

The Effectiveness of Warm Water Foot Soaks and Progressive Muscle Relaxation to Reduce Blood Pressure Among Patients with Hypertension in Cihanjuang Rahayu Village, West Bandung, Indonesia

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ABSTRACT

One of the highest cardiovascular diseases that cause premature death is hypertension. In addition to pharmacological therapy used to maintain blood pressure $\leq 140/90$ mmHg, there are also non-pharmacological therapies, namely warm water foot soak and progressive muscle relaxation. This study aims to determine the effect of a warm water foot soak and progressive muscle relaxation therapy in hypertensive patients. The design used in this research is Quasi-Experiment, with the design with the pretest-posttest nonequivalent control group. The sampling technique is consecutive sampling, the number of samples was 20 patients with hypertension. The tests used were Paired T-test and Independent T-test. The results of the study 10 respondents who had received hydrotherapy soaked in warm water foot got an average systolic and diastolic value of 131,07 mmHg and 82,92 mmHg, while the other 10 respondents who received progressive muscle relaxation therapy received a mean of systolic and diastolic value 131,83 mmHg and 82,93 mmHg. Based on independent t-test significant with p-values of 0,872 and p-values $> 0,993$. There is no difference in effectiveness between interferences of a warm water foot soak and progressive muscle relaxation to decrease systolic and diastolic blood pressure among patients with hypertension in Cihanjuang Rahayu Village, West Bandung.

KEYWORDS

Hypertension; Progressive Muscle Relaxation, Warm Water Foot Soak

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Introduction

Cardiovascular disease is the number 1 cause of death globally every year, the number of hypertension worldwide is around 1 billion and continues to increase every year. Of this number, 2/3 of them are in developing countries (WHO, 2023). High blood pressure is a cardiovascular disease that causes premature death throughout the world. The death rate is nearly 9.4 million people every year worldwide and the problem continues to grow. More than 1 billion people live with high blood pressure problems. In 2008, the overall global prevalence of high blood pressure (including those taking medication for high blood pressure) in adults aged 25 years and over was approximately 40%. Among all WHO regions, the prevalence of blood pressure is highest in the African region (46%) and lowest in the Americas Region (35%). In the Southeast Asia Region, 36% of adults have hypertension (WHO, 2023).

Data on the prevalence of hypertension for each province stated that West Java is in second place in Indonesia at 39.6%. The age groups that experience hypertension in West Java include those aged 18-24 years (16.6%), aged 25-34 years (25.7%), aged 45-54 years (37.4%), aged 45-54 years (52.2%), ages 55-64 years (62.1%), ages 65-74 years (71%) and ages 75+ years (77.8%). Looking at the phenomenon of hypertension percentage above we can conclude that the older a person is the higher the risk of the incidence of hypertension. The Sustainable Development Goals (SDGs) consist of 9 global targets. One of the targets for controlling a non-communicable disease (NCD) by 2025 is reducing hypertension by 25% (Kemenkes RI, 2018).

Hypertension is defined as systolic blood pressure equal to or above 140 mmHg and/or diastolic blood pressure equal to or above 90 mmHg. A person's behavioural and lifestyle factors can increase their risk of developing high blood pressure. Most cardiovascular diseases, such as hypertension, can be prevented by addressing behavioural risk factors such as tobacco consumption, unhealthy diet and obesity, physical inactivity and harmful alcohol use. Pharmacological intervention is by using anti-hypertensive drugs such as diuretics, calcium channel blockers, ACE inhibitors, β -blockers, α -blockers, and arteriolar vasodilators whose function is to reduce increases in heart rate, stroke volume, or Total Peripheral Resistance (TPR), (Joyce M. Black and Jane Hokanson Hawks, 2014). Meanwhile, non-pharmacological interventions include stopping smoking, reducing alcohol consumption, reducing salt and fat intake, reducing excessive body weight, increasing fruit and vegetable intake, physical exercise and complementary therapies.

