

**Original Research Report****AURICULAR ACUPRESSURE EFFECTIVELY REDUCES LABOR ANXIETY IN PRIMIGRAVIDAE BY INCREASING  $\beta$ -ENDORPHIN LEVELS**Setiawandari Setiawandari<sup>1\*</sup> , Koesnadi Saputra<sup>2</sup>, Yuni Khoirul Waroh<sup>1</sup>, Setiana Andarwulan<sup>1</sup> <sup>1</sup>Midwifery Professional Education Study Program, Faculty of Science and Health, Universitas PGRI Adi Buana, Surabaya, Indonesia<sup>2</sup>Akademi Akupunktur Surabaya, Surabaya, Indonesia**ABSTRACT**

Anxiety is a common psychological symptom in expectant mothers, particularly among primigravidae during labor. There is a link between excessive anxiety and prolonged labor. One of the options to manage anxiety is the use of non-pharmacological methods. Numerous studies have investigated the effectiveness of auricular acupressure in treating anxiety, but few have examined its effect on anxiety biomarkers. Thus, the objective of this study was to analyze the effect of auricular acupressure targeting the Shenmen point on the levels of  $\beta$ -endorphins and anxiety among primigravidae during the first stage of labor. This experimental study used a pretest-posttest control group design. The research subjects were primigravidae in the first stage of labor at the independent midwife practice of Yefi Marliandiani in Surabaya, Indonesia. Among 40 primigravidae, 34 individuals met the inclusion criteria and were then equally divided into treatment and control groups using a simple randomization. The treatment group received auricular acupressure at the Shenmen point every 30 minutes for a duration of 5 minutes each time, while the control group practiced deep breathing relaxation. The anxiety levels were assessed using the Hamilton Anxiety Rating Scale. The  $\beta$ -endorphin levels were measured by drawing 3 cc of venous blood before (4 cm cervix dilation) and after (9–10 cm cervix dilation) treatment. The obtained data were analyzed using paired- and independent-samples t-tests. A decrease in the mean anxiety level was observed in the treatment group ( $18.59 \pm 7.52$ ) relative to the control group ( $19.76 \pm 7.11$ ), albeit not significant ( $p=0.64$ ). Simultaneously, the average  $\beta$ -endorphin levels of the treatment group ( $355.4 \pm 224.7$ ) increased compared to the control group ( $225.1 \pm 127.5$ ), with a significant difference observed between the two groups ( $p=0.04$ ). In conclusion, while both auricular acupressure at the Shenmen point and deep breathing relaxation are effective in reducing anxiety, the former is more prominent in its ability to increase  $\beta$ -endorphin levels.

**Keywords:** Childbirth complications; auricular acupressure; primigravidae; anxiety;  $\beta$ -endorphins**\*Correspondence:** Setiawandari, Midwifery Professional Education Study Program, Faculty of Science and Health, Universitas PGRI Adi Buana, Surabaya, Indonesia. Email: setiawandari@unipasby.ac.id**Article history**

● Submitted 19/6/2023 ● Revised 15/7/2023 ● Accepted 2/8/2023 ● Published 10/9/2023

**How to cite:** Setiawandari, Saputra K, Waroh YK, et al (2023) Auricular Acupressure Effectively Reduces Labor Anxiety in Primigravidae by Increasing  $\beta$ -Endorphin Levels. *Folia Medica Indonesiana* 59 (3), 246-255, <https://doi.org/10.20473/fmi.v59i3.46738>

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pISSN:2355-8393, eISSN: 2599-056x

**Highlights:**

1. Auricular acupressure at the Shenmen point is effective in reducing anxiety.
2. Auricular acupressure is more practical than body acupressure since it does not interfere with expectant mothers' mobilization.
3. As a non-pharmacological method, auricular acupressure is cost-effective, efficient, and effective in overcoming maternal anxiety during labor.

**INTRODUCTION**

Expectant mothers frequently experience anxiety throughout the labor process. Pregnant women may have feelings of anxiety as a result of insufficient knowledge or information regarding pregnancy and childbirth. This phenomenon is particularly true for women who are pregnant for the first time, also

known as primigravidae. Previous research findings showed that providing prenatal education and counseling regarding the physiological changes during pregnancy and childbirth can reduce stress and anxiety levels, consequently minimizing the probability of interventions during the labor process (Firouzbakht et al. 2015).

