense of wellbeing.Stress is not just being busy. If you have an injury, infection, gut issue, or food intolerance that is causing inflammation and uncomfortable symptoms, this is stressful for your body as well. These situations can weaken the immune system and can become a form of stress that impacts your adrenal and thyroid glands (Collée, J.; Mawet, M.; Tebache, L.,2021).

So, if you are on a fertility journey then maybe it is time to take stock and consider what is causing you the most stress in your life, whether it is emotional or physical and what steps do you need to take to try and reduce this (Vander Borght, M.; Wyns, C.,2018).

Although the link between stress and reproductive dysfunction has been well-established and extensively investigated in nonhuman animals, where additional variables can be tightly controlled, the question of whether stress directly impedes fertility in humans remains difficult to conclusively examine (Kərimova R.C.,Vəliyeva Z.Y.,Məşədiyeva Bayramova S.Ə.,2022).

Psychological stress experienced by female or male partners of infertile couples has been associated with lower conception rates in at least some cases. However, there have been a number of methodological challenges and conflicting findings facing research in the area. These

include the lack of prospective longitudinal studies on the general population , the use of nonstandardized measures of stress, and the fact that the majority of human studies have been conducted on couples attending fertility clinics with, likely, underlying physical and/or hormonal causes of infertility. There is also the important consideration that stress is a normal facet of life, thereby making nonstressed control groups very difficult to source. Stress is usually dealt with by an appropriate and regulated neuroendocrine response, but although psychological stress affects us all at some point, individuals differ in the impact this has on their physiology, including fertility. These individual differences may explain why some studies have demonstrated substantial reproductive implications of psychological distress, whereas others have found small effect sizes or no association . It is likely that individuals experiencing extreme or long-term stress or those more vulnerable to its effects may be particularly vulnerable to fertility consequences (Alkadi, H. A.,2020).

Infertility itself can be highly stressful. Many of those who struggle with infertility seek help from assisted reproductive technology treatments. These treatments, including in vitro fertilization, can involve invasive techniques that place an additional burden of stress on the couple in addition to the stress associated with an inability to conceive . The effects of stress may therefore be particularly detrimental for couples undergoing assisted reproductive technology, leading in some couples to more treatment cycles to conceive , resulting in discontinuation of treatment before achieving pregnancy , and potentially contributing to the low overall success rates . Similarly, pre-existing psychological conditions, such as anxiety, depression, and high levels of distress, can have a negative effect on assisted reproductive technology outcomes . The same group was not able to replicate this finding in a separate study in 2009 . However, patients who are prone to anxiety, depression, or high stress levels may particularly benefit from psychosocial support during the treatments (Kərimova R.C., Vəliyeva Z.Y.,Məşədiyeva Bayramova S.Ə.,2022).

Stress itself has been a controversial concept since its first description in physiology by Cannon and Selye early last century . However, a stressor (the stimulus) can broadly be considered an intense, nonroutine challenge to homeostasis resulting in a nonspecific response that includes general activation of the hypothalamic-pituitary-adrenal (HPA) axis and sympathomedullary systems. Each stressor can also activate a more specific signature response. Here we will refer to “stress” as the stimulus and the stress response as the body’s reaction to the stimulus (Ibáñez, L.; Oberfield, S.E.,2017).

Although there are myriad types of stress, they can be loosely categorized into "physical" and "psychological" stress based on the immediacy of the impact on the body and the endocrine and neuronal responses they elicit. Physical stressors (interoceptive, homeostatic, systemic) are those involving an immediate disturbance of tissue integrity and a specific activation of the central amygdala and rostral A1 and A2 brainstem noradrenergic cells in addition to general HPA axis and sympathomedullary activation (Dutta, S.; Sengupta, P.,2021).

Psychological stress (neurogenic, psychogenic, emotional) involves a threat to tissue disturbance rather than a direct injury and a specific medial amygdala and caudal A1 and A2 brainstem noradrenergic pattern of neuronal activation (Alkadi, H. A.,2020).

Acutely, within seconds to minutes, both physical and psychological stress generally activates the sympathomedullary system leading to the release of adrenaline and noradrenaline, which increase heart rate, blood pressure, respiration, and blood glucose levels to facilitate attention and action directed at combatting the stress. Within minutes the HPA axis is activated, with corticotropin-releasing hormone (CRH)- and arginine vasopressin-expressing cells in the medial parvocellular region of the paraventricular nucleus of the hypothalamus stimulating the release of CRH from axonal terminal boutons in the median eminence, which, in turn, stimulates corticotrophs in the anterior pituitary gland to release adrenocorticotropic hormone (ACTH) into systemic circulation. By approximately 20 to 30 minutes after the onset of the stress , ACTH is acting at the melanocortin-2 receptors on the adrenal cortex to stimulate the synthesis and release of glucocorticoids into the circulation. Glucocorticoids remain elevated for ~60 to 120 minutes after the onset of an acute stressor and have roles in immunosuppression, glucose uptake and mobilization, fat storage, and memory consolidation, among others. Glucocorticoids also negatively feed back onto glucocorticoid and mineralocorticoid receptors, chiefly in the hippocampus and hypothalamus, to inhibit further activation of the paraventricular nucleus of the hypothalamus (PVN) so suppressing ongoing activation of the HPA axis once the stressor has been resolved (Vander Borght, M.; Wyns, C.,2018).

The two most supportive nutrients for the adrenal glands are vitamin C and vitamin B5 (pantothenic acid). The adrenal glands need both vitamin B5 (pantothenic) and vitamin C to function optimally and produce adrenal hormones (Dutta, S.; Sengupta, P.,2021).

Vitamin B5 (pantothenic acid): Vitamin B5 (pantothenic acid) enhances adrenal function as it is involved in the production of adrenal hormones that help counteract stress and is involved in energy metabolism. Vitamin B5 is known as the `anti-stress' hormone and a deficiency can

result in adrenal dysfunction. Vitamin B5 is found in many foods and is also manufactured by our gut flora so a deficiency is not that common. However, people who have diets high in refined processed foods and have poor gut health are more likely to be deficient. Some of the best food choices of vitamin B5 are brewers' yeast, liver, egg yolks, fish, chicken, lentils whole grains, cheese, peanuts, cashew nuts, dried beans, green peas, cauliflower, mushrooms, and avocados. Deficiency symptoms include fatigue, depression, allergies, poor digestion, blood sugar issues, vomiting, abdominal cramps, skin problems, tingling in hands and feet, and recurring upper respiratory symptoms (Collée, J.; Mawet, M.; Tebache, L.,2018).

Supplementation with about 500mg of Vitamin B5 can be helpful if fatigue is an issue. If you are supplementing with a single B vitamin it is also important to take a separate B complex with all the B group vitamins in and preferably activated in case of methylation issues. In addition, I like to also supplement with a whole B complex with all the B group vitamins together. This is because the B complex vitamins are a family and work synergistically together and an excess in one B vitamin over the long term can cause deficiencies in others (Pandey, A.K.; Gupta, A.; Tiwari.,2018).

Vitamin C : Vitamin C increases adrenal function as it is involved with the production of adrenal hormones. The adrenal glands store and utilise vitamin C, so when the body is under prolonged stress, vitamin C levels in the adrenal glands can be depleted. This is why it is an essential nutrient to take every day if you are experiencing periods of stress, especially as vitamin C is a water-soluble vitamin that is easily excreted from the body.In terms of fertility, a diet rich in vitamin C can protect against genetic abnormalities in both male and female. The ovaries are very rich in vitamin C which highlights the importance of this nutrient. It helps to promote ovulation and improve progesterone levels by lengthening the luteal phase. Vitamin C deficiency during pregnancy has been linked to an increased risk of miscarriage (Collée, J.; Mawet, M.; Tebache, L.,2018).

In men, it has been shown to help with sperm quality, protect sperm from DNA damage, and keep sperm from clumping together making them more motile.Vitamin C levels in the body are reduced by stress, smoking, and infections. Here are some signs that you could be deficient in vitamin C: poor immunity, poor wound healing, rough bumpy skin, bleeding gums, easy bruising, fatigue, and dandruff. Some of the best sources of vitamin C are: citrus fruits such as oranges, lemons, limes, tangerines, grapefruit, rose hips, acerola berries, strawberries, red and green peppers, broccoli, potatoes, tomatoes, asparagus, and Brussel sprouts (Studerus, E.; Ittig, S.; Beck, K.,2021).

