

The Effect of Auricular Acupressure on Uterine Contractions, Fetal Heart Rate, and Length of Labor in the Active Phase of Primigravida

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ABSTRACT

The still high maternal mortality rate (MMR) in Indonesia, especially in East Java, is caused by indirect causes or other causes such as prolonged labor, so a method is needed to treat cases of prolonged labor such as auricular acupressure. Auricular acupressure (AKAR) is a non-pharmacological method proven effective for uterine contractions, but its side effects on the fetal heart rate (FHR) are unknown. The research aimed to analyze the AKAR method on uterine contractions, FHR, and labor duration in the first stage's active phase. This type of research is truly experimental, with a pretest-posttest control group design. The research subjects were 41 respondents, primigravida active phase first-stage mothers, selected by consecutive sampling and randomly divided into two groups, namely 21 AKAR groups and 20 deep breathing relaxation control groups. The research results of the Friedman test statistical test p -value = 0.000 in the AKAR group and p -value = 0.000 in the control group, meaning that AKAR influences uterine contractions. The Friedman Test findings show that AKAR does not affect DJJ (p -value = 0.618). The Independent Sample Test p -value = 0.29 indicates no statistically significant difference between the two groups' labor lengths throughout the first stage's active phase. The AKAR group's average labor time in the first stage of the active phase was 365.40 minutes, with a minimum of 267 minutes and a high of 395 minutes. Conclusion: The auricular acupressure method affects uterine contractions but does not affect the fetal heart rate. There was no difference in the length of labor in the first active phase of labor between the auricular acupressure and deep breathing relaxation groups, so it is recommended that the auricular acupressure method can be used as an alternative complementary care to prevent prolonged labor.

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Introduction

The Indonesian Ministry of Health aims to reduce the country's maternal mortality rate (MMR) to 131 per 100,000 live births by 2030. Ensuring that all mothers have access to high-quality healthcare services, including skilled healthcare providers who help with birthing in medical facilities, is one way to expedite the decrease of the MMR. In Indonesia, 90.9% of births occurred in healthcare facilities in 2021; this percentage did not decrease from 2020 but increased. The MMR increased by 7,389 in 2021, with the majority of cases coming from COVID-19 (2,982 cases), bleeding (1,330 cases), hypertension (1,077 cases), and 1,309 other causes (Kemenkes RI, 2022). Prolonged labor is another factor causing maternal death, where these other causes are the highest cause of MMR in East Java Province (Dinkes, 2021).

Any labor period during the first stage of the primigravid active phase that lasts more than six hours is considered prolonged labor. Stage I, Stage II, Stage III, and Stage IV are the four phases of labor. The first stage is separated into an active phase and a latent phase. The first stage of labor lasts 20 hours in primigravida and 14 hours in multigravidas (Swier, 2021; Julia et al., 2023). Labor issues in the first and second phases are caused by an incoordination of contractions that impedes the labor process and increases its duration.

Active mobility and dietary correction are the first lines of treatment for protracted labor at level-one health institutions; if these methods are ineffective, a referral to a second-level health center for an oxytocin drip is made. Although this care has shown to be effective, a cesarean section is used to deliver the fetus if delivery difficulties arise. This affects both the rate of cesarean section deliveries and the rise in MMR.

Acupressure, body acupuncture, nipple stimulation, massage therapy with oxytocin, and active mobilization are non-pharmacological techniques to induce uterine contractions. Mothers cannot employ all of these techniques; for example, women who give birth with broad apertures find it challenging to mobilize because of contractions in their uterus. Maternal mobilization is hampered by body acupuncture, improper pressure on acupressure points results in suboptimal De Qi, and most mothers feel uncomfortable stimulating their nipples. Auricular acupressure, or AKAR, is a diagnostic and therapeutic approach that stimulates particular ear sites to restore normalcy to bodily dysfunction. Neurological reflexes, neurotransmitters, cytokines, the immunological system, and inflammation are all involved in ear stimulation (Hou et al., 2015).