Anxiety is an emotional state characterized by a combination of worry and fear. According to the principles of Traditional Chinese Medicine (TCM), anxiety arises from an insufficiency of energy that produces cold (*xue* or *yin*), an imbalance due to excessive heat energy (*yang*), or a combination of both (Mafetoni et al. 2018). The Shenmen point is purported to possess the capacity to modulate numerous therapeutic outcomes. Auricular acupressure targeting the Shenmen point can calm the mind, reduce stress, and manage sleep disorders, pain, and withdrawal symptoms (Tseng et al. 2015).

The presence of anxiety among pregnant women has the potential to prolong the labor process. There is an association between prolonged labor and maternal mortality in Indonesia. The findings from an analysis of the 2017 Indonesian Demographic and Health Survey (IDHS) revealed a 44.9% prevalence rate of prolonged labor (Annisya 2020).

The main factors associated with prolonged labor in primigravidae are referred to as the 5P, which includes powers, passenger, passage, psychology, and partner. Prior research reported a significant relationship ( $p=0.000$ ) between uterine contractions and the occurrence of prolonged labor (Putri 2019). The feeling of anxiety throughout the labor process may lead to irregular uterine contractions and affect the psychology of the mother. Another study revealed a statistically significant relationship ( $p=0.009$ ) between anxiety and the duration of labor (Sagita 2018).

Maternal anxiety causes a spike in the hormone catecholamines, consequently disrupting uterine contractions. Physiological labor contractions are initiated by a decrease in progesterone levels and an increase in prostaglandin levels. Prostaglandin serves as a receptor for oxytocin, and suboptimal synthesis of this hormone can lead to uterine inertia, which can interfere with or prolong the birth process (Caughey et al. 2014, Bauer 2019).

Heightened anxiety levels in women during the labor process have been found to result in increased stress. A condition of stress induces tension inside the body, particularly in the muscles of the birth canal. This tension manifests as muscle stiffness and hardness, obstructing cervix dilation and consequently disrupting the progression of labor (Sagita 2018). Maternal anxiety may arise from an individual's response to pain or anticipation of what is to come during labor. The management of anxiety for women nearing labor at primary health services includes prenatal yoga, deep breathing relaxation, aromatherapy, acupressure, and acupuncture. However, as of the conduct of this study, there has been a scarcity of empirical research examining biomarkers associated with the effectiveness of non-

pharmacological methods for anxiety management in childbirth.

One of the recommended preventive measures for maternal anxiety is counseling and non-pharmacological methods such as auricular acupuncture. The purpose of applying acupressure to the auricle, or external ear, is to stimulate the nerves inside this region that are directly connected to the brain. Several major nerve branches in the external ear include the major auricular nerve, minor occipital nerve, trigeminal nerve, temporal auricular nerve, facial nerve, vagus nerve, and glossopharyngeal nerve. These nerves are part of the sympathetic, parasympathetic, and autonomic nervous systems, which are associated with the brain, brain stem, and cerebral cortex (Saputra & Sudirman 2009, Kaniusas et al. 2019).

The effectiveness of auricular point stimulation in anxiety reduction has been assessed in multiple studies. The application of auriculotherapy to expectant mothers was found to be associated with reduced levels of anxiety in comparison to the control groups (RR 4.88 CI95% 1.87-7.88,  $p=0.0015$ ). The research used the Hamilton Anxiety Rating Scale as an instrument for assessing the anxiety levels of pregnant women (Mafetoni et al. 2018). Another study also demonstrated a similar result in terms of the beneficial effects of auriculotherapy. The effectiveness of this therapeutic intervention in reducing anxiety was demonstrated in the experimental group ( $p=0.001$ ) (Vakilian et al. 2022). However, the lack of empirical evidence and research on the use of auriculotherapy in primigravidae during labor restricts the extent of knowledge and practical implementation of auricular acupressure therapy in the field of midwifery. Hence, the aim of this study was to analyze the effect of auricular acupressure, specifically targeting the Shenmen acupoint, on the anxiety levels of primigravidae during labor by assessing the interleukin-6 biomarker.

## MATERIALS AND METHODS

The design of this study was true experimental, particularly the pretest-posttest control group design. This study was conducted from April to September 2022, involving a population of 40 primigravidae at the independent midwife practice of Yefi Marliandiani in Surabaya, Indonesia. A total of 34 primigravidae who met the inclusion criteria were included as the samples in this study. The inclusion criteria comprised a gestational age of 37–40 weeks, a low-risk pregnancy, a Poedji Rochjati score of 2–6, the absence of any skin disease on the ears, and progression into the latent phase of the first stage of labor (Prakasiwi et al. 2023). This study

excluded primigravidae who had complicated births, emergency deliveries, inadequate antenatal care, or less than four antenatal visits. The subjects that met the inclusion criteria were randomly assigned to groups using a random number table, which was prepared by a statistician (Egbewale 2014). The subjects were divided into two distinct groups: the treatment group and the control group. The treatment group received auricular acupressure at the Shenmen point, while the control group received instructions to practice deep breathing relaxation. This study used a double-blind method, wherein both the statisticians and analysts were blind to the distribution of research subjects to either the treatment or control group.

