

## RESEARCH ARTICLE

## Effect of acupressure on procedural pain before heel lancing in neonates

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### Abstract

**OBJECTIVE:** To investigate the effect of acupressure applied to UB60 and K3 acupuncture points in order to relieve the procedural pain caused by heel lancing blood sampling process in the term newborns.

**METHODS:** The data were collected by using the Information Form and the Neonatal Infant Pain Scale. Acupressure applied for 3 min before heel lancing blood sampling in the newborns in the experimental group ( $n = 31$ ). No intervention was applied to newborns in the control group ( $n = 32$ ).

**RESULTS:** A significant difference was found between mean scores of the newborns in the control and acupressure group in favor of the acupressure group in terms of heart rate during and after the procedure, oxygen saturation before, during and after the procedure, duration of crying during and after the procedure ( $P < 0.05$ ). It was found that there

was a significant difference between groups in terms of Neonatal Infant Pain Scale mean scores during ( $P = 0.001$ ) and after the procedure ( $P < 0.05$ ), and the difference was found to be in favor of the acupressure group.

**CONCLUSION:** As a result, acupressure was found to be an effective method in relieving pain caused by heel lancing blood sampling in newborns.

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**Keywords:** Acupressure; Pain, procedural; Infant, newborn; Heel lancing blood sampling

### INTRODUCTION

Pain is one of the most common experiences seen especially in newborn infants and children due to a variety of medical interventions.<sup>1</sup> Severe and long-term pain that develops in newborn infants as a result of interventions causes behavioral stress and physiological imbalances.<sup>2</sup> The purpose in the pain management of a newborn is to minimize the pain felt by the newborn infant who is subjected to painful interventions as from the first moments of life and help her or him cope with the pain.<sup>3</sup>

In order to prevent and relieve the pain, nurses use family-centered care and individualized developmental care, as well as some pharmacological and non-pharmacological methods. Non-pharmacological methods (such as kangaroo care, massage, breast milk and mother's smell, sucking, application of oral sweet solutions, acupressure, aromatherapy and fetal position) are valuable alternatives for pain control especially in minor invasive procedures.<sup>4,5</sup>

Being used in relieving the pain and accepted as a non-pharmacological method; acupressure is an old art

of healing which stimulates the natural self-healing ability of the body by applying pressure on key points on the skin surface using the fingers.<sup>6</sup> In this pain-relieving method, regulatory processes of the body are stimulated with the pressure applied to acupressure points on the skin surface using the fingers.<sup>7</sup> Both acupuncture and acupressure use the same points. While acupuncture is performed using needles, acupressure is performed using the hands for a gentle but strong pressure.<sup>6,9</sup>

In the literature, it is seen that there is a limited number of studies on the effectiveness of acupressure in newborn infants and the studies often focus on other pediatric age groups. The studies have examined the effect of acupressure on pediatric age groups such as reducing nausea-vomiting in children with cancer,<sup>10,11</sup> relieving the side effects of chemotherapy and reducing fatigue,<sup>12</sup> increasing sleep quality,<sup>13</sup> relieving asthma symptoms,<sup>14</sup> reducing physical stress,<sup>15</sup> relieving post-operative symptoms,<sup>16</sup> and relieving procedural pain.<sup>17</sup> There are also studies examining the effect of acupressure on physiological parameters,<sup>18</sup> body weight<sup>19</sup> and Apgar score<sup>20</sup> in term infants; whereas, there is no study investigating the effect of acupressure on the procedural pain in newborn terms. In this context, it is thought that the present study would contribute to filling the gap in the literature and enhancing the scientific accumulation of knowledge on the subject.

This study was conducted to examine the effect of acupressure to be applied to the acupoints UB60 (hollow area between the edge of exterior malleus and calcaneal/Achilles tendon) and K3 (medial side of foot, back of medial malleolus and the hollow area between the edge of Achilles tendon and medial malleolus) before the heel lance procedure in order to relieve the procedural pain in term infants on the procedural pain.