The observed improvement of pain and disease is thought to occur through activating the reticular formation and the sympathetic and parasympathetic nervous systems. Contemporary studies validate the effectiveness of ear acupuncture in relieving pain and reducing anxiety (Gori & Firenzuoli, 2007). This is because the ear is supplied with nerves from cranial and spinal origins, further divided into regions responsible for motor and sensory functions. The motor area pertains to the motor division of the facial nerve (CN VII), which governs the external ear muscles. The sensory area comprises the auricular branch of the vagus nerve (ABVN), the auriculotemporal nerve (a branch of the CN V), the glossopharyngeal nerve, the lesser occipital nerve, and the more significant auricular nerve. These nerves have a direct connection to the brain and impact the functioning of the body's organs (Hou et al., 2015).

Non-pharmacological strategies to invigorate uterine constrictions incorporate dynamic preparation, areola excitement, oxytocin back rub, pressure point massage, and body needle therapy. These techniques cannot be utilized by moms; for example, activation. Moms conceiving offspring with broad openings experience issues assembling because of uterine compressions. Areola excitement: Most moms have an off-kilter outlook on invigorating their areolas. Unseemly tension on pressure point massage guides causes De Qi not to be ideal, and body needle therapy impedes maternal preparation. Auricular pressure point massage (AKAR) is a demonstrative treatment framework in view of the standardization of body brokenness through excitement of explicit focus on the ear. Ear excitement

includes neurological reflexes, synapses, cytokines, the invulnerable framework, and irritation (Hou et al., 2015).

There is currently relatively little research on AKAR in obstetrics, including studies on labor pain, prolonged labor, mother anxiety, and uterine contractions. Additionally, there is a paucity of evidence supporting biomarkers that trigger pain, uterine contractions, and anxiety. Due to these restrictions, further research must be done on AKAR's potential to help women overcome childbirth-related issues. Compared to body acupuncture, AKAR was found to have a significant value ($p < 0.001$) in lowering labor pain and shortening the time of labor during the first active phase (Alimoradi et al., 2020) Long The active phase of the first stage of labor was significantly lower in AKAR compared control group (176.2 ± 1 minutes vs. 342.8 ± 87.2 minutes, $p < 0.001$) and reduced episiotomy pain (Abedi et al., 2017; Jaić et al., 2019), labor pain $p = 0.001$, anxiety level $p = 0.0015$ (Mafetoni et al., 2018), and *low back pain* (Vas; et al., 2014) and the latest research reported that A KAR significantly ($p = 0.011$) increased β -endorphin levels and reduced labor pain. (Setiawandari et al., 2022)

There is still limited research related to acupressure auricular with biomarkers that influence labor and the side effects of AKAR on maternal and fetal health, so it is hoped that AKAR can be applied as a non-pharmacological method to overcome the problem of long labor in type C and D health service institutions that are easily accessible to the public and low cost. Affordable. This study aimed to determine the effectiveness of AKAR on uterine contractions, FHR, and duration of labor during the first stage of the active phase.

Method

This research is true experimental with a pretest-posttest control group design. The research population was all primigravida mothers who were expected to give birth between July and September 2023, 41 people at a midwife's independent practice place, and two enumerators with a registration certificate and a midwife practice permit. The enumerator assists in physical examinations and observing uterine contractions and fetal heartbeat. The research sample was primigravida active phase first-stage mothers. The process of selecting research subjects was conducted via consecutive sampling. Participants who matched the specified criteria were randomly assigned to either the AKAR intervention group or the deep-breathing relaxation control group. Inclusion criteria for this study were as follows: maternal age 20-35 years, gestational age 37-41 weeks, single fetus head position. Variables in the study were auricular acupressure, uterine contractions, fetal heart rate, and length of the first active phase. The intervention group underwent auricular acupressure on Uterine and Shen Men points using the tip of the index finger every relaxation period for 3 minutes from $\emptyset 4$ cm to $\emptyset 10$ cm. Uterine contractions are measured every 30 minutes for 3 hours, with three assessment indicators: 1) adequate (frequency: 5x/minute, duration: 46-50 seconds, intensity/strength: the uterus hardens during contractions, so you cannot press the uterus with your fingers); 2) inadequate (frequency: 4x/minute, duration: 40-45 seconds, intensity/strength: uterus can still be pressed with fingers); 3) not adequate (frequency: 3x/minute, duration: 30-39 seconds, intensity/strength: uterus can still be pressed with fingers). FHR is

