JMCH Journal of Maternal and Child Health (2023), 08(06): 745-754
Masters Program in Public Health, Universitas Sebelas Maret

Research
Open Access

Effectiveness of Auricular Acupuncture on Interleukin-6 Levels and the Duration of Birth Delivery in Primigravida Mothers during Active Phase of Labor

Setiawandari Setiawandari [1)], Setiana Andarwulan[1)], Annah Hubaedah[2)]

[1)]Program Study Midwife Professional Education, Faculty of Science and Health, PGRI Adi Buana University, Surabaya
[2)]Program Study of Midwefery, Faculty of Science and Health, PGRI Adi Buana University, Surabaya

Received: 7 September, 2023; Accepted: 30 October 2023; Available online: 16 November, 2023

ABSTRACT

Background: Auricular acupuncture (AKAR) is a diagnostic and treatment system based on normalizing bodily dysfunctions through stimulation of specific points on the ear. Ear stimulation involves neurological reflexes, neurotransmitters, cytokines, the immune system, and inflammation. This study aimed to investigate the effectiveness of auricular acupucture on interleukin-6 (IL-6) levels and the duration of birth delivery in primigravida mothers during active phase of labor.
Subjects and Method: This was a randomized controlled trial. A sample of 43 primigravida mothers who were expected to give birth between May and July 2023 was selected using consecutive sampling. Sample was divided into two groups, AKAR as the intervention group and control group received deep breathing relaxation. The dependent variable was auricular acupuncture. The independent variables were labor duration and interleukin-6. Length of labor was measured using a partograph. The data were tested using independent t test.
Results: There was no difference of interleukin-6 levels between intervention group (Mean= 187.24 SD= 41.65) and control group (Mean= 181.30; SD= 56.86), with p= 0.176. There was no difference of labor duration between intervention group (Mean= 365.40 minutes; SD= 65.60) and control group (Mean= 407.06 minutes; SD= 77.27), with p= 0.473.
Conclusion: There is no difference of IL-6 levels between intervention group and control group. Labor duration in the intervention group is shorter than control group, but it is statistically non-significant.

Keywords: acupuncture, auricular, interleukin-6, length of labor.

Correspondence:
Setiana Andarwulan. Study Program of Midwife Professional Education, Faculty of Science and Health, PGRI Adi Buana University, Surabaya. Jl. Dukuh Menanggal XII No. 4, East Java, Indonesia. Email: setianaandarwulan@unipasby.ac.id. Mobile: 085806227033.

Cite this as:
Setiawandari, Andarwulan S, Hubaedah A (2023). Effectiveness of Auricular Acupucture (Akar) on Interleukin-6 Levels and Duration of Labor in The Primigravidal Active Phase. *J Matern Child Health*. 08(06): 745-754. https://doi.org/10.26911/thejmch.2023.08.06.08.

BACKGROUND

Reducing the Maternal Mortality Rate (MMR) in Indonesia to 131 per 100,00 live births by 2030 is the performance target of the Indonesian Ministry of Health. Efforts to accelerate the reduction in MMR are by

ensuring that every mother can access quality maternal health services, one of which is childbirth assistance by trained health workers in health service facilities. Childbirth in health service facilities in 2021 in Indonesia was 90.9%, although this figure increased compared to 2020, however, MMR in 2021 increased by 7,389, most of which was caused by COVID-19 with 2,982 cases, bleeding with 1,330 cases, hypertension as many as 1,077 cases, and other causes as many as 1,309 (Durat et al., 2018) Prolonged labor is a factor causing other causes of maternal death, where these other causes are the highest cause of MMR in East Java Province (Hawker et al., 2011) Prolonged labor is the duration of labor that lasts more than 6 hours in the active phase.

The labor period is divided into 4 stages, namely: the first stage of labor, the second stage of labor, the third stage of labor, and the fourth stage of labor. The first stage of labor is divided into the latent phase of the first stage of labor and the active phase of the first stage. In primigravidas, the duration of labor in the first stage is 20 hours, while in multigravidas it is 14 hours (Cunningham et al., 2014; Australian Institute of Health and Welfare, 2018) Most of the problems that occur during labor occur in stages I and stage II, namely due to incoordination of contractions that hinder the delivery process, the duration of labor becomes longer. At a level one health facility, the management of prolonged labor problems is by carrying out active mobilization and correcting nutrition. If that doesn't work, then a referral is made to a level two health facility to get an oxytocin drip procedure.

