



Original Article

The effect of warm water foot bath therapy on the blood pressure and cortisol levels in gestational hypertension

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ABSTRACT

Background: Pregnant women are susceptible to anxiety disorders that result in hypertension. Previous studies that have been carried out with warm water foot bath therapy, which can relax the body, previous research only measured the level of anxiety psychologically and never seen a physiological/molecular increase in blood pressure from the indicator of cortisol levels.

Purpose: To analyze the effect of warm footbath therapy on the blood pressure and cortisol levels in gestational hypertension.

Methods: This experimental study has a randomized pre-post-test control group design. They involved 40 subjects in two groups. The control group was given 10 mg of nifedipine, while the intervention group was given 10 mg of nifedipine and a warm water foot bath at 40-43°C for 15 minutes for 14 consecutive days. Pre-post cortisol levels were measured with the ELISA method cortisol test.

Results: A warm water foot bath therapy effectively decreased systolic blood pressure in the intervention group, which was 43 mm Hg compared to the control group, 19 mm Hg ($p < 0.05$). Diastolic blood pressure in the intervention group was 15.5 mmHg compared to the control group's 6.5 mmHg ($p < 0.05$), and cortisol levels in the intervention group: 48.1 ng/ml compared to the control 14.5 ng/ml ($p < 0.05$).

Conclusion: Warm water foot bath therapy at 40-43°C for 15 minutes for 14 consecutive days reduces systolic blood pressure by decreasing cortisol levels in hypertensive pregnant women.

INTRODUCTION

Hypertension in pregnancy is a major cause of maternal and perinatal morbidity and mortality, accounting for 10% of pregnancies worldwide. Until now, the maternal mortality rate in Indonesia in 2019 caused by gestational hypertension was the second highest cause, namely 305 per 100,000 live births (1,066 cases). Untreated hypertension will lead to more severe complications such as eclampsia and death. Medical and non-medical therapies can be used to treat gestational hypertension. Methyldopa, Labetalol, and Nifedipine are commonly given to pregnant women with hypertension. This drug has good effectiveness but can cause side effects if taken continuously, so it can be added with complementary non-pharmacological obstetric therapy, which is considered safer, more comfortable, and has minimal side effects.¹⁻³

So far, many studies have been carried out to overcome the problem of hypertension in pregnancy but have not been able to provide the expected results, such as listening to the sounds of nature, akumoksa, deep breathing relaxation, aromatherapy, giving chayote extract, bidara leaves, beetroot, star fruit juice, and dhikr therapy.⁴⁻¹⁰ Another alternative therapy for treating hypertension is foot bath therapy. This therapy is straightforward and natural. The treatment is easy, transparent, harmless, and has no side effects.¹¹⁻¹³

Previous studies with various temperatures and durations have not been able to reduce blood pressure to normotensive, so a better temperature and duration are needed so that blood pressure can drop to normotensive. Previous research showed that the average blood pressure decreased but did not reach the standard limit from 146

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mmHg before treatment to 134 mmHg after treatment. Systolic and diastolic blood pressure decreased but had not reached normal; before treatment, it was 165/101 mmHg to 151/92 mmHg.^{4,14}

Other studies also mention that the decrease in anxiety levels occurs because of being given warm water foot bath therapy, where warm water can stimulate endorphins to reduce the strength of the sympathetic nerves so that vasodilation occurs, which makes the body relax. There will be a decrease in the hormone cortisol.⁶⁻⁸ Based on the exposure obtained from previous studies, it has not shown effective results, as seen from the decrease in blood pressure values that have not reached normotensive. Measurements are also only up to psychological measurements using a questionnaire—the biomarker that has not been studied, namely the cortisol hormone. Therefore, this study aimed to determine the effect of warm foot bath therapy on reducing blood pressure by reducing cortisol levels in hypertensive pregnant women.

