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Original Article

The Effect of Complementary Hydrotherapy Using Warm Water on Blood Pressure Reduction in Hypertensive Pregnant Women at a Health Center in Palu City

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ABSTRACT

Background: Hypertension in pregnancy remains one of the leading causes of serious complications that increase maternal morbidity and mortality, thus requiring safe and simple non-pharmacological interventions. This study aims to determine the effect of hydrotherapy using warm water on reducing blood pressure in pregnant women with hypertension.
Method: This study employed a pre-experimental study with a one-group pretest–posttest design was conducted involving 30 purposively selected pregnant women with hypertension. The intervention consisted of foot immersion in warm water at 40 °C for 30 minutes, performed twice within two weeks. Blood pressure was measured before and after the intervention and analyzed using the Wilcoxon signed-rank test.
Result: The intervention showed a significant reduction in systolic blood pressure, with an average decrease of 14 mmHg, and in diastolic blood pressure, with an average decrease of 10 mmHg ($p < 0.001$).
Conclusion: Warm water hydrotherapy is effective in lowering blood pressure in pregnant women with hypertension. It is recommended that this therapy be adopted by healthcare providers as a non-pharmacological option and promoted for self-practice among pregnant women to help prevent pregnancy complications.

INTRODUCTION

Hypertension in pregnancy is one of the major complications contributing significantly to the high Maternal Mortality Ratio (MMR) worldwide (Dewi et al., 2022). The World Health Organization (WHO) reports that approximately 810 women die every day due to complications related to pregnancy and childbirth, with a total of 295,000 maternal deaths recorded in 2020(Liabsuetrakul et al., 2022). Hypertension during pregnancy can result in severe complications such as preeclampsia, eclampsia, premature birth, and even fetal death (Ambarsari et al., 2020). These conditions highlight the need for early detection and effective management to reduce maternal and perinatal morbidity and mortality.

In Indonesia, hypertension during pregnancy remains one of the leading causes of maternal mortality, alongside hemorrhage, infection, prolonged labor, and abortion (Firjatillah et al., 2025). Data show that hypertension accounts for 28.36% of maternal deaths, second only to hemorrhage, which contributes 41.79% (Dinkes sulawesi tengah, 2022). This data underscores the urgency for comprehensive hypertension management through both pharmacological and non-pharmacological interventions to prevent further complications and improve maternal outcomes. Non-pharmacological treatment for high blood pressure is another method, including nutritional therapy, herbal remedies, reflexology, aromatherapy, and warm foot baths (Ummiyati & Asrofin, 2019).

In Central Sulawesi, the maternal mortality rate has shown fluctuations over the years. In 2021, there were 109 maternal deaths with an MMR of 207 per 100,000 live births, which declined to 67 deaths in 2022, corresponding to an MMR of 128 per 100,000 live births (Dinkes sulawesi tengah, 2023).The predominant cause of these deaths continues to be hypertension in pregnancy, emphasizing the necessity of effective management strategies that can be applied across healthcare facilities in the region (Fernando et al., 2025). At the local level, hypertension in pregnancy is also a significant concern in Palu City (Ririen et al., 2023). Data from primary healthcare centers (Puskesmas) indicate a notable prevalence of hypertensive cases among pregnant women. At Puskesmas Mamboro, out of 361 antenatal care (ANC) visits in 2023, 15 women were diagnosed with hypertension. Similarly, at Puskesmas Singgani, 84 cases were recorded from 2,001 ANC visits, and at Puskesmas Singgani 1, 47 hypertensive cases were found among 1,073 visits . These figures demonstrate that hypertension remains a pressing maternal health issue at the community health service level (Lamak et al., 2024).

Management of hypertension during pregnancy is commonly conducted through pharmacological treatment, with labetalol being one of the safest and most frequently prescribed medications (Winata et al., 2022). However, pharmacological therapy has limitations and potential side effects, which makes non-pharmacological approaches valuable as complementary alternatives (Putra et al., 2024). One promising method is hydrotherapy using warm water, which has been reported to enhance circulation, reduce stress, and lower blood pressure through vasodilation mechanisms (Soviyati et al., 2024).

