Non-pharamacological Interventions for Preeclampsia Management in Pregnant Women: A Literature Review

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Abstract

Background: Preeclampsia is one of the leading causes of high maternal and child mortality worldwide, including Indonesia. Comprehensive studies on the application of non-pharmacological approach in reducing preeclampsia symptoms are still limited. This review aims to identify the effectiveness of non-pharmacological nursing interventions for preeclampsia in pregnant women. Methods: A literature search was conducted to identify relevant articles in three databases of PubMed, EBSCOHost, and Scopus. The studies reviewed were in English on the effectiveness of various non-pharmacological interventions for pregnant women with preeclampsia. The article selection was in accordance to the PRISMA guidelines for scoping reviews using the terms ("preeclampsia" OR "pre-eclampsia") AND ("nursing intervention" OR "nursing care") AND ("blood pressure" OR "blood pressure determination" OR "arterial pressure"). Selected studies were based on original research, either a randomized clinical tial or quasi-experimental studies, focusd on pregnant women or mothers with preeclampsia, and were published in the last ten years (2014-2024). Journal eligibility was assessed using the Joanna Briggs Institute Critical Appraisal. Results: The number of articles reviewed was seven. Findings suggest that pharmacologic management plays an important role in the control of preeclampsia, but non-pharmacologic interventions also provide significant benefits with a lower risk of adverse effects. Various non-pharmacological interventions that have been proven effective in reducing blood pressure in pregnant women with preeclampsia are Progressive Muscle Relaxation (PMR), breathing exercise, stretching exercise, autogenic training, and foot massage. Conclusion: Integration of non-pharmacological interventions in the management of preeclampsia is very important to reduce blood pressure and improve maternal and fetal well-being. Expanding the implementation of the interventions mentioned in the study should be done in further studies to measure its effects on the quality of life of the pregnant women and their compliance in preeclampsia management.

Keywords: Nursing interventions, Preeclampsia, Pregnancy

Introduction

Heath development in Indonesia is still characterized by the vulnerability of maternal and child health, marked by its high mortality rates. Maternal mortality rate (MMR) is an assessment of health status and quality of life index and development index of a country, one of the main causes of maternal mortality is preeclampsia. Worldwide, 10% of pregnant women experience preeclampsia and 76,000 women and 500,000 babies die each year due to preeclampsia. Some of the risk factors for preeclampsia are history of hypertension, advanced age, high blood lipids, body mass index and history of diabetes mellitus (Ministry of Health Indonesia, 2021). The number of maternal deaths collected from the Ministry of Health's family health program records in 2021 showed 7,389 deaths in Indonesia. This number shows an increase compared to 2020 of 4,627 deaths. One of the causes of the large number of maternal deaths in 2021 is caused by hypertension in pregnancy or preeclampsia (Ministry of Health Indonesia, 2022).

Preeclampsia is a dangerous pregnancy complication that can be characterized by high blood pressure. Preeclampsia is defined as a condition of elevated blood pressure (>140/90 mmHg) and proteinuria (0.3 grams/day) in a woman whose blood pressure is normal at 20 weeks gestation (Karrar et al., 2024). Preeclampsia is a systemic disease characterized not only by hypertension, but also by increased vascular resistance, diffuse endothelial dysfunction, proteinuria, and coagulopathy. In 20% of severe preeclamptic women, HELLP syndrome (Hemolysis, Elevated Liver Enzyme, Low Platelet Count), eclampsia, pulmonary edema, acute renal failure, and placental abruption are found. The risk factors that can occur in mothers during pregnancy are maternal age <20 years or >35 years, primiparous status, birth spacing <2 years, obesity, genetic history, previous history of preeclampsia, history of stress and anxiety, and history of hypertension (Silvana et al., 2023). Therefore, it is important to manage preeclampsia in pregnant women to reduce or prevent complications that will occur in the future.