## MATERIALS AND METHODS

The study was conducted using quasi-experimental design in an obstetrics and gynecology clinic at a university hospital in the western Turkey between 27 September 2017 and 06 July 2018. The population consisted of the newborn infants who were born in the obstetrics and gynecology clinic between the aforementioned dates and met the inclusion criteria for the sample group.

The required minimum sample size was determined as 29 infants in each group with an expectation that there would be a statistically significant difference in the effect size (difference) of  $(1 \pm 2)$  units between the experimental and control groups in terms of the neonatal infant pain scale (NIPS) scores (Type I Error = 0.05, Power of Test = 0.80).<sup>21</sup> The power analysis was performed using Gpower version 3.1.9.2 (Written by Franz Faul, Universität Kiel, Germany). Considering that there might be losses in the study, three more new-

born infants were included in each group ( $n = 69$ ).

The infants who had a gestational age of 38-42 weeks, a birth weight of 2500 g and above, 1st and 5th minute Apgar score of 8 and above, were breastfed at least half an hour before the procedure, showed no symptom of any disease, had no congenital anomaly and were not subjected to any invasive interventions except for the vaccinations applied routinely and whose mothers agreed to participate in the study were included in the study. The exclusion criteria were as follows; failure of the heel lance procedure during the first attempt in the infants and rejection of participating in the study by mothers.

### Data collection tools

The data were obtained using an information form including descriptive characteristics of newborn infants, NIPS for evaluating pain-related behavioral responses, pulse oximeter for determining oxygen saturation and heart rate, chronometer for evaluating procedure duration and a digital camera for recording images.

Information form: prepared by the researcher according to the literature; information form includes 5 questions about descriptive characteristics of newborn infants such as age, gender, Apgar score, birth weight and birth height.<sup>18,21,22</sup>

Neonatal Infant Pain Scale (NIPS): The scale was developed by Lawrence *et al.*<sup>23</sup> for the purpose of evaluating behavioral pain responses given by neonatal infants before, during and after a needle intervention and the reliability coefficient of the scale was found to be 0.92 to 0.97. The scale was adapted into the Turkish society by Akdovan (1999) and the Cronbach's alpha internal consistency coefficient was found to be 0.83 to 0.86.<sup>24</sup> In the present study, on the other hand, the Cronbach's alpha internal consistency coefficient of the scale was found to be 0.83. The scale evaluates one physiological and five behavioral parameters concerning pain. While facial expression, breathing pattern, arm movements, leg movements and state of arousal are evaluated as 0 or 1 point, cry is evaluated as 0, 1 or 2 points. The highest possible score to be obtained is 7 and a higher pain score indicates a higher pain level.<sup>23,24</sup>

Pulse Oximeter: oxygen saturations and heart rates of the infants in both groups were measured using a calibrated Nellcor Puritan Bennett Inc. N-560 type Pulse Oximeter Device (Made in Korea, Tyco Healthcare UK. Ltd.) before, during and after the heel lance procedure.

Digital camera: the infants in both groups were videotaped with a Canon (IXUS 65, Made in Japan) digital camera before, during and after the heel lance procedure.

Chronometer: the heel lance procedure durations and crying durations of the infants in both groups were measured using the chronometer of a Samsung (SM-N910CQ, Made in Vietnam) mobile phone during and after the procedure.

**Data collection**

Closed envelope method was used to assign newborn infants to the control and experimental groups without any bias effect.

**Control group**

The infants in this group were allowed to eat at least half an hour before the procedure and calm down on their mothers' lap. The group, which was not subjected to any intervention before the procedure, was videotaped for 2 min before the procedure, throughout the procedure (maximum 2 min) and for 3 min after the procedure. Their oxygen saturation levels and heart rates were also evaluated before, during and after the procedure. Information about the infants was collected and recorded in the information form after the heel lance procedure. In terms of the reliability of study results, the heel lance procedure was performed by the same nurse working in the clinic.

