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Clinical trial

The effect of acupressure on vital signs, acute pain, stress and satisfaction during venipuncture: Single-blind, randomized controlled study ☆

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ABSTRACT

Introduction: Pain increases the patient's anxiety levels and prolongs examination and other medical processes. This study was conducted as a single-blind, randomized controlled study to determine the effects of acupressure applied on adult patients and whether it changed their vital signs, acute pain, stress and satisfaction during venipuncture.

Methods: Patients who had a BMI of 18.5–30 kg/m^2, presence of an internal disease, were attending a routine clinic check-up, had requested to have a blood sample, were examined by a physician, had no sign of pain, hematoma, necrosis, scar, incision or infection on the skin around the venipuncture site and had taken no analgesic drug for the last six hours were included in the trial. Patients were randomly allocated to either an acupressure group (n=100) or a no-intervention control group (n=100). Acupressure (LI 4, LI 11 and HT 7 points) was applied once by a certified researcher for 10 min prior to venipuncture. Pain, satisfaction, stress, heart rate and oxygen saturation levels of the patients in the acupressure and control groups were assessed 15 min before and immediately after the venipuncture procedure. The Visual Analog Scale for the Measurement of Pain Severity, the Visual Analog Patient Satisfaction Scale and the State-Trait Anxiety Inventory were used to collect the data.

Results: The acupressure group had a significantly lower mean pain score than the control group (respectively, 1.23±1.09 and 1.95±1.95, p<0.05). The acupressure group had a significantly higher mean satisfaction score than the control group (respectively, 9.13±1.31 and 8.51±1.86, p<0.05). The acupressure group had a significantly lower mean stress score than the control group (respectively, 34.66±7.99 and 41.91±9.21, p<0.05).

Conclusion: Acupressure reduced acute pain and stress and increased satisfaction levels in adult patients undergoing venipuncture.

1. Introduction

Pain, which is acknowledged as the fifth vital sign, is a sophisticated experience affected by physical, emotional and behavioral factors [1]. Giving rise to several physiological and psychological changes in the body, pain increases the patient's anxiety levels and prolongs examination and other medical processes. By considering the severity level of pain and individual differences in reactions to pain, pain should be evaluated for each individual separately [2]. Painful procedures such as venipuncture and injection are intimidating and stressful experiences for patients. Reducing the pain experienced during venipuncture is important for elimination of negative reactions likely to be exhibited toward painful procedures in the future and for the fast adaptation of patients to treatment and care procedures [3]. Therefore, initiatives should be taken to reduce the pain felt by patients during the venipuncture procedure [4].

There are different approaches which aim to eliminate pain. The importance of using non-pharmacological methods in pain control, in addition to pharmacological methods, also increases with each passing day. It is suggested that, from among non-pharmacological methods, practices such as breathing exercises, creating distractions, reflexology, shot blockers, vibration and massage are effective in reducing the pain that patients experience due to invasive procedures [5-7].

Pain is a condition that requires immediate attention, overwhelms the patient, disrupts the patient's behaviors and views, gives rise to behavioral reactions and autonomic changes, delays the recovery process and raises the cost of care [8]. Moreover, pain is directly associated with patient satisfaction. It is expected for patient satisfaction to be enhanced

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as the severity of pain falls. To raise patient satisfaction, pain treatment should be performed properly [9].

There are studies in the literature suggesting that non-pharmacological approaches are effective in the management of pain forming during venipuncture. However, almost all of these studies have been carried out with newborns and children [5, 10-12]. Research has suggested that, in children, cold and vibrating devices were effective in reducing the pain occurring during venipuncture [10]. This research also reported that cartoons, playing video games and being distracted by their parents were effective in reducing children's pain during venipuncture. The researchers concluded that the most effective approach among these interventions was playing video games [11]. Hosseinabadi et al. (2015) examined the effects of massage applied on acupuncture points on the pain and anxiety exprerienced during venipuncture. It was shown that massage applied on the LI4, HT7 and Extra 1 points among acupuncture points reduced pain but did not have an effect on vital signs and anxiety [12]. Koç Özkan and Balcı (2020) found that acupressure they applied on the LI4, L11 and HT7 points in pediatric patients reduced pain but was not effective on vital signs [5].