This management has proven successful, but if there are complications during labor, the fetus is delivered by sectio caesarea. This has an impact on increasing the MMR and the incidence of deliveries by caesarean section. Non-pharmacological methods to stimulate uterine contractions include active mobilization, nipple stimulation, oxytocin massage, acupressure and body acupuncture. Not all of these methods can be carried out by mothers such as mobilization, mothers giving birth with a wide opening have difficulty mobilizing due to uterine contractions. Nipple stimulation, most mothers find it awkward to stimulate their own nipples. Improper pressure on the acupressure points causes De Qi to not be optimal, and body acupuncture interferes with the mother's mobilization. Auricular acupuncture (AKAR) is a diagnostic and treatment system based on normalizing bodily dysfunctions through stimulation of specific points in the ear. Ear stimulation involves neurological reflexes, neurotransmitters, cytokines, the immune system, and inflammation.

The resulting improvement in pain and disease is believed to be via the reticular formation and the sympathetic and parasympathetic nervous systems. Modern research confirms the efficacy of ear acupuncture for analgesia and anxiety. (Desmawati, Kongsuwan and Chatchawet, 2021) This is because the ear is innervated by the cranial and spinal nerves, which are separated into motor and sensory areas. The motor area concerns the motor branch of the facial nerve (CN VII), which controls the muscles of the external ear. The sensory area consists of the auricular branch of the vagus nerve (ABVN), the auriculotemporal nerve (a branch of the CNV), the glossopharyngeal nerve, the lesser occipital nerve, and the greater auricular nerve. These nerves are directly connected to the brain and reflect on the body's organs.

Research related to AKAR in obstetrics is still very limited, such as labor pain, length of labor, maternal anxiety, uterine contractions, and supporting biomarkers

that initiate pain, uterine contractions, and anxiety have not been widely conducted. These limitations require broader development regarding the role of AKAR in overcoming childbirth problems. In previous research, a significant value (p<0.001) was reported for AKAR in reducing labor pain and shortening the duration of labor in the active phase of the first stage compared to body acupuncture. Based on the identification of the problems above, the aim of the research is whether there is effectiveness of auricular acupuncture on Interleuikin-6 levels and length of labor in the active phase of the first stage.

SUBJECTS AND METHOD

1. Study Design

This research is true experimental with a pretest-posttest control group design.

2. Population and Sample

The study population was all 43 primigravida mothers who were expected to give birth between May and July 2023. The research sample was part of the first stage of labor during the primigravida active phase. The selection of research subjects was carried out by consecutive sampling. Subjects who met the inclusion criteria were randomized, and divided into two groups, namely the AKAR intervention group and the deep breathing relaxation control group.

3. Study Variables

The research variables used consisted of the independent variable, namely auricular acupuncture, the intermediate variable interleukin-6 (IL-6) levels, and the dependent variable length of labor.

4. Operational Definition of Variables

Auricular acupuncture was the action of inserting a 0.25 cun needle 1.3 mm deep into the right earlobe and triangular fossa.

Interleukin-6 (IL6) levels was interleukin levels obtained in the blood/ serum of postpartum mothers.

Length of delivery was the time needed by primigravida mothers in labor from the opening of 4 cm to 10 cm.

5. Study Instruments

The instrument uses laboratory tests that are carried out, the research site only has a simple laboratory room and does not have a deep freezer - 80^{o}C, so the biomarker test is carried out in the laboratory. Assessment of the length of labor using a partograph.

6. Data analysis

The data analysis used is Excel and with the help of the SPSS program. The difference between the experimental and control groups was tested using the Mann Whitney test, Wilcoxon Signed Rank Test, and Independent Sample test.

7. Research Ethics

Study ethics issues including informed consent, anonymity, and confidentiality are carefully handled throughout the study process. The study ethics approval letter was obtained from the study ethics committee of the Fakultas Sains dan Kesehatan UNIPA Surabaya Ethical Approval No. 108/KEPK, dated 5 June 2023.

