JMCH Journal of Maternal and Child Health (2024), 09(03): 269-281
Masters Program in Public Health, Universitas Sebelas Maret

Meta Analysis
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Meta-Analysis the Effect of Postpartum Exercise on Uterine Fundal Height

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Received: 24 January, 2024; Accepted: 27 March, 2024; Available online: 16 May, 2024

ABSTRACT

Background: Postpartum is a period that is at risk of causing complications and often contributes to maternal mortality rates in Indonesia. One of the causes of maternal death is an irregularity in the involution process, resulting in the risk of postpartum hemorrhage. This study aims to analyze and estimate the influence of postpartum exercise on reducing TFU in postpartum mothers.
Subjects and Method: This study is a systematic review and meta-analysis. Search for articles through journal databases including: Google Scholar, PubMed, and Springer Link by selecting articles published from 2013 to February 2023. The population in the study was postpartum mothers with intervention in the form of postpartum exercise, comparison in the form of no intervention or no postpartum exercise, and the outcome is a decrease in TFU. The keywords used were (effect OR Influence) AND ("Parturition Gymnastics" OR "Postpartum Gymnastics" AND "fundal height" OR "decline of fundal height" OR "high uterine fundus" OR "Symphysial fundal height" OR "SFH" OR TFU") AND (postpartum). The inclusion criteria were full paper articles using the Randomized Controlled Trial (RCT) research method, the analysis results used the Mean SD value, the intervention provided was postpartum exercise, the research subjects were postpartum mothers, with an outcome of decreasing TFU. Articles were collected using PRISMA flow diagrams and analyzed using the Review Manager 5.3 application.
Results: Meta-analysis of 6 articles showed that postpartum exercise has an effect on reducing TFU in postpartum mothers by 0.46 units, which was higher than other interventions or no intervention, but this was not statistically significant. (SMD -0.46; 95% CI= -1.99 to 1.07; p=0.550).
Conclusion: Postpartum exercise has an effect on reducing TFU in postpartum mothers.

Keywords: postpartum exercise, uterine fundal height, postpartum mothers.

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Cite this as:
Istiqomah AIN, Murti B, Adriani RB (2024). Meta-Analysis the Effect of Postpartum Exercise on Uterine Fundal Height. J Matern Child Health. 09(03): 269-281. https://doi.org/10.26911/thejmch.2024.09.03.01.

BACKGROUND

Postpartum is a period that is at risk of causing complications and often contributes to the maternal mortality rate (MMR) in Indonesia. MMR is one indicator to see the success of maternal health efforts and MMR itself is the ratio of maternal deaths during pregnancy, childbirth and the postpartum period caused by management problems during pregnancy, childbirth and the postpartum period in every 100,000 live births. Data shows a trend of decline in the MMR indicator (per 100,000 live births) from 390 in 1991 to 230 in 2020 or a decrease of -1.80 percent per year. Despite the decline, MMR still has not reached the MDGS target in 2015, which is 102, and SDGs in 2030, which is less than 70 per 100,000 live births, based on the causes of most maternal deaths in 2020 caused by bleeding with 1,330 cases, hypertension with 1,110 cases and bleeding system disorders with 230 cases (RI Health Profile, 2020).

The biggest contributor to maternal mortality is bleeding. During the postpartum period, the mother is at risk for postpartum bleeding. Postpartum bleeding can occur due to failure of the myometrium to contract after delivery so that the uterus is in a state of complete relaxation, is poor and soft. One way to ensure that uterine muscle contractions remain good until the end of postpartum is by early mobilization and simple movements such as postpartum exercises, because postpartum exercises can stretch the uterine muscles after delivery (Intan, 2019).

Postpartum exercise is a form of early ambulation for postpartum mothers, one of the aims is to expedite the involution process, while failure to do so in the involution process has negative consequences for postpartum mothers, such as further bleeding and the smoothness of the involution process. Postpartum exercises are useful for restoring pelvic floor muscle strength, tightening the muscles of the abdominal wall and perineum, forming a good posture and preventing complications. Complications that can be prevented as early as possible by carrying out postpartum exercises to prevent postpartum bleeding (Syaflindawati, 2017).

Based on the background above, postpartum hemorrhage can be prevented by accelerating the reduction in the height of the uterine fundus by using methods that are appropriate and safe for postpartum mothers, therefore the researchers were interested in conducting research using a systematic review and meta-analysis which can summarize several primary or research results from previous research with a systematic search to combine the results and obtain more precise estimates to draw new conclusions.