The anxiety levels of primigravidae were assessed twice using the Hamilton Anxiety Rating Scale (HARS), i.e., before and after a 120-minute treatment session. The scores given to each item on the Hamilton Anxiety Rating Scale were as follows: none=0, mild=1, moderate=2, severe=3, and very severe=4. The total score ranged from 0 to 56. The scores were categorized into the following classifications: no anxiety (<6), mild anxiety (6–14), moderate anxiety (15–27), severe anxiety (28–41), and very severe anxiety (42–56) (Nursalam 2020).

Medical analysts collected 3 cc of venous blood samples for the examination of  $\beta$ -endorphin levels. The collection of blood samples was conducted on two occasions, prior to and following treatment, when the cervix dilated to 9–10 cm. The blood serum was subsequently transported to the GAKI Laboratory of the Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia, where it was stored in a deep freezer at a temperature of  $-80^{\circ}\text{C}$ . The enzyme-linked immunosorbent assay (ELISA) kit was used to test the blood serum samples for  $\beta$ -endorphin levels after all samples had been collected (Clark & Engvall 2018).

The experiment group was subjected to auricular acupressure at the Shenmen point, as shown in Figure 1. The shenmen acupoint is located in the triangular fossa and is innervated by the vagus and trigeminal nerves. These nerves have a role in influencing the brainstem and cortex to receive, condition, and encode auricular reflexes with sedative and analgesic effects. The auricular acupressure was performed by the researchers, who had attended six months of medical acupuncture training at the Acupuncture Research Laboratory in Health Services (LP3A) in Surabaya, Indonesia. Stimulation was applied every 30 minutes for a duration of 5 minutes in a clockwise manner to induce *deqi* (Setiawandari et al. 2022). The term "*deqi*" denotes the sensations that arise with the application of acupuncture at a certain acupoint. It refers to the sensations felt by the patient as well as

the sensory perceptions identified by the acupuncturist.

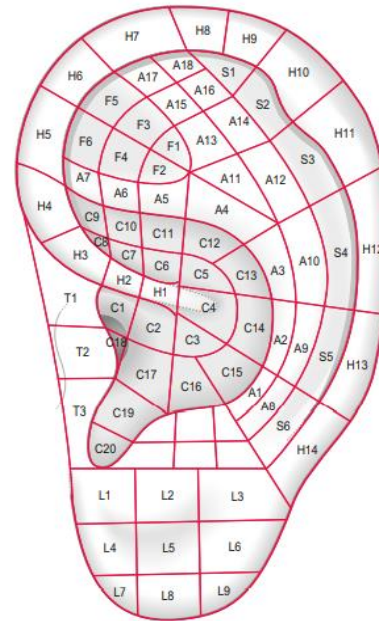


Figure 1. The auricular acupressure nomenclature from the report of the World Health Organization working group (Romoli 2009).

The control group received standard midwifery care for anxiety management, which comprised deep breathing relaxation techniques. A midwife who had completed the Normal Childbirth Care and Midwifery Update Training assisted the subjects in practicing deep breathing relaxation. The progress of labor was observed in accordance with the partograph developed by the World Health Organization (Hofmeyr et al. 2021). The data were analyzed using paired- and independent-samples *t*-tests ( $p < 0.05$ ) in IBM SPSS Statistics for Windows, version 20.0 (IBM Corp., Armonk, N.Y., USA). This study received approval from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia, with protocol No. 352/EC/KEPK/FK-UNDIP/IX/2021 on 2/9/2021.

## RESULTS

From the total population of 40 expectant mothers in the labor process, 34 individuals participated as research subjects in this study. The 34 primigravidae were divided into two groups, i.e., the treatment group that received auricular acupressure and the control group that received instruction to practice deep breathing relaxation. The primigravidae in the first stage of labor were assessed for their anxiety levels using the Hamilton Anxiety Rating Scale before and after applying the 120-minute treatment

session. Figure 2 shows the Consolidated Standards of Reporting Trials (CONSORT) diagram that demonstrates the research flow.

