

Meta-Analysis: The Effect of Prenatal Yoga and the Use of Transcutaneous Electrical Nerve Stimulation During Pregnancy on Labor Pain

Fiqi Widyawati¹⁾, Bhisma Murti¹⁾, Rita Benya Adriani²⁾

¹⁾Masters Program in Public Health, Universitas Sebelas Maret

²⁾Health Polytechnics, Ministry of Health Surakarta

ABSTRACT

Background: Pregnant women are suggested to do light exercise to reduce complaints such as spasms, low back pain, hypertension and other problems. Prenatal yoga and the use of TENS are media that can help reduce pain during labor. The aimed of the study was to analyze the effect of prenatal yoga and the use of TENS during pregnancy on labor pain with a meta-analysis study.

Subjects and Method: This was a systematic review and meta-analysis. The study was carried out using PRISMA flow diagrams. Search articles through journal databases including PubMed, Google Scholar, and Science Direct by selecting articles published in 2001-2021. The keywords used were "pregnancy" OR "pregnant" AND "pregnant women" AND "pregnant" AND "prenatal yoga" AND "Transcutaneous electrical nerve stimulation" AND "labor pain" AND "Randomized Controlled Trial". Article searches were performed using the PICO model. Population: Pregnant women, Intervention: prenatal yoga and TENS practice, Comparison: routine care from midwives, Outcome: labor pain. The inclusion criteria were full text articles with a Randomized Controlled Trial (RCT) study design, articles using English, research subjects were pregnant women, the exercises given were prenatal yoga and TENS, the effect size research method used Mean SD, articles were analyzed using the Revman 5.3 application.

Results: A meta-analysis of 4 primary studies on the use of prenatal yoga on labor pain showed that the reduction in pain in postpartum women was 0.39 times lower than that of women in labor receiving routine care from a midwife (SMD=-0.39; 95% CI=-1.66 to 0.88; p=0.550) and from 5 primary studies on the use of TENS for labor pain, it showed a 0.78 times lower reduction in pain in childbirth compared to women who received routine care from a midwife (SMD= -0.78; 95% CI= -1.92). up to 0.37; p=0.190).

Conclusion: The use of prenatal yoga and administration of TENS can reduce labor pain, but not statistically significant.

Keywords: prenatal yoga, TENS, labor pain, meta-analysis

Correspondence:

Fiqi Widyawati. Masters Program in Public Health, Universitas Sebelas Maret. Jl. Ir. Sutami 36A, Surakarta 57126, Central Java, Indonesia. Email: vikiwidyawati808@gmail.com. Mobile:0822314-58699.

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BACKGROUND

The estimated number of pregnant women in Indonesia in 2019 is 5,256,483 people, and the number of women giving birth is

5,017,552 people. In 2019, the most common causes of maternal death were bleeding (1,280 cases), hypertension during

pregnancy (1,066 cases), and infection (207 cases) (Kemenkes, 2020).

Pregnancy can occur after the sperm and ovum meet, then grow and develop in the uterus for 259 days or 37 weeks or up to 42 weeks (Sari et al., 2018). Important factors that can affect the smooth delivery process include power (energy), passage (birth canal), passenger (fetus, placenta), psychological (influenced by birth attendants), position (Wulan, 2018).

Complete calm and relaxation of the body can be achieved by doing physical exercises that can be carried out before, during and after pregnancy. Prenatal yoga is a moderate-intensity physical activity for pregnant women as well as mind and body exercises including stretching and posture exercises (asana) combined with deep breathing (pranayama) and meditation (Aflahiyah et al., 2020).

Prenatal yoga is a physical exercise that is carried out to create a balance between the emotional, mental, physical and spiritual dimensions to prepare pregnant women for the birth process and help relieve discomfort caused by body changes during pregnancy (Fitriani, 2019).

Based on research by Chuntharapat (2008) that women who do yoga are known to have a higher level of comfort during labor and at 2 hours after delivery, and feel less labor pain than women in the control group. The women who did yoga experienced shorter labor ($p < 0.05$). While Ostrovsky's research (2017), if prenatal yoga can significantly reduce pain during labor compared to routine obstetric care. The degree of pain reduction is most pronounced at 4 hours after cervical dilation reaches 3-4 cm, and reduces the risk of cesarean delivery. Due to labor pain, it can increase catecholamines by 20-40%. An increase in sympathetic response will increase peripheral resistance, increase cardiac output, increase

blood pressure, and increase maternal oxygen consumption during labor.