This complementary therapy has natural healing properties, including herbal therapy, meditation, laughter therapy, nutritional therapy, acupuncture, acupressure, aromatherapy, reflexology, progressive relaxation, and hydrotherapy (Susanti, 2022). According to Setyoadi and Kushariyadi (2011), hydrotherapy is an exercise that uses warm water as a medium. This warm water aims for recovery and according to scientific results, the positive effects of warm water are found, namely the impact on the body's physiology, such as reducing the burden on the joints and the warm water will make blood vessels dilate so that circulation will become smoother. Hydrotherapy is an alternative therapy for patients with hypertension to manage blood pressure. In addition to using medication, hydrotherapy can be done easily and does not cost a lot of money and can be done independently (Sumarmi & Maulida, 2022).

Warm Water Foot soak (foot hydrotherapy) will cause dilation of blood vessels, thereby helping to increase blood circulation, so more oxygen can enter the damaged tissue. People who have diseases such as insomnia, hypertension, stress, rheumatism, sciatica, arthritis, back pain, fatigue, cramps, muscle pain, and stiffness can apply warm water hydrotherapy to reduce these problems (Dilianti et al., 2017). As for the types of hydrotherapy, the methods usually used in hydrotherapy are foot soaking, soaking baths, water massage, compresses, and sitz baths (Wulandari, 2017). Soaking body parts in warm water can increase blood circulation, increase muscle relaxation, and reduce edema because the local response to temperature occurs through the stimulation of nerve endings in the skin that are sensitive to temperature. This stimulation sends impulses from the periphery to the hypothalamus, which will create awareness of local temperature and an adaptive response will arise to maintain normal body temperature. The body can tolerate temperatures in a wide range, the normal skin surface temperature is 34°C, but temperature receptors adapt more quickly to local temperatures of 45°C and below about 15°C. If it is more than this range, it will cause painful effects such as burning if it is too hot and if the temperature is very cold it will cause a numbing effect (Potter, 2010).

According to research by Susanti (2022), entitled "Differences in Blood Pressure Before and After Warm Soak Hydrotherapy in Hypertension Sufferers in Kebondalem Village, Jambu District, Semarang Regency" stated that there was a change in blood pressure after hydrotherapy was carried out, this was shown by the results of the test analysis. The mean difference showed a significant difference in the mean of blood pressure before and after the intervention with a p-value of $0.00 < \alpha (0.05)$ with a mean systolic difference before and after hydrotherapy of 19.1 mmHg and a diastolic difference of 11.9 mmHg. This research is also in line with research conducted by Hutajulu, entitled "Changes in Blood Pressure as a Response to Foot Soaking Hydrotherapy with Warm Water for Adult Women with Stage I Hypertension" stating that there are changes in blood pressure as a response to foot soaking hydrotherapy with warm water with a p-value of 0.000 with a mean systolic difference before and after hydrotherapy of 14.7 mmHg and a diastolic difference of 8.4 mmHg. So, from these two studies, it can be said that there is a difference in blood pressure before and after warm water foot soak hydrotherapy (Hutajulu, 2017).

Relaxation is part of behavioral stimulation, general cognitive and physiological decline. Relaxation involves reducing the stimulation of the relaxation process, namely muscle fibres becoming longer, reducing the transmission of neural impulses to the brain and subsequently reducing the activity of the brain and other parts of the body, such as decreasing heart rate and respiratory frequency, blood pressure and oxygen consumption which are characteristics of the relaxation response. One of the relaxation therapies for hypertensive patients is progressive muscle relaxation. Progressive muscle relaxation is an exercise that teaches individuals how to rest effectively and reduces tension in the body. The long-term goal of progressive muscle relaxation is so that individuals can monitor themselves continuously for indicators of tension (Potter, Patricia A, 2010).

This is in line with the theory of Endang (2014), which says that progressive muscle relaxation is a method to help reduce tension in the body's muscles to relax. According to Muttaqin (2009), this progressive muscle relaxation inhibits or reduces sympathetic nerve activity and increases parasympathetic nerve activity so that causes vasodilation of arteriolar blood vessels. The parasympathetic nervous system releases the neurotransmitter acetylcholine to inhibit sympathetic nerve activity thereby reducing heart muscle contractility, vasodilation of arterioles and veins and then lowering blood pressure.