It is argued that, among non-pharmacological practices, the acupressure method, which is based on traditional Chinese medicine and considered to allow the flow of energy via pressure to be exerted with stimulation tapes, hands and fingers on particular points on meridians which are thought to exist innately in the human body and convey energy, is effective and may be used in reducing pain [13]. Acupressure is also called acupuncture without needles. As needles are not used in acupressure, it is a method that is easily learned and applied, safe, effective and economical. Moreover, stimulation of acupuncture points helps establish the sympathetic and parasympathetic balance and maintain homeostasis healthily [14,15].

Previous studies have identified the effectiveness of using acupressure for regulating sleep patterns, reducing stress, alleviating labor pain, lowering nausea and vomiting that patients experience during chemotherapy or after surgery [7,16,17]. However, in the literature, no study appears to have investigated whether acupressure applied on adult patients during venipuncture has any effect on their vital signs, acute pain, stress and satisfaction levels.

1.1. Aim of the study

This study was conducted as a single-blind, randomized controlled study to determine the effects of acupressure applied on adult patients on their vital signs, acute pain, stress and satisfaction during venipuncture.

2. Methods

2.1. Study design

As a single-blind, randomized controlled study, this study was conducted at the venipuncture room of a hospital in Istanbul, Turkey, between November 2020 and December 2020. Registered as a Clinical Trial with the registration no 'NCT04665518', the study conformed fully with the guidelines of the Consolidated Standards of Reporting Trials (CONSORT) Checklist (Fig. 1).

2.2. Participants

Patients who were aged 18 years or above, volunteered to participate in the study, were conscious, had no speech disorder, had a BMI (Body Mass Index) of 18.5 to 30 kg/m^2, presence of an internal disease, coming to the clinic for a routine checkup, requested to have a blood sample examined by the physician, had no sign of pain, hematoma, necrosis, scar, incision or infection on the skin around the venipuncture site and had no analgesic drug for the last six hours were included in the study. The exclusion criteria were the presence of a neurological disease, an open wound on the body, chronic pain or reluctance to participate in the study.

To calculate the sample size, power analysis was conducted in light of the data obtained from a similar study in the literature [5]. The sample size was calculated by using the G*Power 3.1.9 software. The number of participants to be included in each group based on the effect size of 0.5 and the margin of error of 0.05 was designated as 45 patients. The power of the analysis conducted with this sample size was found as 93.4%. Considering the likely losses due to reasons such as not wanting acupressure to be applied, quitting during the procedure, not wanting to be touched by hand during the COVID-19 pandemic and lack of time to be incurred in the data collection process during the research, the number of participants was designated as 100 patients for each group. Five patients in the acupressure group who did not want to have acupressure intervention and those who were in a hurry and five patients in the control group who did not want to take part in the measurements made after venipuncture were left out of the evaluations to be performed in the scope of the study (Fig. 1. CONSORT flow diagram).

Those patients who met the inclusion criteria were randomized into the groups at a 1:1 ratio. The patients were assigned to the acupressure group or the control group by using a computer-generated randomization list prepared by the researcher (Fig. 1. CONSORT flow diagram).

2.3. Data collection

2.3.1. Measurement tools

A Patient Evaluation Form, the Visual Analog Scale for the Measurement of Pain Severity, the Visual Analog Patient Satisfaction Scale and the State-Trait Anxiety Inventory were used in the research. All outcomes were assessed before and after the venipuncture procedure. Additionally, adverse events (such as irritability, red and swollen skin or infection) associated with acupressure were assessed throughout the entire intervention.

Patient Evaluation Form: The researchers prepared the form by reviewing the relevant literature. The form had ten questions on the participant's certain sociodemographic characteristics (age, sex, marital status, education level, BMI). The sociodemographic characteristics were assessed before venipuncture.

Visual Analog Scale (VAS) for the Measurement of Pain Severity: The scale which was developed by Price et al. (1994) has been used in numerous studies for evaluating the severity of pain perceived subjectively by patients, and its validity and reliability have been tested and verified. The scale is made up of a 10 cm horizontal or vertical line starting with 'No Pain' and ending with 'Intolerable Pain'. The values range from 0 to 10, and the patient's pain level is evaluated out of 10 points. A VAS score of 0 corresponds to no pain, scores of 1–4 correspond to mild pain, scores of 5–6 correspond to moderate pain, and scores of 7–10 correspond to severe pain.