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PDA ESASLI MELAMİN SÜNGERLERİN HAZIRLANMASINDA KATALİZÖR ETKİSİNİN İNCELENMESİ

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Özet
Endüstriyel, mesleki ve evsel faaliyetler gibi farklı kaynaklar sebebiyle petrol, yağ ve organik çözücüler gibi kirleticiler tarafından oluşturulan su kirliliği tüm canlıları ve çevreyi olumsuz etkilemektedir. Bu sorunun çözümüne yönelik olarak, suyun yağsı kirleticilerden etkin bir şekilde arındırılması için bir dizi çalışma yapılmaktadır. Bu çalışmaların bir kısmı, polimerik üç boyutlu sorbentlerin hazırlanması ve yüzey modifikasyonu üzerinedir. Özellikle, yüzey modifikasyonu kullanılarak malzeme yüzeyinin pürüzlülük ve yüzey enerjisi parametreleri ele alınıp su temas açısının 90 ila 150°'nin üzerine çıkarılması ile hidrofobik/süperhidrofobik malzemeler elde edilmesi amaçlanmaktadır. Yaptığımız çalışmanın odak noktası, gelişmiş malzemelerin tasarımı ve uygulaması için etkin bir yaklaşım olan yüzey modifikasyonudur. Bu amaç doğrultusunda, dopaminin alkali sulu ortamda oksidatif polimerizasyonu ile oluşan polidopamin (PDA) ticari melamin sünger (MS) üzerine eş zamanlı kaplanmıştır. Oluşturulan PDA esaslı yüzeyde malzemeye ileri modifikasyonlara olanak tanıyan fonksiyonel gruplar da kazandırılmıştır. Bununla birlikte, dopaminin polimerizasyonuyla ilgili olarak substrat yüzeyinde birikimde sıklıkla karşılaşılan sorunlar ele alınmıştır. Bu sorunların başında, uzun birikim-reaksiyon süresi ve kaplamanın zayıf stabilitesi gelmektedir. Bu problemlerin üstesinden gelinebilmesi için polimerizasyon ortamında reaktif oksijen türleri üretebilecek bir katalizör sisteminden yararlanılmıştır. İlk olarak polimerizasyon süresine katalizör etkisinin incelenmesi için $CuSO_4$, H_2O_2 ve farklı molar oranlarda $CuSO_4$ ve H_2O_2 karışımı reaksiyon ortamına eklenmiştir. Çözeltilerin renk değişimleri ve UV-Vis absorbansları takip edilerek elde edilen sonuçlara göre ortamdaki H_2O_2 miktarı arttıkça PDA için karakteristik olan pikin absorbans değeri artmıştır. Daha sonra, değişen Cu^{2+}/H_2O_2 katalizör oranlarında sentezlenen PDA ile kaplanmış MS'ler hazırlanmıştır ve katalizör oranının mekanik özellikler üzerindeki etkisi incelenmiştir. Bu çalışmanın sonucunda elde edilen ürün, yapısal olarak kararlı bir ara ürün olarak değerlendirilmiş ve ileri modifikasyonlara uygun olduğu tespit edilmiştir. Bu bulgu, su kirliliği sorununa etkili bir çözüm sunma amacıyla literatüre bir katkı yapmayı hedeflemektedir.
Anahtar Kelimeler: dopamin, melamin, katalizör sistemi, mekanik davranış

INVESTIGATION OF CATALYST EFFECT IN THE PREPARATION OF PDA BASED MELAMINE SPONGES

Abstract
Water pollution from various sources, such as industrial, commercial and domestic activities, containing pollutants such as crude oil, oil and organic solvents, adversely affects all living organisms and the environment. In order to address this problem, a number of studies have been carried out to effectively purify water from oily pollutants. Some of these studies focus on the preparation of three-dimensional polymeric sorbents and surface modification. Specifically, the aim is to achieve hydrophobic/superhydrophobic materials by controlling parameters such as surface roughness and surface energy through surface modification, resulting in a water contact angle of 90 to 150° or higher. The focus of our study is on surface modification, which is an effective approach for the design and application of advanced materials. For this purpose, polydopamine (PDA) formed by oxidative polymerisation of dopamine in an alkaline aqueous medium was simultaneously coated onto a commercial melamine sponge (MS). Functional groups were also introduced onto the PDA-based surface to allow further modification of the material. However, the problems often encountered in the deposition on the substrate surface related to the polymerisation of dopamine have been addressed. The main problems are the long deposition-reaction time and the poor stability of the coating. In order to overcome these problems, a catalyst system capable of generating reactive oxygen species in the polymerisation environment was used. Firstly, $CuSO_4$, H_2O_2 and a mixture of $CuSO_4$ and H_2O_2 at different molar ratios were added to the reaction medium to investigate the effect of the catalyst on the polymerisation time. According to the results obtained by monitoring the colour changes and UV-Vis absorbance of the solutions, the absorbance value of the peak characteristic for PDA increased with the increased amount of H_2O_2. Subsequently, MS coated with PDA synthesised at different Cu^{2+}/H_2O_2 catalyst ratios were prepared and the effect of the catalyst ratio on the mechanical properties was studied. The product obtained as a result of this study was evaluated as a structurally stable intermediate and found to be suitable for further modifications. This finding is expected to make a contribution to the literature in order to provide an effective solution to the problem of water pollution.
Keywords: dopamine, melamine, catalyst system, mechanical behaviour

Giriş

Günümüzde yağlı atık suyun deşarjı su kütlelerinin ortamını bozmaya devam etmektedir. Son yıllarda fabrika deşarjları, açık deniz taşımacılığı ve petrol aramaları nedeniyle petrol sızıntıları giderek yaygınlaşmaktadır. Bu durum sadece ekonomi üzerinde olumsuz bir etki ortaya çıkarmakla kalmayıp, aynı zamanda son derece ciddi ekolojik hasara da neden olmaktadır. Yerçekimi yöntemi, santrifüj yöntemi, yerinde yakma yöntemi ve biyolojik arıtma yöntemi gibi geleneksel endüstriyel yağ/su ayırma yöntemlerinin kullanımı kolay olmasına rağmen, düşük ayırma verimliliği, ikincil kirlilik ve yağlı atık su arıtımında düşük geri dönüşüm oranı gibi dezavantajları vardır. Alternatif olarak, halihazırda kullanımda olan bazı sorpsiyon malzemeleri, yüksek maliyet, düşük seçicilik, sınırlı geri kazanılabilirlik ve büyük ölçekli üretimdeki zorluk gibi dezavantajlara sahiptir. Bu nedenle, daha yüksek enerji verimliliği, kullanışlılık, performans ve çevresel özelliklere sahip yeni yağ/su ayırma malzemelerinin geliştirilmesi son yıllarda popüler bir araştırma alanı haline gelmiştir (L. He et al., 2024; Z. He, Wang, & Ma, 2024). Süngerler, köpükler ve aerojeller gibi üç boyutlu sorbentler, yağ/su ayrımı alanında geniş uygulama olanaklarına sahiptir. Bu malzemeler arasında melamin sünger (MS) üç boyutlu gözenekli esnek bir malzemedir. Düşük işlem maliyeti, iyi mekanik özellikler ve esneklik sergilediğinden yağ/su ayırma uygulamalarının ele alınmasında büyük avantajlara sahip olduğu açıktır. Ancak MS'ler amfifilik özelliklerinden dolayı doğrudan yağ ve suyu ayırmak için kullanılamazlar. Bu nedenle denizdeki petrol sızıntılarının, sanayi ve evsel atık yağların arıtılması için belirli yöntem ve malzemelerle hidrofobik olarak modifiye edilmesi gerekmektedir (L. He et al., 2024; Weldemhret, Park, & Song, 2024). Katı bir malzemenin süperhidrofobik özelliklere sahip olması için gerekli iki koşul sırasıyla yüzey pürüzlülüğünün artması ve yüzey enerjisinin azalmasıdır (Getaneh, Temam, Nwanya, Ejikeme, & Ezema, 2023; L. He et al., 2024). MS'nin hidrofobik/süperhidrofobik modifikasyonunda genellikle daldırarak kaplama, karbonizasyon ve yerinde kimyasal reaksiyon teknikleri tercih edilmektedir (Dong et al., 2023; Okutan, 2023; Stolz et al., 2016). Bu tekniklerin arasında yer alan yerinde kimyasal reaksiyon yöntemi, belirli bir substratın yüzeyinde doğrudan kimyasal reaksiyona yönelik bir yöntemdir. Genellikle redoks, polimerizasyon ve plazma biriktirme gibi yöntemleri içerir (L. He et al., 2024).

Yağ/su ayrımı için MS üzerinde yapılan kimyasal modifikasyonları incelediğimizde, biyoyapışkan malzemelerden olan PDA ile yapılan modifikasyon çalışmaları karşımıza çıkmaktadır. Yapısındaki bir protein yardımıyla midyeler, çeşitli substrat yüzeylerine güçlü bir şekilde yapışma gösterirler. Bu proteini moleküler yapısal olarak taklit eden dopamin, kendi

kendine polimerizasyon yoluyla herhangi bir maddeyle sağlam kovalent ve kovalent olmayan ara yüzey etkileşimleri oluşturabilir. Bu bağlamda, MS yüzeyine PDA tabakalarının yapışması, pürüzlülük sağlamak ve MS'nin sonraki kimyasal modifikasyonları için çeşitli fonksiyonel grupların yapıya yerleştirilmesi gibi fırsatlar sunabilir. Ancak dopaminin polimerizasyonuyla herhangi bir substrat yüzeyinde birikiminde karşılaşılan genel sorun uzun birikim-reaksiyon süresi, zayıf homojenlik ve kaplamanın zayıf stabilitesi olarak karşımıza çıkmaktadır (Famkar, Pircheraghi, & Nazockdast, 2022; Jintao Wang et al., 2015). Bu durumda da polimerizasyon esnasında reaktif oksijen türleri üretebilecek bir katalizör sisteminden yararlanılmasıyla daha kararlı ve homojen polimer tabakalarının oluşumu sağlanabilmektedir (Z. Wang et al., 2023).
Bu çalışmada, dopaminin alkali sulu ortamda oksidatif polimerizasyonu ile oluşan PDA'nın ticari MS üzerine eş zamanlı kaplanması esnasında polimerizasyon ortamında reaktif oksijen türleri üretebilecek bir katalizör sisteminden yararlanılmasının mekanik özellikler üzerine etkisi incelenecektir.

Malzeme ve Yöntem

Çalışmada Basotect marka ticari MS, etanol, dopamin hidroklorür, Tris-HCl çözeltisi ve katalizör sistemi olarak $CuSO_4$:H_2O_2 kullanılmıştır. Deneysel çalışmada ilk olarak UV-Vis analiziyle dopaminin polimerleşmesi takip edilmiştir. Farklı oranlarda katalizör sistemi kullanılarak hazırlanan numunelere ait kodlar Tablo 1'de verilmiştir. Daha sonra ticari MS'nin PDA ile modifikasyonu gerçekleştirilmiştir. Son olarak da hazırlanan süngerlere FTIR analizi ve basma testi yapılmıştır (Okutan, 2023).