Literature review

The working principle of hydrotherapy

The effect of providing a heat sensation is vasodilation such as increasing blood flow, increasing the delivery of nutrients and removing waste substances, reducing blood viscosity such as increasing the delivery of leukocytes and antibiotics to the wound area and reducing muscle tension such as increasing muscle relaxation and reducing pain due to stiffness, widening of blood vessels and reducing tension. muscles so that they can improve blood circulation which will influence arterial pressure by baroreceptors in the cortical sinus and aortic arch which will convey impulses carried by nerve fibres which carry signals from all parts of the body to inform the brain about blood pressure, blood volume and the special needs of all organs to the sympathetic nerve centre to the medulla so that it will stimulate systolic pressure, that is, stretching of the ventricular muscles will stimulate the ventricles to immediately contract. At the beginning of the contraction, the aortic valve and semilunar valve have not yet opened. To open the aortic valve, the pressure inside the ventricle must exceed the aortic valve pressure. A condition where ventricular contractions begin to occur so that by widening the blood vessels, blood flow will be smooth so that it will be easier to push blood into the heart, thereby reducing systolic pressure. In diastolic pressure, the state of isovolumic ventricular relaxation is when the ventricles relax, the pressure in the ventricles drops drastically, blood flow is smooth with the dilation of blood vessels, which will reduce diastolic pressure (Potter, 2010).

The working principle of progressive muscle relaxation

Progressive muscle relaxation is an exercise that teaches individuals how to rest effectively and reduce tension in the body. The long-term goal of progressive muscle relaxation is so that individuals can monitor themselves for indicators of tension (Potter & Perry, 2010). Research related to progressive muscle relaxation according to Tyani, Wasisti and Yesi (2015), entitled "Effectiveness of Progressive Muscle Relaxation on Blood Pressure in Patients with Essential Hypertension" states that this relaxation exercise has a significant influence on blood pressure. It can be seen from the statistical tests that the average systolic and diastolic blood pressure values in the experimental group before being given progressive muscle relaxation were 156.60 mmHg and 94.47 mmHg. After being given progressive muscle relaxation, namely 146.53 mmHg and 88.20 mmHg. The results of the analysis obtained p-values for systolic pressure (0.001) and diastolic (0.000), so it can be concluded that there is a significant difference between the mean systolic and diastolic blood pressure before and after the intervention in the experimental group.

Method

This research design used an experimental research design. According to Nursalam (2015), this research connects cause and effect using one group of subjects. The subject group was observed first before the intervention was carried out and then observed again after the intervention was carried out. The type of research used is pre-experimental design one group of subjects is involved in this study, and a cause-and-effect link is revealed. The subject group was observed twice: once before the intervention's implementation and once more following it.

Participants

Participants in this research were individuals in RW 06, Cihanjuang Village who were diagnosed with hypertension. The Technique sampling used was purposive sampling. 20 respondents have been included in this study. The inclusion criteria for the respondents were, hypertensive patients aged 35-60 years; systolic blood pressure ≥ 140 mmHg, diastolic blood pressure ≥ 90 mmHg; able to maintain a sitting position. the research is located in RW 06 Cihanjuang Rahayu Village, West Bandung Regency.

Instruments

Data collection tools including hydrotherapy and progressive muscle relaxation procedure, adult stethoscope and aneroid sphygmomanometer, and observation sheet, were the devices utilized in this investigation. Warm water foot soak therapy progressive muscle relaxation was administered after the patient's blood pressure was taken as part of the intervention.

Table 1. Research Framework

Subject	Pre	Intervention	Post
K	O	I	OI
K	O	II	OI
	Time 1	Time 2	Time 3

- 1) Preparation Stage
 - a. Search for problems based on phenomena.
 - b. Submit a research title based on problems occurring in the field to the supervisor.
 - c. Arrange permits for institutions to conduct preliminary studies.
 - d. Conduct preliminary studies on respondents to obtain the data needed as a research source.
 - e. After obtaining the data, the researcher determines the variables to be studied.
 - f. Prepare a research proposal.
- 2) Implementation Stage
 - a. Obtained permission from the Community Health Center, Cihanjuang Rahayu.
 - b. Researchers visit the research site
 - c. Researchers selected respondents according to the inclusion and exclusion criteria.
 - d. Explain the purpose of the research to respondents, then carry out an informed consent by explaining the aims, objectives, benefits, research procedures, as well as the rights and obligations of respondents to participate in the research process.
 - e. Researchers prepared the selected respondents into two groups, namely intervention group I and intervention group II. Before checking their blood pressure, the respondents rested for 15 minutes, then an initial blood pressure check was carried out in all groups using an aneroid sphygmomanometer and stethoscope.
 - f. Researchers recorded the initial blood pressure of all groups.
 - g. After checking the initial blood pressure. Researchers prepared intervention group I patients to carry out warm water foot soak hydrotherapy by directing the patient to sit on a chair and pay attention to the instructor who would provide an explanation and implementation stages regarding hydrotherapy. This warm water foot soak hydrotherapy uses warm water ± 15 cm or up to the ankles at a temperature of 40