Table 1 shows the demographic characteristics of the research subjects involved in this study. In comparison to the treatment group, the research subjects in the control group had a higher mean age of 23.6 years (SD=3.01). The treatment group consisted of individuals with a mean age of 22.0 years (SD=2.58). However, the statistical analysis revealed that there was no significant difference in the age distribution among the research subjects (p=0.4). The majority of the research subjects were high school graduates, with 88.2% in the treatment group and 70.6% in the control group. There was no statistically significant difference observed in the distribution of education levels between the two groups (p=0.5). Most of the research subjects were housewives, with 70.6% in the treatment group and 58.8% in the control group. The statistical analysis showed that there was no significant difference in the occupational distribution of the research subjects (p=0.3). The control group exhibited a marginally higher mean gestational age of 38.8 months (SD=0.98) compared to the treatment group's average of 37.6 months (SD=0.97). The statistical analysis indicated that there was no significant difference observed between the two groups (p=0.5).

Table 1. Demographic characteristics of the research subjects.

Characteristics	Groups		p
	Treatment (n=17)	Control (n=17)	
Age			0.4*
Mean±SD	22.0±2.58	23.6±3.01	
Median (min-max)	24.5 (18-29)	24.5 (18-29)	
Education			0.5**
Middle school	1 (5.9%)	1 (5.9%)	
High school	15 (88.2%)	12 (70.6%)	
Diploma	1 (5.9%)	4 (23.5%)	
Occupation			0.3**
Housewife	12 (70.6%)	10 (58.8%)	
Self-employed	2 (11.8%)	5 (11.8%)	
Private employee	3 (17.6%)	2 (29.4%)	
Gestational age			0.5***
Mean±SD	37.6±0.97	35.4±0.86	
Median (min-max)	39.0 (37-40)	39.0 (37-40)	

Notes: \*Unpaired t-test; \*\*Fisher's exact test; \*\*\*Mann-Whitney test, significance (p<0.05).

Table 2 presents the prevalence of anxiety among the research subjects in both the treatment and control groups. The severity of anxiety was measured in accordance with the classification of the Hamilton Anxiety Rating Scale. Prior to the intervention, severe anxiety was the most prevalent

condition among the primigravidae in the treatment group (41%). Similarly, severe anxiety emerged as the most predominant condition within the control group (53%). Following the intervention, it was seen that mild anxiety became the most prevalent category among research subjects in the treatment group (47%) of the participants. In contrast, the control group continued to exhibit a prominent presence of severe anxiety (41%).

Table 2. Anxiety prevalence among the research subjects according to the HARS scores.

Scores	Pretest		Posttest	
	Treatment (n=17)	Control (n=17)	Treatment (n=17)	Control (n=17)
<6 (no anxiety)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
6-14 (mild anxiety)	4 (24%)	2 (12%)	8 (47%)	5 (29%)
15-27 (moderate anxiety)	6 (35%)	6 (35%)	5 (29%)	5 (29%)
28-41 (severe anxiety)	7 (41%)	9 (53%)	4 (24%)	7 (41%)
42-56 (very severe anxiety)	0 (0%)	0 (0%)	0 (0%)	0 (0%)
p*	0.26	0.45	0.16	0.36

Notes: \*significant p-value of the Shapiro-Wilk test (p<0.05). HARS: The Hamilton Anxiety Rating Scale.

According to the data presented in Table 3, a significant decrease (p=0.000) was observed in the measurements taken before and after the application of auricular acupressure and deep breathing relaxation techniques. Therefore, it was implied that the use of auricular acupressure and deep breathing relaxation had an impact on the levels of anxiety experienced by primigravidae during the first stage of labor. The treatment group exhibited lower levels of anxiety in comparison to the control group, as indicated by the mean scores obtained from the measurement using the Hamilton Anxiety Rating Scale. The average score in the treatment group was 18.59 (SD=7.52), while it was 19.76 (SD=7.11) in the control group. Nevertheless, the statistical analysis revealed that the observed difference was not significant (p=0.64).

The N-gain score observed in the treatment group was -32.8%, indicating that the use of the auricular acupressure technique did not significantly reduce anxiety levels among primigravidae. On the other hand, the control group exhibited an N-gain score of 65.8%, suggesting that the deep breathing relaxation technique was fairly effective in reducing anxiety levels among primigravidae. This study found a difference in the comparison of effectiveness between auricular acupressure and deep breathing relaxation techniques, albeit without statistical significance (p=0.16).



