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EXPERIMENTAL STUDY: BACK MOVEMENT TECHNIQUE ON BETA-ENDORPHIN LEVELS AND FETAL WELL-BEING

Putri Maretyara Saptyani[1]*, Laeli Farkhah[2], Resti Ikhda Syamsiah[2]
[1]Department of Midwifery, Faculty of Health Sciences, Universitas Al Irsyad Cilacap, Jl. Cerme No.24, Wanasari, Sidanegara, Cilacap Tengah, Cilacap, Central Java 53223, Indonesia
[2]Department of Nursing, Faculty of Health Sciences, Universitas Al Irsyad Cilacap, Jl. Cerme No.24, Wanasari, Sidanegara, Cilacap Tengah, Cilacap, Central Java 53223, Indonesia
*putrimaretyara@universitasalirsyad.ac.id

ABSTRACT
One of the discomforts in the third trimester of pregnancy is lower back pain. This can affect a woman's quality of life during late pregnancy and the early postpartum period. The prevalence of back pain during pregnancy can reach 80%. Treatment using drugs during pregnancy can also cause side effects. The movements in the back movement technique are said to be able to overcome back pain in pregnant women. Research Objective to prove the use of the back movement technique to increase beta endorphin levels and welfare fetus in third trimester pregnant women. This type of research is a Quasy Experiment with a Pretest-Posttest with Control Group. The sample was pregnant women in the third trimester with lower back pain in the Gubug II Community Health Center area, Grobogan, totaling 40 respondents using consecutive sampling technique. Univariate and bivariate data analysis using the Independent T Test and Man Whitney. There was an increase in beta endorphin levels before it was 146.00 ng/ml and after the back movement technique it was 375.21 ng/ml (p = 0.001). Giving the back movement technique was stated to be within normal limits for fetal heart rate and fetal movement (p > 0.05). Back movement technique has been proven to increase beta endorphin levels in pregnant women in the third trimester and is stated safe seen from normal limits for fetal heart rate and fetal movement.

Keywords: beta endorphin; fetal well-being; low back pain

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INTRODUCTION

Hormonal changes that occur accompanied by an increase in body mass and an ever-enlarging uterus cause a shift in the center of gravity thereby placing additional static and dynamic loads on the axial bones (Casagrande et al., 2015) . According to the World Health Organization (WHO), back pain or *low back pain* (LBP) is a symptom of various cases related to spinal problems. Back pain in pregnancy is defined as recurrent or continuous pain for more than 1 week from the spine. The classification of *low back pain* (LBP) according to WHO (2013) is subacute 6-12 weeks, acute <6 weeks, and chronic > 7-12 weeks. In general, lumbar pain during pregnancy is similar to lower back pain experienced by non-pregnant women. This type of pain usually increases with changes in the mother's posture when sitting, standing or lifting (Gharaibeh et al., 2018) . Back pain is a symptom that causes some of the greatest discomfort during pregnancy, such as insomnia, disruption of the mother's daily activities and psychological problems in the postpartum period (Pennick & SD, 2013). Supported by

Gutke's research, it is stated that low back pain can affect women's quality of life during late pregnancy and the early postpartum period (Gutke et al., 2011).

The prevalence of back pain during pregnancy varies around the world, namely around 20% to 90%. Most studies state the prevalence of back pain in pregnancy is >50%. (Ayanniyi et al., 2006; Casagrande et al., 2015; IH Han, 2010; Vermani et al., 2010) In the United States, Europe, and some parts of Africa the prevalence reaches 30% to 78%. (Abebe et al., 2014; Emília et al., 2017; Mota et al., 2015) In Indonesia alone the prevalence of back pain during pregnancy reaches 60% to 80%. (Mafiksari & Kartiksari, 2015) Based on the results of a preliminary study conducted at the Srondol Health Center, Semarang city, from July to September there were 506 pregnant women, of which specifically for third trimester pregnancies there were 167 pregnant women. Interviews conducted with 50 pregnant women in the third trimester showed that 80% of pregnant women experienced back pain during their pregnancy.