RESULTS

1. Sample Characteristics

The data in Table 1 shows that the average age of research subjects in the AKAR group is slightly older, namely 24.05 (SD= 2.59) years compared to the RND group, namely 23.53 (SD= 3.03) years. The statistical test results showed that the difference was not significant (p= 0.370). Most of the research subjects had high school education levels. The statistical test results showed that the difference was not significant (p= 0.540). The most common type of work is a housewife (IRT), statistical test results show that this difference is not significant (p= 0.400). The mean gestational age in the AKAR group was slightly older, namely 38.36 (SD= 0.95) weeks compared to the RND group, which

was 38.08 (SD= 0.82) months. The statistical test results showed that the difference was not significant (p= 0.500).

Table 1. Characteristics sample data continue

Characteristics	Auricular Acupuncture				Deep Breath Relaxation			
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
Age	24.05	2.59	18	30	23.35	3.03	18	32
Gestational Age	38.36	0.95	37	40	38.08	0.82	37	40

Table 2. Characteristics sample data categorical

Characteristics	Auricular Acupuncture (n= 21)		Deep Breath Relaxation n=20		p
	n	%	n	%	
Education					
Junior high school	3	14.29	4	20	0.540
Senior high school	16	76.19	13	65	
Diploma	2	9.52	3	15	
Employment					
Housewife	16	76.19	16	80	0.400
Self-employed	1	4.76	2	10	

2. Bivariate Analysis

Auricular Acupuncture on Interleukin-6 (IL-6)

Before intervention, there was no difference level of interleukin-6 in the intervention (Mean= 157.67 pg/mL; SD 51.58) and control group (Mean= 155.65 pg/mL; SD= 50.07), with p= 0.900.

After intervention, there was no difference of interleukin-6 levels between intervention group (Mean= 187.24 SD= 41.65) and control group (Mean= 181.30; SD= 56.86), with p= 0.176.

Auricular Acupuncture on Active Phase of Labor Duration

After intervention, there was no difference of labor duration between intervention group (Mean= 365.40 minutes; SD= 65.60) and control group (Mean= 407.06 minutes; SD= 77.27), with p= 0.473.

Table 3. Effectiveness of Auricular Acupuncture on Interleukin-6 Levels in the Primigravida Mothers during Active Phase of Labor

Group	Mean	SD	p
Pre-test			
Intervention	157.67	51.58	0.900
Control	155.65	50.07	
Post-test			
Intervention	187.24	41.65	0.176
Control	181.30	56.86	

Table 4. Effectiveness of Auricular Acupuncture on Duration of Labor

Group	Labor duration			Mean	SD	p
	Normal < 360	Prolonged >360 menit	Total			
Intervention	12 (57%)	9 (33%)	21 (100%)	365.40	65.60	0.473
Control	9 (45%)	11 (55%)	20 (100%)	407.06	77.27	

DISCUSSION

The age of the research subjects ranged from 18-30 years, where the mean age of the AKAR group was slightly older than the

RND group, but this difference was not significant (p= 0.370). This shows that the majority of research subjects are in the reproductive age group and are physiologically strong enough to withstand labor pain and menstruation. Mothers who are of productive age (20-35 years) have energy when menstruating.

A mother's age at birth can have important implications for her pregnancy and birth experience. Although the majority of mothers have normal pregnancies and healthy babies regardless of age, younger mothers (under 20 years of age) and older mothers over 40 years of age have an increased risk of complications and adverse pregnancy outcomes (Cunningham et al., 2014).

Although mother teenagers are 1.1 times more likely to experience spontaneous labor (without intervention) 63% compared to 59% of mothers aged 20–24 years, young pregnant women are at risk of experiencing premature birth 1.2 times greater than those of mothers aged 20–24 years, namely born at or before 36 weeks of gestation (11.0% compared to 8.9%). (Australian Institute of Health and Welfare, 2018) Mothers aged over 40 years have a 1.36 risk of premature birth, a risk of 2. 36 times of hypertensive disorders of pregnancy, 1.71 times risk of developing gestational diabetes mellitus, 1.99 times risk of delivery by Caesarean section, and 1.29 times risk of pregnancy with abnormal fetal presentation (Londero et al., 2019).