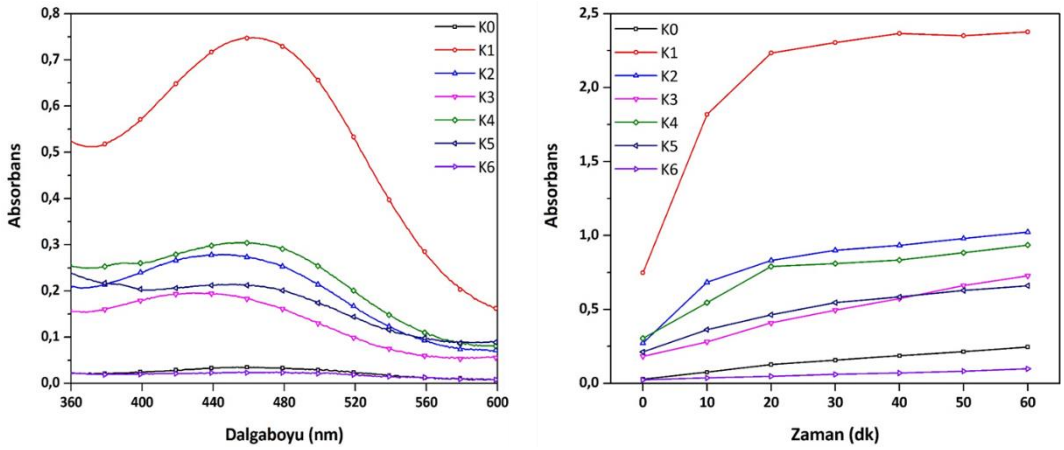
Tablo 1. Numune kodları

Numune Kodu	Katalizör Oranı (M_{CuSO4}:M_{H2O2})
K0	-
K1	1:4
K2	1:2
K3	1:1
K4	2:1
K5	4:0
K6	0:4

Araştırma ve Bulgular

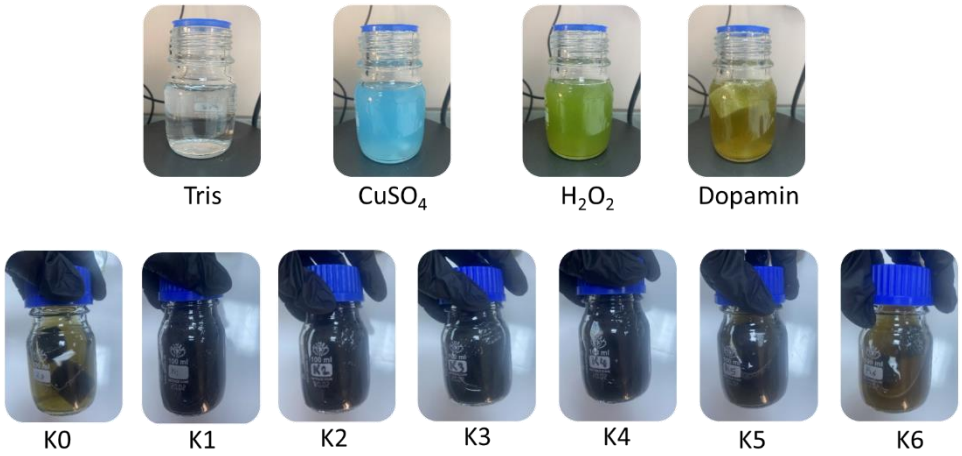
İlk olarak dopamin içeren Tris-HCl çözeltisi hazırlanarak oda sıcaklığında polimerleşmenin zamana bağlı olarak ilerlemesi takip edilmiştir. PDA oluşumu çözelti renginin zamanla siyaha doğru değişmesiyle kendini göstermektedir. İlk 60 dk. içerisinde çözeltiden belirli hacimde alınan numunelere UV analizi yapılmıştır. Dopaminin polimerizasyonuna atfedilebilecek olan absorbans değeri okunarak elde edilen veriler zamana karşı grafiğe geçirilerek meydana gelen değişim incelenmiştir. Benzer şekilde $M_{CuSO_4}:M_{H_2O_2}$ oranı Tablo 1'deki gibi değiştirilip $CuSO_4$:H_2O_2 dopamin çözeltisine ilave edilerek ilgili çözeltilerden alınan numunelere UV-Vis analizi yapılmıştır ve absorbans değerindeki değişim takip edilmiştir (Şekil 1).

Absorbans zaman grafiğinde çeşitli dopamin çözeltilerinin reaksiyon süresine karşı 460 nm'deki absorbans değeri gösterilmektedir. $CuSO_4$:H_2O_2 içeren çözelti 60 dk. içinde siyaha dönüşmüştür ve görünür partiküller oluşmamıştır. UV/Vis spektrumları 460 nm'de dopaminin polimerizasyonuna atfedilen karakteristik bir pik göstermiştir. Absorbans K1 için kademeli olarak yaklaşık 2,5'a kadar yükselmiştir; bu değer diğer çözeltilerden daha yüksektir. Bu süreçte, $CuSO_4$ dopamini oksitlemek için bir oksidan görevi görür ve $CuSO_4$:H_2O_2 dopamin polimerizasyonunu tetiklemek için hidroksil gibi çok sayıda reaktif oksijen türü üretir. Bununla birlikte, dopamin polimerizasyonunun H_2O_2 tarafından bastırılabileceği unutulmamalıdır. Bunun olası bir nedeni H_2O_2'nin dopamin polimerizasyonunun bir ara ürünü olmasıdır; yüksek konsantrasyonu polimerizasyon reaksiyonunu bir dereceye kadar tersine çevirebilir (Zhang et al., 2016). Görüldüğü üzere K6 numunesi katalizörsüz olan K0 dan daha düşük absorbans vermiştir. Sonuç olarak $CuSO_4$:H_2O_2 oranını değiştirerek dopaminin polimerizasyon hızının ayarlanabileceği görülmektedir.



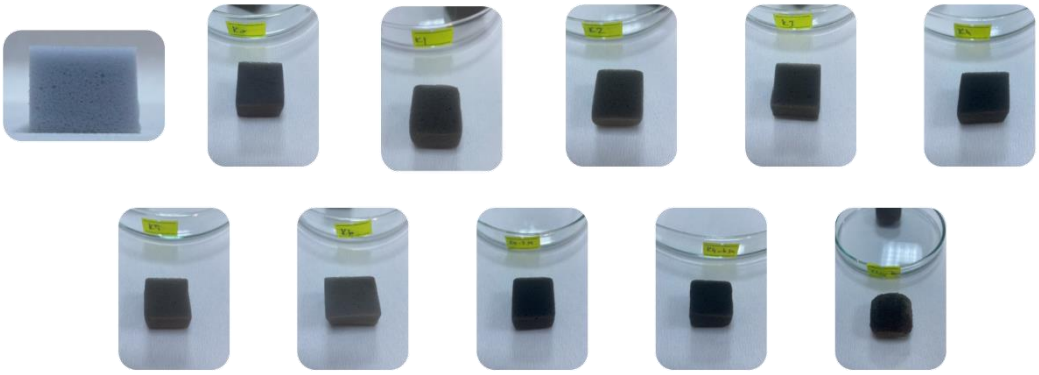
Şekil 1. Farklı oranda katalizör içeren dopamin çözeltilerinin absorbans spektrumu (solda) ve zamana göre absorbanslarında meydana gelen değişim (sağda).

Şekil 2'den Tris-HCl çözeltisine sıra ile $CuSO_4$, H_2O_2 ve dopamin ilavesiyle meydana gelen renk değişimleri ile 1 saat sonunda çözeltilerde gözlenen renk değişimleri görülmektedir. 4:1 $CuSO_4$:H_2O_2 molar oranına göre hazırlanan K1 numunesi UV-Vis grafiğinden en yüksek absorbansa sahip olması nedeniyle en iyi seçim olacağı düşünülmüştür. Yine de MS yüzeyine modifikasyon yapıldığında net durum görülmek istenmiştir ve her oran için MS'ye 1 saat polimerizasyon süresi boyunca PDA kaplanması uygun görülmüştür.



Şekil 2. MS üzerine PDA modifikasyonu.

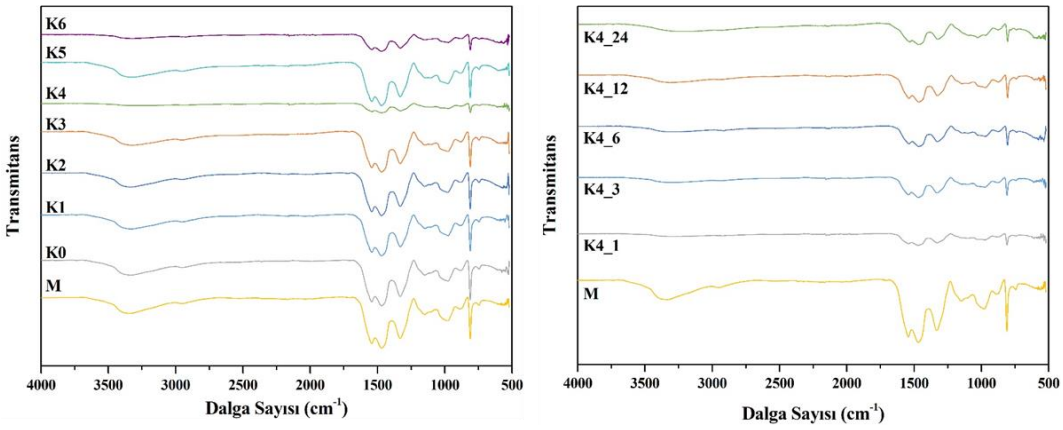
Ön yıkanmış MS'ler belirli miktarda katalizör içeren Tris-HCl çözeltisi içerisine daldırılmıştır. Ardından çalkalayıcılı su banyosunda UV-Vis analizine göre belirlenen süre olan 1 saat ve karşılaştırma için maksimum süre olarak seçilen 24 saat için modifikasyon işlemi gerçekleştirilmiştir. Daha sonra çözeltilerden çıkarılan süngerler yıkama ve kurutma işlemlerine tabi tutulmuştur.