METHOD

Study Design

This experimental study has a randomized pre-post-test control group design.¹⁵

Setting and Respondents

The research was conducted in the working area of the Public Health Center in Cibungbulang in April-May 2022. The subjects were pregnant women with gestational hypertension. The samples in this study were collected by simple random sampling. They were randomly divided into an experimental group ($n = 20$) and a control group ($n = 20$). Subjects must be primigravida pregnant women between the ages of 20 and 35, with a gestational age of 20 weeks, a blood pressure of 130 mmHg systolic and 80 mmHg diastolic, and a willingness to adhere to a strict drug-taking schedule that includes no alcohol or drinks and no smoking. The exclusion was carried out on subjects with preeclampsia, diabetes mellitus, and bleeding history.

Experimental Procedure

Warm water foot bath therapy for 15 minutes with a temperature of 40-43°C was given once a day, 1x1 in the morning, for 14 days. The control group only received 10 mg of nifedipine every 1x1 for 14 days.

The Variables, Instruments, and Measurement

The variables measured in this study were cortisol levels and blood pressure. The cortisol levels were measured using the ELISA method carried out by the laboratory on the 1st and 14th days of the intervention by taking the blood of

a gestational hypertension mother in the morning. In contrast, the blood pressure variable was measured using a sphygmomanometer.

Data Analysis

The difference in cortisol was tested using the Mann-Whitney test, Paired T-Test, and Wilcoxon Test, while the difference in blood pressure was tested using the Mann-Whitney Test.

Ethical Considerations

An ethical license was obtained from the Health Research Ethics Committee of the Health Polytechnic of the Ministry of Health Semarang is 0118/EA/KEPK/2022.

RESULTS

Table 1 shows that all respondents in this study were dominated by mothers of 21-26 years, gestational age 20-32 weeks, with scores of mild-moderate anxiety and a normal body mass index. Table 2 showed that the decrease in the average level of the hormone cortisol of the intervention group given a warm water foot bath was higher than the control group given nifedipine 10 mg only (Intervention: 48.1 ng/ml, Control: 14.5 ng/ml; $p < 0.0001$).

Table 1. Characteristics of Respondent

Characteristic	Result
Age, years	
Mean \pm SD	23.5 \pm 1.4
Gestational Age, weeks	
Mean \pm SD	23.9 \pm 3.4
Parity	
Primigravida	40 (100%)
Multipara	0 (0%)
Anxiety Levels	
Mild Anxiety	20 (50%)
Moderate Anxiety	20 (50%)
Severe Anxiety	0 (0%)
BMI	
Normal	40 (100%)
Overweight	0 (0%)
Obese	0 (0%)
Consume Antihypertensive Agent	
Yes	40 (100%)
No	0 (0%)
Smoke or Consume Alcohol	
Yes	0 (0%)
No	40 (100%)

Table 2. The Differences in Cortisol Levels

Cortisol Levels (ng/ml) (Δ)	Mean \pm SD	p-value
Intervention	48.1 \pm 4.47	0.0001
Control	14.5 \pm 1.58	

