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The effectiveness of prenatal exercise on leg swelling in third-trimester pregnant women: A literature review

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Abstract

Background: Leg swelling (edema) is a common complaint among third-trimester pregnant women due to fluid retention and impaired venous return. Prenatal exercise is a safe nonpharmacological intervention that can help reduce leg edema.

Purpose: To determine the effectiveness of prenatal exercise on leg swelling in third-trimester pregnant women based on previous research findings.

Method: This study employed a literature review method, with articles retrieved from the PubMed, Google Scholar, and ScienceDirect databases from 2021 to 2026. Inclusion criteria included original research articles on prenatal exercise or physical activity regarding leg edema in third-trimester pregnant women. Article selection followed the PRISMA flowchart, resulting in 9 eligible articles.

Results: The review findings indicate that prenatal exercise is effective in reducing leg swelling in third-trimester pregnant women. Prenatal exercise helps improve blood circulation, enhance venous return, improve vascular function, and reduce fluid retention in the lower extremities. Additionally, prenatal exercise improves physical comfort and quality of life for pregnant women.

Conclusion: Prenatal exercise is effective as a nonpharmacological intervention to reduce leg edema in third-trimester pregnant women and can be recommended in antenatal care.

Keywords: Leg Edema; Pregnant Women; Prenatal Exercise.

INTRODUCTION

Pregnancy is a physiological process that causes various changes in the mother's body, including anatomical, physiological, and psychological changes. These changes intensify during the third trimester due to the growing fetus and increased blood circulation requirements. One of the discomforts frequently experienced by pregnant women in the third trimester is swelling of the legs, or lower extremity edema. This condition occurs due to increased fluid retention, uterine pressure on the veins, and impaired venous return from the lower extremities to the heart (Wulandari & Ainiyati, 2025). Leg edema in pregnant women is generally physiological; however, if left untreated, it can cause discomfort, pain, tingling, limited activity, mobility

issues, and even a reduced quality of life for the pregnant woman. In the third trimester, the incidence of leg edema is quite high, with approximately 75-80% of pregnant women reporting it (Rahmawati & Sari, 2022).

Various non-pharmacological approaches have been employed to reduce edema in pregnant women, such as foot massage, warm water soaks, hydrotherapy, and physical exercise. One intervention considered safe and easy to perform is prenatal exercise. Prenatal exercise is a physical activity specifically designed for pregnant women to help improve muscle elasticity, enhance blood circulation, promote relaxation, and reduce discomfort during pregnancy (Fitriani, Lestari, &

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Handayani, 2021). Prenatal exercise can help improve blood flow and venous return in the lower extremities, thereby reducing fluid accumulation in the leg tissues. Stretching movements and muscle exercises during prenatal exercise also help increase muscle pump activity, which plays a role in reducing leg swelling in third-trimester pregnant women. Research shows that there is a reduction in the degree of leg edema after regular prenatal exercise (Lestari & Putri, 2023).

Research shows that most pregnant women experience a reduction in the severity of edema after participating in prenatal exercise, with statistical test results indicating a significant effect of prenatal exercise on the reduction of leg edema in pregnant women in the second and third trimesters (Ningsih & Pratiwi, 2022). Another study also noted that prenatal exercise effectively reduces lower extremity edema in third-trimester pregnant women because it improves blood circulation and reduces fluid retention in tissues (Yuliana & Dewi, 2021). Although various studies on prenatal exercise and leg edema have been conducted, the research findings remain scattered across various sources; therefore, a comprehensive

review is necessary to determine the effectiveness of prenatal exercise on leg swelling in third-trimester pregnant women.

RESEARCH METHOD

This study employed a literature review method to identify, analyze, and synthesize various research findings regarding the effectiveness of prenatal exercise on leg swelling in third-trimester pregnant women. The literature review was conducted systematically by collecting relevant research journals from various scientific databases. Article searches were conducted through electronic databases, namely PubMed, Google Scholar, and ScienceDirect. The inclusion criteria for this study were original research articles discussing prenatal exercise regarding edema or leg swelling in third-trimester pregnant women, available in full text, written in Indonesian or English, and published between 2021 and 2026. The article selection process was conducted using the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart.