A significant factor that influences the presence of back pain in pregnant women is the increase in trimesters in the pregnant woman's gestational age. (Manyozo et al., 2019) The stomach will get bigger as the fetus develops, causing *the center of gravity* to move towards the front. The sacroiliac ligaments weaken so that the pelvis experiences forward rotation which further increases hyperlordosis in pregnant women and increases tension in the pelvis or lower lumbar region. So back pain is one of the most frequently complained of discomforts. (Casagrande et al., 2015) women during pregnancy are strongly advised to do exercises to reduce pain. (J.-H. Han et al., 2014) Non-pharmacological interventions such as postural training and stabilization exercises have been shown to be effective in managing back pain during pregnancy. (Katonis et al., 2011) According to Liddle's research, exercise can effectively prevent and treat back pain in pregnancy. (Pennick & Sd, 2013) Exercise programs also have a very beneficial effect regarding the severity of lumbopelvic pain in pregnancy, they can reduce the intensity of pain and the level of disability. (Kokic et al., 2017) In addition, physical exercise during pregnancy can reduce the severity of back pain compared to those who do not exercise. (Davenport et al., 2019) Research explains that exercise can significantly increase beta-endorphin levels after a training session in athletes with *a p value* (0.024). This was proven by an increase in beta endorphin levels before and after exercise, namely 3.44 ng/mL to 4.82 ng/mL. (Enayatjazi et al., 2015) Where beta endorphin is an endogenous opiate which is believed to modulate pain, improve the immune system, increase feelings of happiness and increase relaxation. (Myint et al., 2017).

In this study, the assessment of fetal well-being was used as an indicator that the intervention that had been carried out, namely the *back movement technique,* in vulnerable groups such as pregnant women in the third trimester did not have the potential to harm the fetus they were carrying. Apart from that, *the back movement technique* consists of movements where there is a modification of the *William flexion technique* which has been proven to reduce back pain but has not been applied to pregnant women, namely the *hamstring stretch movement* so monitoring of fetal well-being is needed in terms of the fetal heart rate (DJJ) and fetal movements. . *Back Movement Technique* is a form of physical exercise that will be given in this research intervention to pregnant women in the third trimester who experience back pain. It can be said that pregnant women are a vulnerable group so all interventions that will be given must ensure that the well-being of the fetus remains good and does not have a bad impact. which can reduce the well-being of the fetus, so monitoring is necessary to avoid potential risks to the fetus. Monitoring fetal well-being is seen from the fetal heart rate (DJJ) using *Doppler* and fetal movements. This monitoring is a form of effort that with the

intervention carried out, namely *the back movement technique*, it is ensured that it is safe for the welfare of the fetus. Judging from the background that has been reviewed, the researchers want to conduct research on *the back movement technique* on β-endorphin levels and fetal well-being in third trimester pregnant women.

METHOD

Types of research This is *quasy experiment* with design *pretest-posttest with control group design* . Intervention This given 2 times a week for 4 weeks with duration 30-60. Population in study This is all Mother There were 190 pregnant people in the third trimester in the Gubug 2 Regency area Grobogan experienced it painful back . Research sample This consisting of 40 respondents _ of 20 respondents group intervention (*back movement technique)* and 20 respondents group control (pregnancy exercise). Sampling technique in research This use *nonprobability sampling*. Determination sample study done with use *consecutive sampling* in accordance with existing criteria _ determined. Intensity measurement painful back to mother pregnant use Beta endofin levels in blood samples _ Mother third trimester of pregnancy. Data analysis using *Paired Sample T-Test Independent T- Test f*or know influence *back movement technique* to Beta endorphin levels in mothers third trimester of pregnancy. Intensity painful back down to mother pregnant be measured before (*pretest*) and 4 weeks after intervention (*posttest*).