SUBJECTS AND METHOD

1. Study Design

The study design used in this research is a systematic review and meta-analysis, using PRISMA flow diagram guidelines. Article searches were carried out using journal databases including: Google Scholar, PubMed, and Springer Link by selecting articles published from 2013 to February 2023. The keywords used to include: (effect OR Influence) AND ("Parturition Gymnastics" OR "Postpartum Gymnastics" AND "fundal height" OR "decline of fundal height" OR "high uterine fundus" OR "Symphysial fundal height" OR "SFH" OR TFU") AND (postpartum).

2. Steps of Meta-Analysis

Meta analysis was carried out in the following 5 steps:

1) Formulate questions in PICO format (Population, Intervention, Comparison, Outcome).
2) Search for primary articles from databases such as Google Scholar, PubMed, and Springer Link.
3) Carry out screening by determining inclusion and exclusion criteria and conducting quality assessments.
4) Extract and analyze data using RevMan 5.3 Software.
5) Interpret the results and draw conclusions.

3. Inclusion Criteria

The inclusion criteria were full paper articles using the Randomized Controlled Trial (RCT) research method, the results of the analysis used the Mean SD value, the intervention provided was postpartum exercise, the research subjects were postpartum mothers, with the outcome of decreasing TFU.

4. Exclusion Criteria

Exclusion criteria in this study included postpartum mothers with surgical births and articles published in other than English or Indonesian.

5. Operational Definition of Variable

The formulation of the problem in this research was using PICO. The subjects were postpartum mothers. Intervention in the form of postpartum exercise, and the comparison was no intervention or not postpartum exercise and outcomes were in the form of a decrease in TFU.

Postpartum exercise is a movement exercise that is done as soon as possible after giving birth, so that the muscles that were stretched during pregnancy and childbirth can return to their normal condition (Asih & Risneni, 2016).

A decrease in TFU is a process of the uterus returning to its pre-pregnancy condition with a weight of around 60 grams. This phase begins immediately after the placenta is born due to contractions of the uterine muscles (Anggraini, 2017).

6. Instrument

The instrument in this study was a published article that tested the delivery of postpartum exercise methods using a TFU measuring tape as a tool for reducing TFU in postpartum mothers. The primary study assessment instrument used critical appraisal from the Master of Public Health Sciences, Postgraduate School (Murti, 2023).

7. Data Analysis

Data analysis in this research used the Review Manager application (RevMan 5.3). Data were analyzed based on variations between studies by determining the use of a random effect analysis model. In this study, I^2 is used to quantify dispersion. The results of data analysis are in the form of study heterogeneity effect size values, which will then be interpreted in the form of forest plots and funnel plots.

RESULTS

Research from primary studies related to the effect of postpartum exercise on reducing TFU in postpartum mothers consists of 6 articles originating from 3 islands in Indonesia, namely, Sumatra, Java and Sulawesi. 3 studies from Sumatra Island, 2 studies from Java, 1 study from Sulawesi (Figure 2).

The article search was carried out using a database based on the PRISMA flow diagram which can be seen in Figure 1. Study quality assessment was carried out qualitatively and quantitatively. Quality assessment in this study used critical appraisal for randomized controlled trials from the Master of Public Health Sciences, Postgraduate School, Sebelas Maret University (Murti, 2023). The answer (Yes) will be given a score of 2, the answer (Undecided) will be given a score of 1, and the answer (No) will be given a score of 0 (Table 1). After assessing the quality of the studies, a total of 6 articles included in the quantitative meta-analysis synthesis process were analyzed using RevMan 5.3.

Forest plot

Interpretation of the results of the meta-analysis process can be seen through the forest plot. Figure 3 shows that there was an effect of postpartum exercise on reducing TFU in mothers after giving birth. Mothers who received postpartum exercise intervention had a decrease in TFU by 0.46 units higher than those who did not receive or did not receive postpartum exercise, but this was not statistically significant (SMD -0.46; 95% CI= -1.99 to 1.07; p=0.550). Meanwhile, there was high heterogeneity in effect estimates between studies (I^2=92%; p<0.001). Thus, the average estimated effect was calculated using the Random Effect Model approach.