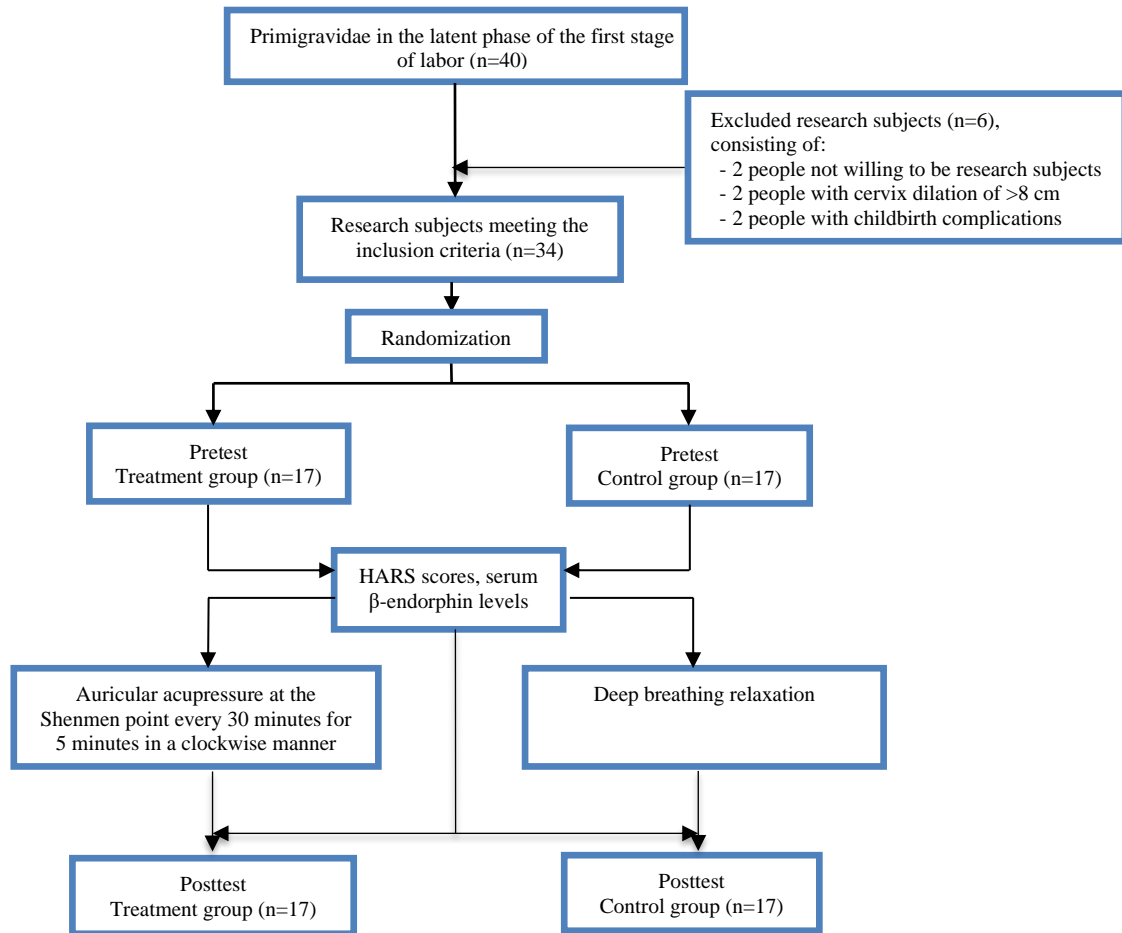


Figure 2. Consolidated Standards of Reporting Trials (CONSORT) diagram of the study population and research flow.

Table 3. Pretest and posttest anxiety levels in the treatment and control groups.

Anxiety levels (HARS scores)	Groups		p
	Treatment (n=17)	Control (n=17)	
Pretest			
Mean±SD	22.18±7.00	24.59±6.74	
Median (min-max)	22 (12-34)	21 (12-33)	
			0.64**
Posttest			
Mean±SD	18.59±7.52	19.76±7.11	
Median (min-max)	20 (9-29)	20 (10-30)	
N-gain percentage			0.16**
Mean±SD	-32.8±148.1	65.8±237.3	
Median (min-max)	-21.4 (-450-300)	25 (-400-600)	
p	0.000*	0.000*	

Notes: \*paired sample t-test; \*\*independent sample t-test, significance (p<0.05).