Hyperventilation can cause respiratory alkalosis, increased adrenaline levels and decreased uterine blood flow. This causes uterine activity to become uncoordinated which results in prolonged labor (Supliyani, 2017). An increase in plasma cortisol can decrease maternal and fetal immune responses. The secretion of catecholamines that flow to the fetus through the placental blood stream causes acidosis in the fetus (Sunarsih and Sari, 2020).

Management of labor pain is necessary for the well-being of the mother and fetus. Transcutaneous electrical nerve stimulation (TENS) unit is a non-pharmacological labor analgesia method used to reduce pain during the early phase of labor and to delay the use of pharmacological interventions (Dowswell et al., 2009).

In the study of Njogu (2021), that the TENS group showed a statistically significantly shorter duration of the active labor phase than the control group ($p < 0.001$). So that TENS is used as a non-pharmacological therapy to reduce pain and shorten the active labor phase. While in Bedwell's (2011) research, that TENS can reduce pain and increase maternal comfort during childbirth.

Based on these studies, it can be seen that some research results are not conclusive, so a comprehensive study is needed from various primary studies involving the effect of physical intervention during pregnancy on labor pain. The data obtained were analyzed using a systematic review and meta-analysis by synthesizing the results of studies conducted to reduce bias.

SUBJECTS AND METHOD

1. Study Design

The study design used was a systematic review and meta-analysis, using PRISMA flow

diagram guidelines. Article searches were conducted using journal databases including: PubMed, Google Scholar, Science Direct. The keywords used were "pregnancy" OR "pregnant" AND "pregnant women" AND "pregnant" AND "prenatal yoga" AND "Transcutaneous electrical nerve stimulation" AND "labor pain" AND "Randomized Controlled Trial".

6. Inclusion Criteria

The inclusion criteria in this study were full text articles from 2001-2021 using a Randomized Control Trial (RCT) study design, the research subjects were pregnant women, the exercises provided were prenatal yoga and TENS, pain assessment using VAS (visual analogue scale), articles published in English, the research method is Mean SD, and analyzed using the Revman 5.3. application.

7. Exclusion Criteria

Exclusion criteria in this study were the results of the study did not include the complete mean and standard deviation, the exercises provided were prenatal yoga treatment and TENS with additional treatments.

8. Operational Definition of Variable

The search for articles was carried out by considering the eligibility criteria defined using the PICO model. The population in the study were pregnant women. Intervention is giving prenatal yoga and TENS exercises. Comparison is the routine care of the midwife, and Outcomes are labor pains.

Prenatal yoga is an exercise activity with special postures and breathing techniques that are beneficial for pregnant women to reduce discomfort due to body changes during pregnancy. Yoga begins at 18 weeks of gestation with intervals of 3 times every week for 60 minutes, for 4 meetings by a yoga instructor. The instrument used is the management of published articles (observations), dichotomous measurement scale.

Transcutaneous electrical nerve stimulation (TENS) is a low-frequency, analgesic-type electrotherapy technique, commonly used in musculoskeletal pathology, but can

also be used as an alternative medicine during labor. The instruments used are the management of published articles (observations) and continuous measurement scales.

Labor pain is the amount of decrease in pain intensity after prenatal yoga and TENS treatment. The instrument used is VAS (Visual Analogue Scale) and continuous measurement scale.

9. Instruments

The study was conducted using the PRISMA flow chart guidelines and assessment of the quality of research articles using the critical appraisal tools Randomized Controlled Trials (RCT) published by CEBMa (Center For Evidence-Based Medicine).

10. Data Analysis

The data in this study were analyzed using the RevMen 5.3 application, to calculate the effect size and heterogeneity of the study. The results of data processing are presented in the form of forest plots and funnel plots.

RESULTS

Research from the primary study related to the effect of prenatal yoga and the use of TENS during pregnancy on labor pain consisted of 9 articles originating from 3 continents, namely Asia, Africa, and Australia.