Women who experience hypertension in pregnancy need optimal management, namely by being observed to detect any symptoms or signs so that the diagnosis can be immediately established and the patient can be immediately given appropriate management. If preeclampsia has been diagnosed, expectant or active management can be done, administering magnesium sulfate (MgSO4), antihypertensives, and corticosteroids if HELLP syndrome occurs (Mamuroh & Nurhakim, 2023). In addition to pharmacologic interventions, non-pharmacologic interventions can be done to overcome various problems experienced by pregnant women with preeclampsia. Usually, non-pharmacological interventions have a very low risk. This is because pharmacological interventions certainly contain chemicals that can cause side effects, while non-pharmacological interventions can be done with a healthier lifestyle, including natural remedies such as herbal therapy, nutritional therapy, aromatherapy, and reflexology massage (Rustanti et al., 2020). The purpose of this study is to comprehensively review non-pharmacological interventions that can be applied to pregnant women with preeclampsia problems.

Methods

This evidence-based practice (EBP) literature review applied a rapid review approach. The literature review was conducted to identify and synthesize existing literature regarding various nonpharmacological interventions that can reduce high blood pressure in mothers with preeclampsia. The search strategy begins with determining keywords using the PICO framework analysis method which is adjusted to the MeSH Term. In this review, articles were obtained from three databases, namely PubMed, EBSCO, and Scopus, with keywords that had been made based on PICO (P (Population) = Preeclampsia, I (Intervention) = Nursing intervention, and O (Outcome) = Lowered blood pressure). The use of PRISMA Flow Diagram 2020 guide was to help proccess the article selection based on keywords, validated against inclusion criteria and titles, and also evaluated by the Joanna Briggs Institute (JBI) Critical Appraisal for eligibility. The authors analyzed the quality

of the articles using the JBI Critical Appraisal Tool assessment for randomized controlled trials and quasi-experimental studies.
Articles were then screened based on inclusion criteria (RCT/Clinical Trial research, publication from 2014-2024, written in English) and exclusion criteria (articles published before 2014, review articles, and non-English articles), duplication, appropriateness of title and abstract to the topic. The final number of articles reviewed was 7 articles. In accordance with the keywords that have been compiled and the inclusion and exclusion criteria previously determined can easily find articles. From the search results, a number of related articles were found which were presented in Figure 1.