**Experimental group**

The infants in this group were also allowed to be fed at least half an hour before the procedure and calm down on their mothers' lap just like those in the control group. Before the acupressure application, hands were washed and adjusted to the body temperature. Acupressure was applied to the acupoints UB60 and K3 of the infants in the experimental group for 3 min before the heel lance procedure in accordance with the literature.<sup>9</sup> The infants in the experimental group who were subjected to acupressure were videotaped by the researcher for 2 min before the heel lance procedure, throughout the procedure (maximum 2 min) and for 3 min after the procedure. Their oxygen saturation values and heart rates were also evaluated and recorded before, during, and after the procedure. Information about the newborns was collected and recorded in the information form after the heel lance procedure. In terms of the reliability of the study results, the heel lance procedure was performed by the same nurse working in the clinic.

Evaluation of pain score: the procedure of evaluating the pain scores of the infants was performed by two observers specialized in their own fields according to the NIPS based on the video images recorded by the researcher during the study process. The experts evaluated the video images without knowing whether or not the infants were from the experimental or the control group. In order to determine the degree of compatibility between the NIPS scores given by two experts who were independent from each other, an interrater reliability analysis was performed. As a result of the agreement analysis, intraclass correlation coefficients of the two experts were determined respectively as; 0.96, 0.88, and 0.90 for the control group before, during, and after the procedure and 0.98, 0.86, and 0.88 for the acupressure group before, during, and after the procedure. These results indicated that there was a strong

agreement between the two experts in terms of the NIPS scores of the control and the acupressure group.<sup>25-27</sup> Considering that agreement; the scores given by the experts were averaged and the NIPS pain scores of the infants before, during, and after the procedure were evaluated.

**Analysis**

The data acquired in the study were evaluated in the computer environment using IBM SPSS Statistics for Windows, Version 19.0 (IBM Corp. Armonk, NY, USA. Released 2010) packaged software. The data was analyzed using percentage distribution, mean  $\pm$  standard deviation, Cronbach's alpha coefficient calculation, independent samples *t*-test according to the result of the Kolmogorov-Smirnov test, Mann-Whitney U test and  $\chi^2$  independence test in the comparison of qualitative variables. The results of the study were evaluated at confidence interval of 95% and significance level of  $P < 0.05$ .

**RESULTS**

The sample group consisted of a total of 63 newborn infants; 32 in the control group and 31 in the experimental group (Figure 1). However, a total of 6 newborn infants was excluded from the study, of which one newborn infants in each group was restless and crying just before the procedure and their mothers wanted to opt out, two newborn infants in the control group were excluded due to the inability to perform the procedure at once, and two newborn infants in the experimental group were excluded from the study because of their procedural time exceeding 2 min.

When examining the infants in terms of the variables of age, Apgar score, birth weight, birth height and gender, it was observed that the acupressure and the control groups had similar characteristics in terms of these variables ( $P > 0.05$ ).

When comparing the heart rate averages of the infants before the procedure, it was determined that the acupressure group ( $124 \pm 12$ ) had a lower mean heart rate than the control group ( $127 \pm 13$ ), but the difference was not statistically significant ( $t = -1.090$ ,  $P = 0.280$ ). The infants in the control group had a lower mean oxygen saturation value ( $93 \pm 4$ ) than the infants in the acupressure group ( $96 \pm 4$ ) before the procedure and the difference was statistically significant in favor of the acupressure group ( $t = 3.107$ ,  $P = 0.003$ ). When examining the mean heart rates of the infants in the acupressure and control groups during and after the procedure; the mean heart rate was found as ( $144 \pm 17$ ) for the infants in the acupressure group and ( $153 \pm 18$ ) for the infants in the control group during the procedure. The mean heart rate was found as ( $147 \pm 24$ ) for the infants in the acupressure group and ( $159 \pm 19$ ) for the infants in the control group after the procedure. It was determined that the mean heart rates of the in-