Furthermore, the researchers assessed the quality of the articles using RCT studies, showing the results that prenatal yoga and the use of transcutaneous electrical nerve stimulation during pregnancy had an effect on labor pain. The article search was carried out using a database based on the PRISMA flow diagram, which can be seen in Figure 1.

Assessment of the quality of research articles using critical appraisal tools Randomized Controlled Trials (RCT) published by CEBMa (Center for Evidence-Based Medicine) can be seen in Tables 1 and 2.

1. Does this study address a clear research focus?

2. Is the Randomized Controlled Trial research method appropriate to answer the research question?
3. Were there enough subjects in the study to establish that the findings did not occur by chance?
4. Were subjects randomly allocated to the experimental and control groups? If not, could this be biased?
5. Were inclusion/exclusion criteria used?
6. Were the two groups comparable at the start of the study?
7. Were objective and unbiased outcome criteria used?
8. Are objective and validated measurement methods used in measuring the results? If not, were results assessed by someone who was not aware of the group assignment (i.e. whether assessment in blinding)?
9. Is effect size practically relevant?
10. How precise is the estimate of the effect? Is there a confidence interval?
11. Could there be confounding factors that has not been taken into account?
12. Are the results applicable to your research?

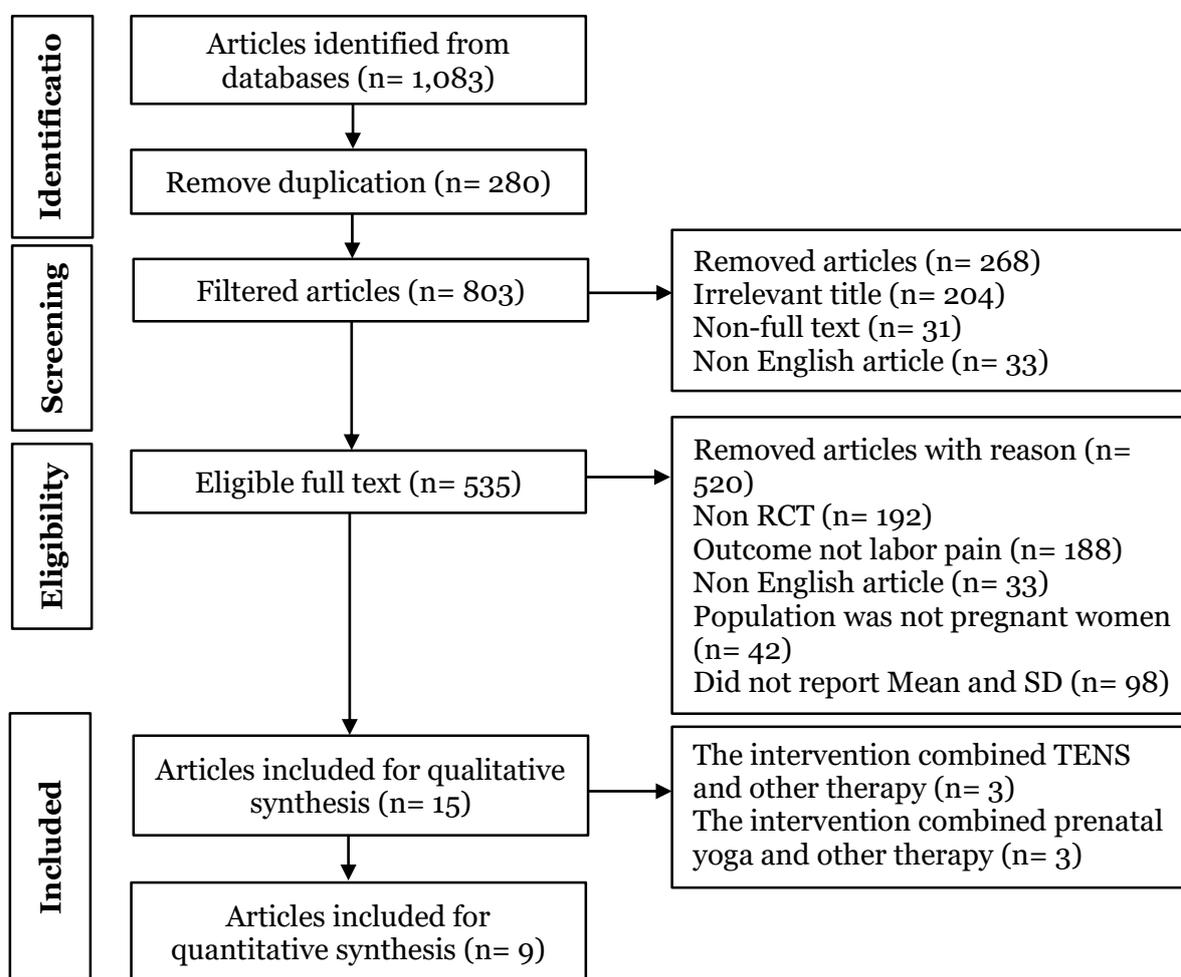


Figure 1. PRISMA flow diagram

Table 1. Research Quality Assessment of the influence of prenatal yoga on labor pain

Primary Study	Criteria												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Jahdi et al., 2016	1	1	0	1	1	1	1	1	1	1	0	1	10
Chuntharapat 2008	1	1	0	1	1	1	1	1	1	1	0	1	10
Bolanthakodi et al., 2018	1	1	1	1	1	1	1	1	1	1	0	1	11
Levett et al., 2016	1	1	1	1	1	1	1	1	1	1	0	1	11

Answer: 1= Yes, 0= No

Table 2. Assessment of Research Quality the effect of TENS on labor pain

Primary Study	Criteria												Total
	1	2	3	4	5	6	7	8	9	10	11	12	
Chao et al., 2007	1	1	1	1	1	1	1	1	1	1	0	1	11
LF HO et al., 2011	1	1	1	1	1	1	1	1	1	1	0	1	11
Shaban, 2013	1	1	1	1	1	1	1	1	1	1	0	1	11
Shahoei et al., 2017	1	1	0	1	1	1	1	1	1	1	0	1	10
Njogu et al., 2021	1	1	1	1	1	1	1	1	1	1	0	1	11