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RESEARCH RESULTS

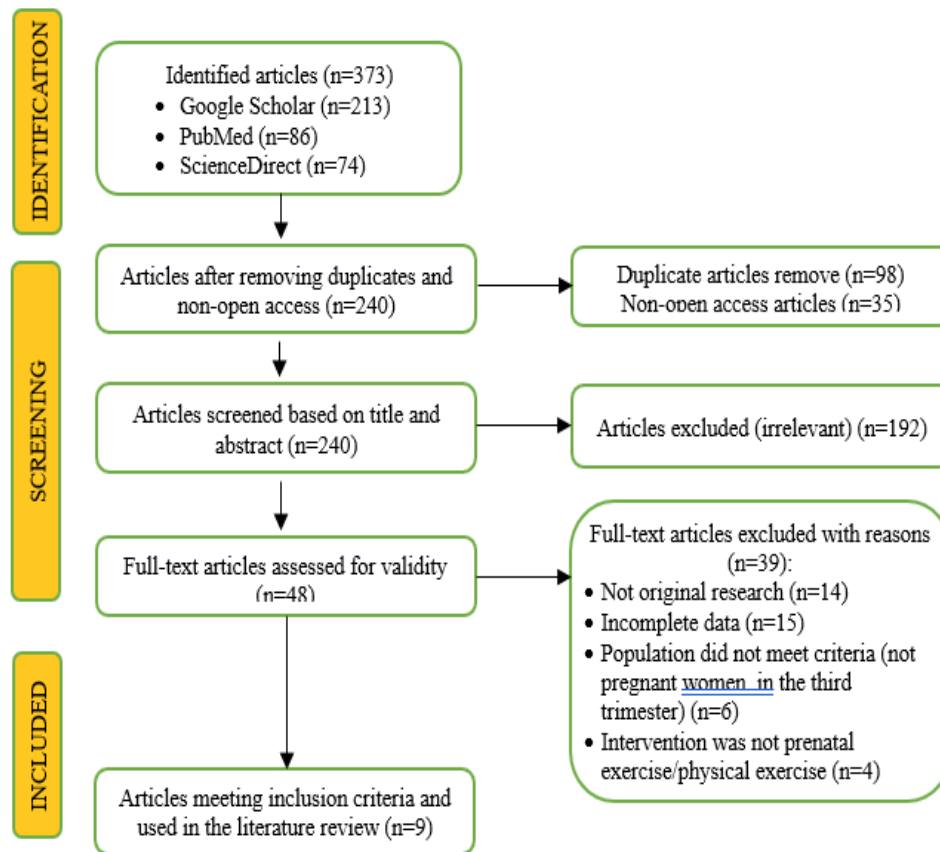


Figure 1. Diagram PRISMA

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Table 1. Results of the Literature Review

(Author, Years) (Country)	Purpose	Method	Results
(Saccone et al., 2026) (Italy)	To evaluate whether regular aerobic exercise during pregnancy reduces the risk of hypertensive disorders of pregnancy and improves maternal cardiovascular adaptation.	This was a secondary analysis of a randomized clinical trial including women with singleton gestation randomly assigned in a 1:1 ratio to an exercise group or a control group. The intervention consisted of a structured aerobic exercise program from the first trimester until 35 weeks.	Among 938 randomized participants, 54 underwent echocardiography. The incidence of gestational hypertension was lower in the exercise group compared with the control group (10.1% vs 15.1%; RR 0.56, 95% CI 0.33–0.97). Preeclampsia incidence was 2.5% and 3.5%, respectively (RR 0.71, 95% CI 0.23–2.21). In the echocardiography subgroup, exercise participants had lower systolic and diastolic blood pressure, higher stroke volume (79.7 ± 7.3 vs 74.5 ± 9.2 ; $p = 0.02$), and more favorable mitral inflow indices, including a higher E'/A' ratio (1.29 ± 0.17 vs. 1.15 ± 0.23 ; $p = 0.01$) and reduced impaired diastolic relaxation (0% vs. 27.3%; $p < 0.01$).
(Farag et al., 2025) (Egypt)	To assess effect of ModifiedBuerger-Allen Exerciseson physiological leg edema during the3rd trimesterof pregnancy.	A quasi-experimental design as employed. Subjectsand Methods: Setting: The antenatal clinic of the National MedicalInstitute atDamanhour, El-Beheira Governorate Egypt. Subjects: A purposive	At 10days post-intervention, experimental group 1 showed a significantreduction in edema severity and circumferences, with 26.7% of participantsimproving to grade +1