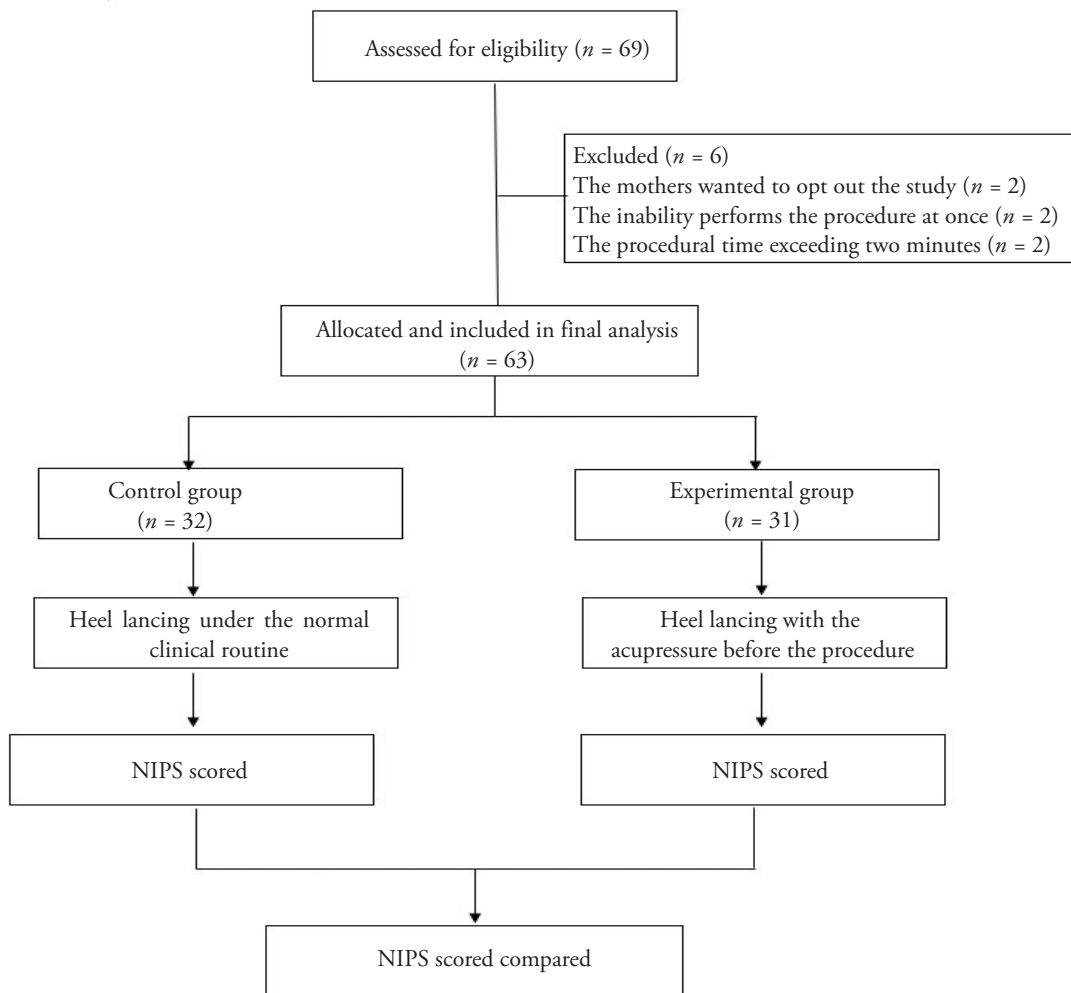


Figure 1 Flow of the study  
NIPS: Neonatal Infant Pain Scale.

Infants in the acupressure group were lower than those of the control group during and after the procedure and the difference between them was statistically significant ( $t = -2.226$ ,  $P = 0.030$ ;  $t = -2.210$ ,  $P = 0.031$ ). In addition, the mean oxygen saturation values of the infants were found to be higher between the groups in favor of the acupressure group during and after the procedure and this was statistically significant ( $t = 2.176$ ,  $P = 0.033$ ;  $t = 2.623$ ,  $P = 0.011$ ).