Answer: 1= Yes, 0= No

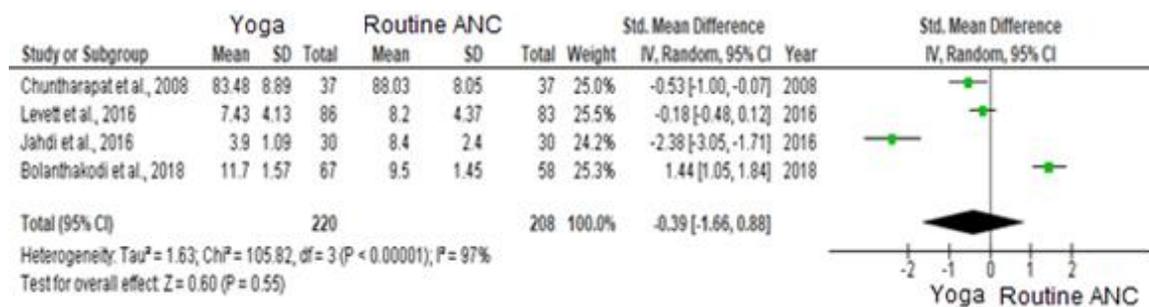


Figure 2. Forest plot of the effect of prenatal yoga on labor pain

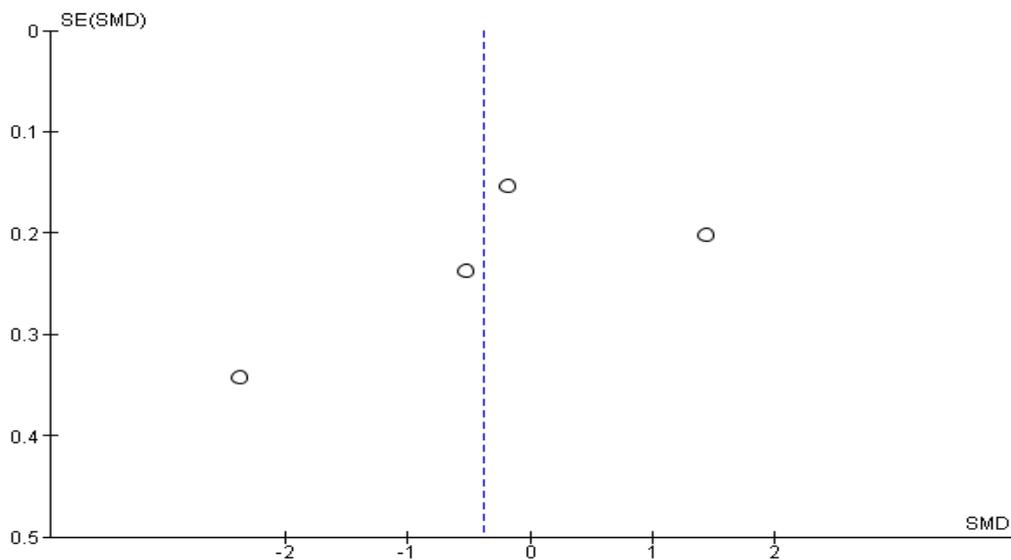


Figure 3. Funnel plot of the effect of prenatal yoga on labor pain

Table 3. Description of the primary study of the effect of prenatal yoga on labor pain

No	Author/ Year	Country	Study Design	Total Sample	Population	Intervention	Comparison	Outcome
1	Jahdi <i>et al.</i> , 2016	Iran	RCT	60	26 weeks pregnant woman	yoga for 60 minutes, 3 times a week	routine care from the midwife	labor pain
2	Chuntha-rapat <i>et al.</i> , 2008	Thailand	RCT	74	28 weeks pregnant woman	yoga for 60 minutes, 3 times a week	routine care from the midwife	labor pain
3	Bolantha-kodi <i>et al.</i> , 2018	India	RCT	200	30 weeks pregnant woman	yoga for 30 minutes, 3 times a week	routine care from the midwife	labor pain
4	Levett <i>et al.</i> , 2016	Australia	RCT	176	Pregnant women aged 24 to 36 weeks	yoga for 30 minutes, 3 times a week	routine care from the midwife	labor pain