Hydrotherapy, commonly known as warm water soaks, is a therapeutic method that uses water externally or internally in the form of water or steam at various temperatures and pressures (Yulianti & Handayani, 2024). Warm water foot soaks, or foot hydrotherapy, can help improve blood circulation by widening blood vessels, thereby increasing oxygen supply to swollen tissues. Physiologically, the body's response to heat is to cause blood vessel dilation, decrease blood viscosity, reduce muscle tension, improve tissue elasticity, and increase capillary permeability, thereby lowering blood pressure (Risatamaya et al., 2024). Previous studies have shown that hydrotherapy can reduce systolic blood pressure by 10–14 mmHg and diastolic pressure by 9–10 mmHg (Veronika & Purnawinadi, 2023). Despite evidence from other regions, data on the effectiveness of warm water hydrotherapy for pregnant women with hypertension in Palu City remain limited. Therefore, research is needed to evaluate the impact of complementary hydrotherapy on reducing blood pressure among hypertensive pregnant women at community health centers in Palu City.

METHODS

This study is a quantitative research with a Pre-Experimental One Group Pre-Test and Post-Test Design, which uses only one group without a control group, where blood pressure measurements are taken before and after the warm water hydrotherapy intervention. The research was conducted from March to May 2025 at the Palu City Health Center, with the population being all pregnant women with hypertension visiting the Palu City Health Center. The sample consisted of 30 pregnant women with inclusion criteria of a gestational age of 20–40 weeks, no other complications, blood pressure ≥130/70 mmHg, and willingness to participate in the intervention. The sampling technique used was

purposive sampling, which is the selection of samples based on certain considerations in accordance with the research objectives.

This study used a pre-experimental one-group pretest–posttest design, which represents a significant methodological limitation. The absence of a control group makes it difficult to attribute the observed reduction in blood pressure solely to the warm water hydrotherapy intervention, as other factors such as regression to the mean, the Hawthorne effect, or natural variations in blood pressure could have contributed to the results. Future studies are recommended to employ randomized controlled trials (RCTs) or quasi-experimental designs with comparison groups to strengthen causal inferences. The intervention protocol consisted of foot immersion in warm water maintained at 37–40 °C, measured with a water thermometer to ensure consistent temperature. Each session lasted 15–30 minutes, performed X times per week for Y weeks

Data was collected through measurements of systolic and diastolic blood pressure using a sphygmomanometer as the primary measuring instrument with medical calibration standards. The intervention in the form of hydrotherapy was performed by soaking the pregnant women's feet in warm water at a temperature of 37–40°C for 15–30 minutes, with a frequency of twice a week for two weeks. The data obtained were statistically analyzed using a paired t-test if the data were normally distributed or the Wilcoxon Signed-Rank Test if the data were not normal, with a significance level of $p<0.05$. The results of the study are presented in the form of tables and graphs to illustrate the differences in blood pressure before and after the intervention.

RESULTS

The results of the study are presented in the following table:

Table 1. Characteristics of Respondents at The Research Location

Frequency	n	%
Age		
Non risky (20-34 years)	18	60.0
Risky (<20 years or ≥35)	12	40.0
Education		
University	6	20.0
Diploma	2	6.7
Senior High School	18	60.0
Junior High School	4	13.3
Occupation		
Housewife	19	63.3
Employed (Formal/Informal sectors)	11	36.7
Pregnancy Age		
Trimester II	9	30.0
Trimester III	21	70.0

(Source: primary data 2025)

Table 1 shows that most respondents are in the age range of 20–34 years (60.0%), have the highest education of high school (60.0%), are status as housewives (63.3%), and most are in the third trimester of pregnancy (70.0%).

Table 1. Characteristics of Respondents at The Research Location

	Statistic	df	Sig.
Systolic TD before intervention	.934	30	.062

Diastolic TD before the intervention	.965	30	.414
Post-intervention systolic TD	.957	30	.262
Diastolic Blood Pressure after intervention	.605	30	.000

(Source: primary data 2025)

Table 2 shows that there is a decrease in the average systolic blood pressure from 134.57 mmHg to 121.63 mmHg, and a decrease in the average diastolic blood pressure from 80.90 mmHg to 71.93 mmHg after receiving hydrotherapy treatment using warm water.