How to use VAS should be explained to the patient in detail. The patient was asked to identify the severity of pain by marking the point on the aforementioned line which they think matches the pain they are experiencing. The distance between this point and the point 'No Pain' is measured and recorded in centimeters. In this study, pain was assessed before and after the venipuncture procedure using VAS [18].

Visual Analog Patient Satisfaction Scale: This scale shares the properties of the well-known VAS described above. It is a 10-cm horizontal line with no numbers. The statement "I am not satisfied at all" is at one end of the line, whereas the statement "I am very satisfied" is at the other end. The patient should identify the state of satisfaction which they feel upon synthesizing all components affecting them in conjunction with the healthcare offered to them and find the point which corresponds to their state of satisfaction. Higher scores on the scale indicate higher levels of

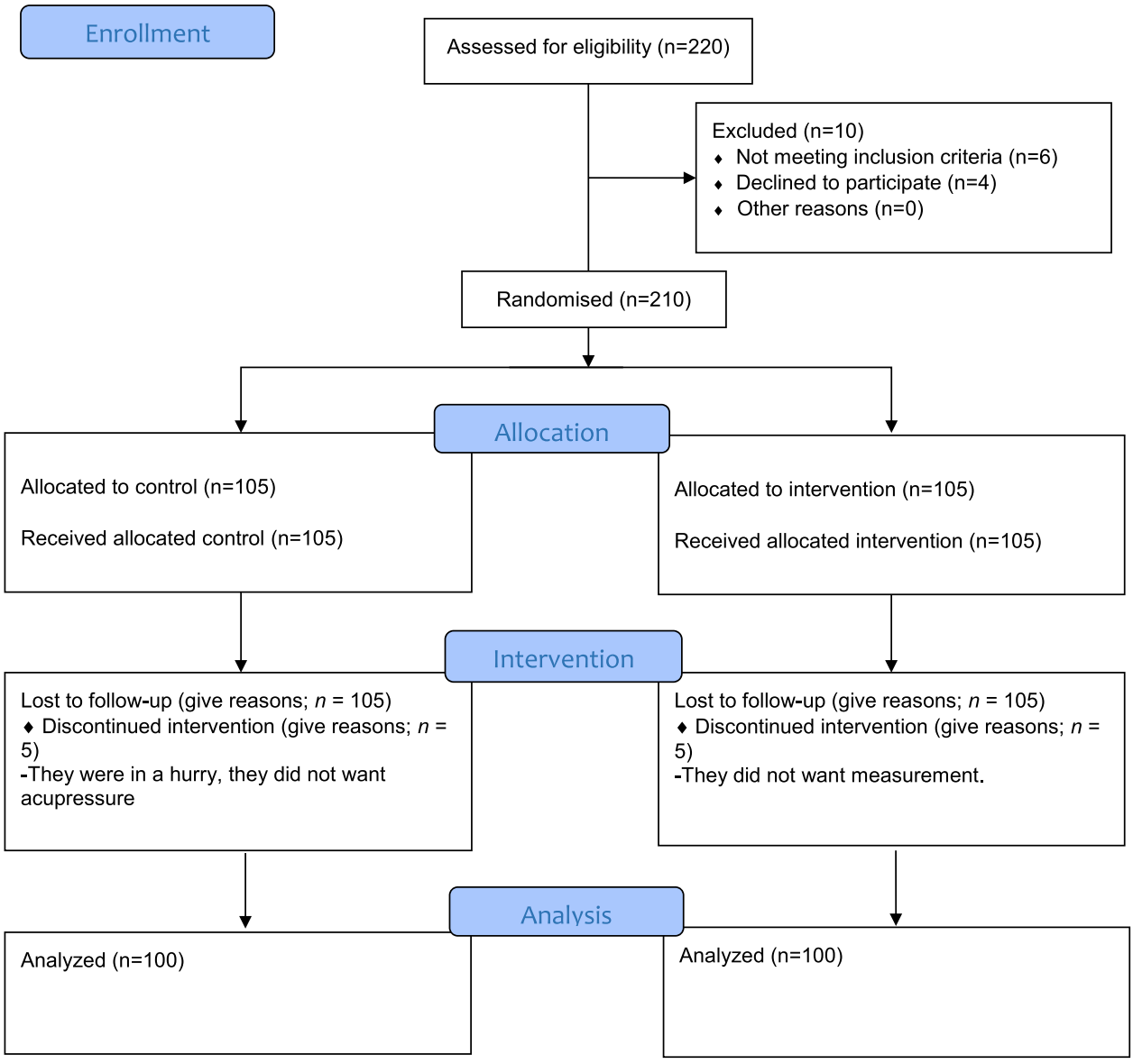

Fig. 1. Consort flow diagram.

satisfaction. In this study, satisfaction was assessed before and after the venipuncture procedure by using the Visual Analog Patient Satisfaction Scale [19].