Table 4 presents the categorization of pre- and post-treatment serum β-endorphin assessment results for both groups. Prior to the therapeutic intervention, it was observed that 53% of the research subjects in

the treatment group had abnormal β-endorphin levels. A similar situation was observed in 59% of the research subjects in the control group. Following the intervention, the majority of the research subjects in both treatment and control groups exhibited β-endorphin levels within the normal range, at 76% and 65%, respectively.

Table 4. Categorization of serum β-endorphin levels in the treatment and control groups.

β-endorphin levels	Pretest		Posttest	
	Treatment (n=17)	Control (n=17)	Treatment (n=17)	Control (n=17)
Abnormal (<202 pg/ml)	9 (53%)	7 (41%)	4 (24%)	6 (35%)
Normal (202–389 pg/ml)	8 (47%)	10 (59%)	13 (76%)	11 (65%)
p*	0.02	0.06	0.08	0.07

Notes: \*paired sample t-test; \*\*independent sample t-test, significance (p<0.05).

As shown in Table 5, the pre-treatment serum  $\beta$ -endorphin level in the treatment group was higher at 298.6 pg/mL (SD=211.6) compared to the control group's  $\beta$ -endorphin level of 223.4 pg/mL (SD=176.3). Following the completion of the treatment, it was found that the treatment group maintained a higher serum  $\beta$ -endorphin level of 355.4 pg/mL (SD=224.7) than the control group, which had a  $\beta$ -endorphin level of 225.1 pg/mL (SD=127.5). The statistical analysis revealed a significant difference between the two groups ( $p=0.04$ ).

Table 5. Pretest and posttest serum  $\beta$ -endorphin levels in the treatment and control groups.

$\beta$ -endorphin levels	Groups		$p^{**}$
	Treatment (n=17)	Control (n=17)	
Pretest			
Mean $\pm$ SD	298.6 $\pm$ 211.6	223.4 $\pm$ 176.3	0.04
Median	277	185	
(min-max)	(78-835)	(54-714)	
Posttest			
Mean $\pm$ SD	355.4 $\pm$ 224.7	225.1 $\pm$ 127.5	0.2
Median	287	227	
(min-max)	(87-913)	(61-443)	
N-gain percentage			
Mean $\pm$ SD	-134 $\pm$ 535.9	23.8 $\pm$ 74.8	0.2
Median	2.89	12.23	
(min-max)	(-216-171.1)	(-66.7-270)	
$p^*$ (pre vs. post)	0.006	0.9	

Notes: \*paired sample t-test; \*\*independent sample t-test, significance ( $p<0.05$ ).

In the treatment group, there was a significant difference ( $p=0.006$ ) in the serum  $\beta$ -endorphin levels before and after the research subjects received auricular acupressure. This indicated that auricular acupressure at the Shenmen point has an effect on serum  $\beta$ -endorphin levels. Conversely, in the control group, there was no statistically significant difference in serum  $\beta$ -endorphin levels before and after the use of the deep breathing relaxation technique ( $p = 0.9$ ). However, the calculation of N-gain scores revealed no statistically significant difference ( $p=0.2$ ) in the effectiveness of auricular acupressure and deep breathing techniques for increasing serum  $\beta$ -endorphin levels in primigravidae during the first stage of labor.

## DISCUSSION

The primigravidae in the labor process that participated in this study had similar characteristics in terms of age, education, occupation, and gestational age, with no statistically significant differences between the treatment and control groups. The average age of the mothers ranged from 22 to 23 years, with the youngest mother being 18 years old and the oldest mother being 29 years old.

The findings from previous studies indicate that age has a significant role in influencing maternal anxiety levels during childbirth. Maternal age even had the greatest influence on stress levels during pregnancy, according to a study by Ayu et al. (2019). In the study, it was found that teenage mothers had a 10.31 times higher chance of experiencing prenatal stress compared to adult mothers. The lower the mother's age, the more psychosocial problems there will be. Conversely, an increase in the mother's age is associated with more social support and a higher ability to adjust to changes throughout pregnancy, leading to a greater sense of relaxation.

Most primigravidae in this study had completed a high school education, indicating that they had sufficient knowledge regarding pregnancy and childbirth. The maternal education level allowed the mothers to receive information from midwives or social media. Mothers who had not received prenatal care or had fewer than four antenatal visits were excluded from this study to avoid any bias related to the information acquired by mothers during antenatal care. According to a recent study conducted by Çankaya & Şimşek (2021), it was found that pregnant women who received antenatal education had lower levels of depression, anxiety, fear of childbirth, and stress symptoms compared to the control group. Additionally, these women demonstrated increased childbirth self-efficacy, resulting in a higher occurrence of vaginal births ( $p=0.043$ ). The provision of childbirth education has been found to have a significant effect on reducing maternal anxiety levels. Sufficient knowledge regarding childbirth is associated with smooth labor and delivery, as well as a decreased inclination among expectant women to choose the cesarean section (Ritonga & Hidayat 2023).