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		sample of 90 pregnant women who met the inclusion criteria. Tools: Four Instruments were employed. These included a structured interview schedule for demographic and obstetric information, a chart to assess the presence and severity of pitting edema, the non-elastic tap measure and figure of eight measurement of ankle swelling.	edema and significant decreases in ankle and instep circumferences. By 20 days, experimental group 2 demonstrated even greater improvements, with 63.3% showing grade +1 edema and significant reductions in ankle, instep, and metatarsal-phalanges joint circumferences compared to the control group.
(Pongpanit et al., 2024) (Eropa)	to assess the effects of exercise training during pregnancy and the postpartum period on maternal vascular health and blood pressure (BP).	The outcome of interest was pulse wave velocity (PWV), flow-mediated dilation (FMD), and BP from pregnancy to 1-year postpartum. Five databases, including Ovid MEDLINE, EMBASE, CINAHL, Web of Science, and Cochrane Library, were systematically searched from inception to August 2023. Studies of randomized controlled trials (RCTs) comparing the effects of prenatal or postpartum exercise to a non-exercise control group were included. The risk of bias and the certainty of evidence were assessed.	a significant reduction in systolic BP (SBP) [mean difference (MD): -4.37 mmHg; 95% confidence interval (CI): -7.48 to -1.26; P = 0.006] and diastolic BP (DBP) (MD: -2.94 mmHg; 95% CI: -5.17 to -0.71; P = 0.01) with very low certainty. Subgroup analyses revealed consistent trends across different gestational stages, types of exercise, weekly exercise times, and training periods
(Marliani et al., 2026) (Indonesia)	to analyze the effect of prenatal exercise on sleep quality in pregnant women during the third trimester.	Quantitative and quasi-experimental, employing a non-randomized one-group pretest-posttest design. This research was conducted at the Marista Sinaga Midwife	The average sleep quality score before the intervention was 3.93; after the intervention, through prenatal exercise, it increased to 8.50. Prenatal exercise

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		Practice, Simpang Talas, Siak Regency, Riau Province, in 2024. The research was conducted in June 2024. The subjects of this research were all third-trimester pregnant women who presented for treatment at the Marista Sinaga Midwife Practice; a total of 30 participants were recruited through purposive sampling.	significantly affected sleep quality in pregnant women in the third trimester ($p < 0.001$).
(Abolbaghaei et al., 2022) (Canada)	to investigate changes in circulating EV levels after an acute bout of moderate-intensity aerobic exercise in healthy pregnant and non-pregnant women.	We studied plasma samples from pregnant (N = 13, 13–28 weeks) and non-pregnant (N = 17) women. A pre-exercise blood sample was obtained followed by a 30 min bout of moderate-intensity treadmill-based exercise. Immediately following the exercise, a post-exercise blood draw was collected. Large EVs were isolated from plasma by differential centrifugation and characterized by Western blot and electron microscopy. We quantified circulating EVs by nanoscale flow cytometry.	Collectively, our study highlights that after a matched acute exercise, changes to circulating EV levels differ depending on pregnancy status.
(Ferrari & Joisten, 2021) (Eropa)	to find out the impact of physical activity on course and outcome of pregnancy from pre- to postnatal.	Review Study	Banyak wanita menunjukkan penurunan tingkat aktivitas fisik selama kehamilan dibandingkan dengan tingkat sebelum kehamilan. Alasan di balik perubahan ini bermacam-macam dan termasuk kekhawatiran tentang efek aktivitas fisik terhadap janin.