°C for 15 minutes and is done once a day for 3 days. After soaking for 15 minutes the water temperature was measured again.

- h. Researchers prepared patients in intervention group II for progressive muscle relaxation by directing the patient to sit on a chair and pay attention to the instructor who would guide them through progressive muscle relaxation. This relaxation is carried out for \pm 15 minutes and is done once a day for 3 days.
 - i. If the patient is taking antihypertensive drugs, intervention I and intervention II are carried out \pm 4-5 hours after taking antihypertensive drugs.
 - j. After doing hydrotherapy and progressive muscle relaxation, rest again for 15 minutes, and then blood pressure measurements are taken again.
 - k. Researchers record or document measurement results.
- 3) Final Stage
- a. Researchers carry out data processing and data analysis using statistical software.
 - b. Preparation of research results and discussion.
 - c. Present the results and discussion of research (session).
 - d. Documentation of research results.

Data analysis

The data in this study, which includes research problems, and testing research problems using the Paired T-Test was utilized for bivariate, analysis while the values of the mean were used for univariate analysis (Notoatmodjo, 2012)

Results

The distribution of mean systolic and diastolic blood pressure before and after warm water foot soak in hypertensive patients

Based on the table below, it can be seen that the average systolic and diastolic blood pressure post warm water foot soak was 131.07 mmHg and 82.92 mmHg, in hypertensive patients 10 participants in Cihanjuang Rahayu Village, West Bandung.

Table 2. Distribution of mean systolic and diastolic blood pressure before and after warm water foot soak intervention

Variables	N	Mean	SD
Systolic Blood Pressure Pre	10	147,74	16,67 (4,422)
Systolic Blood Pressure Post	10	131,07	
Diastolic Blood Pressure Pre	10	89,61	6,69 (1,675)
Diastolic Blood Pressure Post	10	82,92	

The distribution of mean systolic and diastolic blood pressure before and after progressive muscle relaxation in hypertensive patients

Based on the table below, it can be seen that the average systolic and diastolic blood pressure post progressive muscle relaxation was 131.83 mmHg and 82.93 mmHg, in hypertensive patients 10 participants in Cihanjuang Rahayu Village, West Bandung.

Table 3. Distribution of mean systolic and diastolic blood pressure before and after progressive muscle relaxation intervention.

Variables	N	Mean	SD
Systolic Blood Pressure Pre	10	142,19	10,36 (3,894)
Systolic Blood Pressure Post	10	131,83	
Diastolic Blood Pressure Pre	10	88,49	5,55 (2,363)
Diastolic Blood Pressure Post	10	82,93	

Test analysis on the effect of warm water foot soaks on reducing blood pressure in hypertension patients

Based on the table below, the 20 research respondents who were given warm water foot soak and progressive muscle relaxation intervention showed that the results of the Paired T. Test statistical test showed a significant figure, namely p-value 0.000. Thus, it can be concluded that there is a significant difference in mean systolic and diastolic blood pressure before and after administration. hydrotherapy intervention warm water foot soak. Description of mean

systolic and diastolic before warm water foot soak hydrotherapy intervention in hypertensive patients in Cihanjuang Rahayu Village West Bandung.