According to this study, before the implementation of the therapeutic intervention, the majority of the mothers in both the treatment group (41%) and the control group (53%) experienced severe anxiety. The treatment group had an average level of anxiety that was 2.41 times lower compared to the control group. Following the use of auricular acupressure, it was observed that mild anxiety emerged as the most predominant condition within the treatment group (47%). Anxiety is a common problem faced by women during childbirth, particularly primigravidae. The lack of information regarding pregnancy, unfamiliar circumstances, and limited understanding of childbirth among primigravidae, coupled with the anticipation of potential interventions, contribute to heightened levels of stress and anxiety (Mafetoni et al. 2018).

Severe anxiety towards childbirth greatly influences the duration of labor in primigravidae. On the contrary, it has been observed that multigravidae,

who have carried several pregnancies, tend to have a comparatively smoother childbirth due to lower levels of anxiety (Aral et al. 2014, Feng et al. 2017). A study by Shodiqoh & Syahrul (2014) found that primigravidae had a higher level of anxiety compared to multigravidae ( $p=0.006$ ). Anxiety during childbirth can induce both physiological and psychological stress, hence negatively impacting the overall birthing process. Anxiety has been shown to prolong labor, which is correlated with reduced concentrations of oxytocin in the blood plasma. A positive relationship exists between the duration of labor and the concentration of  $\beta$ -endorphin, an endogenous opioid that is released in response to stress. The inhibition and regulation of oxytocin secretion via opioid-induced mechanisms play a crucial role in controlling labor contractions and preventing pathological uterine contractility.

The presence of stress in pregnant women can increase the opioid-mediated inhibition of oxytocin secretion. The inhibition potentially leads to a decrease in uterine contractility, hence obstructing the progress of labor. Furthermore, the concentrations of corticotrophin-releasing hormone (CRH) and  $\beta$ -endorphin in the maternal plasma may increase as a response to pain perception and increased stress during labor (Dixon et al. 2013, Walter et al. 2021). In the context of labor, situations that compromise women's sense of privacy, safety, and tranquility can trigger an increase in the levels of epinephrine and norepinephrine, which may slow or delay the labor process and reduce the fetal blood supply. Stress hormones, such as adrenaline, interact with receptors located in the uterine muscles to reduce their contractility (Buckley 2015, Ayu et al. 2019).

Efforts aimed at mitigating anxiety in expectant mothers include the provision of non-pharmacological interventions, such as the auricular acupressure technique. Auricular acupressure is a complementary therapy that applies pressure to the ear, which contains nerve fibers that connect to the entire human body. The objective of this therapy is to overcome energy imbalances, such as anxiety experienced by women during labor. The results of this study are in line with prior research, which showed that mothers who received auriculotherapy during labor had lower levels of anxiety, as indicated by the Hamilton Anxiety Rating Scale scores, in comparison to women in the other groups (Mafetoni et al. 2018).

A study by Novianti & Muchtar (2021) revealed that acupressure at the Yintang and Shenmen points produced a statistically significant effect ( $p=0.001$ ) in reducing anxiety levels among primigravidae in labor. Another study showed comparable results regarding the beneficial effect of acupressure. The

application of auricular acupressure at the Shenmen point was found to reduce anxiety and fatigue in mothers who had undergone a caesarean section compared to those who received standard care (Kuo et al. 2016). The Shenmen acupoint is known for its ability to calm the mind and soul, reduce anxiety, and produce analgesia and sedation. The study conducted by Silva et al. (2020) revealed that auriculotherapy significantly decreased anxiety levels ( $p=0.033$ ). The effect was evident between the third and fourth applications of auriculotherapy.

The Shenmen point is located in the triangular fossa, an anatomical region innervated by the trigeminal and vagus nerves. Acupressure manipulation at the Shenmen point induces heightened neural activity, resulting in the transmission of impulses to the central nervous system. The central nervous system is responsible for stimulating the activation of the pituitary and endocrine systems. The secretion of the hormone  $\beta$ -endorphin by the pituitary gland, along with the modulation of the autonomic nervous system, can produce analgesic effects such as reduced pain perception (Dixon et al. 2013). This can be obtained by various mechanisms, such as raising the parasympathetic nervous response, decreasing the sympathetic nervous response, and reducing impulses in the nervous system.