Table 4. Description of the primary study of the effect of TENS on labor pain

No	Author/ Year	Country	Study Design	Total Sample	Population	Intervention	Comparison	Outcome
1	Njogu <i>et al.</i> , 2021	China	RCT	326	37 weeks pregnant woman	TENS for 30 minutes, 2 times 24 hours	routine care from the midwife	labor pain
2	Chao <i>et al.</i> , 2007	Taiwan	RCT	105	37 weeks pregnant woman	TENS for 30 minutes starting from the beginning of the active phase of labor	routine care from the midwife	labor pain
4	Shahoei <i>et al.</i> , 2017	Iran	RCT	60	Pregnant women aged 38-42 weeks	TENS for 30 minutes starting from the beginning of the active phase of labor	routine care from the midwife	labor pain
5	LF HO <i>et al.</i> , 2011	Hong Kong	RCT	158	Mother in active labor stage 1	TENS for 30 minutes starting from the beginning of the active phase of labor	routine care from the midwife	labor pain

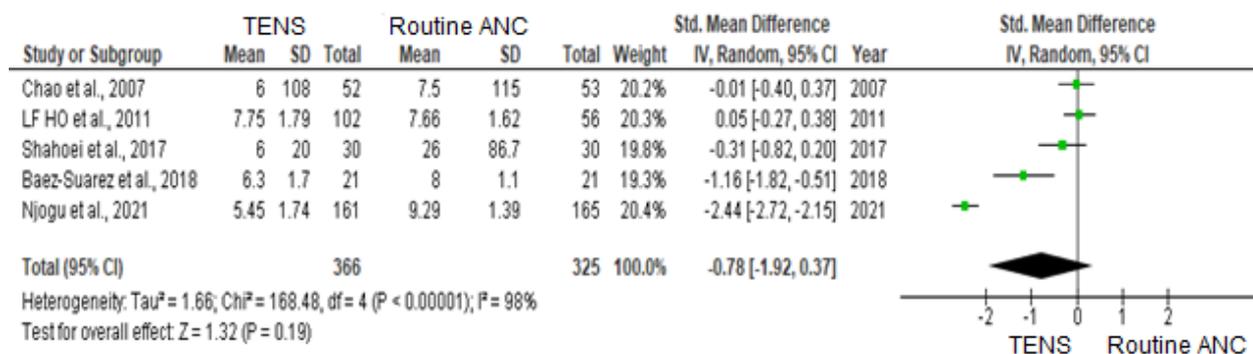


Figure 4. Forest plot of the effect of transcutaneous electrical nerve stimulation on labor pain