Table 1. Results of the Paired T-test analysis on the effect of warm water foot soaks on reducing blood pressure in hypertension patients

Variables	N	Mean	SD difference	p-value
Systolic I	10	131,07	12,478	0,872
Systolic II	10	131,83	6,265	
Diastolic I	10	82,92	3,088	0,993
Diastolic II	10	82,93	2,580	

Discussion

In this study, there were 20 respondents in the interventions and control group, aged 36-60 years at Posbindu RW 06 in the working area of the Parongpong Community Health Center, the average systolic and diastolic blood pressure before warm water foot soak hydrotherapy was 147.74 mmHg and 89.61 with a standard deviation of 11.53. and 3.10. According to the researchers' assumptions, systolic and diastolic blood pressure before therapy was carried out fell into the average blood pressure of grade 1 hypertension, namely the systolic blood pressure range of 140-150 mmHg and diastolic 90-100 mmHg, this was because some respondents were not optimal in their diet and consumption of anti-inflammatory drugs hypertension.

Blood pressure is the force generated by the arterial walls by pumping blood from the heart and pushing the blood into the aorta and distributed throughout the body (Potter, Patricia A, 2010). Blood pressure is divided into 2, namely systolic and diastolic blood pressure, where systolic blood pressure is the peak pressure that occurs when the ventricles contract, while diastolic blood pressure is the lowest pressure that occurs when the heart is at rest. The average normal blood pressure in adults is around 120/80 mmHg. Treatment for patients with hypertension is to maintain blood pressure below 140/90 mmHg (Bare, 2021).

Research conducted by Hutajulu (2017) shows that warm water foot soak hydrotherapy intervention can reduce systolic and diastolic blood pressure. Based on the results obtained, the systolic and diastolic blood pressure before warm water foot soak hydrotherapy was 147.60 mmHg and 94.60 mmHg and after warm water foot soak hydrotherapy the results were 132.90 mmHg and 86.20 mmHg. Description of mean systolic and diastolic after warm water foot soak hydrotherapy intervention in hypertensive patients in Cihanjuang Rahayu Village West Bandung.

In this study, the mean systolic and diastolic blood pressure after warm water foot soak hydrotherapy was 131.07 mmHg and 82.92 with a standard deviation of 12.48 and 3.09. According to (Kushariyadi, 2011), hydrotherapy is a form of exercise therapy that uses warm water as a modality, foot soak therapy (foot hydrotherapy) can help dilate blood vessels thereby increasing blood circulation so more oxygen is supplied to the tissues and can also reduce blood pressure in hypertensive patients. This research also is in line with research conducted by (Susanti, 2022), the systolic and diastolic blood pressure obtained before being given the warm soak hydrotherapy intervention was 152.8 mmHg and 97.1 mmHg and after being given the intervention the blood pressure obtained was 133.7 mmHg and 85.2 mmHg. This shows that blood pressure after being given this hydrotherapy intervention has decreased.

According to Mutaqqin (2009), this progressive muscle relaxation inhibits or reduces sympathetic nerve activity and increases parasympathetic nerve activity, thereby causing arteriolar vasodilation. The parasympathetic nervous system releases the neurotransmitter acetylcholine to inhibit sympathetic nerve activity thereby reducing heart muscle contractility, vasodilation of arterioles and veins and then lowering blood pressure. This is also related to the application of progressive muscle relaxation carried out by the author, after applying progressive muscle relaxation for 3 days Both subjects showed a decrease in stress levels, progressive muscle relaxation helped reduce the stress levels experienced by hypertensive patients, because the benefits of progressive muscle relaxation can stimulate the body's muscles so that blood pressure can decrease and the body relaxes (Halimah *et al.*, 2023). In line with this research Pratiwi & Soesanto (2023), blood pressure after progressive muscle relaxation therapy which has been applied for 3 days within ± 10 -20 minutes at each meeting explains the results of changes in blood pressure before and after application, through the average The patient's systolic blood pressure decreased to 6.6 mmHg and diastolic blood pressure to 1.6 mmHg. This is in line with research conducted (Syah & Agusthia, 2024) showing that the mean systolic and diastolic blood pressure after the procedure was 138.85 (SD 12.40) and the mean diastole was 88.62 (SD 4.27). showed a decrease of 13.65 in systole and 6.19 mmHg in diastole. According to Kushariyadi (2011), hydrotherapy is a form of exercise therapy that uses warm water as a modality. Foot soak therapy (foot hydrotherapy) can help dilate blood vessels thereby increasing blood circulation so that more oxygen is supplied to the tissues and can also reduce blood pressure in hypertensive patients.