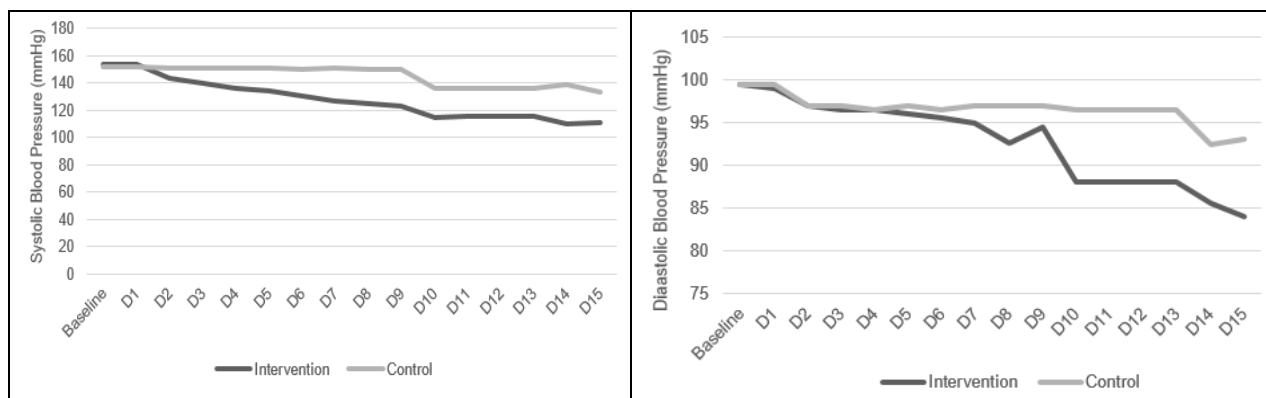


Figure 1. Average Decrease in Systolic and Diastolic Blood Pressure

Measurements related to systolic blood pressure were carried out before treatment, on days 1 to 14 in the intervention group given warm water foot bath therapy and the control group with 10 mg nifedipine alone, and on the 15th day after treatment. Based on Figure 1, it was found that the reduction in systolic blood pressure in the intervention group compared to the control group with the difference in the decrease in systolic blood pressure in the intervention group was 43 mmHg compared to the control group 19 mmHg ($p < 0.0001$).

Measurements related to diastolic blood pressure were carried out before treatment, on days 1 to 14 in the intervention group with warm water foot bath therapy and the control group with 10 mg of Nifedipine alone, and on the 15th day after treatment. Based on Figure 1, the results of a decrease in diastolic blood pressure in the intervention group compared to the control group with a difference in the decrease in diastolic blood pressure in the intervention group of 15.5 mmHg compared to the control group of 6.5 mmHg ($p < 0.009$).

DISCUSSION

In this study, giving warm water foot bath therapy once a day for 14 consecutive days at a temperature of 40-43°C with a duration of 15 minutes was effective in reducing blood pressure and cortisol levels in hypertensive pregnant women. Warm water foot soak therapy can stimulate the pituitary gland in the body to release endorphins, which will reduce the strength of the sympathetic nerves so that vasodilation occurs. Vasodilation is the widening of blood vessels that relax the body, decreasing the hormone cortisol. The decrease in the hormone cortisol decreases the heart rate, so blood pressure becomes controlled and decreases.

The results of this study follow previous studies, which found that, statistically, warm water foot bath therapy was proven to be effective in reducing systolic blood pressure with a $p < 0.005$ and an effect size = 0.5 at a temperature of

39-40°C for 15 minutes. For three weeks, the blood pressure dropped by 20 mmHg before dropping to 46 mmHg. Compared with giving warm water foot bath therapy for 15 minutes for 14 consecutive days at a temperature of 40-43°C, the same results show promising results. However, the decrease in this study is better because it can reduce systolic blood pressure by 43 mmHg.¹⁶

Warm water foot bath therapy has the physical effect of heat or warmth, which can cause liquids, solids, and gases to expand in all directions and can increase chemical reactions. In the tissue, metabolism and increased exchange between body chemicals and body fluids will occur. The biological effect of heat or warmth can cause dilation of blood vessels, resulting in increased blood circulation. Physiologically, the body's response to heat is to cause dilation of blood vessels, decrease blood viscosity and muscle spasms, and increases tissue metabolism and capillary permeability.¹⁶⁻²² So that the effect of warm foot bath therapy with warm water will cause dilation of blood vessels, which can increase blood circulation, thus effectively lowering the blood pressure of pregnant women who experience high blood pressure when done regularly.²⁰⁻²²

This study is in line with previous studies, which found that the average diastolic blood pressure before treatment was 92.9 mmHg and after therapy was 87.6 mmHg or 5.3 mmHg with $p < 0.0001$ and effect size = 0.7 after giving warm water foot bath therapy at a temperature of 40-43°C with a duration of 15 minutes for ten consecutive days, which was changed to 7.42 mmHg. This study is better than previous studies because it can reduce systolic blood pressure by 15.5 mmHg.⁷ Also, this study has several limitations, such as uncontrolled factors affecting cortisol hormone levels.

CONCLUSIONS AND RECOMMENDATION

Giving warm water foot bath therapy for 15 minutes with a temperature of 40-43°C given once a day in the morning for 14 days is proven to reduce the blood pressure of pregnant women with hypertension to normotensive levels and

can also reduce cortisol levels. Researchers suggest that future researchers can combine it with other ingredients that can lower cortisol levels and blood pressure and also expand the criteria for research subjects.

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