In this study, more than half of the 58.53% of mothers who gave birth experienced anxiety (>50), the results of the one-way ANOVA test p= 0.360, meaning that the level of anxiety in both groups was homogeneous, so the results of IL-6 levels were not influenced by anxiety. Anxiety is a common symptom faced by mothers giving birth which is related to a lack of information about pregnancy and childbirth during pregnancy checks or is caused by mothers who are giving birth for the first time. The anxiety experienced by mothers is related to postnatal depression, premature birth, cesarean delivery, and difficulties in raising children (Mohebi et al., 2018), but if anxiety is not controlled it will disrupt the birth process because it increases stress hormones. Increased maternal catecholamine production due to anxiety reduces the strength, duration, and coordination of uterine contractions and consequently increases the duration of labor (Mohebi et al., 2018).

The level of pain in both groups was homogeneous so increasing IL-6 levels in research subjects was not influenced by labor pain. Labor pain is a feeling of pain due to uterine contractions and is accepted as part of the birthing process. Pain can be subjective and influenced by many factors, for example, uterine contractions, cervical dilation, and parity. Women respond to labor pain uniquely and differently, depending on the level or severity of labor pain, experience, coping strategies, motivation to endure the pain and culture.

The first experience of labor pain was found to be very severe in primiparous women. Stronger stimulation of pelvic and cervical nociceptors by the fetal head causes greater pain in primiparous women. Severe labor pain has a bad impact on the mother and fetus. Severe pain during labor is reported to disrupt maternal autonomic function and cause the release of catecholamines, resulting in abnormal labor and fetal distress, obstruction of uterine activity, abnormal uterine contractions, prolonged labor, and increased risk of intrapartum problems (Desmawati et al., 2021).

There was a difference in IL-6 levels before and after AKAR treatment, but there was no significant difference in IL-6 levels between the two groups. The results of this

study are in line with previous research, namely that Regiosacral Counter-Pressure (CPR) therapy did not significantly reduce IL-6 and prostaglandin hormone levels in mothers experiencing uterine contractions, meaning that there was no increase in IL-6 levels before (Mean= 185.159; SD= 3.76) pg/ml and after (Mean= 180.782; SD= 22.05) pg/ml CPD, so it is concluded that the action of reducing pain with CPR acts to influence uterine contractions and does not interfere with the labor process (Rejeki et al., 2021) Interleukin-6 (IL-6) is a pro-inflammatory cytokine that is The main mediator of the body's response to inflammation and infection. Interleukin-6 is produced by various types of cells, such as T cells, B cells, macrophages, fibroblasts, keratinocytes, endothelial cells, mesangial cells, adipocytes, and some tumor cells. Interleukin-6 stimulates the placenta to produce corticotropin-releasing hormone (CRH) so that it can increase cortisol. High levels of CRH modulate myometrial contractions, while increased cortisol stimulates prostaglandin synthesis resulting in myometrial contractility which can result in the start of labor (Cunningham et al., 2014).

The level of pain in both groups was homogeneous so increasing IL-6 levels in research subjects was not influenced by labor pain. Labor pain is a feeling of pain due to uterine contractions and is accepted as part of the birthing process. Pain can be subjective and influenced by many factors, for example, uterine contractions, cervical dilation, and parity. Women respond to labor pain uniquely and differently, depending on the level or severity of labor pain, experience, coping strategies, motivation to endure the pain and culture. The first experience of labor pain was found to be very severe in primiparous women. Stronger stimulation of pelvic and cervical nociceptors by the fetal head causes greater pain in primiparous women. Severe labor pain has a bad impact on the mother and fetus. Severe pain during labor is reported to disrupt maternal autonomic function and cause the release of catecholamines, resulting in abnormal labor and fetal distress, obstruction of uterine activity, abnormal uterine contractions, prolonged labor, and increased risk of intrapartum problems (Desmawati et al., 2021).