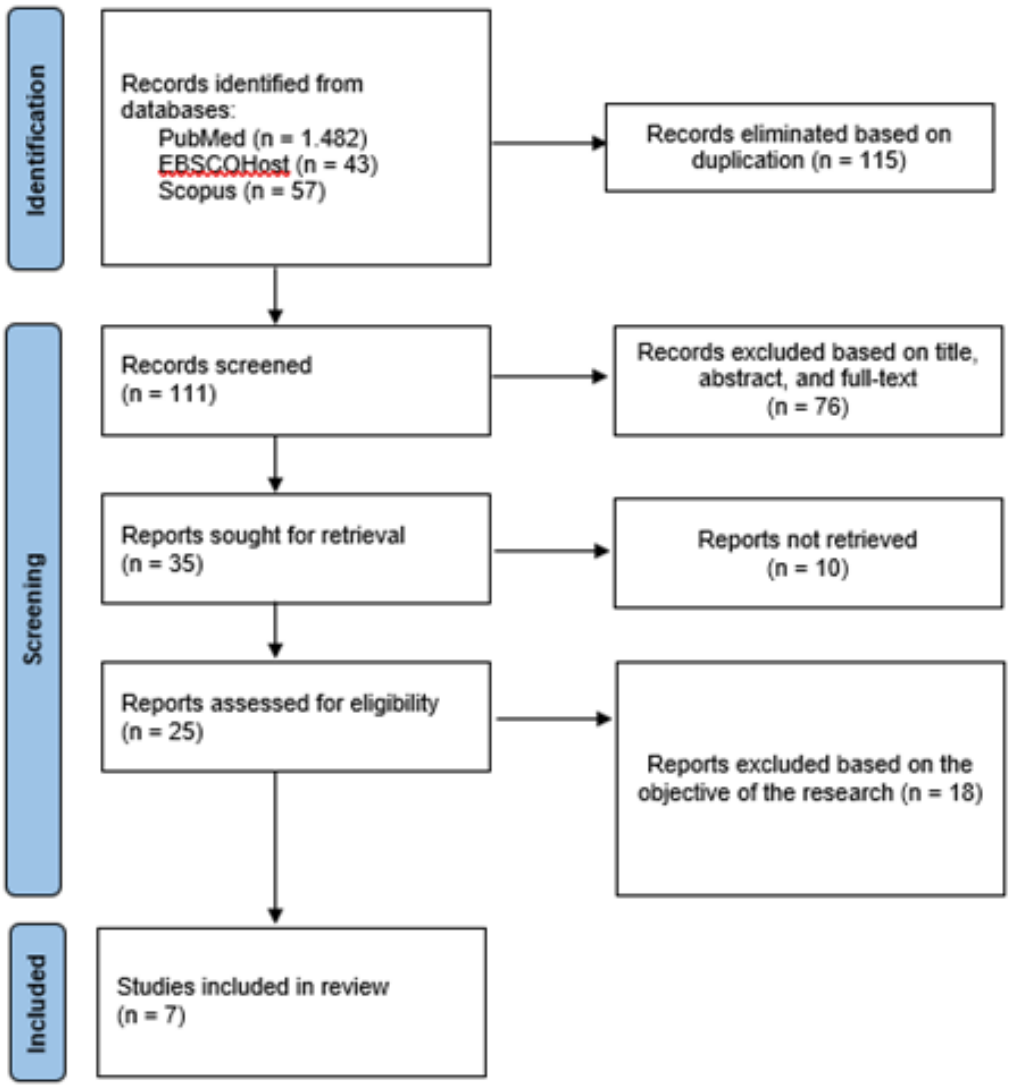

Figure 1. PRISMA Flow Diagram

Results

The authors identified a total of 1.582 articles through keyword search results in the three databases. After filtering out the duplicates, applying inclusion criteria, and ensuring access to the full-text articles, the amount of articles were narrowed down to seven. The authors thoroughly checked to guarantee that only relevant publications were considered for review. All seven articles fulfilled the minimum risk of bias standards as evaluated by the JBI critical appraisal tools. The majority of the countries involved were from developing countries, including Egypt, Indonesia, Iran, and Pakistan. The study participants were consisted of pregnant women diagnosed with preeclampsia. The research design included four quasi-experimental studies and three randomized controlled trials. The studies had sample sizes ranging from 30 to 96 participants.

Table 1. Study Characteristics

No.	Year	Country	Title & Author	Objective	Sample	Procedure	Research Design	Results
1.	2024	Egypt	Progressive Muscular Relaxation Versus Breathing Exercise Techniques to Control Blood Pressure among Mild Preeclamptic Pregnant Women (Ibrahim et al., 2024)	Comparing the effectiveness of progressive muscle relaxation (PMR) intervention with breathing exercise techniques in reducing blood pressure in pregnant women with preeclampsia.	75 pregnant women with preeclampsia in the Obstetrics Clinic of Suez Canal Ismailia University Hospital, Egypt	The study was divided into 3 groups, namely deep breathing exercise technique group, progressive muscle relaxation group, and control group. Data collection was carried out using two methods, namely interviews and physiological measuring instruments. Data were collected over a period of 8 months.	Quasi-experimental	There was a significant decrease in blood pressure in both intervention groups (PMR and deep breathing exercise technique) compared to the control group at week 2 to 6 of the study. However, researchers did not see a significant difference between the PMR and deep breathing exercise technique intervention groups. Thus, progressive muscle relaxation PMR) and deep breathing exercise techniques can effectively reduce and control blood pressure in pregnant women with preeclampsia.
2.	2024	Iran	The effectiveness of Jacobson's progressive muscle relaxation technique on maternal, fetal and neonatal outcomes in women with non-severe preeclampsia: a randomized clinical trial (Ghorbannejad et al., 2022)	Determine the effectiveness of Jacobson's progressive muscle relaxation technique on maternal, fetal, and neonatal outcomes in women with non-severe preeclampsia.	A total of 88 pregnant women with non-severe PE at Kamali Hospital in Karaj.	Exercises were performed in the intervention group twice a week for 6 weeks. There were 6 groups of 6 people and one group of 8 people who performed the exercises twice a week (once a day). Each session lasted an average of 45 minutes. Participants in this group received the intervention during four face-to-face sessions and eight online sessions due to Covid-19. The duration and method of exercise in the online sessions were done according to the face-to-face sessions. The control group did not receive any intervention except for routine perinatal care.	Randomized clinical trial	The mean values of systolic blood pressure, diastolic blood pressure, proteinuria, fasting blood sugar, early fetal heart rate and number of fetal movements for 20 minutes based on NST and AFI were statistically significant in the intervention group before and after the intervention. However, there was no statistically significant difference in the control group in terms of the above variables before and after the intervention. Therefore, this progressive muscle relaxation technique can be used as an alternative in reducing hypertension.