Şekil 3. Üst sıra soldan sağa doğru ticari MS, K0, K1, K2, K3, K4; alt sıra soldan sağa K5, K6, K4(3sa), K4(6sa), K4(24sa) olmak üzere modifiye edilmiş MS'ler.

Şekil 3'de kurutulduktan sonra süngerlerde meydana gelen renk değişimleri modifikasyonsuz süngere nazaran görülmektedir. Burada süngerlerdeki renk değişimine göre UV-Vis analizinde

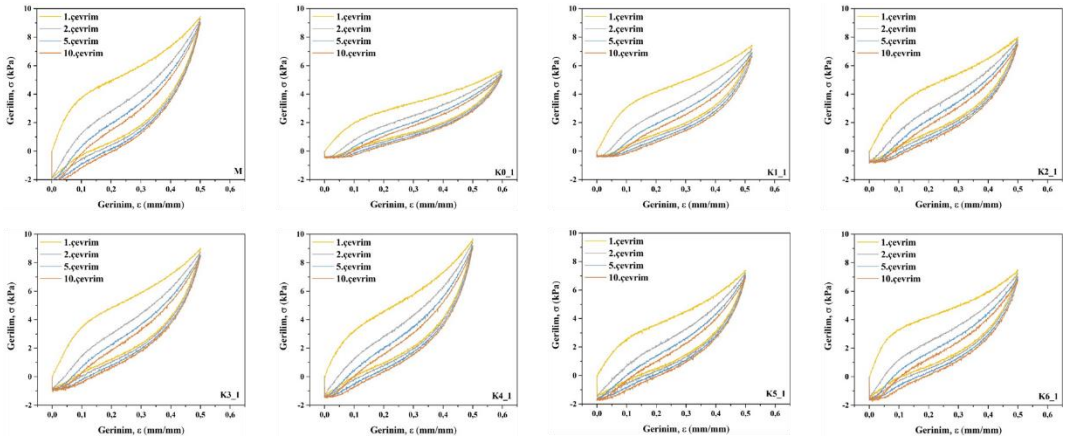
belirlenen K1 yerine K4 numunesi ile devam edilmesine karar verilmiştir. Modifikasyon süresinin etkisi de K4 numunesi ile incelenmiştir. Bu numuneye 3, 6, 12 ve 24 saatlik modifikasyon işlemleri yapılmıştır. 24 saatlik modifikasyon işleminin ardından, uzun süreli çalkalama sebebiyle süngerlerin çoğunda birbirlerine sürtünmelerinden kaynaklanabilecek gözle görülür bir aşınma olduğu tespit edilmiştir.



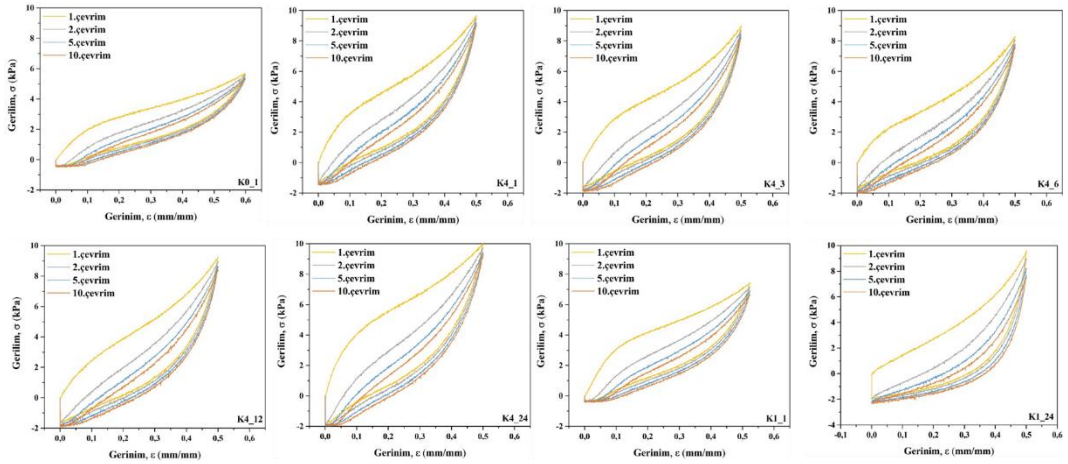
Şekil 4. Tüm numunelerin FTIR spektrumları.

Şekil 4'de tüm numunelere ait FTIR spektrumları verilmiştir. MS sırasıyla triazin halkası bükülmesi ve C-H bükülmesine karşılık gelen 830 ve 980 cm^{-1}'de belirgin pikler göstermiştir. 1370 ve 1453 cm^{-1}'deki pikler C-H deformasyon titreşimine atfedilmektedir. Modifikasyonsuz MS'nin spektrumu 3385 cm^{-1}'de N-H (ikincil amin) gerilmesine atfedilebilen bir pik sergilemiştir. Bu karakteristik piklerin tümü, modifikasyonsuz süngerin bir tür melamin süngeri olduğunu doğrulamaktadır. PDA modifikasyonundan sonra hazırlanan MS'lerin spektrumları modifikasyonsuz olanınkine benzerdir.

PDA, MS ile -OH grupları ve N-H grupları arasındaki hidrojen bağları ve C-H grupları ve N-H grupları arasındaki kovalent bağlar aracılığıyla etkileşime girmektedir. İlk şekilde PDA'nın karakteristik pikleri görülmektedir. N-H gerilmesi haricinde, 3100-3400 cm^{-1}'de geniş pikler O-H germe titreşimlerine atfedilebilir ve PDA'nın hidroksil grubuna karşılık gelmektedir. Bu pikin şiddetinde meydana gelen değişim hidrojen bağının söz konusu olduğuna işaret etmektedir. Bunun dışında belirtmek gerekir ki MS piklerinde çok büyük değişimler söz konusu değildir. Bu durum da fiziksel tutunmanın daha etkin olabileceğini göstermektedir (Mendez et al., 2023; Tan & Zhang, 2022; Jiaqi Wang et al., 2021).



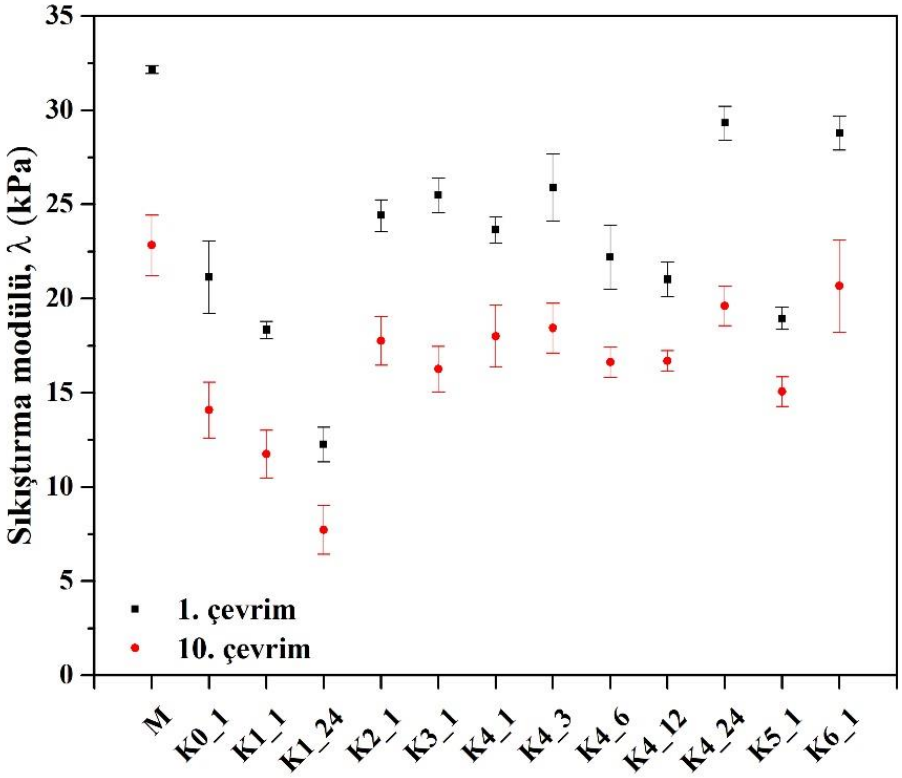
Şekil 5. 1 saat süre ile modifiye edilen süngerlerin döngüsel sıkıştırma eğrileri (soldan sağa olmak üzere üst sıra MS, K0, K1, K2; alt sıra K3, K4, K5, K6).



Şekil 6. Farklı sürelerde modifiye edilen süngerlerin döngüsel sıkıştırma eğrileri (soldan sağa olmak üzere üst sıra K0(1sa), K4(1sa), K4(3sa), K4(6sa); alt sıra K4(12sa), K4(24sa), K1(1sa), K1(24sa)).