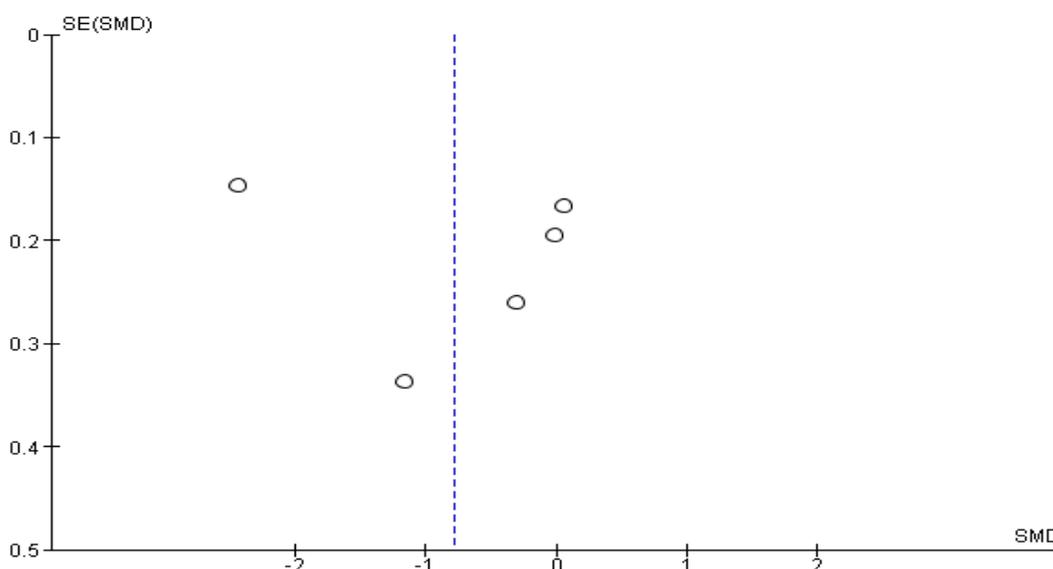


Figure 5. Funnel plot of the effect of transcutaneous electrical nerve stimulation on labor pain

The description of the primary study analyzed as a source of meta-analysis of the effect of prenatal yoga and the use of TENS on labor pain can be seen in Tables 3 and 4.

1. Effect of prenatal yoga on labor pain

Research related to the effect of prenatal yoga on labor pain comes from Iran, Thailand, India, and Australia. An overview of each study can be seen in Table 3.

a. Forest plot

The interpretation of the results of the meta-analysis of the effect of prenatal yoga on labor pain is seen through the forest plot. Figure 2 shows that there is a decreasing

effect on labor pain. Maternity women who routinely practice yoga during pregnancy experienced 0.39 times lower labor pain than women who received regular care from midwives. Based on the analysis, there was a high heterogeneity between experiments (I²=97%; P<0.001) so the Random Effect Model (REM) was used.

b. Funnel Plot

A funnel plot is a plot that represents the approximate size of the effect of each study against an estimate of its accuracy which is usually the standard error. Based on Figure 3, it shows that there is no publication bias

characterized by a balance between the right plot and the left plot.

2. Effect of transcutaneous electrical nerve stimulation on labor pain

Research related to the effect of TENS on labor pain comes from China, Taiwan, Spain, Iran, and Hong Kong. An overview of each study can be seen in Table 4.

a. Forest plot

Interpretation of the results of the meta-analysis of the effect of TENS on labor pain seen through the forest plot, it can be seen in Figure 4 which shows that women giving birth during the early active phase of labor using TENS experienced labor pain 0.78 times lower than women giving birth who received routine care from midwives.

In the analysis there was a high heterogeneity between experiments ($I^2=98\%$; $p < 0.001$) so the Random Effect Model (REM) was used. Statistically not significant (Standardized Mean Difference=-0.78; 95% CI= -1.92 to 0.37; $p=0.19$).

b. Funnel Plot

A funnel plot is a plot that depicts the approximate size of the effect of each study on the estimate of its accuracy which is usually the standard error.