Funnel Plot

A funnel plot is a plot that depicts the estimated effect size of each study against its estimate of accuracy which is usually the standard error. Based on Figure 4, it shows that the distribution of estimated effects is not symmetrical. The plots tend to be more stacked to the right of the vertical line of the average estimate, which is opposite to the location of the diamond shape in Figure 3. So the funnel plot indicates that there is a publication bias that reduces the true effect.

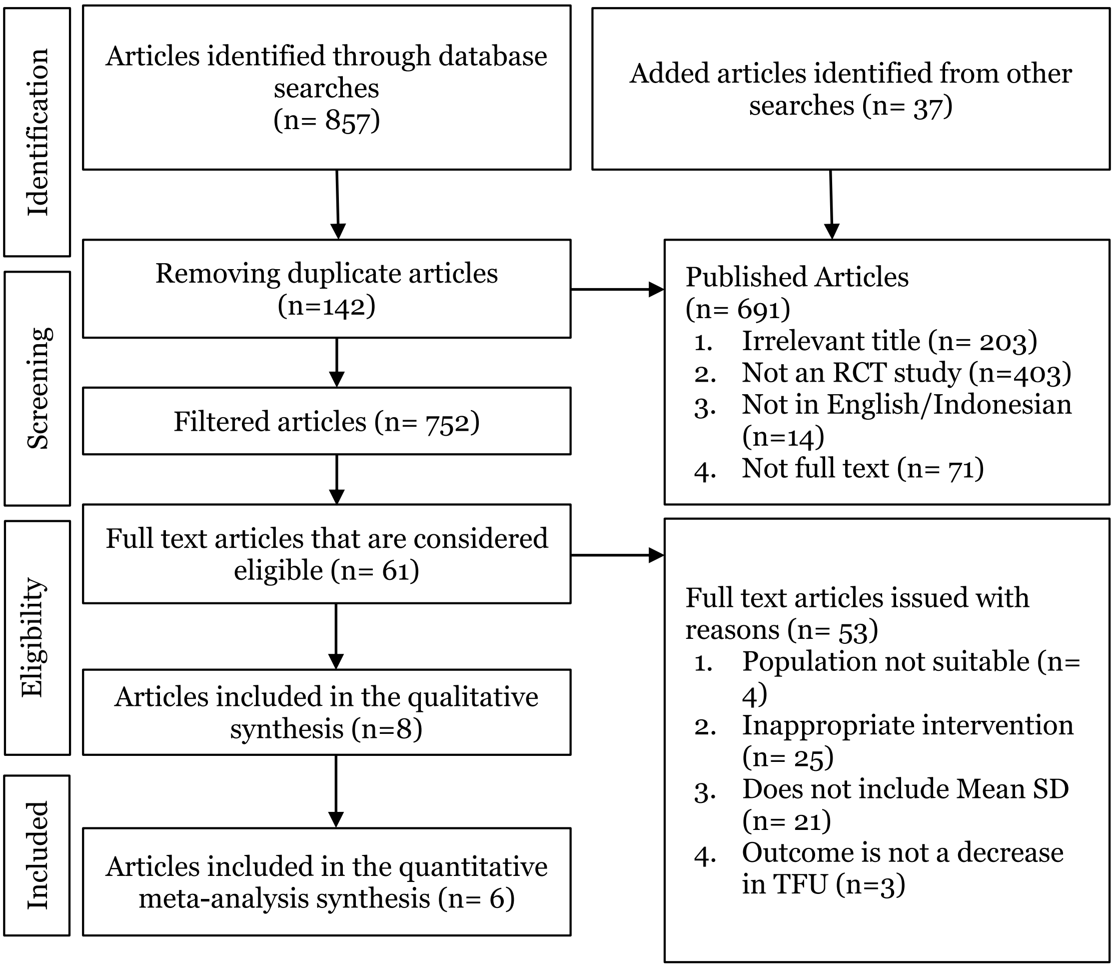

Figure 1. Results of PRISMA flow diagrams of effect of postpartum exercise on uterine fundal height