measured every 30 minutes for 3 hours, with three indicators: 1) FHR <120 bpm (bradycardia); 2) FHR 120-160bpm (standard); 3) FHR 160bpm (tachycardia). The length of labor in the active phase of the first stage of labor was observed using the WHO Partograph sheet from a 4-10 cm cervical opening, with two indicators: 1) 6 hours (360 minutes) (normal); 2) >6 hours (>360 minutes) (not normal). Statistical tests using the Friedman test for data with repeated measurements in this study are uterine contractions and fetal heart rate and independent sample tests to determine the effect of auricular acupressure and deep breathing relaxation on the duration of labor in the active phase of the first stage.

The study ethics approval letter was obtained from the study ethics committee of the Faculty of Health Sciences UNIPA Surabaya Ethical Approval No. 108/KEPK, dated 5 June 2023.

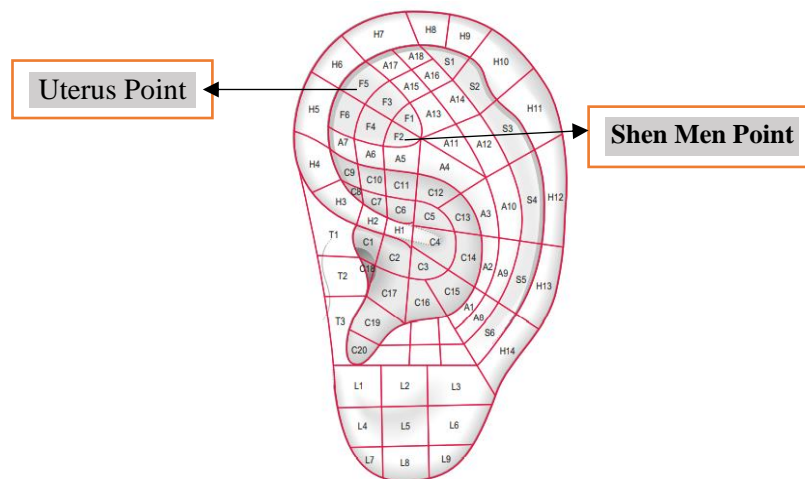


Figure 1. Uterus Point (TF5) and Shen Men (TF 2)

Results

Table 1. Characteristics of Respondents Based on Age, Education, Work, and Gestational Age

Characteristics	Group Auricular Acupressure		Mean (±SD); Median, Min-Mak	Group Deep Breathing Relaxation		Mean (±SD); Median, Min-Mak	p value
	N=21	%		N=20	%		
Age (years)							
<20	3	14.30	25.24(±4.80);	4	20.00	24.85(±4.63);	0.783
20-30	15	71.40	25.00(18-34)	13	65.00	24.00(18-33)	
31-35	3	14.30		3	15.00		
Education							
Junior High School	4	19.00		3	15.00		0.793
Senior High School	15	71.50		13	65.00		
Bachelor	2	9.50		4	20.00		
Work							
Housewife	13	61.90		15	75.00		0.265
Private sector employee	4	19.00		2	10.00		
Self-employed	1	4.80		2	10.00		
Civil servants	3	14.30		1	5.00		
Gestational age (weeks)							
37 Weeks	1	4.80	38.86(±0.91);	3	15.00	38.55(±0.88);	0.956
38 Weeks	7	33.30	39.00 (37-40)	5	25.00	39.00(37-40)	
39 Weeks	7	33.30		10	50.00		
40 Weeks	6	28.60		2	10.00		

*Oneway Test

Table 1 shows that most respondents in the intervention group and the control group were aged between 20-30 years, namely 15 people (71.40%) in the intervention group and 13 people (65.00%) in the control group. Most of the respondents' education was senior high school, namely 15 people (71.50%) in the intervention group and 13 people (65.00%) in the control group. Most of the respondents' work were non-working/housewives, namely 13 people (61.90%) in the intervention group and 15 people (75.00%) in the control group. In comparison, the gestational age in the intervention group was 38 and 39 weeks of gestation—7 people (33.30%) and mostly 10 people (50.00%) in the control group.

