

## CLINICAL STUDY

## Evaluation of peripheral perfusion in term newborns before and after Yintang (EX-HN 3) massage

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### Abstract

**OBJECTIVE:** To identify how acupressure on the acupoint Yintang (EX-HN 3) impacts oxygen saturation, pulse rate, and peripheral perfusion in term-born infants without underlying disease.

**METHODS:** Infants born between weeks 37 and 42 of gestation were included in this study. The polyclinic's neonatology room was noise-controlled and made half-dark to prevent the perfusion index from being confounded. A pulse oximeter was linked to the baby's left lower extremity. Acupressure was applied on Yintang (EX-HN 3) for 30 s clockwise, held for 30 s, and then acupressure was applied for another 30 s counterclockwise. The baby's SaO<sub>2</sub>, pulse rate, and perfusion index were recorded for each minute before and after acupressure.

**RESULTS:** When pre- and post-acupressure pulse

rate values were compared, a significant decrease in pulse rate values after acupressure application was observed. When pre- and post-acupressure oxygen saturation values were compared, a significant increase in post-acupressure oxygen saturation was observed. In addition, peripheral perfusion increased significantly after acupressure.

**CONCLUSION:** Acupressure application has been used in traditional medicine for many years. However, it is not yet widely used in modern medicine. This study shows the impact of acupressure on neonatal skin perfusion, oxygen saturation, and pulse rate.

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**Key words:** Acupressure; Point EX HN3 (Yintang); Perfusion; Term birth; Infant, newborn

### INTRODUCTION

Acupressure has been used since the ancient times. It is a healing method performed by pressing with the fingers on acupuncture points (acupoints) on the skin surface. It is thought that pressure on acupoints contributes to the healing process by decreasing muscular tonus and increasing blood circulation.<sup>1</sup> Acupoint Yintang (EX-HN 3) refers to the mid-point between the eyebrows. It has been demonstrated that acupressure application on this point reduces frontal headaches and relieves anxiety, insomnia, and stress.<sup>2-4</sup> In addition, a study by Arai et al. showed that acupressure on Yintang (EX-HN 3) decreases sympathetic activity.<sup>5</sup> Some studies have also shown that stimulating Yintang (EX-HN 3) alleviates preoperative anxiety in patients undergoing surgery.<sup>2,5-7</sup> Various techniques, including

acupressure with the thumb, have been used for stimulating Yintang (EX-HN 3).<sup>2,3,5,7,8</sup> Available literature suggests that acupressure on this point is mainly used for its sedative effect, and new studies have tried to determine the mechanisms of this effect.

The perfusion index (PI), defined for the first time in 2000 through pulse oximetry, reflects the relative value of the pulse power of a specific monitored area.<sup>9</sup> The method used to measure the PI is noninvasive. The mathematical ratio of pulsatile signal to non-pulsatile signal in the measured area provides a value of PI (AC/DC × 100). Both signals are obtained from the amount of light (940 nm) absorbed by tissue in the treated area.<sup>10</sup> In situations causing changes in skin perfusion such as cold/warm conditions, acetylcholine, sodium nitrate, local nerve block, nociceptive signals, or hormonal changes, as the amount of blood changes in the periphery, so does the PI.<sup>11,12</sup> The PI differs from patient to patient and depends on the measured area (i.e., lower or upper extremity).

The aim of this cross-over study was to identify how acupressure application on Yintang (EX-HN 3) impacted oxygen saturation, pulse rate, and peripheral perfusion in term-born infants without underlying disease who presented for routine examination.

## MATERIALS and METHODS

Infants born between weeks 37 and 42 of gestation and who presented to our hospital's neonatology polyclinic for routine examination on the fifth postnatal day were included in this study. The study was conducted in 2014 at Baskent University Ankara Hospital. The parents of infants were informed about the study and gave verbal consent. For each infant, gestational term, gender, birth weight, form of nutrition, mother's age, and information about whether or not he/she stayed at the hospital were recorded. Ethics approval was provided by the institutional review board of the Baskent University Faculty of Medicine, Ankara Hospital.

The polyclinic's neonatology room was noise-controlled and made half-dark to prevent the PI from being impacted by light. With the baby conscious on a stretcher, a pulse oximeter was linked to his/her left lower extremity. A Masimo Radical 7 Pulse Oximeter (Masimo Signal Extraction Pulse Oximetry, Masimo Corp., Irvine, CA, USA) was used to evaluate peripheral perfusion. Acupressure was applied on Yintang (EX-HN 3) for 30 s clockwise, held for 30 s, and applied for another 30 s counterclockwise. The baby's SaO<sub>2</sub>, pulse rate, and PI were recorded for each minute before and after acupressure.

The collected data were evaluated using SPSS 15.0 (SPSS Inc., Chicago, IL, USA). Measurement data were expressed as the mean ± standard deviation ( $\bar{x} \pm s$ ). Statistical analysis of the changes in pulse rate and pre- and post-acupressure saturation was carried out using paired *T*-tests, and statistical analysis of the changes between pre- and post-acupressure peripheral PI was carried out using the Wilcoxon signed-rank test. The significance level was set at  $P < 0.05$ .