State-Trait Anxiety Inventory (STAI): The inventory was developed by Spielberger et al. (1970) for identifying individuals' state and trait anxiety levels [20]. The reliability and validity tests for the inventory in Turkish were performed by Öner and Le Compte. The inventory measures the anxiety levels of adults. The overall score to be obtained from each subscale of the inventory, which comprises 20 items and was designed as a four-point Likert-type scale, ranges between 20 and 80 points. Higher scores in the inventory indicate higher anxiety levels, while lower scores indicate lower anxiety levels. In the inventory, the scores to be obtained in the ranges of 0–19 points, 20–39 points, 40–59 points and 60–80 points respectively refer to no anxiety, mild anxiety, moderate anxiety and severe anxiety [20,21]. The Cronbach's Alpha coefficient as the measure of internal consistency was calculated as 0.92 for the inventory in this study. Accordingly, the inventory had high-level reliability for this study. Anxiety was assessed before and after the venipuncture procedure by using the State-Trait Anxiety Inventory.

2.4. Procedure

Acupressure (LI 4, LI 11 and HT 7 points) was applied by a certified researcher on the patients in the acupressure group for 10 minutes before the venipuncture procedure. The acupressure points were as follows: HT7 Shenmen - On the ulnar end of the transverse crease of the wrist, in the small depression between the pisiform and ulna bones; LI4 Hegu - On the dorsum of the hand, between the 1st and 2nd metacarpal bones; LI11 Quchi - With a bent elbow, the point lies in the depression at the lateral end of the transverse cubital crease, midway between LU5 and the lateral epicondyle of the humerus [22].

The researcher who performed the acupressure had completed theoretical and practical acupuncture training courses before the study. At the end of this training, the researcher received an internationally valid acupressure application certificate (i.e., a PhD, researcher nurse who passed special courses on Traditional Chinese Medicine and was licensed for practicing in Turkey. The researcher was trained for a month under the supervision of an acupuncturist who was qualified in acupuncture and acupressure therapy). Additionally, it should be noted that selection of the intended acupressure points in this study and the techniques

for acupressure application on the points were performed by the researcher on 30 patients before the interventions under the supervision of an acupuncturist, who confirmed the selection of the points and the application techniques.

Firstly, all patients were informed about the procedure and invited to complete and submit informed consent forms. All patients provided informed consent before starting the study. The patients were assigned to the acupressure and control groups based on the randomization list prepared by the researchers. The baseline examinations of all patients were conducted by using the patient evaluation form, VAS Pain, VAS Satisfaction and STAI about 15 minutes before the venipuncture procedure. The demographic characteristics of each patient were recorded by the researcher. Heart rate, blood pressure, respiratory rate and oxygen saturation values were measured for each patient.

Ten minutes before venipuncture, the following procedures were applied by the nurse to the patients in the acupressure group:

Before the application of acupressure, the nurse firstly washed hands, and then, warmed them up until they reached the normal body temperature. Before the application of acupressure, the patient was allowed to be comfortably seated in an armchair in the venipuncture room which was designed for one person. Before starting the acupressure intervention, the arm was massaged from the fingertips to the elbow and relaxed. In the next step, pressure was exerted on the acupressure points (Large Intestine Meridian 4th Point [LI 4], Large Intestine Meridian 11th Point [LI 11] and Heart Meridian 7th Point [HT 7]) by the researcher. Pressure was exerted on each acupressure point for two minutes (3 to 5 kg of pressure). Each patient had one session of acupressure, and each acupressure session took 10 min [19]. Blood was drawn from the patient immediately after the end of the acupressure session. While acupressure was being applied on a patient, and while blood was being collected from them, the other patients who participated in the study were not allowed to observe the process. Blood was collected from all patients by the same nurse and in the same venipuncture room. Blood was collected from the left arm of all patients by using vacuumed blood collection tubes and needles with a gauge of 0.8*38 mm (21G x $1\frac{1}{2}$, green). Blood was drawn at the first attempt from all patients both in the acupressure and control groups.