Şekil 5 ve 6'da farklı oranlarda katalizör ile hazırlanan numunelerin döngüsel sıkıştırma eğrilerini görmekteyiz. Basma testinde modifiye edilmiş ve edilmemiş süngerlerin mekanik davranışını değerlendirebilmek için süngere belirli bir deformasyon oranı (maksimum %50 gerinim, 5 mm/dk. deformasyon hızı) uygulanmış ve stres (gerilim) tepkisi ölçülmüştür. Şekildeki eğrilerde elastik alana (tersinir deformasyon) karşılık gelen başlangıç bölgesi doğrusaldır. Yükleme ve boşaltma süreci arasında, mekanik enerjinin dağılmasından dolayı test edilen tüm süngerlerin gerilim-gerinim eğrilerinde bir histerez (gecikme) mevcuttur. Bu durum, test edilen süngerlerin enerji yayma özelliklerine işaret etmektedir. 1. ile 2. çevrimler arasında belirgin olarak gözlenen bu enerji, stres altındaki hücre duvarlarının kırılmasından veya viskoelastisiteden kaynaklanabilir. Tüm numunelerde gözlenen ve modifikasyonsuz ticari MS için karakteristik olan bu deformasyon davranışının gözlendiği birinci çevrimden sonraki

çevrimlerde elde edilen sıkıştırma-yük boşaltma çevrimi birinciden farklıdır ve literatürde benzer davranış sergileyen malzemeler bulunmaktadır. PDA ile modifikasyon sonrasında MS'e göre bazı süngerlerde uygulanan maksimum kuvvetin kısmen azaldığı ve şekil değiştirmenin arttığı görülmektedir. Bununla birlikte modifikasyon adımları MS'nin yapısal formunu ve elastik davranışını bozmamıştır. Örneğin katalizörsüz numune olan K0(1sa) 1:4 oranında $CuSO_4$:H_2O_2 katalizörüyle hazırlanan K1(1sa)'e göre daha az kuvvetle daha fazla şekil değiştirmiş, ayrıca tüm katalizörlü numuneler K0'a göre daha yüksek gerilimde şekil değiştirmiştir. MS'nin basma dayanımı %50 gerinimde 9,3 kPa civarında iken, ki bu değer literatürle uyumludur, basma dayanımı K1 için 7,15; K2 için 7,7; K3 için 8,6; K4 için 9,3; K5 için 7,1 ve K6 için 7,0 kPa civarındadır. Katalizör oranı 2:1 iken (K4) gözlenen mekanik davranışın ticari süngere oldukça benzer olduğu değerlendirilmiştir. K6'nın modifiye bir numunedense daha ziyade MS gibi davrandığı düşünülmektedir. Çünkü hem UV analizinden hem de kaplama sonrası renginden PDA kaplamasının kararlı ve homojen olmadığı gözlemlenmiştir. K1 ve K4 kodlu süngerler için farklı sürelerde kaplama sonrası mekanik davranış da incelenmiştir. H_2O_2 yoğun katalizör içeren K1 için 24 saat modifikasyon yapıldığında aynı şekil değiştirme için daha fazla kuvvet uygulandığı görülmektedir, ancak eğrinin eğimi de azalmıştır. Katalizör oranı $CuSO_4$ yoğun olan (2:1 oran) numune K4 için mekanik davranışta çok anlamlı bir değişim olmadığı ancak zamanla eğrinin eğiminin de kısmen arttığı görülmektedir (Okutan, 2023; Okutan et al., 2023).



Şekil 7. %50 gerinim ve 5 mm/dk. deformasyon hızında süngerlerin sıkıştırma modülleri.

Gerilme-gerinim eğrisi, literatürde bildirildiği gibi süngerlerin elastik bükülmesi nedeniyle %10'un altındaki ilk gerinimlerde yaklaşık doğrusal bir elastik rejime sahiptir. Bu son şekilde tüm numuneler için 1. ve 10. çevrimler için sıkıştırma testi gerilim-gerinim eğrilerinden hesaplanan sıkıştırma modülleri verilmiştir. Ticari MS'nin sıkıştırma modülünün hem katalizörsüz hem de katalizörlü ortamda PDA ile modifiye edilen süngere göre görece daha yüksek olduğu ancak 24 saat reaksiyon süresi sonuncunda elde edilen ve 2:1 oranında katalizör içeren örneğinin modülünün ticari örneğe oldukça yakın olduğu tespit edilmiştir. Ek olarak tüm numuneler için 1. ve 10. çevrimler arasında sıkıştırma modülünde meydana gelen azalma yüzdesi ticari numuneye benzerdir. Hatta bazıları için ticari olandan daha azdır. Bu da ilgili numunelerin 10 çevrim sıkıştırma sonrasında mekanik kararlılıklarını işaret etmektedir (Okutan, 2023; Okutan et al., 2023).

Sonuç

Yapılan çalışmada, tüm süngerlerin mekanik davranışı basma testi ile incelendiğinde, bir sıkıştırma çevriminden sonra tüm numunelerin mekanik direncinin azaldığı, bununla birlikte tekrarlanan çevrimlerde iyi geri kazanılmış elastik davranış sergileyen süngerlerin başlangıç şekline büyük ölçüde döndüğü görülmüştür. Katalizör katkısıyla MS yüzeyine kaplanan

PDA'nın H_2O_2 yoğun olmayan katalizör sistemlerinde katalizörsüz olana nazaran daha yüksek kuvvet altında şekil değiştirdiği tespit edilmiştir. Modifiye sünger 10 çevrim sonunda büyük bir yapısal değişime uğramamıştır. Dolayısıyla bu modifiye süngerin muhtemel pratik uygulamalarda çok önemli olan ideal elastikiyet ve basınç dayanıklılığına sahip olduğu düşünmektedir.

Teşekkür

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KARA PARA AKLAMA SUÇU VE İLGİLİ DÜZENLEMELER

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ÖZET
Kaynağı legal olmayan bir paranın legal gösterilerek ekonomik faaliyetlere dâhil edilmesi durumu kara para aklama olarak ifade edilmektedir. Kara para aklama, tarihsel süreç içerisinde farklı medeniyetlerde çeşitli yöntemler ile denenmiştir. Bu durum ekonomik, sosyal ve toplumsal olarak pek çok sorunu da beraberinde getirmiştir. Teknolojinin gelişmesi neticesinde yeni yöntemler ortaya çıkmış ve bu yöntemler para aklama konusunda güncel formatlara uygun hale dönüştürülmeye çalışılmıştır. Modern yöntemler, klasik yöntemlerin güncel halleri gibi işleyişe konu olmuş ve trilyonlarca dolarlık ekonomik maliyeti beraberinde getirmiştir. Kara para aklama faaliyetlerinin minimum seviyeye indirilebilmesi için hem ülkeler kendi yasaları çerçevesinde hareket etmekte olup hem de uluslararası kuruluşlar ülkeler için bazı çözüm önerileri sunmaktadır. Uluslararası kurum ve kuruluşlar kara paraların ülkeler arası hem fiziki hem de dijital ortamda taşınması konusuna özellikle eğilmektedir. Bunun temel nedeni ülkelerarasında ekonomik işbirliklerinin gelişmesi için kara para aklamanın çok ciddi bir tehlike arz etmesidir. Türkiye'nin yeni yöntemlere karşı yasal düzenlemeleri arttırması gerekmekle birlikte uluslararası işbirliği kapsamında diğer ülkelerin hem mali hem de hukuki pozisyonlarından faydalanması gerekmektedir. Uygulanabilecek olası yeni yöntemler kapsamında önceden tedbir alınması, son dönemde kara para aklanması kapsamında oldukça popüler olan kripto para düzenlemelerinin sürekli güncel tutulması ve kara para aklamanın ülke ekonomisine verdiği zararların topluma aktarılması toplumsal reaksiyonlar için elzemdir.
Anahtar Kelimeler: Kara para aklama, uluslararası işbirliği, kripto para

MONEY LAUNDERING CRIME AND RELATED REGULATIONS

ABSTRACT
Money laundering is defined as money laundering when money whose source is not legal is included in economic activities by pretending to be legal. Money laundering has been tried with various methods in different civilizations throughout history. This situation has brought about many economic, social and social problems. As a result of the development of technology, new methods have emerged and efforts have been made to transform these methods into current formats for money laundering. Modern methods operate like the current versions of classical methods and have brought about economic costs of trillions of dollars. In order to minimize money laundering activities, countries act within the framework of their own laws and international organizations offer some solution suggestions for countries. International institutions and organizations pay particular attention to the issue of transferring black money between countries both physically and digitally. The main reason for this is that money laundering poses a very serious danger for the development of economic cooperation between countries. Although Turkey needs to increase legal regulations against new methods, it also needs to benefit from both the financial and legal positions of other countries within the scope of international cooperation. It is essential for social reactions to take precautions within the scope of possible new methods that can be applied, to keep the cryptocurrency regulations, which have recently become extremely popular within the scope of money laundering, constantly updated, and to convey to the society the damage that money laundering causes to the country's economy.
Keywords: Money laundering, international cooperation, cryptocurrency

GİRİŞ

Paranın kaynağını bilme ve bu doğrultuda paranın yolculuğu hakkında bilgi sahibi olmak devletlerin arzuladığı bir durumdur. Bu kapsamda devletler gelirin kaynağını bilerek tüm aşamaların kayıt altında olması yönüne çaba sarf ederler. Yasa dışı yollardan elde edilen ya da yasa dışı yollardan elden çıkarılmaya çalışılan paralar kara para kapsamına girmektedir. Kara paranın legal hale getirilmesi yani aklanması pek çok farklı yöntemle olabilmektedir. Geleneksel yöntemlerin etkisi azalmamakla birlikte sürekli yeni aklama yöntemleri ortaya çıkmaktadır. Özellikle teknolojik gelişmeler, bankacılık sektörünün ilerlemesi, sigortacılık sektörünün kapsamının genişlemesi, kripto paraların barındırdığı özellikler, kara para aklamanın yöntem değiştirmesine neden olmaktadır. Klasik yöntemler ile nakit paranın ülke dışına çıkarılma çabası, yerini dijital ortamda yeni yöntemlere bırakmış ve bu durum paranın takibini zorlaştırmıştır. Kara para aklama suçunun önüne geçebilmek için var olan kanuni düzenlemelerin yeterli olmadığı dönemlerde kanunlar güncellenmiş ve kapsam genişletilmiştir. Bununla birlikte özellikle uluslararası işbirlikleri büyük önem arz etmektedir. Vergi cennetlerinin sürekli olarak yatırımları ülkelerine alabilme çabalarının yanında kimi dünya ülkeleri de kaynağını sorgulamadan bazı durumlara göz yummaktadırlar. Paranın takibinin yapılması, suç teşkil eden bir para için gerekli yaptırımların yapılması uluslararası işbirliğine ihtiyaç duyulan bir husustur. Aklama işleminin her aşamasında uluslararası işbirliğinin olması kara para aklamanın önüne geçmekte ve ülke ekonomilerinin zarar görmesini engellemektedir.