RESULTS

Table 1.
Distribution of Respondent Characteristics Based on Age, Gravity and Occupation

Variable	Group		*p value*
	Control n=20	Intervention n=20	
Age (years):			
a. Mean ± SD	27 ± 4,316	26.45 ± 4.478	0.718 [a]
b. Min-max	20-34	20-34	
c. Median	26.50	26.50	
Gravida:			
a. Primigravida	9 (45%)	10 (50%)	0.786 [b]
b. Multigravida	11 (55%)	10 (50%)	
Work :			
a. Work	8 (40%)	4 (20%)	0.168 [b]
b. Doesn't work	12(60%)	16(80%)	

Table 1 shows that the characteristics of respondents include age, gravida and occupation. The respondents in this study were 40 pregnant women who were divided into 2 groups, namely 20 respondents in the control group and 20 respondents in the intervention group. The average age of pregnant women in the control and intervention groups is 27 and 26.45, which is still within healthy reproductive age and the p value = 0.718, where $p > 0.05$ means there is no difference in the average age in the two groups. Based on the results of the gravida analysis in both groups, it was found that respondents were primigravida (1st pregnancy) with the following percentages: 9 people in the control group (45%) and 10 people in the intervention group (50%). Respondents with multigravida (2-4th Pregnancy) with the following percentage: control group of 11 people (55%) and intervention group of 10 people (50%), and p value = 0.786 where $p > 0.05$ which means there is no significant difference in gravida in the two groups.

Based on the results of the job analysis in both groups, it was found that the percentage of respondents who did not work was as follows: 12 people in the control group (60%) and 16 people in the intervention group (80%). The percentage of respondents who worked was as

follows: the control group was 8 people (40%) and the intervention group was 4 people (20%), and the p value = 0.168 where p > 0.05, which means there was no significant difference in work between the two group.

Table 2.
Analysis of Differences in *Beta Endorphin Levels* in the Control Group and Intervention Group

Variable	*Pretest*	*Posttest*	*P Value*	*Difference*
	Mean ± SD	Mean ± SD		
Beta Endorphin				
Control	152.6110±22.34	282.8300±80.25	0.001 [f]	130.2190±84.59
Intervention	146.0070 ± 25.73	375.2105±57.13	0.001 [f]	229.2035±70.91
P value	0.392 [e]	0.001 [e]		0.001 [e]

shows that the results of measuring *beta endorphin levels* before being given treatment in the control group had a mean of 152.6110±22.34 ng/ml while the mean after being given treatment was 282.8300±80.25 ng/ml with a *p value of* 0.001 (< 0.05). *Beta endorphin* levels before treatment in the intervention group were 146.0070 ± 25.73 ng/ml while the mean after was 375.2105 ± 57.13 ng/ml with *a p value of* 0.001 (<0.05). This means that there is a significant difference between the *beta endorphin levels* of pregnant women before and after treatment in the control and intervention groups. *beta endorphin* levels in the control group was 130.2190 ± 84.59 ng/ml, while in the intervention group the mean was 229.2035 ± 70.91 ng/ml with *a p value of* 0.001 (<0.05). It can be said that the use of *the back movement technique* has a greater effect on increasing *beta endorphin* levels in third trimester pregnant women compared to pregnancy exercise in the control group.

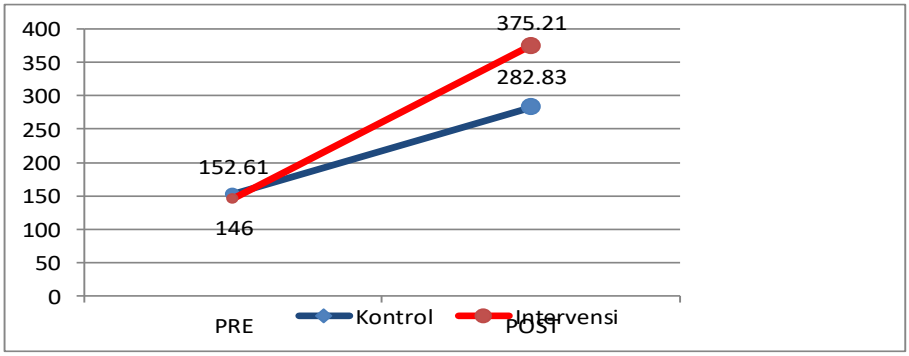

Figure 4.2 Comparison of Average *Beta Endorphin Levels* Before and After Treatment in Both Groups