3.	2019	Egypt	Effect of stretching exercises versus autogenic training on preeclampsia. (Awad et al., 2019)	The aim of this study was to compare the effects of stretching exercises and autogenic training in the treatment of preeclampsia.	A total of 40 primiparous women with preeclampsia and gestational age exceeding 20 weeks at the outpatient clinic of Cairo University Hospital, Egypt. The respondents were randomly assigned to group A for stretching exercises (n=20) and group B for autogenic training (n=20).	Both groups (A & B) completed a 6-week treatment program (3 sessions per week) of stretching exercises and autogenic training.	Randomized clinical trial	There was a statistically significant reduction in systolic blood pressure and diastolic blood pressure in both groups A and B after the intervention. When comparing the two groups together, there was no statistically significant difference between the two groups before and after the intervention. It can be concluded that stretching exercise and autogenic training proved to be effective non-pharmacological therapies to control preeclampsia symptoms.
4.	2018	Indonesia	Foot Massage Modification to Reduce Blood Pressure in Pregnant Woman with Preeclampsia (Ermiati et al., 2018)	The purpose of this study was to determine the effectiveness of complementary therapy: foot massage to reduce blood pressure in pregnant women with preeclampsia.	The samples in this study were 30 pregnant women with preeclampsia at the Jatinangor Primary Health Center.	The instrument of this study was an observation sheet containing demographic data of respondents. Results Univariate analysis was applied to analyze the characteristics of respondents including: Method The research design used was quasi experimental with time series design. The population in this study were all pregnant women in the Jatinangor Health Center working area. The sample in this study were 30 pregnant women with preeclampsia at the Jatinangor Health Center. Researchers also provided foot massage intervention protocols to respondents. Data were collected using a time series design.	Quasi experimental	The results showed that there was no significant difference in mean systolic and diastolic blood pressure between pre-test and post-test (p>0.05) in the control period. While in the treatment period showed that there was a significant difference in mean systolic blood pressure between pre-test and post-test on the seventh day to the twelfth day (p<0.05). Foot massage technique can be used as one of the interventions to reduce blood pressure in pregnant women with preeclampsia.
5.	2016	Egypt	Impact of Physical Stretching Exercise on Feto-Maternal Outcomes Among Mild Preeclamptic Pregnant Women in Egypt (Yakout, 2016)	This study aims to evaluate the impact of Physical Stretching Exercise by pregnant women with mild preeclampsia.	The population of this study was pregnant women in the antenatal and delivery unit at El-Shatby Maternity University Hospital in Alexandria. The study sample amounted to 64 pregnant women with mild preeclampsia.	The patients were instructed to perform the following set of exercises four to five times per week for 3 months until the end of pregnancy. The patients were followed up monthly at the Outpatient Clinic for 3 months (from 28 weeks of pregnancy to delivery) to ensure compliance with the application of the independent intervention provided (physical stretching exercise).	Quasi Experimental	The results of the current study illustrated that the mean systolic and diastolic blood pressures before and after physical stretching exercise had significant differences (P = 0.001). All (100%) study subjects who practiced physical stretching exercise did not suffer from complications while about half (42.1%) who did not practice suffered from severe preeclampsia.
6.	2021	Pakistan	Role Of Stretching Exercise On Preeclampsia; Quasi Experimental Study (Saeed & Imama, 2021)	The purpose of this study was to determine the effect of stretching on preeclampsia in pregnancy.	The study sample was 50, 25 in each Stretching Exercise and Routine care group. Inclusion criteria: Pregnant women aged >18 years, regardless of the number of children with symptoms of preeclampsia.	The program was designed to consist of 20 minutes of exercise in various positions and intensities. Stretching exercises were performed in a sequence that involved the muscles of the neck to the muscles of the upper limbs and lower limbs to the trunk. Usually this 20-minute session is divided into two parts: 10 minutes upper- and 10 minutes lower limbs. Stretching movements are performed on the knees and hands or in a seated position.	Quasi Experimental	The results showed that Stretching exercise can prevent and reduce preeclampsia compared to routine care in pregnant women.