Kara Para Aklama ve Tarihsel Süreci

Kara para hacmi sürekli büyümektedir. Bununla birlikte devletler kara para ile mücadele konusunda yeni adımlar atmakta ve yeni çözümler geliştirmektedir. Kara para kapsamlı, elde edilen gelirler ülkeleri sosyal, siyasal ve ekonomik anlamda tehdit etmekte olup özellikle son yıllarda teknolojinin etkisiyle ortaya çıkan dijital yöntemler mücadelenin farklı bir boyuta geçmesi sonucunu ortaya çıkarmaktadır. Kara para hacminin büyümesi ve ilgili paraların ülkeler arasında yer değiştirmesi pek çok ülkede huzursuzluk yaratmakta ve bu kapsamda yeni politikalar ortaya konma zorunluluğunu getirmektedir (Ünlü, 2019). Suç teşkil eden bir eylemden elde edilen bir gelirin yasal olmayan kaynağının gösterilmemesi maksadıyla, legal bir kaynak aracılığıyla elde edilmiş gibi ortaya konması kapsamındaki işlemler ve eylemler aklama olarak ifade edilmektedir. Kara para aklama kavramı bununla birlikte gerçek ve tüzel kişilerin suçlarını saklamak ya da illegal yöntemlerle elde edilen gelirlerine legal bir görüntü kazandırarak elde edilen varlıkların kaynağını, hareket sürecinin ve kime ait olduğunu gerçek durumundan ayrı bir biçimde ortaya konan süreçleri belirtmektedir (Aydoğan, Akpınar, 2016).

Tarihsel süreç içerisinde kara paraya M.Ö 2000'li yıllarda rastlanılmaktadır. O dönemde Çinli tüccarların kara para aklama çabaları ile günümüzdeki yöntemler arasında bir takım benzerlikler bulunmaktadır. Mali literatüre kara paranın girişi ise 1970'li yıllardan itibaren olmuştur. Mali para o dönemlerde haksız kazanç ile birlikte rekabette de olumsuzlukları beraberinde getirmiştir. 1980'lerden itibaren teknolojik gelişmeler ile birlikte piyasalar gelişmeye başlamış, illegal yollardan elde edilen paralar aklanarak mali sistemlere entegre edilmeye başlamıştır (Doğan, Yıldız, 2021).

Karapara Aklama Aşamaları

Karapara aklama genel itibariyle üç aşamada yapılmaktadır. Bu aşamalar sırasıyla yerleştirme, ayırma ve bütünleştirme aşamalarıdır.

Yerleştirme

Genel itibariyle fazla miktarda ve nakit olan paralar suç kaynaklı kara para potansiyeli barındırmadırlar. Bireyler nakit olmayan araçlar ve kredi kartı gibi farklı yöntemler kullandıklarından dolayı yüklü miktardaki nakit paralar dikkat çekmektedir. İlgili paranın nakit halden kurtulabilmesi için mali sisteme dahil edilmesi veya yurtdışına çıkarılması amaçlanır. Kara para aklayanlar için en zor, aklamayı engellemek isteyen merciiler için ise kolay olan bu yöntem yerleştirme olarak adlandırılmaktadır (Başak, 1998).

Ayırma

Ayırma aşamasında nakit olmaktan çıkan paranın mevcut kaynağından uzaklaştırarak yetkili makamların paranın izini kaybettirme amacı vardır. Böylelikle paranın bulunmasının imkansız hale gelmesi amaçlanmaktadır. Bu aşamada para bankacılık sistemine entegre edilmiş ise kaynaktan uzaklaştırmak daha kolay hale gelmektedir. Burada karmaşıklık, sıklık ve hacim ile ilgili mali işlemler yapılmakta ve denetimden sorumlu kurumların paranın izini kaybetmesi amaçlanmaktadır (MASAK, 2024).

Bütünleştirme

Yerleştirme ve ayırma aşamalarının ardından son aşama olarak bütünleştirme aşaması gelmektedir. Bu aşamada yasal bir zemine oturtulmuş bir varlıktan bahsetmek mümkündür. Kara para kaynaklı herhangi bir yatırımın hangi para ile yapıldığı veya paranın kaynağının ne olduğu sorularına maruz kalmamak adına kara para suçtan uzaklaşmış bir forma gelmektedir. Yine burada diğer bir önemli nokta ise ülkede yapılan yatırımın karşısında sessiz kalınmasıdır. Küresel rekabet kapsamında bazı ülkeler yatırımcıları ilgili sorularla karşı karşıya bırakmaktan imtina etmektedir (Kara, 2018).

Karapara Aklama Yöntemleri

Karapara aklamanın çeşitli yöntemleri bulunmaktadır. Bu para aklama yöntemlerinin bazıları klasik yöntemler olmakla birlikte uzun yıllardır bu yöntemler kullanılmaktadır. Klasik para aklama yöntemleri arasında şirinler yöntemi, parçalama yöntemi, vergi cennetleri yöntemi, oto finans borç yöntemi, hayali ithalat-ihracat yöntemi, paravan şirketler ile para aklama yöntemi, kumarhaneler aracılığıyla kara para aklama yöntemi ve fiziki olarak parayı yurtdışına çıkarma yöntemi bulunmaktadır (Ünlü, 2019). Teknolojinin gelişmesi ile birlikte dijitalleşme, beraberinde pek çok yöntemi de beraberinde getirmiştir.

Kriptoparaların kullanılması ve yaygınlaşması süreci son dönemde en popüler olan yöntemler arasında sayılmaktaktadır. Bitcoin'in sahip olduğu bir takım özellikler karapara aklama ile ilgili cezbediciliği de beraberinde getirmektedir. Bitcoin'in dijital olması, merkezi olmaması, anonimliğinin bulunması, tüm kullanıcıların özel şifrelerinin bulunması, gönderilirken herhangi bir ülke sınırlamasının bulunmaması, işlem hızlarının yüksek olması ve özellikle kripto para transferlerinde işlem ücretlerinin düşük olması kara para aklamak isteyen bireylerin ve şirketlerin ilgisini çekmektedir (Oral, Yeşilkaya, 2021).

Son yıllarda kullanılan bir diğer yöntem ise sigortacılık kapsamındaki kara para aklama yöntemleridir. Sigorta sektörünün her geçen gün büyümesi kara para aklamak isteyenlerin ilgisini çekmektedir. Özellikle sahte hasarlar kapsamında kara para aklanmakta ve ülke ekonomilerine zarar verilmektedir. Sigorta şirketlerinin fonlarını transfer edebilmeleri ve farklı yatırım araçları kullanmaları durumları da kara para aklanmasında kullanılan aracı unsurlar arasında yer almaktadır (Aydoğan, Akpınar, 2016).

Kara Para Aklama ile ilgili Mevzuatı

Yeni dünya düzeni içerisinde ekonomik hayata yeni yöntemler eklenmesi, finans piyasalarında derinleşmenin olması, teknolojinin ilerlemesi gibi hususlar hem bölgesel, hem ulusal hem de uluslararası işbirliklerinin önemli hale gelmesine neden olmaktadır. Kara para aklanmasının önlenmesi kapsamında ülkelerin kanunlarının paralel ve uyumlu olması mücadele kapsamında büyük önem arz etmektedir (Çelik, Koçağra, Güler, 2000).

Türkiye'de suçtan kaynaklı olarak elde edilen gelirin aklanması kapsamında ilk olarak 19.11.1996 tarih ve 4208 sayılı Kara Paranın Aklanmasının Önlenmesine Dair Kanun yürürlüğe girmiştir. İlgili Kanun'un kapsamında suç kapsamında sayılan fiiller neticesinde elde edilen paralar, bütün kıymetli evraklar, mallar, para birimlerinin dönüşümleri neticesinde elde edilen menfaatler yer almaktadır (Erdağ, 2007). 4208 sayılı Kanun'un bazı hususlarda eksik kalması yeni bir kanun ihtiyacını beraberinde getirmiştir. Bu doğrultuda 11.10.2006 tarihinde 5549

Sayılı Suç Gelirlerinin Aklanmasının Önlenmesi Hakkında Kanun kabul edilmiştir. İlgili Kanun 18.10.2006 tarih ve 26323 sayılı Resmi Gazetede yayınlanmasının akabinde yürürlüğe girmiştir (26323 sayılı Resmi Gazete). Bununla birlikte 5237 sayılı Türk Ceza Kanunu'nun Suçtan Kaynaklanan Malvarlığı Değerlerini Aklama başlığını taşıyan 282. Maddesinde suç kavramının kapsamlı bir şekilde açıklamasını içermektedir. Ulusal kanunların dışında kara para aklama ile mücadele kapsamında uluslararası sözleşmelerde büyük önem taşımakta ve mücadelenin daha kapsamlı yapılmasına zemin hazırlamaktadır. Örnek olarak Türkiye'nin de anlaşmanın tarafları arasında yer aldığı Sınıraşan Organize Suçlara Karşı Birleşmiş Milletler Sözleşmesinin Suç Gelirlerinin Aklanmasının Suç Haline Getirilmesi başlıklı altıncı maddede suç gelirleri ile ilgili kapsamlı açıklamalar yer almaktadır. Sınıraşan Organize Suçlara Karşı Birleşmiş Milletler Sözleşmesinde aklama filli ifade edilirken; suç geliri olan malvarlıklarının kaynaklarının gizlenerek ya da farklı gösterilerek dönüştürülmeleri ya da devredilmeleri, bir malvarlığının kaynağının yerinin ya da hareketlerinin gizlenmesi, tesellüm anında suç geliri olduğu bilinmesine rağmen yardım yataklık, yol gösterme gibi davranışlarda bulunulması sayılmaktadır (Hazine ve Maliye Bakanlığı, 2024).