No prior studies have established a correlation between auricular acupressure and the biomarkers associated with anxiety during labor. Senudin (2019) conducted a study by applying the acupressure technique at the EX-HN 3 and HT 7 points on pregnant women in their third trimester. The study demonstrated that the acupressure yielded a significant decrease in anxiety levels. However, it did not result in a significant increase in endorphin levels. Therefore, this present study further examined the effects of auricular acupressure specifically targeting the Shenmen point on the levels of  $\beta$ -endorphin, which indicated the anxiety levels of primigravidae during labor.

The results of this study revealed a statistically significant difference ( $p=0.04$ ) in serum  $\beta$ -endorphin levels between the treatment and control groups following the intervention. The treatment group exhibited higher levels of serum  $\beta$ -endorphin, with a mean increase of 56.8 pg/mL ( $p=0.006$ ). In prior research, it was observed that there was an increase in the levels of  $\beta$ -endorphin in both the treatment and control groups. However, the treatment group had a significantly higher increase in  $\beta$ -endorphin levels at  $88.57 \pm 52.46$  pg/mL in comparison to the control group's increase of  $12.86 \pm 56.76$  pg/mL ( $p=0.001$ ) (Saraswati et al. 2021). In a separate study, the application of auricular acupressure at the Shenmen point was found to result in decreased cortisol levels. The average

difference between the treatment and control groups was measured at 4 µg/dL. Consequently, auricular acupressure was proven to reduce anxiety and fatigue symptoms on day 5 postpartum (Kuo et al. 2016).

The effects of acupressure manifest at various levels within the nervous system, including the peripheral, segmental (spinal), and central levels. Numerous regions within the brain and spinal cord have been recognized as sites of action for endogenous opioids. These regions include the hypothalamus, limbic system, basal ganglia, periaqueductal gray area, raphe magnus nucleus, reticular activating system, and dorsal horn of the spinal cord. The Shenmen acupoint is known to have direct contact with the central nervous system, bypassing the body's meridian system. Thus, the Shenmen point plays an important role in reducing anxiety at a faster speed. This study revealed that auricular acupressure at the Shenmen point resulted in increased β-endorphin levels, hence providing a sense of comfort and relaxation for anxious expectant mothers. On the other hand, heightened maternal stress during labor may cause an excessive release of β-endorphins. Supraphysiological β-endorphin levels can inhibit the function of oxytocin, which subsequently slows down the progress of labor. According to the gate control theory, the application of auricular acupressure activates larger afferent fibers that can inhibit the transmission of pain and anxiety signals via smaller fibers. This mechanism provides a means to modulate the perception of labor pain and anxiety (Bonapace et al. 2018).

### Strength and limitations

The findings of this study suggest that auricular acupressure has the potential to increase the secretion of β-endorphins. Hence, auricular acupressure can be useful as a complementary therapy to reduce the anxiety levels of pregnant women, particularly those in the labor process. Auricular acupressure may alleviate expectant mothers' anxiety through stimulation of the hypothalamus and anterior pituitary, resulting in increased production of β-endorphin. However, this study was limited to pregnant women undergoing natural childbirth, which imposed a time constraint on the research. The effect of auricular acupressure on prolonged or induced labor remains inconclusive, indicating the need for further research.

### CONCLUSION

Both auricular acupressure at the Shenmen point and deep breathing relaxation techniques have comparable effectiveness in reducing anxiety levels among primigravidae. However, auricular

acupressure targeting the Shenmen point is more effective in increasing β-endorphin levels compared to the deep breathing relaxation technique.

### Acknowledgment

We would like to thank Universitas PGRI Adi Buana, Surabaya, Indonesia, for providing support in conducting this research.

### Conflict of interest

None.

### Ethical consideration

The Health Research Ethics Committee of the Faculty of Medicine, Universitas Diponegoro, Semarang, Indonesia, issued the ethical approval for this study with protocol No. 352/EC/KEPK/FK-UNDIP/IX/2021 on 2/9/2021.

### Funding disclosure

None.

### Author contribution

S and KS contributed to the conceptualization, preliminary study, and provision of study materials. S and YKW contributed to the analysis and interpretation of the data, drafting of the article, critical revision of the article for important intellectual content, and final approval of the article. SA contributed to the statistical expertise, the acquisition of funding, the provision of administrative, technical, and logistic support, and the collection and assembly of data.

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