The pain and satisfaction felt by the patients were evaluated once again by using VAS (Pain and Patient Satisfaction) and STAI immediately after the venipuncture procedure. Each patient's heart rate, respiratory rate and oxygen saturation values were once again measured by the researcher. Each patient's pain, satisfaction and anxiety levels were recorded. All measurement results were evaluated by the other blinded researcher who was not told which participants were in which group. All procedures took approximately 20–25 min for each participant (Fig. 2).

2.5. Data analysis

The data were analyzed by using SPSS (Statistical Package for the Social Sciences, Chicago, Illinois) version 26.0. In the statistical analysis of the data, percentages, frequencies and mean values (min-max) were calculated. Whether the research data were normally distributed was tested with Shapiro-Wilk test. Independent-samples t-test and Mann–Whitney U test were used for identifying whether there was any statistically significant difference between the two groups, and paired-samples t-test and Wilcoxon signed-rank test were used for evaluating whether there was any statistically significant intragroup difference. Pearson's chi-squared test was used for analyzing the categorical data. $p<0.05$ was accepted as statistically significant. According to the per protocol (PP) analysis principle in the study, the data of the dropout patients were not included in the analysis.

2.6. Ethical considerations

Before the study was performed, ethical approval was obtained from the Ethics Committee of Istanbul Kent University (No. 08/2020). Besides, all participants were asked to fill in and submit informed consent forms in written format. The study was carried out according to the principles of the Declaration of Helsinki.

3. Results

Upon the comparison of the mean ages of the participants in the acupressure and control groups (respectively, 43.49±10.54 and 40.01±15.86), it was found that there was no statistically significant difference between the two groups ($p>0.05$, Table 1). Likewise, in the comparison of the two groups in terms of sex, marital status, education level, having blood collected before, needle phobia and the stage of previous venipuncture procedure in which pain was most severely felt, it was ascertained that there was no statistically significant difference between the two groups ($p>0.05$, Table 1). Hence, the two groups had similar characteristics.

Moreover, it was observed that, in terms of heart rate, respiratory rate and oxygen saturation values, there was no statistically significant difference between the patients in the acupressure and control groups both before and after the venipuncture procedure ($p>0.05$) (Table 2).

Comparing the acupressure and control groups, showed that there was no statistically significant difference in the mean scores for the pain expected before the procedure ($p>0.05$). However, the acupressure group had a significantly lower mean score than the control group for the pain experienced during the procedure (respectively, 1.23±1.09 and 1.95±1.95), ($p<0.05$). Likewise, it was ascertained that, between the acupressure and control groups, there was no statistically significant difference in the mean scores for the satisfaction expected before the procedure ($p>0.05$). On the other hand, the acupressure group had a significantly higher mean score than the control group for the satisfaction experienced during the procedure (respectively, 9.13±1.31 and 8.51±1.86), ($p<0.05$). Moreover, it was found that, between the acupressure and control groups, there was no statistically significant difference in the mean scores for the stress expected before the procedure ($p>0.05$). However, the acupressure group had a significantly lower mean score than the control group for the stress experienced during the procedure (respectively, 34.66±7.99 and 41.91±9.21), ($p<0.05$) (Table 3).

3.1. Adverse events

No adverse events (such as irritability, red and swollen skin or infection) were associated with acupressure throughout the whole intervention.

4. Discussion

This study was performed as a single-blind, randomized controlled study for evaluating whether acupressure applied on adult patients during venipuncture had any effect on their vital signs, acute pain, stress and satisfaction. This study hypothesized that the acupressure intervention would reduce acute pain and stress and raise satisfaction in the adult patients during the venipuncture procedure. Acupressure had no significant effect on the vital signs of the patients.

The perception of pain is affected by factors such as age, past pain experience, sex, emotional states such as fear and sociocultural factors [23,24]. In this study, based on age, past pain experience, sex, emotional states such as fear and sociocultural characteristics, there was no statistically significant difference between the acupressure and control groups. The descriptive and pain-related characteristics of the acupressure and control groups were similar. This situation is of importance to the reliability of the research results.