Table 2.
Analysis of Differences in DJJ in the Two Groups

Variable	Group		*p value*
	Control n=20	Intervention n=20	
	Mean ± SD	Mean ± SD	
DJJ 1	139.40 ± 3.926	141.15 ± 4.660	0.207
DJJ 2	140.70 ± 4.692	142.55±6.295	0.299
DJJ 3	144.25±5.902	146.15±5.896	0.315
DJJ 4	142.05 ± 5.661	142.70 ± 7.035	0.749
DJJ 5	144.15±6.037	144.40±8.586	0.916
DJJ 6	144.85 ± 7.666	146.75±6.488	0.403
DJJ 7	144.15±6.167	146.65±5.566	0.186
DJJ 8	143.35±4.934	145.95±4.571	0.092

Table 2 shows the analysis of differences in fetal heart rate (DJJ) using the ANOVA test, the results showed that all *p values* were > 0.05, which means that there were no differences in fetal heart rate (DJJ) in respondents who were given *the back movement technique* or pregnancy exercise. This states that the fetal heart rate (djj) is still within normal limits.

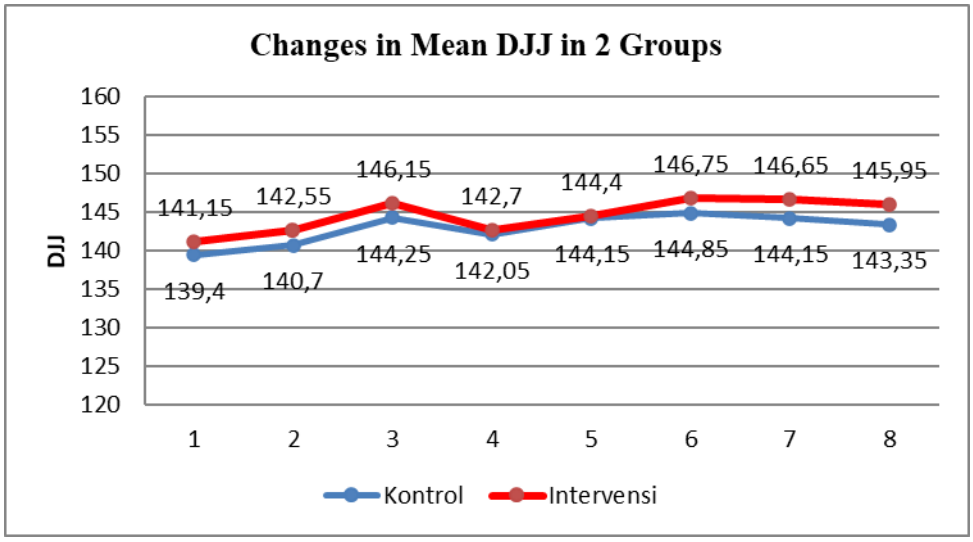

Figure 3 Analysis of Mean DJJ for Each Treatment Given in Both Groups

Figure 3 shows that the change in the average fetal heart rate in the control group and intervention group each time they were given treatment was still in the normal fetal heart rate (DJJ) category, namely 120-160x/minute so that the treatment given to the control group and intervention group was still considered safe for the welfare of the fetus. in third trimester pregnant women.

Table 4.
Analysis of Differences in Fetal Movement in the Two Groups

Variable	Group		*p value*
	Control n=20	Intervention n=20	
	Mean ± SD	Mean ± SD	
GJ 1	17.60 ± 2.664	18.45 ± 2.781	0.330
GJ 2	17.85 ± 2.720	19.10 ± 2.693	0.152
GJ 3	18.95 ± 2.665	19.45 ± 1.731	0.486
GJ 4	19.40 ± 2.563	19.95 ± 1.538	0.416
GJ 5	19.25 ± 1.164	19.95±1.099	0.058
GJ 6	18.85±1.599	19.65 ± 1.531	0.114
GJ 7	19.55±1.572	20.35 ± 1.226	0.081
GJ 8	19.45±1.099	19.80 ± 1.196	0.341

Table 4 shows the analysis of differences in fetal movements using the ANOVA test, with all *p values* > 0.05, which means that there were no differences in fetal movements in respondents who were given *the back movement technique* or pregnancy exercises. This states that fetal movements are still within normal limits.