When examining the crying durations of the infants in the acupressure and control groups; the average crying duration was found as  $(37 \pm 32)$  s for the acupressure group and  $(71 \pm 33)$  s for the control group during the procedure. On the other hand, the average crying duration was found as  $(34 \pm 53)$  s for the acupressure group and  $(69 \pm 56)$  s for the control group after the procedure. It was determined that the average crying duration was significantly shorter in the acupressure group than the control group during and after the procedure, which was statistically significant in favor of the acupressure group ( $t = -4.087$ ,  $P < 0.001$ ;  $Z = -2.946$ ,  $P = 0.003$ ).

When examining the infants in the acupressure and control groups in terms of procedure duration, it was determined that the procedure was completed in  $(66 \pm$

$27)$  s in the acupressure group and in  $(80 \pm 29)$  s in the control group. However, this condition did not cause any statistically significant difference between the groups ( $t = -1.868$ ,  $P = 0.067$ ).

It was determined that the infants in the acupressure group had a lower NIPS mean score during  $(4.8 \pm 2.0)$  and after the procedure  $(1.9 \pm 2.8)$  compared to the score of the control group during  $(6.6 \pm 0.9)$  and after the procedure  $(3.7 \pm 3.0)$ . This caused a statistical significance in favor of the acupressure group ( $Z = -4.779$ ,  $P < 0.001$ ;  $Z = -2.354$ ,  $P = 0.019$ ).

## DISCUSSION

Today, it is becoming more and more important for nurses to use non-pharmacological methods for the purpose of controlling pain and enhancing quality of life in newborns.<sup>22</sup> Non-pharmacological methods are valuable alternatives for controlling the effects of invasive interventions applied to the newborn.<sup>28</sup> Non-pharmacological methods which are often used for the purpose of reducing the effects of invasive interventions on the newborn include applications such as; individualized developmental care,<sup>29,30</sup> music therapy,<sup>31,32</sup> breast milk, massage and touching,<sup>33-35</sup> positioning, kangaroo



care<sup>36-38</sup> and reflexology.<sup>39,40</sup> Limited number of studies on term infants indicate that acupressure which was used in the study is effective on regulating physiological parameters<sup>18</sup> and Apgar score of the newborn<sup>20</sup> and it increases weight gain.<sup>19</sup> However, no study has been found concerning the effect of acupressure on controlling the procedural pain in term infants. Accordingly, the study was conducted to examine the effects of acupressure method on pain perception, vital signs, and crying duration during the heel lance procedure in infants.

Interventional applications cause the newborn to experience stress, which consequently stimulates the sympathetic nervous system.<sup>41</sup> Stimulation of the sympathetic nervous system increases the newborn's heart rate and breathing rate and reduces the SpO<sub>2</sub>.<sup>1,42-45</sup> In the study, it was observed that the heart rate was lower in the infants in the acupressure and control groups during and after the procedure, which was statistically significant in favor of the acupressure group ( $P < 0.05$ ). As a result of a study, it was determined that acupressure application significantly reduced the sympathetic activity.<sup>46</sup> In another study conducted with term infants just like the present study, it was determined that the heart rates of the infants became lower and more stable after the acupressure application, which was statistically significant ( $P = 0.001$ ).<sup>18</sup> In this study and in other studies, it was also determined that the acupressure application significantly increased the oxygen saturation level, which was statistically significant.<sup>18,47,48</sup> The results of this study and results of limited studies in the literature have indicated that acupressure is an effective method for regulating the heart rate and oxygen saturation.

