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The Effect of Combined Foot Massage and Leg Elevation on Foot Edema in Third-Trimester Pregnant Women

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Abstract:
Pregnancy, particularly during the third trimester, is commonly associated with lower-limb edema due to increased pressure on the pelvic veins and inferior vena cava from the enlarging uterus. Foot edema in late pregnancy results from this venous compression, leading to elevated hydrostatic pressure and fluid accumulation in the interstitial spaces of the feet and ankles. Management of foot edema can be performed non-pharmacologically, one approach being a combination of foot massage and leg elevation. The objective of this study was to determine the effect of the combination of foot massage and leg elevation on foot edema in third-trimester pregnant women. This research employed a quasi-experimental study design with a two-group pretest-posttest design and a control group. The sample was 30 respondents. The sampling technique used was purposive sampling. The instruments used were the SOP and the pitting scale observation sheet. Data analysis using the Wilcoxon test showed a p-value < 0.001, indicating a statistically significant reduction in foot edema before and after the intervention. Additionally, the Mann-Whitney test yielded a p-value of 0.003, confirming a statistically significant difference in posttest results between the intervention and control groups. The combination of foot massage and leg elevation significantly reduced foot edema in pregnant women in the third trimester. Clinically, this combination can be applied as a simple and effective non-pharmacological intervention to reduce physiological foot edema during pregnancy.

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INTRODUCTION

Pregnancy is a dynamic physiological state characterized by profound anatomical, metabolic, hormonal, and cardiovascular adaptations that support fetal growth and prepare the mother for childbirth (Mockridge & Maclennan, 2022). Among these adaptations, increased blood volume, hormonal fluctuations (notably elevated progesterone and relaxin), and mechanical compression from the enlarging uterus significantly affect circulatory dynamics (Gangakhedkar & Kulkarni, 2021). These changes often manifest clinically as lower-limb edema, particularly during the third trimester (Ochalek, 2021). While mild edema is considered a normal physiological response, excessive or persistent swelling can cause discomfort, impair mobility, and reduce the overall quality of life for pregnant women, thereby necessitating effective and safe management strategies (Dalio et al., 2022).

Foot edema in late pregnancy primarily results from mechanical obstruction of venous return due to compression of the inferior vena cava and pelvic veins by the gravid uterus (Mollaelahi & Shahali, 2022). This obstruction increases hydrostatic pressure in the lower extremities, promoting

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fluid leakage into interstitial spaces (Singh & Revand, 2022). Additionally, increased capillary permeability and decreased oncotic pressure, both influenced by hormonal shifts associated with pregnancy, further exacerbate fluid retention (Robinson & Phelan, 2024). Although typically benign, unrelieved edema may contribute to skin breakdown, venous stasis, and heightened maternal anxiety, underscoring the need for accessible, non-invasive interventions that align with the principles of safe antenatal care (Dalio et al., 2022).

Non-pharmacological approaches are increasingly emphasized in prenatal management due to their safety, affordability, and cultural acceptability (Biana et al., 2021). Among these, foot massage and leg elevation stand out as low-risk, self-administrable techniques with strong theoretical and empirical foundations. Foot massage stimulates lymphatic flow and enhances venous return through rhythmic, distal-to-proximal strokes, thereby reducing interstitial fluid accumulation (Songwathana et al., 2025; Ni Putu et al., 2023). Concurrently, leg elevation leverages gravity to facilitate redistribution of blood and fluids toward the central circulation, effectively lowering venous pressure in dependent limbs (Baish et al., 2022). Individually, both interventions have demonstrated efficacy in mitigating edema in various populations, including pregnant women (Chadwick, 2022).

Despite promising evidence supporting each method in isolation, research examining their synergistic effect remains scarce, particularly in low- and middle-income settings such as Indonesia, where access to specialized maternal care may be limited. Integrating these two simple modalities could offer a practical, cost-effective strategy for managing pregnancy-related edema within primary healthcare frameworks (Igwesi-Chidobe et al., 2021). Given the high prevalence of third-trimester edema and the emphasis on holistic, patient-centered prenatal care, evaluating combined non-pharmacological interventions is both clinically relevant and socially significant (Mollaelahi & Shahali, 2022).