There was a difference in IL-6 levels before and after AKAR treatment, but there was no significant difference in IL-6 levels between the two groups. The results of this study are in line with previous research, namely that Regiosacral Counter-Pressure (CPR) therapy did not significantly reduce IL-6 and prostaglandin hormone levels in mothers experiencing uterine contractions, meaning that there was no increase in IL-6 levels before (Mean= 185.159; 3.76) pg /ml and after (Mean= 180.782; SD= 22.05) pg/ml CPD, so it is concluded that the action of reducing pain with CPR acts to influence uterine contractions and does not interfere with the labor process (Rejeki et al., 2021).

Interleukin-6 (IL-6) is a pro-inflammatory cytokine that is the main mediator of the body's response to inflammation and infection. Interleukin-6 is produced by various types of cells, such as T cells, B cells, macrophages, fibroblasts, keratinocytes, endothelial cells, mesangial cells, adipocytes, and some tumor cells. Interleukin-6 stimulates the placenta to produce corticotropin-releasing hormone (CRH) so that it can increase cortisol. High levels of CRH modulate myometrial contractions, while increased cortisol stimulates prostaglandin synthesis resulting in myometrial contractility which can result in the start of labor (Cunningham et al., 2014)

The normal value of IL-6 in mothers has different values such as during pregnancy and childbirth. At this stage of pregnancy,

pregnancy can be considered as an inflammatory process caused by the embryo in the endometrium. As pregnancy progresses, the inflammation caused by the embryo gradually becomes stronger, leading to increased levels of IL-6 in pregnant women. Research by Fu et al. (2020) reported that IL-6 levels in pregnancy varied each semester. IL-6 levels in healthy pregnant women are <4.19 pg/ml, first trimester <3.52 pg/ml, second and third semesters <4.40 pg/ml. This is also confirmed by the results of the study which showed a significant difference in serum IL-6 levels between the first and second trimesters, first and third trimesters (p = 0.003) and there was no significant difference in serum IL-6 between the second and third trimesters (Fu et al., 2020).

In labor IL-1b, IL-6, and IL-8 are biomarkers that stimulate uterine contractions. IL-1b increases just before delivery then returns to pregnant levels, whereas IL-6 and IL-8 increase early in labor and exceed pregnancy levels until the third day postpartum (Hebisch et al., 2004) The role of IL-6 in the development of labor is to stimulate the production of prostaglandins and oxytocin, which facilitate cervical ripening and induce uterine contractions. IL-6 has been shown to stimulate the production of prostaglandins by decidual cells and the chorioamniotic membrane, the main source of intrauterine prostaglandins (Vilotić et al., 2022) Increased IL-6 initiates prostaglandins and oxytocin, so that uterine contractions become stronger, and the labor process becomes shorter. In research conducted, AKAR treatment could increase IL-6 levels significantly (p= 0.006) with an average increase of 2.957 pg/ml. Changes in mean IL-6 levels were manifested by 90% of research subjects experiencing increased IL-6 levels. Based on the results of this analysis, it can be concluded that AKAR treatment increases IL-6 levels. These results are in line with previous research where AKAR treatment increased PGF2a levels although not significantly (p=0.764) with an average increase of 2.29 pg/ml. When compared with RND, this difference is significant (p=0.002) (Setiawandari et al., 2022).

Root treatment of the uterine point and prostaglandin point stimulates the posterior pituitary to secrete the hormone oxytocin. The direct action of oxytocin on the myometrium produces regular and effective contractions, while the indirect action of oxytocin on the decidua basalis increases the production of PGE1 and PGF2α. PGE1 and PGF2α help oxytocin bind to its receptors. Increased levels of PGF2α and the hormone oxytocin cause increased activity of the uterus and pain-stimulating terminal nerve fibers. An increase in IL-6 will increase the hormone prostaglandin so that the hormone oxytocin also increases. Increased oxytocin affects uterine contractions. Adequate uterine contractions make the labor process run smoothly.