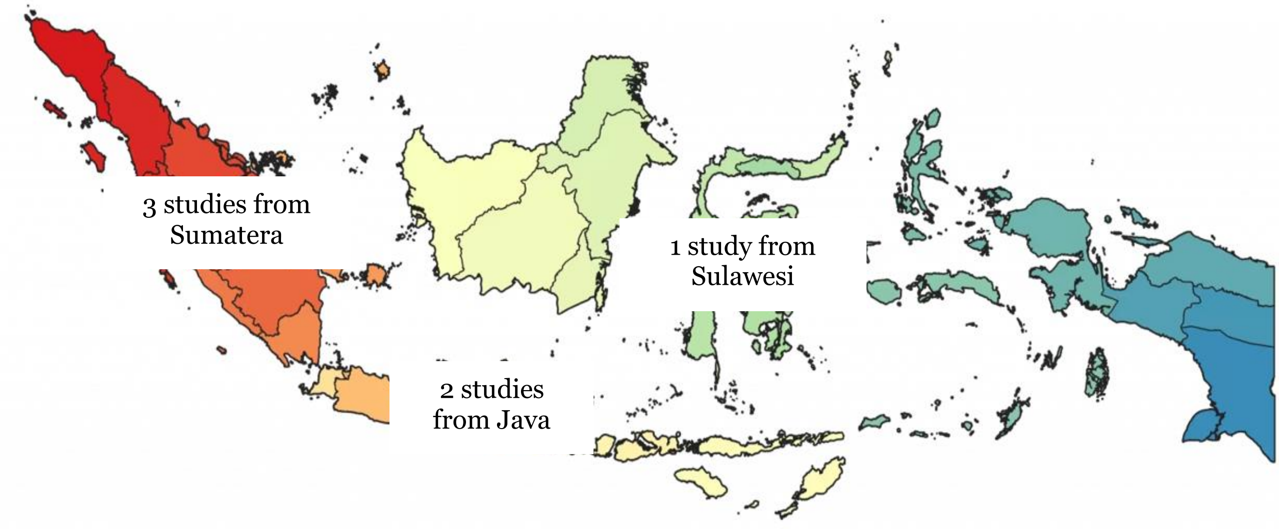

Figure 2. Map of the postpartum gymnastics research area

Table 1. The results of the quality assessment study of the effect of postpartum exercise on uterine fundal height

Publication	P1				P2		P3		P4			P5		P6	Total
	a	b	c	d	a	b	a	b	a	b	c	a	b		
Rullynil et al. (2014)	2	2	2	2	2	1	2	2	1	2	2	2	1	2	25
Colin et al. (2019)	2	2	2	2	2	1	2	2	1	2	2	2	1	2	25
Mardiya et al. (2022)	2	2	2	2	2	1	2	2	1	2	2	2	1	2	25
Kholisotin et al. (2021)	2	2	2	2	2	1	2	2	1	2	2	2	1	2	25
Haslan et al. (2022)	2	2	2	2	2	2	2	2	1	2	2	2	2	2	27
Kasiati et al. (2019)	2	2	2	2	2	2	2	2	1	2	2	2	2	2	27

Description of critical appraisal criteria

1a: Is the population in the primary study the same as the population in the PICO meta-analysis?

1b: Is the operational definition of intervention in the primary study the same as the definition intended in the meta-analysis?

1c: Is the operational definition of comparison used by the primary study the same as the scheme planned in the meta-analysis? In RCTs, comparators can receive placebo or standard therapy.

1d: Are the operational definitions of the outcome variables studied in the primary study the same as those planned in the meta-analysis?

2a: Is the sample selected from the population so that the sample represents the population?

2b: Is the allocation of subjects into experimental and control groups carried out by randomization? Random allocation is useful for controlling the influence of all confounding factors, both known and unknown to the researcher.

3a: Are the intervention and outcome variables measured with the same instruments (measuring tools) in all primary studies? If the outcome variable is measured with different instruments, then the effect size used in meta-analysis must be a standardized version, for example Effect Size (Standardized Mean Difference).

3b: If the variable is measured on a categorical scale, are the cutoffs or categories used the same across primary studies?
4a: Is double-blinding done? Which means the research subjects and research assistants who help measure outcome variables do not know the research subject's intervention status?
4b: Is there no possibility of “Loss-to Follow-up Bias”?
4c: Have primary study investigators made efforts to prevent or overcome such bias? (for example, choosing highly motivated subjects, subjects who are easy to follow, or providing incentives to subjects so they don't drop out)
5a: Are outcome data comparable between the experimental group and the control group after the intervention? Because the research subjects had been randomly allocated into the experimental group and the control group before the intervention, the two groups were comparable in the distribution of confounding factors before the intervention, so to determine the effect of the intervention it was sufficient to compare the outcomes of the two groups after the intervention.
5b: Are all data analyzed according to randomization results? Randomization carried out before intervention is only effective in controlling the influence of confounding factors if all data are analyzed according to randomization.
6. Is there no possibility of a conflict of interest with the research sponsor, which could cause bias in concluding the research results?