SONUÇ

Yasadışı yollardan elde edilen bir parayı yasal gibi gösterebilmek adına çaba sarfetmek ve farklı yollara başvurmak suç teşkil etmektedir. Bu suçlar hem ülke ekonomilerini hem de küresel ekonomiyi tehdit etmektedir. Ülkeler elde edilen gelirlerin kaynaklarını bilmek ve bu doğrultuda vergilendirerek kamu için gelir elde etmeyi amaçlarlar. Bu amaca ulaşılamaması durumunda yatırımlar azalacak, refah seviyesi düşecek, pek çok ekonomik gösterge bu durumdan olumsuz etkilenecektir. Kara para aklama hususu çok uzun yıllardan beri farklı yöntemlerle denenmekle birlikte Türkiye özelinde son dönemlerde magazinsel bazı figürlerin yaptıklarıyla kamuoyunda geniş yer bulmuştur. Kara para aklanmasının önlenebilmesi için yasaların doğru bir biçimde uygulanması kadar aklama çabasının ilk aşamada önüne geçilmesi gerekmektedir. Yine sadece tek bir ülkenin çabası yeterli olmayacaktır. Kaynağı önemsemeden sadece ülkeye yatırım yapılması çerçevesinde olaya bakmak kısa vadeli olarak ekonomiye olumlu etki gösterse bile uzun dönemde beraberinde pek çok olumsuzluğu da getirecektir. Bu doğrultuda; uluslararası işbirliğine önem verilmeli, uluslararası kurumların almış oldukları kararlar yasal mevzuatlar ile paralellik göstermelidir. Uluslararası anlaşmalara imza atan ülkeler vergi cennetleri gibi ülkelere birlikte yaptırımlarda bulunmalıdır. Yine bir diğer önemli husus son on yıllık süreçte popülaritesi hızla artmakta olan kripto paraların dünya genelinde yasal bir zemine oturması için çaba sarf edilmelidir.

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AN OVERVIEW OF ARTIFICIAL INTELLIGENCE (AI) APPLICATIONS IN AGRICULTURAL BIOTECHNOLOGY

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ABSTRACT
Artificial Intelligence (AI) is revolutionizing agricultural biotechnology by enhancing productivity, improving crop quality, and enabling sustainable farming practices. Agricultural biotechnology has revolutionized farming and food production, bringing advancements that have significantly increased yield, improved resistance to pests and diseases, and enhanced nutritional quality. Recently, the integration of Artificial Intelligence (AI) has further accelerated these advancements, providing innovative solutions to complex agricultural challenges. AI applications in agricultural biotechnology span from crop monitoring and disease prediction to genetic modification and sustainable farming practices. AI in agriculture can be used for a variety of technological advancements. This includes consulting services, data analytics, the internet of things, and the use of cameras and other sensors, among other things. AI in agriculture will become competent enough to produce better predictive insights by examining various data sources such as weather, soil, crop performance, and temperature. This investigated the risks in agriculture, such as interoperability, safety and security, data dependability, and unanticipated socio-ecological consequences of using ML models to optimise yields This article provides a comprehensive overview of AI applications in agricultural biotechnology, highlighting advancements in crop management, pest control, plant breeding, and soil health monitoring.
Keywords: Artificial intelligence, biotechnology, plant breeding

INTRODUCTION

Biotechnology firms are now leveraging AI/ML solutions to develop autonomous robots that handle important agricultural tasks such as harvesting crops at a much faster pace than humans. Computer Vision and DL algorithms are leveraged to process and analyze the data captured by drones. This helps in monitoring crop and soil health. ML algorithms help in tracking and predicting various environmental changes including weather changes that impact the crop yield. Digital transformation is also having a strong impact on the field of smart agriculture. Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems. These processes include learning (the acquisition of information and rules for using it), reasoning (using rules to reach approximate or definite conclusions), and self-correction. Agricultural biotechnology involves using scientific tools and techniques, including genetic engineering, molecular markers, molecular diagnostics, vaccines, and tissue culture, to modify living organisms: plants, animals, and microorganisms. The integration of AI into agricultural biotechnology offers significant potential for enhancing efficiency and sustainability (Holzinger et al., 2022; Kalmar et al., 2022; Naqvi et al., 2022).

Importance of AI in Agriculture

The global agricultural sector faces numerous challenges, including climate change, a growing population, and the need for sustainable practices. Traditional methods are often insufficient to address these issues effectively. AI, with its ability to process large amounts of data and make intelligent decisions, can help overcome these challenges by improving productivity, reducing resource wastage, and enabling more precise and efficient farming practices. Stress physiology of crops effected by water and nutrient limitation can be directly addressed by advances in remote sensing beyond solutions that are already used in agriculture for biomass estimation, crop type classification, and mapping of soil characteristics. The use of AI together with low-cost multi-channel sensors as well as remote sensing to collect big data requires infrastructure with data security. These technologies can also be applied to identify new crop phenotypes that are more efficient in resource use and resistant to highly variable climate conditions. Phenotyping has become a key discipline of plant sciences in the last decade. Sensor developments and “big data” technologies have driven phenotyping as a main field of application in breeding to meet better the challenges of global change with increasing pressure from abiotic and biotic stresses (Barnab et al., 2008; Barnes et al., 2017; Holzinger et al., 2021).

AI in Crop Managemen

- **Precision Agriculture**

Precision agriculture aims to optimize field-level management concerning crop farming. AI plays a critical role in this by analyzing data from various sources such as satellite imagery, weather forecasts, and soil sensors. These analyses help farmers make informed decisions about planting, fertilizing, and harvesting crops, thereby maximizing yields and minimizing environmental impact (Fiorani and Schurr, 2013).

- **Crop Monitoring and Yield Prediction**

AI algorithms can monitor crop health by analyzing images taken by drones or satellites. Machine learning models detect signs of stress or disease in plants early on, allowing for timely interventions. Additionally, predictive analytics uses historical and real-time data to forecast crop yields, helping farmers plan better and reduce losses (Tester and Langridge, 2010).

- **Irrigation Management**

AI-driven irrigation systems optimize water usage by analyzing data on soil moisture, weather conditions, and crop requirements. These systems ensure that crops receive the right amount of water at the right time, which conserves water resources and enhances crop health and yields (Jalal et al., 2021).

AI in Pest and Disease Control

- **Early Detection Systems**

AI-based early detection systems use image recognition and machine learning to identify pests and diseases at an early stage. These systems can analyze images from cameras installed in fields or from drone footage to detect anomalies indicating the presence of pests or diseases, allowing for quick and targeted responses (Holzinger, 2019).

- **Integrated Pest Management (IPM)**

Integrated Pest Management (IPM) combines biological, cultural, physical, and chemical tools in a coordinated way to manage pest populations. AI enhances IPM by providing predictive models and decision-support systems that help farmers choose the most effective and sustainable pest control methods. For instance, AI can predict pest outbreaks based on weather patterns and crop conditions, allowing farmers to take preventative measures (Ribaut et al., 2010; Jung et al., 2021).

AI in Plant Breeding

- **Genomic Selection**

Genomic selection involves using genetic information to predict the performance of plants and select the best candidates for breeding. AI tools, such as machine learning algorithms, analyze genetic data to identify genes associated with desirable traits. This accelerates the breeding process and enhances the development of crops with improved yield, disease resistance, and climate resilience (Hesami and Jones, 2020; Zhu et al., 2016).

- **Trait Prediction and Improvement**

AI models can predict how different genetic variations will express in terms of traits like yield, drought tolerance, and pest resistance. By analyzing vast amounts of genomic and phenotypic data, AI helps breeders identify the best genetic combinations for developing superior crop varieties. This not only speeds up the breeding process but also reduces the costs associated with traditional breeding methods (Zhang et al., 2021).

AI in Soil Health Monitoring

- **Soil Quality Analysis**

AI applications in soil health involve using sensors and imaging technologies to collect data on soil properties such as moisture, pH, nutrient levels, and organic matter content. Machine learning algorithms analyze this data to provide insights into soil health and recommend appropriate management practices. This helps in maintaining soil fertility and preventing degradation (Dharmaraj and Vijayanand, 2018).

- **Soil Management Practices**

AI-driven systems can recommend soil management practices based on continuous monitoring and analysis of soil data. These systems provide guidance on fertilizer application, crop rotation, and other practices that improve soil health and enhance crop productivity. By optimizing soil management, AI contributes to sustainable agricultural practices and long-term soil conservation (Jha et al., 2019).

Challenges and Future Prospects

- **Challenges**

The integration of AI in agricultural biotechnology is not without challenges. Data availability and quality are significant issues, as AI models require large amounts of high-quality data to function effectively. Technical challenges include the need for advanced infrastructure and computational resources. Additionally, there are ethical and regulatory concerns related to data privacy and the use of AI in decision-making processes (Bannerjee et al., 2018; Smith, 2018).