Therefore, this study was conducted to assess the effectiveness of a combined foot massage and leg elevation protocol in reducing foot edema among third-trimester pregnant women in the working area of the Magelang City Health Center, Indonesia. We hypothesized that this dual-intervention approach would yield a significantly greater reduction in edema compared to standard antenatal care alone (Carolin et al., 2023; Nursanti et al., 2024). By addressing a common yet often undermanaged symptom through accessible means, this research contributes to the growing body of evidence supporting integrative, non-pharmacological strategies in maternal health.

METHOD

The research design employed was a quasi-experimental, two-group pretest-posttest control-group design. The research site was the Magelang City Health Center's working area. The research took place from January to June 2025. The population comprised 71 third-trimester pregnant women, of whom 30 were selected through purposive sampling. The inclusion criteria were a third-trimester pregnancy with pitting edema, age 18-40 years, willingness to participate, and the ability to communicate effectively. Exclusion criteria included hypertension, preeclampsia, shortness of breath, leg injury or deformity, and use of diuretics.

The intervention group (n = 15) received a foot massage using effleurage and petrissage techniques for 10 minutes per foot (20 minutes total), followed by leg elevation at 30° for 10 minutes, once daily for 5 consecutive days in the afternoon. The 5-day duration was chosen based on prior findings that non-pharmacological edema reduction typically occurs within this period. The control group (n = 15) received only routine care.

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The Instruments used in this study included a Standard Operating Procedure (SOP) and the standardized pitting edema scale, which has been widely applied in clinical studies; therefore, no local validation was performed. Data were analyzed using the Wilcoxon signed-rank and Mann-Whitney U tests because the data did not meet normality assumptions. Blinding was not applied due to the intervention's visible nature; however, data collection and analysis were performed by independent researchers.

This study was conducted in accordance with the ethical principles of human subject research and received formal approval from the Ethics Committee of the Health Polytechnic, Ministry of Health, Semarang, Indonesia, under reference number 483/EA/F.XXIII.38/2025. The ethical clearance ensured that all procedures adhered to established guidelines for participant protection, including obtaining informed consent, maintaining confidentiality, ensuring voluntary participation, and upholding the right to withdraw at any time without consequence. This approval underscores the study's commitment to maintaining the highest ethical standards throughout the research process.

RESULT

Univariate Analysis Results

Table 1. Frequency Distribution of Respondents Based on Age, Education, Occupation, and Parity

Characteristics	Category	Intervention group (n=15)		Control group (n=15)	
		f	%	f	%
Age	<20 Years	0	0	0	0
	20-35 Years	14	93.3	14	93.3
	>35 Years	1	6.7	1	6.7
Education	Elementary School	0	0	0	0
	Junior High School	1	6.7	1	6.7
	Senior High School	13	86.7	14	93.3
	Bachelor	1	6.7	0	0
Occupation	Laborer	0	0	2	13.3
	Self-employed	1	6.7	0	0
	Civil servant	0	0	0	0
	Farmer	0	0	0	0
	Housewives	14	93.3	13	86.7
Parity	Primigravida	7	46.7	5	33.3
	Multigravida	6	40.0	10	66.7
	Grande Multigravida	2	13.3	0	0

Based on Table 1, the intervention group was predominantly composed of respondents aged 20–35 years, totaling 14 individuals (93.3%). Regarding education level, most respondents had a senior high school education, totaling 13 individuals (86.7%). Most respondents in the intervention group were housewives, amounting to 14 individuals (93.3%). By parity, most respondents in the intervention group were primigravida, totaling 7 individuals (46.7%).

According to Table 1, the control group data indicate that most respondents were aged 20–35 years, comprising 14 individuals (93.3%). The education level of respondents in the control group was predominantly senior high school, with 14 individuals (93.3%). Most respondents in the control group were housewives, totaling 13 individuals (86.7%). Based on pregnancy parity, most respondents in the control group were multigravida, totaling 10 individuals (66.7%).