Assessment Instructions:

1. Total number of questions = 14 questions. Answer "Yes" to each question gives a score of "2". The answer "Uncertain" gives a score of "1". The answer "No" gives a score of "0".
2. Maximum total score= 14 questions x 2= 28.
3. Minimum total score = 14 questions x 0 = 0. So, the range of total scores for a primary study is between 0 and 28.
4. If the total score of a primary study is >= 24, then the study can be included in the meta-analysis. If the total score of a primary study was <24, then the study was excluded from the meta-analysis.

Table 2. Mean and SD data regarding the effect of postpartum exercise on TFU in postpartum mothers

Author (Year)	Intervention		Control	
	Mean	SD	Mean	SD
Rullynil et al. (2014)	5.72	0.88	7.37	0.68
Colin et al. (2019)	4.00	0.739	5.67	1.073
Mardiya et al. (2022)	8.52	0.363	7.36	0.281
Kholisotin et al. (2021)	5.80	0.457	6.73	0.351
Haslan et al. (2022)	5,2	0,918	6.70	0.948
Kasiati et al. (2019)	5.00	0.704	2.20	1.304

Table 3. Summary of Primary Studies on the effect of postpartum exercise on fundal uterine in postpartum mothers

Author (year)	Country	Sample size	P	I	C	O
Rullynil et al. (2014)	Indonesia (West Sumatera)	40	Postpartum mother	Postpartum Exercise	No Postpartum Exercise	Decreased in TFU
Colin et al. (2019)	Indonesia (Bengkulu)	24	Postpartum mother	Postpartum Exercise	No Postpartum Exercise	Decreased in TFU
Mardiya et al. (2022)	Indonesia (Riau)	10	Postpartum mother	Postpartum Exercise	No Postpartum Exercise	Decreased in TFU
Kholisotin et al. (2021)	Indonesia (East Java)	30	Postpartum mother	Postpartum Exercise	Kegels Exercise	Decreased in TFU
Haslan et al. (2022)	Indonesia (South Sulawesi)	20	Postpartum mother (20-35 years old)	Postpartum Exercise	No Postpartum Exercise	Decreased in TFU
Kasiati et al. (2019)	Indonesia (East Java)	20	Postpartum mother (20-35 years old)	Postpartum Exercise	No Postpartum Exercise	Decreased in TFU

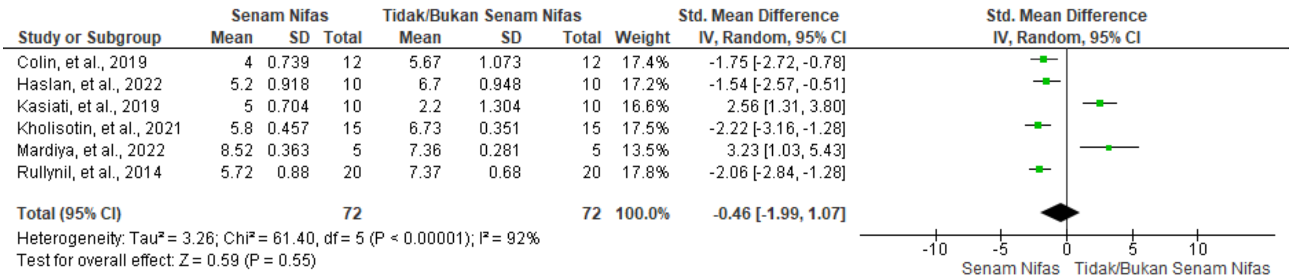

Figure 3. Funnel Plot of the Effect of Postpartum Exercise on Reducing Fundal Uterine