In the study, examining the pain scores of the infants according to the NIPS; it was determined that the control group had a higher pain mean score and the "acupressure application" was effective on reducing pain ( $P < 0.001$ ). In several studies investigating the effect of acupressure which is a non-pharmacological pain relieving method on pain in pediatric age groups, it has been determined that acupressure is effective on relieving the procedural pain, which shows a parallelism with the result of the present study.<sup>49-53</sup> When examining the literature; there is no study on the effect of acupressure on reducing pain that may develop after the heel lance procedure in term infants; whereas, there is a similar study conducted with preterm infants. In this respect, to our knowledge the study is a first study on the subject and makes an important contribution to the literature. As a result of the study which was conducted by Abbasoğlu *et al*<sup>22</sup> on preterm infants, it was determined that there was no significant difference between pain scores of the infants in the control and acupressure groups, which contradicts with the present study ( $P > 0.05$ ). However, it was observed that the infants in the acupressure group had lower mean scores of the PIPP than the control group.<sup>22</sup> Acupressure

starts the nociception process, stimulates impulses, increases serotonin, norepinephrine, beta-endorphin and enkephalin levels in the plasma and creates an analgesic effect.<sup>54</sup> This condition is important because it proves that acupressure method helps newborns feel less pain and cope with pain also after the procedure even if there is a sense of pain.

Although crying behavior is not specific to the formation of pain, it is commonly considered as an indicator of pain. The most distinctive and observable behavioral response of newborns to painful interventions is crying.<sup>55</sup> In the present study, the infants in the acupressure group had significantly lower crying durations than the infants in the control group during and after the procedure ( $P = 0.000$ ). In the study conducted by Abbasoğlu *et al*<sup>22</sup> on preterm infants, it was also determined that acupressure which was applied right before the heel lance procedure considerably reduced crying durations in the preterm infants throughout the procedure and this was statistically significant ( $P = 0.001$ ). In the literature, no study has been encountered examining the effect of acupressure on crying duration in term infants, whereas there are studies determining the effect of acupuncture which is another non-pharmacological method on crying duration during invasive interventions. Acupressure and acupuncture applications may be confused with each other since they basically have the same philosophy of reducing the sense of pain and discomfort and use points on the same meridian.<sup>54</sup> While acupuncture is applied by sticking specific sterilized needles with a thin pin on certain points of the body, acupressure is applied by pressurizing the points on the meridian with the help of hands and fingers.<sup>9</sup> In the study conducted by Landgren *et al*<sup>56</sup> on 86 newborn infants aged 2-8 weeks, it was determined that acupuncture applied to the point LI4 reduced colic and shortened crying durations of the infants. In their study examining the effect of acupuncture on the pain experienced by 10 preterm infants during the heel lance procedure, Ecevit *et al*<sup>57</sup> determined that the preterm infants who received acupuncture had lower NIPS pain scores and shorter crying durations than those who did not receive acupuncture. The results of the present study and the results of limited studies in the literature indicate that acupressure is an effective method for shortening crying duration in such a way to cause a highly significant difference.

To our knowledge, this is the first study investigating the effect of acupressure on the procedural pain in term infants in the nursing literature. When examining the literature, no nursing study has been found examining the effect of acupressure on the procedural pain in term infants. Thus, it is envisaged that the study would contribute to filling the gap in the literature and enhancing the scientific accumulation of knowledge on the subject. In the study, it was determined that acupressure application was effective on relieving the pro-

cedural pain and on some physiological parameters in term infants, because it is a low-cost and non-invasive method. It is thought that including acupressure application in nursing curriculum and clinical nursing practices will increase the comfort of infants and guide clinicians and research nurses who will use this method.

As a consequence, it was determined that acupressure was effective on infants to relax, feel less pain, have a higher oxygen saturation, a lower heart rate and a shorter crying duration after a painful procedure. According to the results of the present study, it is suggested to include acupressure application, which has been proved to be effective on relieving the procedural pain caused by the heel lance procedure in term infants, in procedural pain management and conduct randomized controlled studies to compare the effect of acupressure on pain control in infants along with other non-pharmacological methods.

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