## RESULTS

Seventeen infants were included in the study. All infants were born at Baskent University Ankara Hospital, and came to the neonatology polyclinic for routine examination on the fifth postnatal day. Of the 17 infants, there were 9 females (52.9%) and 8 males (47.1%). It was determined that all infants were delivered through caesarean section and none of them stayed at the hospital. None of the infants included in the study had any underlying disease. Of the 17 infants, 11 were breast-fed (64.7%), 5 were fed by both breast milk and formula (29.4%), and 1 was fed only with formula (5.9%). The average age of the mothers was 32.7 years (range, 28-42 years), the gestational-week average was 38. 17 weeks (range, 37-40 years), and the average body weight of infants was 3055.3 g (range, 3170-4051 g). Pulse rate values decreased significantly after acupressure application compared with before acupressure ( $P = 0.001$ ), and an increase in post-acupressure oxygen saturation was also observed compared with before acupressure ( $P = 0.001$ ). In addition, peripheral perfusion values increased significantly after acupressure ( $P = 0.009$ ) (Table 1).

## DISCUSSION

In this study, we found that post-PI and SaO<sub>2</sub> values increased significantly in infants on whom Yintang (EX-HN 3) acupressure was applied compared with pre-acupressure values, while pulse rate values decreased significantly compared with pre-acupressure values.

Receptors such as nociceptors, Meissner's corpuscles, Krause corpuscles, and Golgi tendon organs are located extensively on acupuncture points.<sup>13</sup> Nociceptors become active with pressure on the acupuncture point. Consequently, nociceptor stimulation is transferred to the medulla spinalis via spinal ganglion cells.<sup>14</sup> Stimulation of neurons in the mesencephalon during the trans-

Table 1 Average pulse, Perfusion index, and Oxygen saturation values of pre- and post-acupressure on Yintang (EX-HN 3) ( $\bar{x} \pm s$ )

Item	Before	After	<i>P</i> value
Pulse (beat/min)	136.3±8.1	128.8±8.9	0.001
Perfusion index	0.8±0.4	0.9±0.4	0.009
Oxygen saturation (%)	98.1±0.6	99.4±0.3	0.001

fer of pain impulses from the medulla spinalis to the cortex activates the pain control system.<sup>14,15</sup> In addition, increases in endorphins, enkephalin, serotonin, and norepinephrine levels in the central nervous system and plasma also impacts the pain control system.<sup>14,15</sup> The analgesic impact of enkephalin, endorphins, serotonin, and norepinephrine is well known.<sup>16-19</sup> Additionally, some studies have shown that enkephalin and endorphin modulate the cardiovascular system after stimulating  $\mu$ - and  $\delta$ -opioid receptors.<sup>20</sup>

Clinical studies have revealed that acupressure/acupuncture decreases sympathetic activity, the frequency of vomiting, post-surgical pain, and the need for analgesia. Thus, its application is suited to use before and after surgery.<sup>21,22</sup> The sympathetic nervous system innervates all vasculature except the capillaries, precapillary sphincters, and metarterioles. Stimulation of the sympathetic system decreases blood flow to tissues by constricting arteries and arterioles, and increases venous return to the heart by constricting veins.<sup>23</sup>

Serotonin impacts many systems, particularly the nervous system.<sup>24</sup> In addition, it also acts on veins<sup>25</sup> and 5-HT<sub>2A</sub> receptors exist widely in the endothelium.<sup>24,26</sup> Direct stimulation to these receptors leads to vasoconstriction. Stimulation to 5-HT<sub>2A</sub> receptors also increases the permeability of capillaries and blood flow to the area increasing the excretion of endothelium-dependent nitric oxide.<sup>24,27-29</sup>

The main factor impacting peripheral perfusion is the total amount of blood in the measured area. In this study, we posited that acupressure application on Yintang (EX-HN 3) activates the pain control system and increases the amount of serotonin in the central nervous system and in plasma. We argue that increased serotonin as a result of Yintang (EX-HN 3) acupressure leads to vasomodulation through 5-HT<sub>2A</sub> receptors in vascular smooth muscle and the endothelium, increasing the amount of peripheral blood, and thus increasing values of the PI. In addition, acupressure-related decreases in sympathetic activity and increases in the amount of peripheral blood flow will also result in increasing values of the PI.

Our study demonstrated that after acupressure application on Yintang (EX-HN 3), pulse rate values in the infants decreased significantly. In our opinion, this decrease occurs as a result of the fact that acupressure application on this acupoint decreases sympathetic activity. The study done by Arai *et al.* also demonstrated that acupressure application significantly decreases sympathetic activity.<sup>5</sup>

Although acupressure application has been used in traditional medicine for many years, it is not yet widely used in modern medicine. This study shows the impact of acupressure on neonatal skin perfusion, SaO<sub>2</sub>, and pulse rate. This study suggests that the development of acupressure in the treatment of disease, or in conjunction with other treatments, should be further investigated.

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