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(Davenport et al., 2021) (Canada)	to perform a systematic review and meta-analysis of the relationships between prenatal exercise and GDM, GH and PE.	Systematic review with random effects meta-analysis and meta-regression.	A total of 106 studies (n=273 182) were included. 'Moderate' to 'high'-quality evidence from randomised controlled trials revealed that exercise-only interventions, but not exercise+cointerventions, reduced odds of GDM (n=6934; OR 0.62, 95% CI 0.52 to 0.75), GH (n=5316; OR 0.61, 95% CI 0.43 to 0.85) and PE (n=3322; OR 0.59, 95% CI 0.37 to 0.9) compared with no exercise. To achieve at least a 25% reduction in the odds of developing GDM, PE and GH, pregnant women need to accumulate at least 600 MET-min/week of moderate-intensity exercise (eg, 140 min of brisk walking, water aerobics, stationary cycling or resistance training).
(Bhattacharjee et al., 2021) (Canada)	to determine the potential for lifestyle changes and healthy behaviors to improve placental growth, development, and function.	This review will focus on prenatal exercise and its promising influence on the structures of the maternal-fetal interface, with particular emphasis on the placenta. Potential molecular mechanistic hypotheses are presented to aid future investigations of prenatal exercise and placental health.	It is abundantly clear that regular moderate-intensity PA during pregnancy is strongly associated with beneficial pregnancy outcomes. Placental biology research examining the potential mechanisms at play as a direct consequence of prenatal exercise is still in its infancy. The placenta is central to successful pregnancy outcomes and plays a substantive role in the

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(Wulandari & Ainiyati, 2025) (Indonesia)	to explore the molecular and physiological mechanisms contributing to the prevention of HDP through antenatal exercise.	Research articles published between 2015 and 2025 were systematically identified from PubMed, ScienceDirect, and Google Scholar databases, resulting in 10 studies meeting the inclusion criteria.	pathogenesis of many gestational diseases or complications, including but not limited to, PrE, GDM, and FGR. Findings indicate that regular exercise during pregnancy improves endothelial function, balances angiogenic activity, and reduces oxidative stress and inflammation. Molecular mechanisms include increases in vascular endothelial growth factor (VEGF) and nitric oxide (NO), as well as decreases in inflammatory markers.
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DISCUSSION

Based on a search of articles in the PubMed, Google Scholar, and ScienceDirect databases from 2021 to 2026, nine articles that met the inclusion criteria were identified and analyzed in this literature review. The selected articles examined the effectiveness of prenatal exercise or physical activity during pregnancy on leg swelling (edema) in third-trimester pregnant women. Based on the journal review, most studies indicate that prenatal exercise has a positive effect on reducing leg edema in third-trimester pregnant women. Prenatal exercise helps improve blood circulation, facilitate venous return, increase muscle elasticity, and reduce fluid retention in the lower extremities.

A other study states that physical exercise during pregnancy plays a crucial role in improving changes in the maternal cardiovascular system. Physical activity helps improve blood circulation and prevent venous stasis in the lower extremities, thereby reducing the risk of leg swelling in third-trimester pregnant women. Additionally, exercise during pregnancy helps maintain vascular function and enhances the body's tolerance to physiological changes throughout pregnancy (Saccone et al., 2026). Other research demonstrates that the Modified Buerger-Allen Exercise significantly reduces the degree of physiological edema in the legs of third-trimester pregnant women. This exercise helps enhance leg muscle contractions, thereby improving venous circulation and reducing fluid accumulation in peripheral tissues. Regular leg elevation and positioning exercises can accelerate venous return to the heart, leading to a gradual reduction in leg edema (Farag et al., 2025). A systematic review that physical activity during pregnancy offers benefits for the vascular health of pregnant women. Physical activity helps improve vascular elasticity, enhance peripheral blood flow, and aid in controlling blood pressure during pregnancy and the postpartum period. These improvements in the vascular system contribute to reducing the risk of fluid retention and swelling in the lower extremities (Pongpanit et al., 2024).