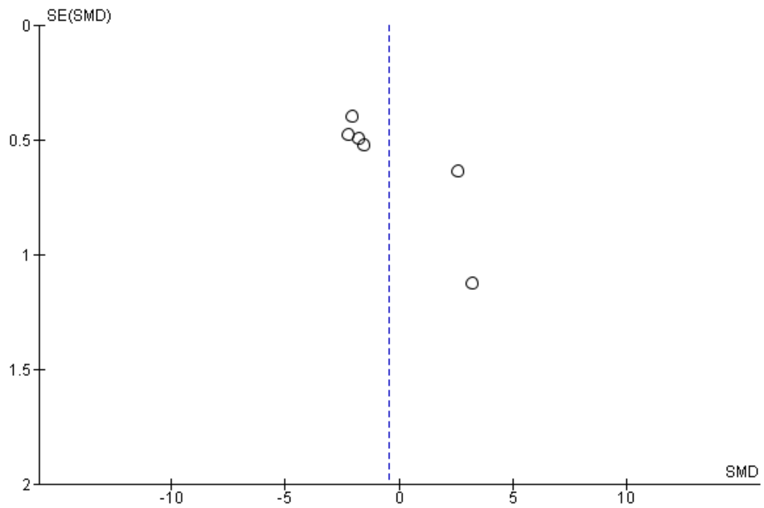

Figure 4. Forest Plot of the Effect of Postpartum Exercise on Reducing Fundal Uterine

DISCUSSION

Based on 6 articles that were included in the criteria as sources for this research, the research locations were spread across 3 islands in Indonesia with different sample sizes ranging from 10 to 40 samples. There is 1 article that uses another intervention as a comparison, which is Kegel exercises and 5 other articles that use no intervention.

After conducting an analysis using the RevMan application, it was found that postpartum exercise intervention could have an effect on reducing TFU in postpartum mothers by 0.46 units higher than not receiving intervention or not conducting postpartum exercise, but it was not statistically significant (SMD= -0.46; 95% CI= -1.99 to 1.07; p=0.550). This is in line with research conducted by Anggraeni et al., (2019) which stated that postpartum exercise was proven to be an effective tool for accelerating uterine involution in the postpartum period with an effect size of 1.63. There was a significant difference in the average uterine involution gain score between the postpartum exercise group and the control group with p=<0.001. This is in line with research done by Rianti et al. (2019) which concluded that by implementing the Otaria postpartum exercise model and caregiver assistance, the process of fundal height returning to its original shape as in pregnancy occurred on the seventh day after delivery.

Similar research was conducted by (Silviani and Maryana, 2020) which explained that mothers who did postpartum exercise had a faster rate of uterine involution than mothers who did not do postpartum exercise, this was proven by the presence of 9 respondents whose uterine fundus height on the first day was 12 cm experienced a decrease on the 5th day, which was only 5 cm left and on the 7th day the uterus was not palpable or 0 cm but there was 1 respondent whose the uterus was still palpable on the 7th day by 2 cm, and there were 7 respondents whose uterine fundus height was 13 cm on the first day then there was a decrease in the height of the uterine fundus on the 5th day, which was only 6 cm and 0 cm on the 7th day. The similar result was also stated by Fadhli and Indriani (2022) that the average (mean) uterine involution in postpartum mothers who were not treated with postpartum exercise on day 1 was 10.13 with a standard deviation of 0.641. The average (mean) on day 2 was 9.75 with a standard deviation of 1.04. The average (mean) on day 3 was 4.75 with a standard deviation of 0.707.

Another study was also conducted by (Kusumastuti et al., 2021) where researchers analyze the differences between the effectiveness of oxytocin massage, and the results showed that the average uterine involution time for the postpartum exercise group was 137.60 hours and 159.06 hours for the oxytocin massage group. The results of the independent t-test showed p=0.002, meaning that there was a difference in the effective time of uterine involution between the ostpartum exercise group and the oxytocin group. The difference is 22.68 hours. After analyzing the uterine involution time in both groups, it can be concluded that postpartum exercise is the most effective way to achieve minimal uterine involution time in postpartum mothers.

In contrast to research conducted by Azizah et al. (2018) which showed that there was a difference in uterine involution by measuring the decrease in uterine fundal height between the back massage intervention group using Clary Sage (salvia sclarea) essential oil and the control group (postpartum exercise). The results of the study showed that the back massage intervention using Clary Sage essential oil had an effect on uterine involution through high uterine fundus measurements compared to the control group. Another research that was not in line was conducted by Kholisotin et al. (2021), it was found that the results of the independent t test showed that there was no significant difference between postpartum exercises and Kegel exercises in overcoming uterine involution in postpartum mothers with a value of p=0.039. Kholisotin stated that the two techniques are more effective in reducing uterine involution than postpartum exercises with a mean difference of 6.73 > compared to the mean of postpartum exercises of 5.80.