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Table 2. The Degree of Foot Edema Before and After the Intervention

Degree of Foot Edema	Intervention Group		Control Group	
	Pretest n (%)	Posttest n (%)	Pretest n (%)	Posttest n (%)
Mild (Degree I)	0 (0)	13 (86.7)	4 (26.7)	4 (26.7)
Moderate (Degree II)	5 (33.3)	2 (13.3)	9 (60.0)	8 (53.3)
Severe (Degree III)	10 (66.7)	0 (0)	2 (13.3)	3 (20.0)
Very Severe (Degree IV)	0 (0)	0 (0)	0 (0)	0 (0)

Table 2 shows that before the intervention, most respondents in the intervention group (10, 66.7%) experienced severe edema (degree III), which decreased to mild edema (degree I) in 13 respondents (86.7%) after the intervention. Meanwhile, in the control group, the proportion of respondents with moderate edema remained relatively unchanged, with 9 respondents (60.0%) at the pretest and 8 respondents (53.3%) at the posttest.

Bivariate Analysis Results

Table 3. Results of the Wilcoxon Test Analysis for the Intervention Group and the Control Group

Group		Median (Minimum-Maximum)	p-value
Intervention	Pretest	3 (2-3)	0.000
	Posttest	1 (1-2)	
Control	Pretest	2 (2-3)	0.317
	Posttest	2 (1-3)	

Table 3 presents the results of the Wilcoxon test analysis, showing a p-value of 0.000 <0.05, meaning p-value <0.05 in the intervention group. In contrast, the control group showed a p-value of 0.317, indicating a p-value greater than 0.05. The p-value in the intervention group is less than 0.05, indicating that the combined intervention of foot massage and foot elevation has a significant effect on foot edema in third-trimester pregnant women. Conversely, the p-value in the control group is greater than 0.05, indicating that there is no effect in the control group that received routine conventional care.

Table 4. Results of the Independent-Samples Mann-Whitney U Test in the Intervention and Control Groups

Group	Median (Minimum-Maximum)	Z	p-value
Intervention Group	1 (1-2)	-3.309	0.003
Control Group	2 (1-3)		

The results of the difference test for the reduction in edema degree scores between the intervention group and the control group, as shown in Table 4, revealed a Z-value of -3.309 and a significance value (p) of 0.003 (<0.05). This indicates a significant difference (p-value = 0.003, < 0.05) between the intervention and control groups in the reduction of foot edema. Therefore, it can be concluded that the combined intervention of foot massage and foot elevation significantly reduces foot edema in third-trimester pregnant women.

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DISCUSSION

Based on a study conducted in the Working Area of the Magelang City Public Health Center regarding the effect of a combination of foot massage and leg elevation on foot edema in third-trimester pregnant women, the results showed that the study involved 30 respondents, consisting of 15 third-trimester pregnant women with foot edema in the intervention group and 15 third-trimester pregnant women with foot edema in the control group. The respondents exhibited a range of characteristics, including age, education, occupation, and parity. In terms of age, most respondents in the intervention group were aged 20–35 years, as were most in the control group. Regarding education, most respondents in the intervention group had a senior high school diploma. In contrast, most individuals in the control group also held a senior high school diploma. In terms of occupation, most respondents in the intervention group were homemakers, as were most in the control group. Regarding parity, the intervention group consisted predominantly of primigravida women, while the control group consisted predominantly of multigravida women.

Based on the research data, it was found that among the 15 respondents in the intervention group prior to receiving the combination of foot massage and leg elevation, most had degree III (severe) edema. Meanwhile, the pretest results for the control group showed that among the 15 respondents, the majority had degree II (moderate) edema. This lower extremity edema is caused by fluid retention and pressure from the uterus, which impedes venous return (Kumar et al., 2024). Foot edema in pregnant women commonly occurs after prolonged standing, as pressure on the leg blood vessels is greater than when lying down (Dalio et al., 2022). This condition causes edema in pregnant women to typically appear in the late afternoon to evening (Luo et al., 2020).