The mean age in the intervention group was 25.24 (± 4.80), with a minimum age of 18 and a maximum age of 34. Meanwhile, the mean age in the control group was 24.85 (± 4.63), with a minimum age of 18 years and a maximum age of 33 years.

The homogeneity test results with the One-way test p -value for age, occupation, education, and gestational age were >0.05 , meaning the characteristics of the two groups were homogeneous.

In Table 2, it is known that pre-test uterine contractions in the intervention group were more than half of 13 people (61.90%) with inadequate uterine contractions, as well as in the control group, more than half of 13 people (65.00%) also had inadequate uterine contractions. Post-test uterine contractions in the intervention group (52.38%) were inadequate, while in the control group, the majority of 14 people (70.00%) were also inadequate.

More than half of the uterine contractions 90 minutes later in the intervention group, 12 people (61.90%) were inadequate, while in the control group, most of the 17 people (85.00%) were inadequate.

At the 120th minute, more than half of the uterine contractions in the intervention group, 11 people (52,38%), were adequate, while in the control group, less than half, nine people (45,00%) were inadequate.

At the 150th minute, uterine contractions in the intervention group, 14 people (66.67%) were primarily adequate, while in the control group, less than half, eight people (40,00%) were inadequate.

At the 180th minute, uterine contractions in the intervention group were mainly 16 people (76.19%) adequate, while in the control group, nine people (45.00%) were adequate.

At the 210th minute, uterine contractions in the intervention group, the majority of 19 people (90.48%) were adequate, while in the control group, the majority of 17 people (80.95%) were also adequate.

The normality test results with Shapiro Wilk p -value in both groups were <0.005 , meaning that the data in the intervention and control groups were not normally distributed. The results of the Friedman test statistical test p -value = 0.000 ($<0,05$) in the intervention group and p -value = 0.000 ($<0,05$) in the control group, meaning that there is an influence of the auricular acupressure method on uterine contractions.

Table 2. Observation Results of Uterine Contractions in the Intervention Group and Control Group Before and After Intervention

Uterine Contractions	Group Auricular Acupressure (N=21)							p value	Group Deep Breathing Relaxation (N=20)							p value
	Adequate	%	In adequate	%	Not adequate	%	Adequate		%	In adequate	%	Not adequate	%			
	<i>Pre-test</i>															
30 minutes	0	0.00	8	38.10	13	61.90	0,000*	0,000**	0	0.00	7	35.00	13	65.00	0,000*	0,000**
<i>Post-test</i>																
60 minutes	0	0.00	11	52.38	10	47.62	0,000*		0	0.00	14	70.00	6	30.00	0,000*	
90 minutes	4	19.05	13	61.90	4	19.05	0,001*		0	0.00	17	85.00	3	15.00	0,000*	
120 minutes	11	52.38	10	47.62	0	0.00	0,000*		5	25.00	9	45.00	6	30.00	0,000*	
150 minutes	14	66.67	7	33.33	0	0.00	0,000*		7	35.00	8	40.00	5	25.00	0,001*	
180 minutes	16	76.19	5	23.81	0	0.00	0,000*		9	45.00	9	45.00	2	10.00	0,001*	
210 minutes	19	90.48	2	9.52	0	0.00	0,000*		17	80.95	8	40.00	0	0.00	0,000*	

*Shapiro Wilk test

**Friedman test

Table 3. Observation Results of Fetal Heart Rate in the Intervention Group and Control Group Before and After Intervention