Based on the research results, it was found that the mean systolic blood pressure before the warm water foot soak hydrotherapy intervention was 147.74 mmHg and after the intervention was 131.07 mmHg with a difference of 16.67 and a standard deviation of 11.53 and 12.48. Meanwhile, diastolic blood pressure before was 89.61 mmHg and after the intervention was 82.92 mmHg with a difference of 6.69 and a standard deviation of 1.68. By carrying out the paired T-test statistical test, a significant figure is obtained, namely p-Value 0.000, thus, H_0 is rejected. So it can be concluded that there is a difference in the average systolic and diastolic blood pressure before and after being given the warm water foot soak hydrotherapy intervention. This is in line with research by (Susanti, 2022), (Hutajulu Elisabet Hotnida, 2017), which states that foot soak hydrotherapy using warm water affects reducing blood pressure, both systolic and diastolic, in other words, hydrotherapy. This is effective in reducing blood pressure in hypertensive

patients. In hypertensive patients, there is usually a constant increase in blood pressure so it requires appropriate treatment, one of which is therapy.

According to (Potter, Patricia A, 2010), the principle of warm water foot soak hydrotherapy is that it causes dilation of blood vessels and a decrease in muscle tension so that blood circulation is smooth, thereby influencing arterial pressure. Baroreceptors in the cortical sinus and aortic arch will convey impulses carried by the nerve fibres that carry signals from all parts of the body to inform the brain about blood pressure, blood volume, and the special needs of all organs to the sympathetic nerve centre to the medulla so that it will stimulate systolic pressure, namely stretching of the ventricular muscles which will stimulate the ventricles to immediately contract. When the aortic valve and semilunar valves begin to contract, they have not yet opened. To open the aortic valve, the pressure inside the ventricle must exceed the aortic valve pressure. A condition where ventricular contractions begin to occur so that by widening the blood vessels, blood flow will be smooth so that it will be easier to push blood into the heart, thereby reducing systolic pressure. In diastolic pressure, the state of isovolumic ventricular relaxation is when the ventricles relax, the pressure in the ventricles drops drastically, and blood flow is smooth with the dilation of blood vessels, which will reduce diastolic pressure. So, this hydrotherapy intervention is effective in reducing blood pressure in hypertensive patients. According to (Guyton, 1990), when progressive muscle relaxation is carried out in the arterial walls there are receptors which are 'spray' type nerve endings that are stimulated when stretched. Several baroreceptors are found in the walls of the large arteries in the chest and neck area, but there are more baroreceptors in the carotid walls often called the carotid sinuses, and in the aortic arch junction. Baroreceptor impulses inhibit the vasoconstriction centre in the medulla oblongata and stimulate the vagus nerve centre, the effect of which is vasodilation throughout the peripheral circulatory system and a decrease in the frequency and strength of contractions. Therefore, stimulation of the baroreceptors by pressure in the arteries reflexively causes a decrease in arterial pressure.

From the theory above, it can be concluded that the hydrotherapy intervention of warm water foot soaking and progressive muscle relaxation is a relaxation technique that can be carried out in hypertensive patients because these two interventions cause vasodilation in the blood vessels so that they can reduce blood pressure, both systolic and diastolic. and from the results obtained from the warm water foot soak hydrotherapy intervention and progressive muscle relaxation p value > 0.05, it can be concluded that there is no difference in effectiveness for lowering blood pressure in hypertensive patients so that hypertensive sufferers can choose between these two interventions according to their abilities. owned by the patient. Providing warm water foot soaks and progressive muscle relaxation can be used as independent measures to reduce blood pressure in hypertensive patients in addition to pharmacological treatment. Apart from lowering blood pressure, these two interventions, if carried out regularly, can also prevent severe hypertension and complications such as stroke.

Conclusion

After researching 20 respondents in the warm water hydrotherapy foot soak dan progressive muscle relaxation intervention and control group, the mean blood pressure results were 131,07/82.92 mmHg and 131.83/82.93 mmHg, based on the paired T-test statistical test, a significance figure was obtained. namely p-Value 0.872 and 0,993, so it can be concluded that there is a difference in the mean systolic and diastolic blood pressure before and after being given the warm water foot soak hydrotherapy intervention, whether it will benefit our society to conduct warm water foot soak and progressive muscle relaxation in their house because the intervention is easy to conduct, cheap effective to reduce blood pressure.

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