Figure 4 shows that the change in the average fetal movement in the control group and intervention group each time they were given treatment was still in the normal fetal movement category, namely within the 12 hour measurement period (09.00-21.00 WIB) they experienced > 10x movement so that the treatment given to the control group and intervention group is still considered safe for the welfare of the fetus in third trimester pregnant women.

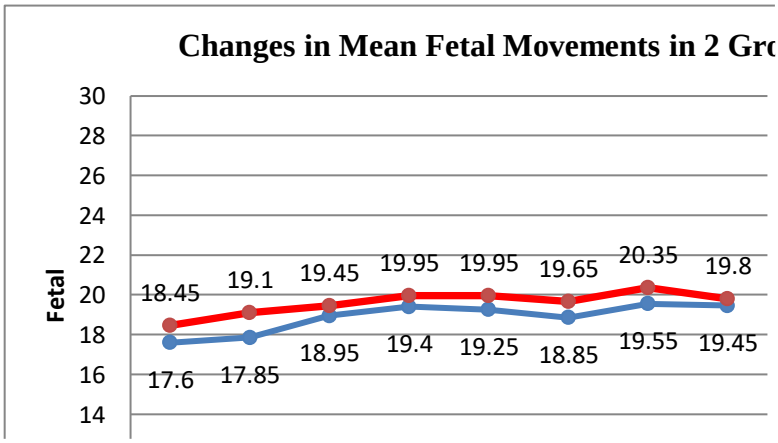

Figure 4 Analysis of average fetal movements for each treatment given to both groups

DISCUSSION

Utilization of *the Back Movement Technique* is more effective in increasing *beta endorphin levels* compared to the control group

beta endorphin levels before being given treatment in the control group had a mean of 152.6110 ± 22.34 ng/ml while the mean after being given treatment was 282.8300 ± 80.25 ng/ml with a *p value of* 0.001 (<0.05) . *Beta endorphin* levels before treatment in the intervention group were 146.0070 ± 25.73 ng/ml while the mean after was 375.2105 ± 57.13 ng/ml with *a p value of* 0.001 (<0.05). This means that there is a significant difference between the *beta endorphin levels* of pregnant women before and after treatment in the control and intervention groups. *beta endorphin* levels in the control group was 130.2190 ± 84.59 ng/ml, while in the intervention group the mean was 229.2035 ± 70.91 ng/ml with *a p value of* 0.001 (<0.05). It can be said that the use of *the back movement technique* has a greater effect on increasing *beta endorphin* levels in third trimester pregnant women compared to pregnancy exercise in the control group .

β-Endorphin is one of the most prominent and potential biomarkers that modulate pain pathways, among the many biomarkers that modulate pain pathways such as *met-enkephalins, oxytocin, dynorphin, and serotonin* . (Corti, 2014; Vigotsky & Bruhns, 2015) Endorphins or happiness hormones are released during every physical activity. Endorphins are secreted by the anterior pituitary gland in response to exercise, physical and psychological stress. This hormone is released from hypothalamic neurons in the spinal cord and brain as well as from the pituitary gland. The effects of *beta endorphins* have been determined by the growth function of the brain and possibly by hypothalamic neurons which are the largest source of *beta endorphins* . Various research results show that different types of anaerobic, aerobic and strength training will result in an increase in serum endorphins. (Sharifi et al., 2018). *Endorphins* can improve mood and reduce anxiety after exercising due to the release and binding of beta endorphin levels (endogenous opioids) to their receptor locations in the brain. Other research shows that exercise can increase endogenous opioid activity in the central and peripheral nervous system, causing a state of euphoria and reducing pain. (Anderson & Shivakumar, 2013) Movement from the *back movement method* This *technique* consists of movements that have been confirmed to be safe for pregnant women, namely *pelvic rock, pelvic tilt, hamstring stretch, lumbar rotation,* and *cat and cow*. Stretching exercises for around 30 minutes every day can be useful for strengthening the abdominal and back muscles, but it can also improve swelling that can interfere with joint movement and function. Where According to research, it is explained that *pelvic rock* in the management of low back pain has

important value in reducing disability during pregnancy. (Elkheshen et al., 2016) Apart from that, *the cat and cow movement* is part of pregnancy exercise movements and is found in yoga movements which focus on reducing complaints of lower back pain in pregnant women.