In the study, it was ascertained that the application of acupressure reduced venipuncture-related acute pain and enhanced satisfaction. In

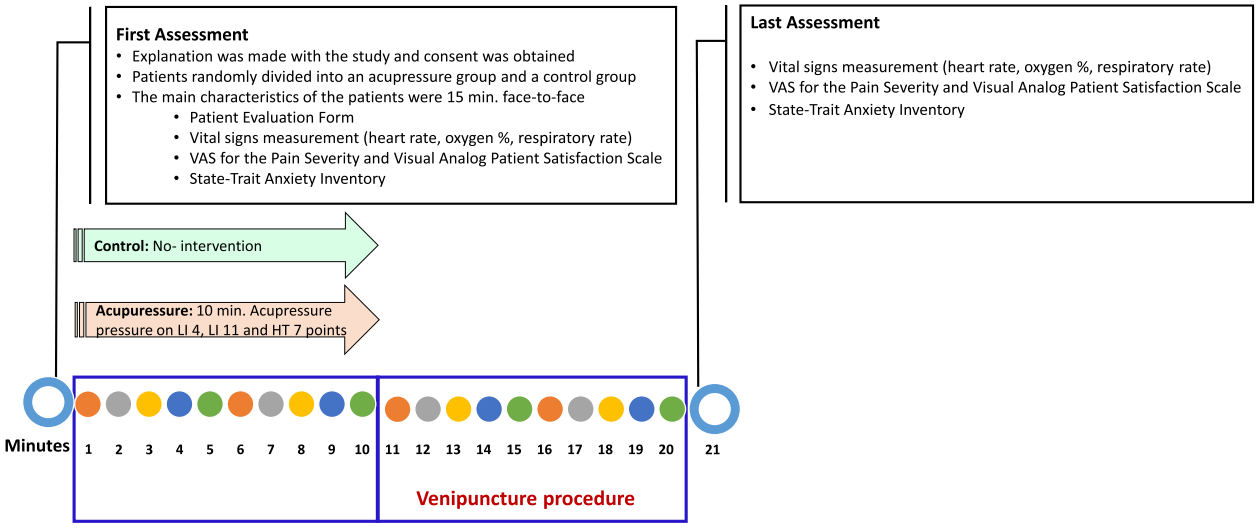

Fig. 2. Study flow diagram.

Table 1
Descriptive characteristics of the groups (N= 200).

Characteristics	Acupressure Group (n=100)		Control Group (n=100)			Test		p
	Minimum-Maximum	$\bar{x}\pm$ SD	Minimum-Maximum	$\bar{x}\pm$ SD				
Age	18-66	43.49±10.54	18-78	40.01±15.86	t: 0.332			0.736
BMI	16.33-36.79	25.17±4.52	16.33-38.61	24.82±4.23	Z=0.298			0.766
	n	**%**	**n**	**%**	χ^2			**p**
Sex								
Female	59	59	72	72		3.739	0.053	
Male	41	41	28	28				
Marital status								
Single	32	32	28	28		0.383	0.826	
Married	68	68	72	72				
Education level						10.258	0.114	
Illiterate	10	10	10	10				
Literate	-	-	4	4				
Primary school graduate	20	20	10	10				
Secondary school graduate	9	9	7	7				
High school graduate	24	24	20	20				
University graduate	37	37	49	49				
Having given blood before							0.999	
Yes	95	95	95	95		0.001		
No	5	5	5	5				
Needle phobia							0.854	
Yes	81	81	83	83		0.034		
No	19	19	17	17				
Stage of previous venipuncture procedure in which the pain was most severely felt							0.387	
When the needle was inserted	55	55	59	59		3.027		
When blood was drawn	9	9	9	9				
When the needle was removed	9	9	14	14				
All	27	27	18	18				

Chi-Squared Test, independent-samples t-test, Z; Mann Whitney U Test, p<0.05

a similar vein to the finding of this study, a study performed for evaluating the effects of acupressure on intramuscular injection (IM) pain, satisfaction and vital signs reported that acupressure applied on the GB30 point for one minute in one session reduced acute pain associated with IM injection and raised satisfaction but had no effect on vital signs in adult patients [6]. Other studies in the literature also stated that there was a decrease in pain associated with medical interventions such as IM injections, venipuncture and bone marrow biopsy [12, 25-27]. Furthermore, in the study by Arai et al., it was observed that application of acupressure on the yin tang acupuncture point (the mid-point

Table 2
Comparison of the Measurements of the Vital Signs of the Groups.