DJJ Observations	Group Auricular Acupressure (N=21)								p value	Group Deep Breathing Relaxation (N=20)								p value		
	120-160 bpm		Mean(±SD);		<120 bpm		>160 bpm			120-160 bpm		Mean(±SD);		<120 bpm		>160 bpm				
	N	%	Min	Mak	n	%	n	%		n	%	Min	Mak	n	%	n	%			
<i>Pre-test</i>																				
30 minutes	21	100.00	144.67(±3.18);	138-148	0	0.00	0	0.00	0.002*	0.618**	20	100.00	144.50(±3.17);	138-148	0	0.00	0	0.00	0.003*	0.182**
<i>Post-test</i>																				
60 minutes	21	100.00	145.05(±2.80);	138-148	0	0.00	0	0.00	0.002*		20	100.00	145.00(±2.79);	138-148	0	0.00	0	0.00	0.002*	
90 minutes	21	100.00	145.71(±2.15);	140-148	0	0.00	0	0.00	0,000*		20	100.00	146.009±1.58);	140-148	0	0.00	0	0.00	0,000*	
120 minutes	21	100.00	144.67(±3.18);	138-148	0	0.00	0	0.00	0.002*		20	100.00	144.80(±3.33);	138-148	0	0.00	0	0.00	0.001*	
150 minutes	21	100.00	145.05(±2.80);	138-148	0	0.00	0	0.00	0.002*		20	100.00	145.009 ± 2.79);	138-148	0	0.00	0	0.00	0.002*	
180 minutes	21	100.00	145.71(±2.12);	140-148	0	0.00	0	0.00	0,000*		20	100.00	144.90(±2.93);	138-148	0	0.00	0	0.00	0,000*	
210 minutes	21	100.00	143.33(±3.86);	138-148	0	0.00	0	0.00	0.001*		20	100.00	142.60(±3.61);	138-148	0	0.00	0	0.00	0.002*	

*Shapiro Wilk test

**Friedman test

In Table 3, it is known that the observation results for Fetal Heart Rate (FHR) in the intervention group were 21 people (100%) with normal FHR (120-160 bpm), as well as FHR in the control group, were 20 people (100%) with normal FHR (120- 160bpm). No one experienced FHR < 120 bpm and >160 bpm.

In the intervention group, the average increase in FHR was 1-2bpm, with the highest rank being 90 minutes of FHR. The Shapiro Wilk test results from the seven FHRs in the intervention group ρ -value = <0.05, meaning the seven FHR data above are normally distributed. The statistical test results using the Friedman Test ρ -value = 0.618 (>0,05) means that the auricular acupressure method does not affect FHR, so it is safe for the fetus.

In the control group, the average increase in Fetal Heart Rate was 1-2bpm, with the highest rank at 90 minutes of Fetal Heart Rate. The Shapiro Wilk test results from the seven Fetal Heart Rates in the control group ρ -value = <0.05, meaning that the seven Fetal Heart Rate data above are normally distributed. The statistical test results using the Friedman Test ρ -value = 0.182 (>0,05) means that the deep breathing relaxation method does not affect the Fetal Heart Rate, so it is safe for the fetus.

Table 4. Length of Labor in the First Stage of Primigravida Active Phase in the Intervention Group and Control Group

Length of Labor in the First Stage of the Active Phase	Group Auricular Acupressure (N=21)		Group Deep Breathing Relaxation In (N=20)		ρ value	
	N	%	N	%		
	6 hours (\leq 360 minutes)	13	61.90	9		
> 6 hours (>360 minutes)	8	3.81	11	55.00		
Mean(\pm SD)	365.40(\pm 65.60)		395.55(\pm 79.38)		0.241*	
Median; Min-Mak	360.00;267-395		396.00;270-540			
Total	21	100.00%	20	100.00%		

*Wilk Shapiro test

#Independent samples test

In Table 4, it is known that in the intervention group, the majority of 13 people (61.90%) had a duration of labor of \leq 360 minutes, whereas in the control group, the majority of 13 people (65.00%) had a duration of labor of >360 minutes.

The average duration of labor in the active phase of the first stage of labor in the auricular acupressure group was 365.40, with a minimum duration of 267 minutes and a maximum duration of 395 minutes. The average duration of labor in the active phase of the first stage in the deep breathing relaxation group was 395.55, with a minimum duration of 270 minutes and a maximum duration of 540 minutes. The average difference between the two groups was 30 minutes and 15 seconds.

Shapiro Wilk test results ρ -value = 0.311 (pre-test) and ρ -value = 0.241 (post-test), meaning the data is usually distributed. The results of the Independent Sample Test ρ -value = 0.293 (>0.05) mean no significant difference between the length of labor in the active phase of the first stage of labor in the auricular acupressure group and the deep breathing relaxation group.

Discussion

Friedman Test statistical test ρ -value = 0.000 in the intervention group and ρ -value = 0.000 in the control group, meaning that the auricular acupressure method influences uterine contractions. The statistical test results using the Friedman Test ρ -value = 0.618 means that the auricular acupressure method does not affect FHR, so it is safe for the fetus.