Supported by research which explains that aerobic exercise combined with *pelvic rocking movements* is useful for treating primary dysmenorrhea through various modes such as reducing stress, attenuating menstrual symptoms through increasing local metabolism and increasing local blood flow at the pelvic level as well as increasing *endorphin production.* (El-Refaye & El-Bandrawy, Asmaa M. Ghareeb, 2014) In line with other research, the application of *pelvic rocking* to mothers in labor can reduce labor pain and stimulate the release of *beta endorphins* which can block the transmission of pain stimuli to mothers in labor. (Hidayati & Santoso, 2018) Sport can trigger release of beta endorphin from pituitary and hypothalamus , which in turn can activate μ- opioid receptors peripheral and central and triggers the endogenous opioid system. (Bender et al., 2007) With the *back movement technique* , it will stretch the lower back muscles so they are not tense, strengthen the flexibility of the lower muscles as a balance to increase abdominal mass, flex the lower back muscles and increase flexibility in the spine. (Elkheshen et al., 2016; Marelly, 2017; RNV et al., 2016; Suputtitada et al., 2002; Talsma, 2016; Wulandari & Wahyuni, 2019)

Back movement technique can be said to be a form of physical exercise, where physical exercise is believed to increase *beta endorphin levels* . *Endorphins* are neuromodulators that the body produces naturally to relieve pain and create comfort. (Potter & Perry, 2005) When someone stretches, *beta endorphin levels increase* will be received by receptors in the hypothalamus. When peripheral neurons deliver signals to the synapse, what happens is that the synapse between the peripheral neurons and neurons that go to the brain should release substance P which will continue the stimulation but at the same time endorphins will block the release of substance P so that pain stimulation is inhibited. With these obstacles, a feeling of comfort is created and pain is resolved. (Nur et al., 2018)

Based on table 1, namely data on the characteristics of respondents consisting of maternal age, gravida and occupation in the intervention group and control group, it was found that the average age in the control group was 27 years and the control group was 26 years. In accordance with the healthy reproductive age for women, it ranges from 25 to 35 years, which is a safe age for pregnancy and childbirth. (Megasari, 2015) An increase in the incidence of *low back pain* can occur due to the mother's age, among other things. (Casagrande et al., 2015) In relation to back pain experienced by pregnant women, it is also stated that age is a factor that can influence back pain with a prevalence of 48%. (Ansari et al., 2010) In accordance with the research results in terms of the age of the respondents, other research revealed that the average age of pregnant women was 26.2 years, pregnant women experienced back pain during pregnancy. (Emília et al., 2017). Data obtained on the characteristics of respondents, namely gravida, the majority of respondents in both groups, namely mothers with multigravida, was shown with a percentage of 55% in the control group and 50% in the intervention group. In accordance with the theory that multiparous women have a 2x higher chance of experiencing *low back pain* (LBP), that is, of the 172 research subjects there were 105 multiparous and 67 uniparous. The multiparous incidence rate is 67.6%, which is 2x higher compared to uniparous which is 49.3%. (Kurup, 2012) The incidence of *low back pain* (LBP) is higher in multigravidas than in primigravidas. (Join, 2018) Data obtained on the characteristics of respondents, namely employment, the majority of respondents in both groups, namely mothers who did not work, was shown with a percentage of 60% in the control group and 80% in the intervention group. In accordance with

other research which states that increased physical stress due to housework can be associated with risk factors for lower back pain in pregnant women. (Sencan et al., 2017) Supported by other research which also reveals that lower back pain is mostly experienced by housewives because they do a lot of activities in poor positions, where lower back pain is one of the disorders of the musculoskeletal system caused by daily activities. -a day that ignores body position issues. (Shonafi, 2012)