	Acupressure Group *n*=100	**Control Group *n*=100**		
Heart rate (Min)	$\bar{x}$±**SD**	$\bar{x}$±**SD**	**Z**	***p***
Before the procedure	74.49±12.61	71.64±9.50	−1.099	0.272
After the procedure	81.2±11.75	81.58±8.94	−0.911	0.362
Z[a]	.262	1.116		
p	.783	.243		
Oxygen saturation (%)	$\bar{x}$±**SD**	$\bar{x}$±**SD**	**Z**	***p***
Before the procedure	97.77±1.39	97.54±0.64	.338	0.402
After the procedure	97.58±1.27	97.53±0.63	.182	0.736
Z[a]	.326	1.105		
p	.612	.282		
Respiratory rate (Min)	$\bar{x}$±**SD**	$\bar{x}$±**SD**	**Z**	***p***
Stress before the procedure	15.64±3.87	14.94±3.46	−1.245	0.213
Stress experienced during the procedure	16.12±4.6	15.24±4.24	−1.359	0.674
Z[a]	−2.065	−1.182		
p	0.420	0.560		

Z Mann-Whitney U Test, Z[a] Wilcoxon Test $^{*}p<0.05$ $^{**}p<0.01$

Table 3
Comparison of the physiological measurements and pain scores of the groups.

	Acupressure Group n=100	**Control Group n=100**			
Pain	$\bar{x}$±**SD**	$\bar{x}$±**SD**	**Z**	***p***	**Effect size**
Pain expected before the procedure	0.34±0.89	0.29±1.1	−1.858	0.063	
Pain experienced during the procedure	1.23±1.09	1.95±1.95	−2.144	**0.032***	0.61
Satisfaction	$\bar{x}$±**SD**	$\bar{x}$±**SD**	**Z**	***p***	
Satisfaction expected before the procedure	8.02±1.99	8.42±1.9	−1.601	0.109	
Satisfaction experienced during the procedure	9.13±1.31	8.51±1.86	−2.148	**0.031***	0.39
Z[a]	−4.858	−0.584			
p	**0.001****	0.560			
STAI	$\bar{x}$±**SD**	$\bar{x}$±**SD**	**Z**	***p***	**Effect size**
Stress before the procedure	46.52±3.78	47.04±5.25	−1.203	0.229	
Stress experienced during the procedure	34.66±7.99	41.91±9.21	−5.644	**0.001****	0.11
Z[a]	−7.547	−4.292			
p	**0.001****	0.560			

Z Mann-Whitney U Test, Z[a] Wilcoxon Test $^{*}p<0.05$ $^{**}p<0.01$

located between the inner eyebrows) was effective in reducing pain associated with insertion of a needle into the skin [28]. The study by Alavi et al. explored whether acupressure applied on the UB31 point had any effect on acute pressure felt during IM injection. According to the results of their study, the mean VAS pain severity scores were 3.0±2.0 and 5.0±2.0 points respectively for the acupressure and control groups, and the difference between the two groups was statistically significant [29]. Moreover, in another study, the effect of acupressure (UB32 point) during dorsogluteal injection was analyzed. In the study, it was stated that the mean pain severity scores were 2.34±1.47 and 7.12±1.88 points respectively for the acupressure and control groups [25].

It was reported that self-administered acupressure application (on the HT7, SP6, ST36, LI4, LIV3 and K3 points for 27–30 min/day, once) had positive effects on chronic lower back pain, fatigue, sleep problems and disability. In the same study, it was stated that the pain in the group that received acupressure decreased by 35–36% [30]. It was discovered that self-administered acupressure applied 2 times per day for 15 min each time to alleviate fatigue and accompanying symptoms (anxiety, depression, pain, insomnia, distress, etc.) among advanced-stage cancer patients was only effective in alleviating the symptom of fatigue [31]. Another study concluded that self-administered acupressure application performed for 3 consecutive days with a duration of 3 min on each of the Si Shen Chong and bilateral—LI 4, St 36, K 1 and UB 10 points reduced fatigue and sleep problems in healthcare workers [32]. The results of the aforementioned studies suggest that acupressure is an effective, easily applied and cost-free method. At crowded clinics, especially self-administered acupressure application may be more ad-

vantageous than acupressure applied by the nurse in terms of saving time.