This study did not find significant results regarding the effect of postpartum exercise on reducing TFU in postpartum mothers. This is possible because the decrease in TFU is also influenced by age, where age is closely related to the decrease in uterine fundal height in postpartum mothers. The older a person is, the less productive their reproductive organs are. This is usually found in women over 35 years old (Sari et al., 2020). As women aged, the elasticity of the muscles of the reproductive organs also decreased (Rahayu and Solekah, 2020). Most of the respondents were multiparous (94.1%). The uterine involution process in multiparous women tends to decrease compared to primiparous women because the elasticity of the uterine muscles decreases and can inhibit uterine involution (Utami, 2015). The uterine muscles of multiparous women often stretch so that it takes longer for the uterine involution process (Colin et al., 2019).

In postpartum conditions, the mother will be in a position to enter a recovery period where she will return to her pre-pregnancy condition. The actions and movements of pregnancy exercise really help accelerate the mother's physiological recovery slowly (Zakiyyah et al., 2018). Generally, the main concern of the mothers during the postpartum period is how to restore the shape of the body and the abdominal wall to its normal state, so that by doing postpartum exercises the body shape and abdominal wall will return to the normal condition (Priyanti and Syalfina, 2017).

Overall, postpartum exercise is beneficial for postpartum mothers. Postpartum exercise can strengthen uterine muscle contractions due to an increase in extra cellular calcium ions which bind to calmodulin and will increase myosin kinase and phosphorylase (Isti, 2015). This causes continuous muscle pulling and uterine contractions (Asyima et al., 2019). Continuous contractions and retraction of the uterus will cause narrowing and rupture of blood vessels. Then, it will disrupt blood flow to the uterus. Therefore, muscle tissue will have lack of the necessary substances so that its size becomes smaller. In addition, poor blood circulation to the uterus also causes it to atrophy and return to its original size (Walyani et al., 2017).

In addition, postpartum exercise also has other benefits for health and body fitness. Zourdalani et al. (2015) argue that implementing a low-intensity physical exercise program such as postpartum exercise can improve physical fitness and overall fitness in postpartum mothers, including improving cardio-respiratory function, muscle strength and endurance in the upper and lower body, abdominal legs, stretching, musculoskeletal back and thighs, and reduction of total body fat.

Physiologically, muscle endurance is known to decrease after giving birth along with hormonal changes that occur. Physical exercise such as gymnastics and yoga can increase muscle strength, stretching and relaxation so that the quality of life after giving birth can also increases (Timlin and Simpson, 2017).

In line with Mahishale's research, postpartum mothers who received postnatal physical training immediately after giving birth were proven to have better physical well-being and improved quality of life (Mahishale et al., 2014). Exercise causes an increase in endorphin levels in the brain which acts as an internal psychoactive agent to produce a sense of euphoria, a pleasant feeling associated with a positive self-image, a sense of vitality, control, and satisfaction, beta-endorphin is produced endogenously from within the body during exercise (Szabo et al. al., 2019). Physical exercise as a holistic behavior has been proven to be effective in improving psychological well-being, helping to build physical strength recovery after childbirth, and providing social support to postpartum mothers (Buttner et al., 2015).

Based on the discussion above, it is highly recommended for postpartum mothers to do postpartum exercises. From a health perspective, this can also prevent postpartum bleeding (Siregar, 2019). Postpartum bleeding can occur due to poor uterine contractions and a soft uterus. One way to ensure that contractions remain good until the end of postpartum is by mobilizing and doing movements such as postpartum exercises (Gunawan, 2017).

AUTHOR CONTRIBUTION

Anisa Ikhlasani Nur Istiqomah is the main researcher who chose the topic, searched for and collected research data. Bhisma Murti and Rita Benya Adriani analyzed the data and reviewed research documents.

FUNDING AND SPONSHORSHIP

This study used personal funds.

CONFLICT OF INTEREST

There was no conflict of interest in this study.

ACKNOWLEDGMENT

The researchers would like to thank all parties who have helped to create this article and also thank to the database providers namely PubMed, Google Scholar, and Springer Link.

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