7.	2023	Iran	The Effect of Body Relaxation Techniques on Pre-Eclampsia Syndrome (Valiani et al., 2023)	The purpose of this study was to determine the effect of stretching on preeclampsia in pregnancy.	The population of this study was high-risk pregnant women. The sample in this study amounted to 96 high-risk pregnant women selected by random sampling method from among mothers at health centers in Isfahan city.	The selected high-risk pregnant women completed the DASS2 questionnaire. In addition to receiving routine medical care and participating in childbirth preparation classes (PLC), intervention group subjects participated in sixteen relaxation sessions.	Randomized Clinical trial	The results showed no significant difference between the two groups in terms of diastolic blood pressure and proteinuria. Systolic blood pressure and stress were also significantly reduced in the intervention group. However, proteinuria was not significantly different between the two groups.

Discussion

Preeclampsia is a condition that occurs at 20 weeks of pregnancy, characterized by high blood pressure even though the pregnant woman has no history of hypertension (Mamuroh & Nurhakim, 2023). Preeclampsia is a serious problem and has a high level of complexity. The magnitude of this problem is not only because preeclampsia affects the mother during pregnancy and childbirth, but also causes postpartum problems due to dysfunction of the endothelial layer in various organs, such as the risk of cardiometabolic diseases and other complications. Based on the results of the analysis of articles that have been conducted, there are several non-pharmacological interventions to reduce blood pressure in pregnant women with preeclampsia that have been studied in various studies, namely progressive muscle relaxation, breathing exercise, stretching exercise, autogenic training, and foot massage.

Progressive Muscle Relaxation

Relaxation techniques can regulate how the hypothalamus responds to parasympathetic nerves, lowering heart rate, blood pressure, respiratory rate and reducing oxygen consumption and muscle tension (Verma et al., 2021). One of the commonly used techniques in relaxation is progressive muscle relaxation (PMR). This method was first introduced by Edmund Jacobson in 1938. This technique involves muscle tension and release, which continues throughout the body, focusing on muscle release as the relaxation phase (Norelli et al., 2023).

Research conducted by Ghorbannejad et al. (2022) showed that PMR can have a good effect on systolic blood pressure, diastolic blood pressure, proteinuria, fasting blood sugar, early fetal heart rate and the number of fetal movements. Ghorbannejad et al. (2022) found a decrease in both systolic and diastolic blood pressure values in the group given PMR intervention. This is believed to occur because PMR makes the heart work better and can regulate blood pressure. In line with recent research by Ibrahim et al. (2024) that progressive muscle relaxation (PMR) can effectively control blood pressure in pregnancy with preeclampsia complications.

The same results were found in a study conducted by Valiani et al., (2023) that stretching and relaxation exercises significantly reduced the systolic and diastolic blood pressure of pregnant women with mild PES after the intervention. Exercise and relaxation can improve arterial endothelial function and help reduce endothelin-1 levels and vasodilation-inducing factors by stimulating nitric oxide release, which is the most important mechanism of walking and relaxation to control gestational blood pressure abnormalities and preeclampsia.