As collection of blood samples is an invasive procedure, it may give rise to anxiety in the individual. As a consequence of the fear of giving blood, needle phobia and the feeling of pain, individuals put off their visits to the hospital for having healthcare services, and they fail to get a diagnosis and treatment. It was stated that undesired symptom indications (hematoma, dizziness, headache, numbness in the arm) were observed during the venipuncture procedure in cases of fear of giving blood [33]. It is known that anxiety, worry and fear are directly associated with pain, and they raise the severity of each other [34]. In the study by Rhudy and Meagher (2000), it was stated that fear triggered by a sudden stimulus raised the pain tolerance, whereas anxiety felt from the threat of a sudden stimulus reduced the pain tolerance [35]. By affecting the adrenal medulla, stress gives rise to vasoconstriction in veins through stimulation of the sympathetic system. This somatic response makes the performance of invasive intravenous interventions harder [36]. Therefore, stress management is essential during venipuncture. Another significant finding of this study was that the acupressure group had a significantly lower mean stress score than the control group during the venipuncture procedure. Acupressure is effective in the management of stress. In a similar vein to the finding of this study, the study by Basampour et al. reported that application of acupressure lowered stress and anxiety [37]. Likewise, in experimental studies which were performed with different groups (e.g., cancer patients who had bone marrow biopsy, patients before a surgical operation) and in which pressure was exerted on different acupressure points (Auricular, extra 1, HT7), it has been demonstrated that acupressure was effective in reducing stress [12,26,37-39].

Another finding of this study was that the acupressure intervention had no effect on the vital signs of the patients during the venipuncture procedure. Even though there is a limited number of studies that analyzed the effects of acupressure on vital signs, the results of existing studies were in support of the finding of this study. In a study, it was shown that acupressure which was applied on the GB30 point for one minute in one session had no effect on vital signs in adult patients who had IM injections [6]. Another study also discerned that, in comparison to the control and placebo groups, massage applied on the acupuncture points of LI 4, HT7 and extra 1 had no effect on vital signs in adult patients who had venipuncture ($p>0.05$) [12]. In the relevant literature, it is argued it is difficult to identify the physiological changes set in motion in painful procedures in a short period of time as the changed values quickly return to their former normal levels, and physiological adaptation is rapidly in place [40]. For this reason, the values of the patients' vital signs such as oxygen saturation, respiratory rate and heart rate might not have been affected by the acupressure intervention in this study.

4.1. Strengths and limitations

The most significant strength of this study was that a randomized controlled design was utilized. It is the largest study conducted up to the present. To the best of our knowledge, this is the first study that has evaluated whether acupressure applied on the LI 4, LI 11 and HT 7 points has any effect on vital signs, acute pain, stress and satisfaction during venipuncture. Another strength of the study was that the procedure of blood collection from the patients in both groups was performed by the same nurse and in the same room. However, the participants expressed their consent to participate in the research after they were informed about the research procedure. Therefore, in advance, the participants knew the group in which they were placed, and accordingly, whether they would have acupressure or not. A potential positive effect of the voluntary nature of this study was not controlled for. The participants in this study were recruited on a voluntary and open-label basis, and therefore, they probably had a positive attitude toward acupressure, a factor which negatively impacts the ability to generalize the results. This situation may be considered as a limitation of this study. Furthermore, as this study was performed at only one medical institution and included only one experienced acupressure practitioner, the results may have been affected by the practitioner's ability, experience and capacity.

5. Conclusions

It was determined that the acupressure intervention applied on the adult patients reduced their acute pain and stress during the venipuncture procedure while raising their satisfaction levels with the procedure. However, acupressure had no effect on the vital signs in the adult patients during the venipuncture procedure. For reducing acute pain and stress and enhancing satisfaction in adult patients during the venipuncture procedure, acupressure is a safe, easy, non-invasive and effective technique that needs no additional equipment when it is applied on the LI 4, LI 11 and HT7 points. However, to advocate its effectiveness through evidence-based studies, acupressure should be applied in different painful procedures.

Authorship contribution

Dilek Yildirim: Conceptualization, Methodology, Validation, Investigation, Resources, Writing - original draft, Writing - review & editing. **Cennet Ciris Yildiz:** Conceptualization, Validation, Investigation, Writing - original draft, Writing - review & editing, Supervision.

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Declaration of Competing Interest

The authors would like to declare that there is no issue related to conflict of interest for this study.

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Data availability

The data that support the findings of this study are available from the authors (i.e. upon reasonable request).

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