Other research indicates that prenatal exercise offers benefits for the physical comfort of third-trimester pregnant women, including reducing heaviness and swelling in the legs. Pregnant women who regularly engage in prenatal exercise experience improved sleep quality, reduced muscle soreness,

and decreased physical discomfort during pregnancy. Prenatal exercise also helps promote relaxation, allowing pregnant women to feel more comfortable during the final trimester of pregnancy (Marliani et al., 2026). that moderate-intensity physical activity during pregnancy enhances the body's physiological responses through improved blood circulation and metabolism. Physical activity can enhance the distribution of oxygen and nutrients to body tissues, thereby helping to reduce fluid retention in the legs of pregnant women. These findings reinforce that light to moderate exercise is safe during pregnancy and provides positive physiological benefits (Mohammad et al., 2021).

Explain in a review study that physical activity during pregnancy offers broad benefits for maternal health, including improved physical comfort and maintenance of cardiovascular health. Regular physical activity helps reduce pregnancy-related complaints such as back pain, fatigue, and leg swelling caused by fluid retention (Ferrari & Joisten, 2021). Physical activity during pregnancy can improve maternal vascular adaptation and enhance peripheral blood flow. Both aerobic exercises and combination exercises have been shown to be effective in maintaining vascular function and reducing venous pressure in the lower extremities. This helps reduce leg edema, which frequently occurs in the third trimester due to increased uterine pressure on the inferior vena cava (Davenport et al., 2021). Also explain that exercise during pregnancy has a positive impact on maternal-fetal interface organs and structures. Physical activity helps improve uteroplacental blood flow and enhances the efficiency of maternal circulation. Good circulation helps reduce fluid retention in the legs, thereby minimizing leg swelling (May et al., 2021). Other research indicates that prenatal exercise has physiological mechanisms that improve vascular function and help prevent hypertension during pregnancy. Physical exercise helps improve blood vessel elasticity and enhances muscle pump function in the lower extremities, thereby reducing fluid retention. This indicates that prenatal exercise is not only beneficial for labor preparation but is also effective in reducing leg swelling in third-trimester pregnant women (Wulandari & Ainiyati, 2025).

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Overall, the results of the literature review indicate that prenatal exercise is effective as a non-pharmacological intervention in reducing leg swelling in third-trimester pregnant women. This effectiveness is influenced by prenatal exercise's ability to improve blood circulation, enhance venous return, increase muscle elasticity, and reduce fluid retention in the lower extremities. Thus, prenatal exercise can be recommended as a promotive and preventive measure to alleviate discomfort during pregnancy, particularly leg edema in the third trimester.

Leg swelling, or lower extremity edema, is one of the most common complaints experienced by women in the third trimester of pregnancy. This condition occurs due to increased plasma volume, fluid retention, hormonal changes, and pressure from the enlarging uterus on the inferior vena cava, which impedes venous return from the lower extremities to the heart (Ferrari & Joisten, 2021). Additionally, elevated progesterone levels during pregnancy cause relaxation of blood vessel walls, contributing to venous stasis and fluid accumulation in peripheral tissues (Pongpanit et al., 2024). Based on the results of the literature review, all journals in the table indicate that physical exercise and prenatal exercise have a positive impact on the circulatory system and reduce leg swelling in third-trimester pregnant women. The other study demonstrated that the Modified Buerger-Allen Exercise effectively reduces physiological edema in the legs of third-trimester pregnant women. This exercise works through the mechanism of positional changes and leg muscle contractions, which help increase venous return so that fluid retained in peripheral tissues can return to the central circulation (Farag et al., 2025). These findings align with the study which stated that leg exercises and stretching in pregnant women can significantly reduce the degree of edema by enhancing the activity of the calf muscle pump (Ningsih & Pratiwi, 2022).