Monitoring Fetal Welfare Seen from Fetal Heartbeat (DJJ) and Fetal Movement

The results of the analysis of differences in fetal heart rate (DJJ) using the ANOVA test showed that all *p values were* > 0.05, which means that there were no differences in fetal heart rate (DJJ) between the control group and the intervention group. Similarly, the results of the analysis of differences in fetal movements obtained all values. *p value* > 0.05, which means that there is no difference in the frequency of fetal movements between the control group and the intervention group. This proves that the treatment in this research, namely *the back movement technique* in the intervention group and pregnancy exercise in the control group, did not affect the well-being of the fetus in the research respondents. Judging from the results of the average fetal heart rate (DJJ) in the control group and intervention group each time they were given treatment, it was still in the normal fetal heart rate (DJJ) category, namely 120-160x/minute. The average results of fetal movements in the control group and intervention group for each treatment were still in the normal fetal movement category, namely within a measurement period of 12 hours (09.00-21.00 WIB) they experienced > 10x movements.

It was proven that *the back movement technique* in the intervention group did not provide potentially dangerous side effects and was detrimental to the health of the fetus which was monitored through the fetal heart rate and fetal movements during each treatment which were still classified as normal. This could happen because the treatment in the intervention group, namely *back movement technique* , and in the control group, namely pregnancy exercise, are both forms of physical exercise or sports that are safe and in accordance with the recommendations of the established rules. Supported by research that explains that women pregnant can follow sport in accordance with the recommended , as long as exercise the No identify adverse response to the fetus proven in research _ that well-being fetus Still Good during follow sport . (Szymanski & Satin, 2012) Exercise done during pregnancy is contributor important for health physical and psychological Mother . Physical exercise such as stretching exercises has been reported to be safe to do during pregnancy. Benefits for fetus that can used For motivating woman do sport during pregnancy that is decline Rest beat heart fetus , increase viability placenta and improve fluid amniotic fluid . (Prather et al., 2012) It can be said in this research that *the back movement technique* is similar to a form of exercise. Supported by research which states that exercise during pregnancy is safe and not dangerous for the fetal cardiovascular system. (Roldan-Reoyo et al., 2019) Physical exercise does not have an adverse effect on fetal cardiovascular activity. (May et al., 2016)

During the process of physical activity, there is an increase in the amount of hormones that flow to the placenta, such as norepinephrine, which plays a very important role in the development of autonomic nerves. The autonomic nervous system regulates the main functions of the body, including heart rate. Exercise will result in increasing heart rate and cardiac output volume. A series of physical exercises carried out when a woman is pregnant will cause blood circulation to become smooth so that more oxygen is transported and will influence a more regular fetal heartbeat. (Mutmainnah, 2016) Another study explained that fetal heart rate did not show statistical differences before and after exercise. The physiological

response of the fetus to maternal stimulation or the release of vasoactive hormones that are not metabolized by the placenta often shows transient fetal tachycardia after maternal exertion. (Santos et al., 2016) The main factors that determine oxygen delivery to the fetoplacental are cardiac output, maternal hemoglobin and oxygen pressure (Newton & May, 2017).

Apart from that, there was no difference in fetal movements in this study between the control group and the intervention group. However, the frequency of fetal movements is classified as normal because within 12 hours the average fetal movement frequency is > 10x. Monitoring fetal body movements and breathing during and after exercise can help elucidate the physiological impact of exercise and physical activity on the fetus. Research that proves the effect of maternal exercise on fetal body movements is still very rare. Several studies were found that reported no effect or decreased fetal movement after the mother exercised. (Sussman et al., 2016) However, in this study the average results in each research group showed normal limits so that it can illustrate that the treatment given in this study did not disturb or endanger the welfare of the fetus.

CONCLUSION

Based on the results of the research and discussion, it can be concluded that the use of the back movement technique can increase beta endorphin levels in third trimester pregnant women. This can be proven by the use of the back movement technique carried out twice a week for 4 weeks has been proven to increase beta endorphin levels in pregnant women in the third trimester compared to pregnancy exercise. Fetal well-being in the form of fetal heart rate (djj) and fetal movements were within normal limits during treatment in the control group and intervention group.

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