Based on Figure 5, it shows that there is no publication bias which is indicated by the symmetry of the right and left plots.

DISCUSSION

This paper discusses the effect of prenatal yoga and the use of transcutaneous electrical nerve stimulation during pregnancy on labor pain. The dependent variable in this study was labor pain in pregnant women, while the independent variables in this study were prenatal yoga and transcutaneous electrical nerve stimulation.

This meta-analysis study uses critical appraisal tools Randomized Controlled Trials (RCT) because the research involved is the overall Mean Different (MD) result,

describing the 95% confidence interval (CI) using the effects model and also I^2 or data heterogeneity. Estimates of the combined effect of prenatal yoga and the use of TENS during pregnancy on labor pain were processed using the RevMan 5.3 application.

The primary studies involved in this research are research conducted in various countries and races, so that general conclusions can be obtained that can be applied. The results of the systematic study and meta-analysis are presented in the form of forest plot and funnel plot diagrams. Forest plots show visually the magnitude of variation (heterogeneity). The funnel plot shows the relationship between the study effect size and the sample size of the various studies studied, which can be measured in different ways (Murti, 2018).

Based on the primary research, it was found that the basic similarities of this research are that the research subjects are pregnant women, the intervention given is the provision of prenatal yoga care and the use of TENS compared to routine care from a midwife, the duration of giving yoga is 30-60 minutes, while the implementation of TENS is 30 minutes. However, there are also fundamental differences in the primary research taken, including the smallest number of samples used as many as 42 and the largest as many as 326.

Yoga is a gymnastic activity that can improve health and fitness during pregnancy, provide a sense of comfort and support during childbirth. The gentle stretching that occurs during yoga positions (asanas) can help relieve musculoskeletal disorders during pregnancy and prepare the lower muscles for labor (Reis et al., 2014).

Prenatal yoga is beneficial for the biomotor component of the muscles being trained, increases cardiorespiratory endurance by increasing oxygen consumption, has a positive effect on cervical dilatation

and coordinated uterine activity during labor (Büssing et al., 2012).

The transcutaneous electrical nerve stimulation (TENS) unit is a global therapeutic device for pain management in acute and chronic pain conditions and is easily accessible for a variety of uses. High-frequency, low-intensity vibration currents from TENS activate large-diameter fibers selectively, produce segmental analgesia quickly and localized to the dermatome, then close the gate or gate to reduce pain perception to the brain. So that TENS can be used to reduce pain intensity during the first stage of labor (Yulifah et al., 2009).

1. The effect of prenatal yoga on labor pain

Based on the results of the analysis in 4 articles reporting that prenatal yoga during pregnancy can reduce pain during labor, and the results of the forest plot there are insignificant values influenced by several factors such as high heterogeneity between experiments ($I^2=97%$; $p<0.001$) so randomized use is used. Effect Model (REM), the population and the number of samples between the experimental group and the control group are not the same so that the total proportion of the two is not balanced.

In the study of Chuntharapat et al. (2008) the number of samples used was 74 pregnant women aged 28 weeks, the duration of giving the yoga intervention for 60 minutes was carried out 3 times a week. Research by Levett et al., 2016 the number of samples used was 176 pregnant women aged 24-36 weeks, the duration of giving a yoga intervention for 30 minutes was carried out 3 times a week. Research by Jahdi et al. (2016) the number of samples used was 60 pregnant women aged 26 weeks, the duration of giving yoga interventions for 60 minutes was done 3 times a week. In the research of Bolanthakodi et al. (2018), if the sample size

is 200 pregnant women aged 30 weeks, the duration of the yoga intervention for 30 minutes is done 3 times a week.

Based on the results of research by Byrne and Dennard, 2018 reported that the number of samples was 37 in the yoga group and 37 in the control group of pregnant women aged 26-37 weeks, showing mean differences of 6.1, 4.7, and 4.6. So that the yoga group who felt pain was lower than the control group. Meanwhile, in the research of Evrianasari and Yantina (2020), the results showed a mean value of 3.80 for mothers who did yoga with a standard deviation of 1.031. Meanwhile, the mean value is 6.47 for mothers who do not do yoga with a standard deviation of 0.973.