The mean duration of labor in the AKAR group was shorter than in the RND group, but this difference was not significant. The results of this study are in line with previous research, where auricular acupuncture treatment shortened the length of labor in the active phase of the first stage of labor (Mean= 440.3; SD= 72.94) when compared with the deep breathing relaxation group (Mean= 517.6; SD= 101.00) and there was a very significant difference (p= 0.004), so it was concluded that ROOT Uterine point was effective in shortening the length of labor by increasing PGF2α levels (Setiawandari et al., 2022). The results of previous research, namely measuring serum IL-8, PGF2α, and β-endorphin levels in women giving birth with and without acupuncture. Acupuncture significantly reduced the duration of labor (p=<0.001), but serum levels of IL-8, PGF2α, and β-endorphin were not

significantly different in the two groups (p= 0.700) so it was concluded that acupuncture did not affect serum levels of IL-8, PGF2α, and β-endorphin, but was effective in reducing the duration of labor.

These results are not in line with research by Valiani (2018) which reported that auriculotherapy shortened the first stage of labor (p= 0.008) and the second stage (p= 0.001) compared to the control group. The average duration of the first stage is reduced by 23 minutes and the second stage is reduced by 20 minutes (Valiani et al., 2018) This ear acupuncture method produces a decrease in adrenaline and noradrenaline, and an increase in endorphins which make uterine contractions regular, thus effectively shortening the duration of labor. Another study reported that the length of the active phase was significantly lower in auriculotherapy than in the control group (Mean= 176.2; SD= 1 minute vs. Mean= 342.8; SD= 87.2 minutes, p<0.001) (Abedi et al., 2017) Auriculotherapy has an effect on increasing endorphins, which may be the cause of increased oxytocin from the posterior pituitary, leading to this outcome and shortening the length of the labor stage. These results are also in line with research by Alimoradi et al. (2020) where the duration of the active phase of labor in the ear acupressure group was significantly shorter than in the body acupressure group and the control group (p<0.001) (Alimoradi et al., 2020).

The duration of the first stage of labor in the active phase in primigravidas generally lasts g hours, from 4 cm dilated to 10 cm dilated, with an average speed of 1 cm per hour (JNKR, 2017; WHO, 2020). Uterine root and Prostaglandin treatment stimulates the posterior pituitary produces the hormone oxytocin. The increase in the hormone oxytocin makes uterine contractions stronger, this is proven by 57% of mothers experiencing a shorter labor duration (<360 minutes). Contractions that become progressively stronger cause the cervix to stretch so that the baby is pushed into the birth canal. This creates positive feedback where the stretching of the cervix due to the pushing of the baby stimulates the uterus to contract more strongly in the next cycle. As contractions increase, the cervix continues to stretch causing the baby to be expelled. The frequency of contractions increases as labor progresses, accompanied by an increase in intensity, and can cause uterine spasms if not balanced with rhythmic relaxation. Uterine spasms will result in cessation of blood flow through the placenta, which can cause fetal death (Cunningham, 2014). In this study, the average length of labor in the first active phase of labor in the AKAR group was (Mean= 365.40; SD= 65.60), meaning that no research subjects experienced precipitate labor due to AKAR treatment. So, AKAR can be used as a non-pharmacological alternative to overcome the problem of length of labor in the first stage.

AUTHOR CONTRIBUTION

Setiawandari analyzed the data, Setiana Andarwulan collected the data, Annah Hubaedah checked and edited the article.

FUNDING AND SPONSORSHIP

This research was funded by DIKTI grant receipts

ACKNOWLEDGEMENT

The researcher's thanks go to DIKTI for the financial support and PGRI Adi Buana University Surabaya.

CONFLICT OF INTEREST

There are no conflicts of interest.

REFERENCE

Abedi P, Rastegar H, Valiani M, Saadati N (2017). The Effect of auriculotherapy on labor pain, length of active phase and episiotomy rate among reproductive aged women. J Family Reprod Health. 11(4): 185–190.

Alimoradi Z, Kazemi F, Gorji M, Valiani M (2020). Effects of ear and body acupressure on labor pain and duration of labor active phase: A randomized controlled trial. Complement Ther Med. 51:102413. doi: 10.1016/j.ctim.-2020.102413.

Australian Institute of Health and Welfare (2018). Teenage Mothers in Australia. (May), p. 16.