- **Future Prospects**

Despite these challenges, the future of AI in agricultural biotechnology is promising. Advancements in AI technologies, such as improved machine learning algorithms and more sophisticated sensors, will enhance the capabilities of AI applications in agriculture. The continued development of AI-driven solutions will help address global food security challenges, promote sustainable farming practices, and improve the resilience of agricultural systems to climate change. AI-enabled technologies use data like temperature, precipitation, wind speed, and solar radiation in combination with ML algorithms and images taken by satellites and drones to predict weather conditions, analyse crop sustainability, and evaluate farms for the presence of diseases or pests and inadequate plant nutrition. Farmers with Wi-Fi connectivity may use AI applications to receive an AI-tailored farm plan. Using AI-driven solutions that enhance output and income without diminishing priceless natural resources, farmers can fulfil the global need for higher food supply and profitability. Farmers can use AI to get real-time insights from their fields, identifying areas that need irrigation, fertilisation, or pesticide treatment. Innovative farming practices such as vertical agriculture may help increase food production while using lesser resources. As a result, herbicides are used less, harvest quality is improved, profits are increased, and significant cost savings are realised. AI tools collect high-resolution aerial images and data on irrigation systems needed for the fields. AI aids in the detection of soil issues such as clogs and leaks. It assesses and rates the soil's poor condition; AI assists in increasing farm productivity. The net output from the field is improved by automated and autonomous farming operations, AIenabled productions, and yield management. AI-assisted picking, packing, and sorting enhances food production, packaging, and sorting. Farmers benefit from its assistance in comprehending agricultural data insights related to temperature, precipitation, wind speed, and solar radiation. Farmers' problems, such as climate change and insect and weed infestations that lower yields, may be resolved through AI solutions. AI will be used in agriculture to improve the entire agriculture process (Eli-Chukwu, 2019; Waleed et al., 2020; Mor et al., 2021.)

Conclusion

Artificial Intelligence (AI) has been extensively applied in farming recently. To cultivate healthier crops, manage pests, monitor soil and growing conditions, analyse data for farmers, and enhance other management activities of the food supply chain, the agriculture sector is turning to AI technology. It makes it challenging for farmers to choose the ideal time to plant seeds. AI helps farmers choose the optimum seed for a particular weather scenario. It also offers

data on weather forecasts. AI-powered solutions will help farmers produce more with fewer resources, increase crop quality, and hasten product time to reach the market. AI aids in understanding soil qualities. AI helps farmers by suggesting the nutrients they should apply to increase the quality of the soil. AI can help farmers choose the optimal time to plant their seeds. Intelligent equipment can calculate the spacing between seeds and the maximum planting depth. An AI-powered system known as a health monitoring system provides farmers with information on the health of their crops and the nutrients that need to be given to enhance yield quality and quantity. AI is transforming agricultural biotechnology by providing innovative solutions to longstanding challenges. From precision agriculture and pest control to plant breeding and soil health monitoring, AI applications are enhancing productivity, sustainability, and resilience in agriculture. As technology advances, the integration of AI in agricultural biotechnology will continue to evolve, offering new opportunities for improving global food security and promoting sustainable agricultural practices.

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MODERN PLANT BIOTECHNOLOGY TO ACHIEVE FOOD SECURITY

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ABSTRACT
Food security, defined as the availability, accessibility, and affordability of food to all people at all times, is a fundamental pillar of global well-being. However, the growing global population, climate change, and diminishing arable land are significant challenges to achieving food security. Modern plant biotechnology emerges as a crucial tool in addressing these challenges by enhancing crop yield, improving nutritional quality, and ensuring resilience to biotic and abiotic stresses. This article explores the various facets of modern plant biotechnology and its role in securing a sustainable food supply for the future.
Keywords: Food security, plant biotechnology, quality

INTRODUCTION

Advancements in Genetic Engineering

Genetic engineering, a cornerstone of modern plant biotechnology, involves the direct manipulation of an organism's genes to achieve desired traits. Techniques such as CRISPR-Cas9 have revolutionized genetic engineering, allowing for precise and targeted modifications (Wada et al., 2020; Ahmad, 2023).

1. **Increased Crop Yield**

By inserting genes that promote growth and development, scientists have created high-yielding crop varieties. For instance, Bt corn, which contains a gene from the bacterium Bacillus thuringiensis, is resistant to certain pests, reducing crop losses and increasing overall yield.

2. **Enhanced Nutritional Content**

Genetic engineering has also been used to biofortify crops with essential vitamins and minerals. Golden Rice, enriched with Vitamin A, is a prime example, designed to combat Vitamin A deficiency in developing countries (Ahmad, 2023).

3. **Stress Tolerance**

Crops engineered to withstand extreme weather conditions, such as drought, heat, and salinity, are crucial in the face of climate change. Drought-tolerant maize and salt-tolerant rice are examples of crops that can thrive in adverse conditions, ensuring stable food production (Basonde and Andhare, 2014).

Role of Genomics and Marker-Assisted Selection

Genomics, the study of an organism's entire genome, has provided insights into the genetic basis of important agronomic traits. Marker-assisted selection (MAS) leverages genomic information to accelerate the breeding process (Habibi-Najafi and Lee, 2014; Webb et al., 2018).

1. **Disease Resistance**

By identifying genetic markers linked to disease resistance, breeders can develop varieties that are less susceptible to pathogens. This reduces the reliance on chemical pesticides, promoting sustainable agriculture.

2. **Quality Traits**

Traits such as taste, texture, and shelf life can also be improved through MAS. For example, tomatoes with longer shelf life and wheat with improved baking quality are products of genomic-assisted breeding (Yin ve Qiu, 2019).

Biotechnological Approaches to Sustainable Agriculture

Sustainable agriculture aims to meet the needs of the present without compromising the ability of future generations to meet their own needs. Biotechnological innovations play a vital role in this regard (Militao et al., 2022).

1. **Biopesticides and Biofertilizers**

Biotechnological advancements have led to the development of environmentally friendly biopesticides and biofertilizers. These products, derived from natural sources, reduce the environmental impact of conventional agricultural practices.

2. **Crop Rotation and Polyculture**

Biotechnology facilitates the development of crop varieties suitable for rotation and polyculture systems, enhancing soil health and reducing pest outbreaks.

3. **Precision Agriculture**

The integration of biotechnology with precision agriculture techniques, such as drone technology and satellite imagery, allows for the precise application of inputs, optimizing resource use and minimizing environmental impact (Clark et al., 2020).

Biotechnology in Combating Post-Harvest Losses

Post-harvest losses significantly impact food security, as a substantial portion of harvested crops is lost due to spoilage and pests. Biotechnology offers solutions to reduce these losses.

1. **Storage and Preservation**

Genetic modifications can extend the shelf life of perishable crops, reducing spoilage. For example, the Flavr Savr tomato was engineered for longer shelf life, reducing waste during transportation and storage.

2. **Pest Control**

Biotechnological solutions, such as RNA interference (RNAi), target specific pests without harming beneficial insects, reducing post-harvest losses due to pest infestations (Asmamaw ve Zawdie, 2021).

Ethical and Regulatory Considerations

While the benefits of modern plant biotechnology are evident, ethical and regulatory considerations are paramount to ensure safe and equitable use (Govender, 2021).

1. **Safety Assessments**

Rigorous safety assessments are conducted to evaluate the potential risks of genetically modified organisms (GMOs) to human health and the environment. Regulatory frameworks ensure that only safe and effective biotech crops are commercialized.

2. **Public Perception and Acceptance**

Public perception of biotechnology varies, with concerns about GMOs and their impact on health and the environment. Transparent communication and education are essential to build public trust and acceptance.

3. **Intellectual Property Rights**

The ownership and control of biotechnological innovations raise ethical concerns, particularly regarding the accessibility of these technologies to small-scale farmers. Policies promoting fair access and benefit-sharing are crucial to address these issues (Liu et al., 2017).

Future Prospects and Challenges

The future of plant biotechnology holds immense potential for achieving food security, but several challenges remain (Bickel et al., 2000).

1. **Research and Development**

Continued investment in research and development is critical to harnessing the full potential of plant biotechnology. Interdisciplinary collaboration and innovation are essential to address emerging challenges.

2. **Climate Change**

Adapting to and mitigating the effects of climate change requires resilient crop varieties. Biotechnology offers solutions, but their implementation must be complemented by sustainable agricultural practices.

3. **Global Collaboration**

Achieving food security is a global challenge that requires international collaboration. Sharing knowledge, resources, and technology can accelerate progress and ensure food security for all (Bickel et al., 2000).

Conclusion

Modern plant biotechnology is a powerful tool in the quest for global food security. Through genetic engineering, genomics, and sustainable agricultural practices, biotechnology enhances crop yield, nutritional quality, and resilience to stress. However, ethical and regulatory considerations, along with continued research and global collaboration, are essential to fully realize its potential. As we move forward, the integration of biotechnology with sustainable practices will be key to ensuring a stable and secure food supply for future generations.

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İKTİSADİ KALKINMA VE SOSYAL ARAŞTIRMALAR ENSTİTÜSÜ
(İKSAD)

Ege Üniversitesi Ziraat Fakültesi ve İKSAD Enstitüsü işbirliğinde 9-16 Nisan 2024 tarihlerinde, Lizbon, Portekiz'de düzenlenecek **"International Conference on Global Practice of Multidisciplinary Scientific Studies-VI"** kongresi düzenleme kurulunda yer almak üzere Ege Üniversitesi Ziraat Fakültesi Dekan Yardımcıları Prof. Dr. Özer Hakan BAYRAKTAR ve Doç. Dr. İsmail Can PAYLAN görevlendirilmiştir.

Bilgi edinilmesi ve gereği arz/rica olunur.

Prof. Dr. Banu YÜCEL
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