The results of the Independent Sample Test ρ -value = 0.293 means that there is no significant difference between the length of labor in the active phase of the first stage of labor in the auricular acupressure group and the deep breathing relaxation group. The average duration of labor in the active phase of the first stage in the auricular acupressure group was 365.40, with a minimum duration of 267 minutes and a maximum duration of 395 minutes.

Auricular acupressure is a method carried out by stimulating the outer earlobe at the Uterus point, Oxytocin point, and Prostaglandin point, using the tip of the index finger above each relaxation period for 3 minutes from \emptyset 4 cm to \emptyset 10 cm. Auricular stimulation of the Uterine and Prostaglandin points is connected to the central nervous and neurovascular systems. Uterine point auricular acupressure activates the posterior pituitary to release oxytocin. The direct action of oxytocin on the myometrium produces regular and effective contractions, while the indirect action of oxytocin on the basal decidua increases $\text{PGF}_{2\alpha}$ production. Prostaglandins ($\text{PGF}_{2\alpha}$ and PGE_2) are important bioactive metabolites for arachidonic acid involved in labor. PGE_2 is found mainly in the amnion and chorion. In contrast, $\text{PGF}_{2\alpha}$ is found in the decidua basalis and endometrium, so it is reported that the decidua is the source of this uterotonic agent (Yanuarman, 2008.).

$\text{PGF}_{2\alpha}$ increases intracellular concentrations by stimulating the release of stored calcium, resulting in uterine contractions. When the uterus contracts, it pushes the fetus into the cervix, sending nerve signals to the brain and causing oxytocin secretion. Oxytocin stimulates myometrial contraction by lowering the threshold for action potential generation and inducing an influx of intracellular calcium. A positive feedback cycle is propagated as contractility becomes more intense and there is more oxytocin release. $\text{PGF}_{2\alpha}$ helps oxytocin bind to its receptors. Increasing levels of $\text{PGF}_{2\alpha}$ and the hormone oxytocin cause an increase in uterine activity and pain-stimulating terminal nerve fibers, which causes auricular acupressure stimulation to influence uterine contractions and duration of labor.

Research on acupressure and uterine contractions has been widely conducted in Indonesia and abroad. The effect is not only on increasing uterine contractions but also on cervical dilatation. Research on auricular acupressure on reducing the duration of labor carried out by Setiawandari et al. (2023) reported that there was no significant difference in the length of labor in the active phase of the first stage between the auricular acupuncture and deep breath relaxation groups, meaning that auricular acupuncture was as effective as the deep breath relaxation method for reducing the duration of labor, the first phase of the active phase with an average difference of 42.15 minutes (Setiawandari et al., 2023).

The auricular acupressure method affects uterine contractions, where the results of observations carried out for 3 hours of uterine contractions are adequate and do not cause pathological uterine

contractions, namely hypotonic or hypertonic. This affects the fetal heart rate. The results of this study report that the fetal heart rate is normal and does not cause fetal distress (bradycardia or tachycardia). However, so far, there has been no research on the effects of auricular acupressure on fetal heart rate, the general research outcomes are on the results end of the birthing process. Research conducted on healthy adults reported that auricular acupuncture on the left sympathetic point caused a significant decrease in heart rate $p < 0.05$ and activated the parasympathetic nervous system when healthy people lay relaxed. This is because stimulation of acupuncture points in the ear of the vagus nerve will increase parasympathetic activity, and HF (High Frequency), modulated by parasympathetic activity, can increase (Trinh et al., 2023). Of course, there is a difference between the fetal heart rate and the heart rate of a healthy adult. Therefore, follow-up research is needed regarding the effects on the fetal heart rate by using fetal heart rate detection tools that are more sophisticated than the funandoscope and Doppler.

Conclusions

This study concludes that auricular acupressure affects uterine contractions. However, it does not affect the fetal heart rate. There is no difference in the length of labor in the active phase of the first stage of labor between the ear acupressure group and the deep breathing relaxation group, with a difference in the average length of labor in the active phase of the first stage of labor in both group 30 minutes 15 seconds.

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