Cunningham (2014). Williams Obstetrics. 24th edn. Edited by F. G. Cunningham et al. New York: Mc Graw Hill Education Medical.

Cunningham (2014). Obstetric Williams Edition 23. Jakarta: EGC.

Desmawati, Kongsuwan W, Chatchawet W (2021). Level of labor pain, level of labor pain behaviors, and cultural pain behaviors among first-time Indonesian muslim mothers. J Obstet Gynecol. 11(01): 27–39. doi: 10.4236/ojog.-2021.111004.

Durat G, Çulhacik GD, Doğu Ö, Turan Z, Atasoy I, Toker E (2018). The development of an anxiety assessment scale for pregnant women in labor. Saudi Med J. 39(6):609–14. doi: 10.15537/-smj.2018.6.22266

Fu Y, Tang L, Hu M, Xiang Z, Hu Y (2020). Changes of serum interleukin-6 in healthy pregnant women and establishment of relevant reference intervals. Clin Chim Acta. 502:116-119. doi: 10.1016/j.cca.2019.12.013.

Hawker GA, Mian S, Kendzerska T, French M (2011). Measures of adult pain: Visual Analog Scale for Pain (VAS Pain), Numeric Rating Scale for Pain (NRS Pain), McGill Pain Questionnaire (MPQ), Short-Form McGill Pain Questionnaire (SF-MPQ), Chronic Pain Grade Scale (CPGS), Short Form-36 Bodily Pain Scale (SF-36 BPS), and Measure of Intermittent and Constant Osteoarthritis Pain (ICOAP). Arthritis Care Res (Hoboken). 63 Suppl 11:-S240-52. doi: 10.1002/acr.20543.

Hebisch G, Neumaier-Wagner PM, Huch R, von Mandach U (2004). Maternal serum interleukin-1 beta, -6 and -8 levels and potential determinants in pregnancy and peripartum. J Perinat Med. 32(6):475-80. doi: 10.1515/-JPM.2004.131.

JNKR (2017). Asuhan persalinan normal asuhan esensial bagi ibu bersalin dan bayi bayu lahir serta penatalaksanaan komplikasi segera pascapersalinan dan nifas (Normal delivery care, essential care for mothers and newborn babies, as well as management of immediate postpartum and postpartum complications). Jakarta: JNPK-KR, POGI, IDAI, USAID.

Londero AP, Rossetti E, Pittini C, Cagnacci A, Driul L (2019). Maternal age and the risk of adverse pregnancy outcomes: a retrospective cohort study. BMC Pregnancy Childbirth. 2019 Jul 23;19(1):261. doi: 10.1186/s12884-019-2400-x.

Mohebi S, Parham M, Sharifirad G, Gharlipour Z, Mohammadbeigi A, Rajati F (2018). Relationship between perceived social support and self-care behavior in type 2 diabetics: A cross-sectional study. J Educ Health Promot. 7:48. doi: 10.4103/jehp.jehp_73_17.

Rejeki S, Solichan A, Nuroini F (2021). Maternal interleukin-6 and prostaglandin levels post-regiosacral counter-pressure as pain therapy due to uterine

contractions. Media Keperawatan Indonesia. 4(4): 291. doi: 10.26714/mki-.4.4.2021.291-297.

Setiawandari S, Pramono N, Saputra K (2022). Auricular acupuncture on uterine point on PGF2α levels and first-stage of labor duration among primigravida women. Embrio. 14(2): 159–167.doi: 10.36456/embrio.v14i2.6003.

Valiani M, Azimi M, Dehnavi ZM, Mohammadi S, Pirhadi M (2018). The effect of auriculotherapy on the severity and duration of labor pain. J Educ Health Promot. 7:101. doi: 10.4103/-jehp.jehp_141_17.

Vilotić A, Nacka-Aleksić M, Pirković A, Bojić-Trbojević Ž, Dekanski D, Jovanović Krivokuća M (2022). IL-6 and IL-8: an overview of their roles in healthy and pathological pregnancies. Int J Mol Sci. 23(23):14574. doi: 10.3390/ijms232314574.

WHO (2020). Labour care guide user's manual. licence: C. Geneva: World Health Organization.