However, another study by Karnasih (2018) showed that there was a difference in pain scale II between mothers who did yoga and those who did not do yoga with a mean value of 6.82 in the yoga group with a standard deviation of 1,537 so that yoga reduced the labor pain scale. Meanwhile, the mean value in the control group was 8.91 with a standard deviation of 0.944.

In 35% of pregnant women aged 28-33 years who have done yoga, it is very effective in reducing complaints such as stress, anxiety, pain, discomfort, and other variables as well as on labor and birth outcomes (Curtis et al., 2012).

Based on 4 primary research articles that have been analyzed, 2 articles show significant results seen in the forest plot where 2 studies by Jahdi et al. (2016) and Bolanthakodi et al. (2018) do not touch the vertical line, while 2 articles by Chuntharapat et al. (2008) and Levett et al. (2016) showed insignificant results because the horizontal line of the primary study touched the vertical line. So, based on this description, the 2 primary studies with insignificant results showed a significant

difference in the proportion between the yoga group and the control group.

2. Effect of transcutaneous electrical nerve stimulation on labor pain

Based on the analysis results in 5 articles reported that the insignificant value in the TENS study which can reduce labor pain is influenced by several factors such as there is high heterogeneity between experiments ($I^2=98\%$; $p<0.001$) so the Random Effect Model (REM) is used on forest results. In the plot, there is a population and the number of samples between the experimental group and the control group is not the same so that the proportions of the two are not balanced.

In the study of Chao et al. (2007) if the number of samples used were 105 pregnant women aged 37 weeks, and the duration of the TENS intervention was 30 minutes starting from the beginning of the active phase of labor. Research by LF HO et al. (2011) the number of samples used was 158 mothers in active labor in the 1st stage, the duration of the TENS intervention was 30 minutes starting from the beginning of the active phase of labor. Research by Shahoei et al. (2017) the number of samples used was 60 pregnant women aged 38-42 weeks, the duration of the TENS intervention was 30 minutes starting from the beginning of the active phase of labor. The research of Baez-Suarez et al. (2018) the number of samples used was 42 pregnant women aged 37 weeks, the duration of the TENS intervention was 30 minutes starting from the beginning of the active phase of labor. Research by Njogu et al. (2021), the number of samples used was 326 pregnant women aged 37 weeks, the duration of the TENS intervention was 30 minutes, 2 times 24 hours.

In current clinical practice, TENS is used to reduce pain or tenderness during the early phase of labor as well as delay the use of pharmacological methods (Mello et al.,

2011). The TENS technique basically consists of administering low-voltage electrical impulses or stimulation through electrodes placed on the skin. Although it can be applied at any time during labor, TENS is more effective in the early stages of labor (Gentz, 2001).

In a study by Van der Spank, 2000, the results showed a very significant difference ($p < 0.001$). Another study by Santana, 2016 showed the results of the mean value of 57 in mothers who underwent TENS with a standard deviation of 24. While the results of the mean value in the control group were 73 with a standard deviation of 15. So that TENS given at the beginning of the active phase of labor resulted in a significant reduction in pain. and delays the need for pharmacologic analgesia and is considered a useful alternative method for labor analgesia.

However, another study by Yuliyani (2014) showed that giving the TENS method which had been carried out on 25 respondents, it was found that 92% or 23 respondents experienced mild pain and 8% or 2 respondents experienced moderate pain. Pain that is felt is a sensation that arises due to trauma to body tissues due to ischemia of the uterine muscles due to hormonal influences and loads that cause contractions.

Based on the results of 5 primary research articles that have been analyzed, 2 articles show significant results seen in the forest plot where 2 articles by Baez-Suarez et al. (2018) and Njogu et al. (2021) do not touch the vertical line, while 3 articles by Chao et al. (2007), LF HO et al. (2011) and Shahoei et al. (2017) showed insignificant results because the horizontal line of the primary study touched the vertical line. So based on the description, the 3 primary articles with insignificant results showed a significant difference in the proportion

between the TENS group and the control group.

AUTHOR CONTRIBUTION

Fiqi Widyawati is the main researcher who chooses topics, searches and collects research data. Bhisma Murti and Rita Benya Andriani played a role in analyzing data and reviewing research documents.

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This study is self-funded.

CONFLICT OF INTEREST

There is no conflict of interest in this study.

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