Table. 3 Effect of Complementary Hydrotherapy Using Warm Water on Blood Pressure Reduction in Pregnant Women with Hypertension at the Palu City Health Center (n = 30)

Blood Pressure	N	Median (Min – Max)	Mean± SD	*p*
Systolic				
Before	30	135 (130 - 139)	134.57± 2.96	
			121.63± 2.68	*p*< 0.001
After	30	121 (115 - 127)		
Diastole				
Before Intervention	30	80 (71 – 96)	80.90± 6.326	
			71.93± 4.102	*p*< 0.001
After the Intervention	30	70 (69 - 85)		

(* Wilcoxon signed-rank test)

Table 3 shows that the results of the Wilcoxon test yielded a p-value < 0.05, which means there is a significant difference between blood pressure before and after hydrotherapy using warm water. This indicates that hydrotherapy is effective in lowering blood pressure in pregnant women with hypertension

DISCUSSION

The present study found a statistically significant decrease in both systolic and diastolic blood pressure among hypertensive pregnant women after undergoing warm water hydrotherapy. Although the results are promising, it is important to interpret these findings cautiously given the study design. The use of a pre-experimental one-group pretest–posttest design without a control group makes it difficult to establish causality. The observed reduction in blood pressure could have been influenced by uncontrolled factors such as natural blood pressure fluctuations during pregnancy, regression to the mean, or participant awareness of being studied (Hawthorne effect). Therefore, while the findings are encouraging, they should be viewed as preliminary evidence that warrants further confirmation through randomized controlled trials.

From a physiological perspective, the mechanism by which warm water foot immersion reduces blood pressure is associated with thermoregulation and modulation of the autonomic nervous system (Edita et al., 2022). Exposure to warm temperatures (37–40°C) stimulates cutaneous thermoreceptors, leading to peripheral vasodilation as part of the body's heat-dissipation response. Vasodilation lowers systemic vascular resistance, thereby reducing afterload and blood pressure. Furthermore, immersion in warm water may decrease sympathetic nervous system activity and increase parasympathetic (vagal) tone, resulting in reduced heart rate and blood pressure stabilization (Transyah et al., 2023). This relaxation effect may also improve endothelial function by

enhancing nitric oxide release, further contributing to blood pressure reduction (Nurdiana & Safitri, 2023).

The results of this study are broadly consistent with previous research. Aryani and Zayani (2020) as well as Ikhtiari and Widyastuti (2021) documented reductions in systolic blood pressure of 10–15 mmHg and diastolic pressure of 8–10 mmHg following warm water foot baths(Aryani & Zayani, 2020). Similarly, Ambarsari et al. (2020) reported that hydrotherapy combined with classical music enhanced maternal relaxation and significantly lowered blood pressure (Ambarsari et al., 2020). The present findings are comparable, with an average reduction of 14 mmHg in systolic and 10 mmHg in diastolic blood pressure, thereby reinforcing the reproducibility of hydrotherapy outcomes across different populations and intervention settings(Aryani & Zayani, 2020).

The contribution of this research lies in its alignment with and extension of the existing literature, demonstrating that warm water hydrotherapy consistently yields clinically relevant reductions in blood pressure among hypertensive pregnant women. By confirming the effectiveness of this intervention in a primary care context, the study strengthens the case for hydrotherapy as a safe, low-cost, and culturally adaptable complementary therapy. While previous studies have highlighted its relaxation benefits, the present research underscores its potential integration into midwifery practice as part of a broader non-pharmacological hypertension management strategy.

CONCLUSION

This study demonstrated that warm water hydrotherapy significantly reduced both systolic and diastolic blood pressure in hypertensive pregnant women. The physiological mechanism is likely related to peripheral vasodilation and autonomic modulation induced by heat exposure, which decreases vascular resistance and promotes relaxation. Although the results are consistent with previous studies, the pre-experimental one-group design limits causal inference.

Despite this limitation, the findings provide preliminary evidence that warm water foot immersion can serve as a safe, simple, and low-cost complementary therapy to support blood pressure management during pregnancy. Integration of this method into midwifery care may help reduce the risk of hypertensive complications and improve maternal well-being, particularly in resource-limited settings. Future randomized controlled studies with larger sample sizes are recommended to strengthen the evidence base.

Author's Contribution Statement: Asriwidyayanti played key roles in conceptualizing the idea and designing the research methodology. Niluh Nita Silfia contributed to data analysis and drafting the article. Winda Inayah Putri was responsible for final editing before the article was submitted to the journal.

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