Breathing Exercise

Breath relaxation techniques can allow muscle tension to be released thereby increasing peripheral blood flow, lowering blood pressure and heart rate, and allowing slower and deeper breathing. This relaxation suppresses the hypothalamic sympathetic response which is thought to lower blood pressure. When sympathetic activity is reduced, plasma renin-angiotensin activity and aldosterone concentrations are also reduced resulting in lower blood pressure (Ibrahim et al., 2024). Research by Ibrahim et al. (2024) showed that not only the progressive muscle relaxation (PMR) technique, the breath relaxation technique was also considered to effectively control blood pressure in pregnancy with preeclampsia complications. This is discussed in a prior study that highlighted the significance of

breathing exercises in lowering systolic and diastolic blood pressure after following a 4-week continuous intervention program (Gouda et al., 2024). This finding is also supported by another study by Ayuni et al. (2023) that showed breathing relaxation techniques made significant changes in blood pressure post-intervention in preeclampsia pregnant women. Physiologically, the blood pressure of pregnant women tends to increase at the third trimester. This could be caused by the effects of pregnancy hormones that retain fluid and interferes with the blood flow back to the heart, which increases the blood pressure. Breathing exercises have shown to have calming influences on the autonomic nervous system, and previous studies have shown beneficial impacts of doing breathing exercises to lower the blood pressure of pregnant women.

Stretching Exercises

Physical activity or exercise done regularly during pregnancy will reduce the risk of a pregnant woman to develop hypertension and preeclampsia (Rini & Marfu'ah, 2023). The recommended exercise is a sport that is not too heavy and safe for pregnant women to do, one of which is stretching exercise. In a study by Awad et al. (2019), showed that there was a decrease in systolic and diastolic blood pressure in pregnant women with preeclampsia after being given a stretching exercise intervention for 6 weeks. Stretching exercise is performed on the pectoralis major, neck, back, hip, hamstring, and calf muscles. Physical activity increases parasympathetic activity and causes bradycardia, so stretching exercise can significantly reduce the risk of preeclampsia by reducing blood pressure and heart rate at rest. Moderate to vigorous physical activity performed before and during pregnancy can reduce the incidence of preeclampsia by 35%. Stretching exercise can also reduce the risk of preeclampsia because the concentration of oxidative substances produced by pregnant women due to stress will be reduced.

The study by Awad et al. (2019) also highlighted that stretching exercise can prevent and reduce preeclampsia. According to Saeed & Imama, (2021), stretching exercises can prevent and reduce preeclampsia compared to routine care in pregnant women. Testing was carried out on both groups before intervention and after intervention, namely with an intervention duration of 3 weeks. Analysis showed significant differences in terms of improvement in blood pressure, diastolic pressure, and heart rate at the end of the intervention, while before the intervention both groups showed similar scores. In the Routine Care group, diastolic blood pressure and heart rate did not improve, while the Stretching Exercise group had significant improvement in all variables. Therefore, stretching exercises can improve blood pressure and heart rate and is a recommended method to stabilize blood pressure, diastolic pressure, and heart rate during pregnancy. This is in line with another study by Yakout (2016) which showed that stretching exercises are effective in reducing systolic and diastolic blood pressure in pregnant women suffering from preeclampsia. Additionally, pregnant women who do physical stretching exercise do not suffer from complications, while pregnant women who do not practice physical stretching exercise suffer from severe preeclampsia.

Autogenic Training

Psychological techniques such as relaxation can help control high blood pressure. This is because psychological factors such as stress play a major role in increasing blood pressure. One of the relaxation techniques that can be done is autogenic training. Autogenic means self-generated or generated from within. This reflects the ability to produce a relaxed feeling of warmth and heaviness throughout the body by saying various verbal phrases that aim to encourage a state of physical relaxation and emotional calmness (P. H. Lestari et al., 2025).

Another study stated that autogenic training conducted for 6 weeks is effective in reducing blood pressure in pregnant women with preeclampsia. The release of tension in skeletal muscles obtained through relaxation increases peripheral blood flow which will cause a decrease in blood pressure and heart rate and cause slower and deeper breathing. In addition, the relaxation response will

control the effects of sympathetic activity by increasing the action of the parasympathetic nervous system. When sympathetic activity decreases, there will be a decrease in plasma renin-angiotensin activity and aldosterone concentration leading to a decrease in blood pressure (Awad et al., 2019).