The posttest results for the control group, which received conventional routine care, showed that most respondents (53.3%) experienced degree II (moderate) edema. These findings indicate that there was no significant difference in the degree of foot edema in the control group between the pretest and posttest. Meanwhile, the results in the intervention group showed that after receiving the combination therapy of foot massage and leg elevation, most respondents (86.7%) experienced this edema (degree I). These results indicate that there was a difference in the degree of foot edema in third-trimester pregnant women before and after combined therapy with foot massage and leg elevation.

The administration of the combined intervention of foot massage and leg elevation in this study was effective in reducing the degree of foot edema in third-trimester pregnant women. The combination of foot massage and leg elevation is a method for managing foot edema, which involves gently massaging the dorsum of the affected foot and then elevating the legs to promote circulation. Foot massage can improve blood circulation, allowing oxygen to be optimally distributed throughout the body, thereby helping to reduce foot edema in pregnant women in the third trimester (Solmaz, 2023; Rondhianto et al., 2025).

Another study on the effect of leg elevation on foot edema found that leg elevation uses gravity to enhance venous and lymphatic return, thereby reducing venous pressure and decreasing foot edema. Elevating the legs above the level of the heart, ideally at a 30-degree angle, facilitates venous return and reduces hydrostatic pressure in the lower extremities. This positional intervention helps prevent or minimize fluid accumulation, thereby alleviating the swelling and discomfort associated with dependent edema (Singh & Revand, 2022).

The bivariate analysis indicates a significant difference in the degree of foot edema before and after the combined foot massage and leg elevation intervention. This difference in edema severity indicates a significant effect of the combined intervention. In contrast, the analysis of differences in foot edema in the control group indicates no significant change in its degree between the pretest

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and posttest. The analysis of edema levels in the control group showed no significant change between the pretest and posttest measurements.

A previous study found that foot massage can reduce the severity of foot edema in pregnant women. Therefore, it can be concluded that foot massage and a warm-water, aromatic-ginger foot bath can help reduce foot edema in third-trimester pregnant women (Novelia et al., 2022). The combination of foot massage and leg elevation can provide a more optimal effect in reducing the severity of foot edema in third-trimester pregnant women, as it involves two complementary mechanisms that act together.

The results of the difference test for the reduction in foot edema between the intervention group (combined foot massage and leg elevation) and the control group showed a Z-value of -3.309 and a p-value of 0.003. This indicates a significant difference in the degree of foot edema between the intervention and control groups ($p < 0.05$). Therefore, H0 is rejected, indicating a significant difference in the degree of foot edema between the intervention group, which received foot massage and leg elevation, and the control group, which received conventional routine care.

The significant difference may be attributed to the intervention group receiving combined therapy, including foot massage and leg elevation, which provided direct physical stimulation. In contrast, the control group received only conventional routine care, which is passive and does not involve direct physical stimulation. The intervention group received direct physical stimulation through foot massage, which can stimulate the production of endorphins that help relax the muscles, thereby reducing discomfort caused by foot edema. This was combined with leg elevation, which can improve blood flow to the heart and prevent fluid accumulation, thus helping to prevent foot edema (Anwar et al., 2022).

Meanwhile, in the control group, the intervention was passive and did not directly affect the physiological processes underlying foot edema. Conventional routine care generally consists only of education, monitoring, and recommendations for rest, without involving direct physical stimulation such as foot massage and leg elevation, which have been proven to improve blood circulation and lymphatic flow. Without active efforts to enhance venous return or reduce fluid accumulation, foot edema tends to persist. Passive interventions have no significant impact on reducing foot edema in pregnant women during the third trimester.

CONCLUSION

Based on the study's results, the combination intervention significantly reduced foot edema. The comparative analysis between the intervention and control groups showed a significant difference. A significant reduction in edema was observed following combined foot massage and leg elevation therapy. This therapy provides direct physical stimulation that can trigger endorphin release, relax muscles, and improve lymphatic blood flow, making it effective in reducing fluid accumulation in the lower extremities. Midwives and other maternal health providers should be trained to apply and teach this combined technique as a first-line, non-pharmacological intervention in antenatal care. Integrating this simple, low-cost practice into routine maternal health services can support pregnant women’s comfort and mobility while minimizing dependence on pharmacological options.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest in this research. All data and research findings were compiled independently without any influence from anyone.

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