Indicates that exercise during pregnancy helps improve maternal cardiovascular changes, including increasing peripheral blood flow and reducing venous stasis in the lower extremities. Physiologically, physical activity during pregnancy can increase cardiac output, improve vascular elasticity, and facilitate the distribution of oxygen and nutrients throughout the body's tissues. These conditions contribute to reduced fluid retention, which is the

primary cause of leg swelling in third-trimester pregnant women (Saccone et al., 2026). This is supported by other research who state that aerobic exercise during pregnancy effectively enhances maternal vascular adaptation and maintains vascular endothelial function (Davenport et al., 2021).

In addition to improving blood circulation, prenatal exercise also offers benefits for the physical and psychological comfort of pregnant women. Other research found that pregnant women who regularly engage in prenatal exercise experience reduced heaviness in the legs, improved sleep quality, and decreased stiffness and discomfort during the third trimester (Marliani et al., 2026). This aligns with the study which explains that prenatal exercise can enhance muscle relaxation and reduce physical tension, thereby helping pregnant women feel more comfortable in performing daily activities (Kusumawati et al., 2023). In a systematic review explain that physical activity during pregnancy has a significant impact on maternal vascular health (Pongpanit et al., 2024). Physical activity helps improve blood vessel elasticity and enhance peripheral circulation, thereby preventing fluid buildup in the legs. The latest evidence-based research also indicates that light to moderate exercise performed regularly during pregnancy is safe and recommended by international health organizations to alleviate various pregnancy discomforts, including leg edema (World Health Organization, 2022).

A other study shows that moderate-intensity physical activity during pregnancy enhances the body's physiological response through increased metabolism and blood circulation. This improved circulation helps optimize the distribution of body fluids, thereby reducing fluid accumulation in peripheral tissues (Mohammad et al., 2021). These findings align with other research, which states that prenatal exercise can improve maternal cardiovascular function and metabolism, thereby helping to maintain fluid balance during pregnancy (Field, 2021). Physical activity during pregnancy offers benefits for both maternal and fetal health, including reducing the risk of gestational hypertension, gestational diabetes, and peripheral circulatory disorders. Regular physical activity also helps maintain leg muscle tone, thereby optimizing venous return. This is important because a decrease in physical activity during the third trimester can

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worsen venous stasis and increase the risk of edema (Ferrari & Joisten, 2021).

Other study state that exercise during pregnancy has a positive impact on the maternal-fetal interface through increased uteroplacental blood flow and improved efficiency of the maternal circulatory system. This improved circulation not only supports fetal growth but also helps reduce peripheral vascular pressure, which contributes to leg swelling (May et al., 2021). Another study also shows that prenatal exercise effectively improves the quality of life for pregnant women and reduces various physical complaints during the third trimester of pregnancy (Li, Zhang, & Chen, 2025). Other research explains that prenatal exercise has physiological mechanisms that improve vascular function and help prevent hypertension-related complications during pregnancy. Stretching movements and muscle exercises in prenatal exercise help increase the pumping activity of the lower extremity muscles, allowing interstitial fluid to return more easily to the circulatory system (Wulandari & Ainiyati, 2025). These findings are supported who noted that pregnant women who regularly attended prenatal exercise classes experienced a significant reduction in leg edema compared to those who did not engage in regular physical exercise (Rahmawati & Dewi, 2024).

Overall, evidence from various studies conducted between 2021 and 2026 indicates that prenatal exercise is an effective, safe, and easily implementable non-pharmacological intervention for reducing leg swelling in third-trimester pregnant women. This effectiveness is achieved through improved blood circulation, enhanced venous return, increased vascular elasticity, activation of the leg muscle pump, and reduced fluid retention in peripheral tissues. Therefore, prenatal exercise can be recommended as part of antenatal care to enhance the comfort and quality of life for pregnant women in the third trimester.

CONCLUSION

Prenatal exercise is effective in reducing leg swelling (edema) in third-trimester pregnant women. Prenatal exercise helps improve blood circulation, facilitate venous return, increase muscle pump activity, and reduce fluid retention in the lower extremities. Additionally, prenatal exercise offers

benefits regarding physical comfort, sleep quality, and quality of life for pregnant women. Thus, prenatal exercise can be recommended as a safe and effective non-pharmacological intervention to reduce leg edema in third-trimester pregnant women.

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