Foot Massage

Research by Ermiati et al., (2018) explained that foot massage techniques can be one of the interventions to reduce blood pressure in pregnant women with preeclampsia, physiologically, foot massage is part of the stimulation that helps the body achieve homeostasis through extrinsic and intrinsic peripheral blood flow regulation. Foot massage is a systematic and rhythmic touch using manipulation of all soft tissue areas in the foot. Physically, foot massage has an impact on muscle relaxation, relieving pain, increasing blood flow and stretching joints. This study proves that there is a significant difference in blood pressure reduction of preeclamptic pregnant women after foot massage. First, the respondents' blood pressure was measured by the researcher without any intervention for 6 days. Second, the 7th to 12th respondents did massage for 20 minutes, and observed blood pressure in the first minute before massage (pre-test), and the 30th minute after massage (post-test). There was a significant difference in mean blood pressure, systolic blood pressure between pretest and posttest on day 7 to day 12 ($p < 0.05$). Overall, this study can be concluded that foot massage technique can be used as one of the interventions to reduce blood pressure in pregnant women with preeclampsia (Ermiati et al. 2018).

The results of the study reviewed is in correlation with a study by Lestari et al., (2023) that implemented foot reflexology intervention for hypertension patients. Although the study had a different sample pool, it still demonstrated that foot massages can help lower blood pressure due to its relaxing effects on the body, which helps blood vessels that initially undergo vasoconstrictions to dilate. The relaxation is caused by tactile stimulation on the body tissues. When the body relaxes, the serotonin hormone excreted plays a role in physiological changes in the body so that blood circulation improves, lowering the blood pressure. Another study also stated that foot messages given with warm water mixed with aromatic ginger foot bath increase blood circulation, relax muscles, relieve muscle spams, reduce anxiety, and reduce foot swelling in pregnant women (Novelia et al., 2022). The researchers found that foot messages given for 20 minutes for three consecutive days are very effective in improving blood circulation, which results in the vasodilation of blood vessels that affects blood flow to increase (Novelia et al., 2022).

Conclusion

Preeclampsia is one of the leading causes of high maternal and child mortality worldwide, including Indonesia. The disease is characterized by high blood pressure and proteinuria, and can lead to serious complications such as HELLP syndrome, eclampsia and placental abruption. Various risk factors, such as a history of hypertension, advanced age, obesity and stress, contribute to the increased risk of preeclampsia, so proper management is essential to prevent further complications. In addition to pharmacological interventions, the role of non-pharmacological interventions is also increasingly necessary.

Various non-pharmacological interventions have been proven effective in reducing blood pressure in pregnant women with preeclampsia, such as Progressive Muscle Relaxation (PMR), breathing exercise, stretching exercise, autogenic training, and foot massage can help reduce blood pressure significantly. PMR, as one of the relaxation methods, reduces muscle tension and regulates blood pressure through parasympathetic mechanisms. Similarly, breathing exercise and stretching exercise improve endothelial function and reduce the risk of preeclampsia. Autogenic training, which focuses on self-suggestion, and foot massage, which stimulates peripheral blood flow, have also been shown to lower blood pressure and improve the well-being of pregnant women.

The routine application of non-pharmacological intervention techniques

can be an important supportive method in the care of pregnant women with preeclampsia. Health workers should adopt non-pharmacological interventions, such as Progressive Muscle Relaxation (PMR), breathing exercise, stretching exercise, autogenic training, and foot massage, as part of comprehensive care for pregnant women with preeclampsia. To support the success of these interventions, structured training needs to be provided to pregnant women, either directly or through antenatal education programs. Integrating these techniques into routine care is expected to help lower blood pressure, reduce the risk of complications, and improve maternal and fetal well-being. In addition, interprofessional collaboration and the provision of facilities that support the practice of these interventions in health facilities need to be improved to ensure effective and sustainable implementation. Therefore, further research must be done in implementing these non-pharmacological interventions to reduce blood pressure in preeclampsia pregnant women using an interprofessional approach, which can then measure its effects on the pregnant women's quality of life and their adherence to the management of preeclampsia.

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