

Efficacy of Hydrotherapy Soak Feet in Lowering Blood Pressure of Hypertension Sufferers in Dauhwaru Village, Jembrana

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ABSTRACT

Hypertension fluctuates significantly every year, especially in Jembrana Regency. Long-term consumption of the drug may result in complications. This study aims to analyze the efficacy of foot soak hydrotherapy in lowering the blood pressure of hypertension sufferers in Dauhwaru Village, Jembrana. Experimental research design with one group pretest-posttest design without any control group. In 37 respondents with hypertension, the treatment consisted of 20 minutes of hydrotherapy in which the feet were immersed in 25-centimeter-deep water. The data was analyzed using a Paired T-Test and descriptive tests. The results showed that respondents aged 31–40 years (51.4%), male (54.1%), independent entrepreneurial work (40.5%), senior high school graduate education (35.1%), a daily work duration of > 12 hours/day, and respondents who had used anti-hypertensive medications for 6–8 years (37.8%) dominated the age characteristics. Hence, the results obtained from the T-test obtained a probability value (2-tailed) of $0,000 < 0.01$. Hence, there is a very noticeable difference in blood pressure before and after being given foot-soak hydrotherapeutic treatment in hypertension patients in Dauhwaru Village, with a lowering in systolic blood pressure of 124.3 mmHg and diastolic blood pressure of 0.62.2 mmHg. Therefore, hydrotherapy soak feet is effective in lowering blood pressure.

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INTRODUCTION

Many people worldwide have non-communicable diseases (NCDs) like hypertension (Campbell et al., 2022). Hypertension is a persistent disease characterized by increased systolic blood pressure of > 120 mmHg and diastole > 80 mmHg (Rowland, 2014). Hypertension has the term "The Silent Killer," which is referred to as a disease whose signs and symptoms are not realized and complaints generally do not arise and trigger other diseases, especially cardiovascular diseases (Beevers, 2001). The mechanism of hypertension is due to the formation of angiotensin II from angiotensin I by the angiotensin-converting enzyme (ACE), which is the physiological control center in regulating blood

pressure (Harrison et al., 2021). Thus, joint management and education are needed to reduce this disease in the community.

The development of hypertension is increasingly concerning from time to time, considering that the incidence of cases worldwide is increasing significantly every year. According to estimates released by the World Health Organization, the global prevalence of hypertension is 22% of the world population (WHO, 2021). Furthermore, the Ministry of Health of the Republic of Indonesia, through the results of primary health research, reported the prevalence of the population with a high blood pressure of 34.11% and was dominated by women (36.85%) while men (31.34%) (Ministry of Health, 2019). The same thing was reported in Bali Province; namely, the percentage of people with hypertension in the community > 15 years higher in women (51%) while men (49%) (Bali Health Department, 2021). The report of the Jembrana Regency Health Office in 2020 showed that the number of people with hypertension in Jembrana Regency > 15 years of age amounted to 54,082 with details of men (26,539) and women (27,543), while the number of hypertension sufferers who received health services was only 43.3% (23,041). In terms of work areas, the most people with hypertension > 15 years are in the work area of Puskesmas I Jembrana as an area located in the Jembrana Regency Government Center, with the number of cases reaching 6,673 with coverage of health services of 54.5% while cases in the work area of Puskesmas II Jembrana amount to 4,024 with coverage of health service acquisition of only 13.3% (Jembrana Health Department, 2021).

The low percentage of health service acquisition has increased hypertension cases in Jembrana (Jembrana Health Department, 2021; Sudaryati et al., 2019). Comprehensive education is required to increase community understanding and practices in dealing with and preventing hypertension using individual and family approaches (Fadlilah et al., 2020; Widiyanto et al., 2021). Efforts that can be made are to introduce preventive therapy that is easy, cheap, and able to be done independently, namely hydrotherapy soaking feet using warm water to stabilize blood vessels through thermal therapies on the walls of blood vessels (Bakar et al., 2020; Dulawa & Kokot, 2018; Valado et al., 2022). Multiple studies have demonstrated that foot-soaking hydrotherapy effectively reduces blood pressure in hypertensive patient (Ambarwati et al., 2020; Bakar et al., 2020; Irawan, 2017; Pramono et al., 2021), provides muscular relaxation and a soothing effect (Fadlilah et al., 2020; Murwidi & Abdullah, 2019). However, not many have introduced this method, especially in people suffering from hypertension in Jembrana Regency. This study aims to analyze the efficacy of foot soak hydrotherapy in lowering the blood pressure of hypertension sufferers in Dauhwaru Village, Jembrana. Through this research, it is hoped that it will be a preventive effort to reduce the incidence of hypertension cases in Dauhwaru Village, Jembrana Regency. It helps develop health policies by related agencies, especially in eradicating non-communicable diseases, especially hypertension.

RESEARCH METHOD

Experimental research design with *one group pretest-posttest design* without any control group. The study was conducted for two months (November-December 2020) at the respondents' respective homes in the Dauhwaru Village area, Jembrana District, Jembrana Regency, Bali. The Head has approved the research protocol of the Research and Community Empowerment Section and the Village Head of Dauhwaru Village Number 005/138/Pem/2020. The study measured the blood pressure of people with hypertension before treatment (*pre-test*) and after being given a foot bath hydrotherapy treatment (*post-test*) and compared the decrease in blood pressure before and after. Each respondent received the same treatment, namely measuring blood pressure before and after treatment and giving hydrotherapy, soaking the feet with warm water with a temperature of 40 °C, water level 25 cm from the sole, and administration for 20 minutes (Devkate et al., 2016; Juarez, 2020; Sudaryati et al., 2019).

The variables studied in this study were the demographic characteristics of respondents, which included age, gender, occupation, education, length of work in a day, length of taking hypertension drugs, and blood pressure before and after treatment. Sampling and determination

using *purposive sampling* obtained 37 respondents (n = 37) who were included in this study. The inclusion criteria set are 1) respondents are permanent residents in Dauhwaru Village, Jembrana; 2) ≥ 31 years old; 3) taking hypertension drugs ≥ 3 years; 4) have a permanent job; 5) blood pressure above normal, namely > 120 mmHg (systole) and ≥ 80 mmHg (diastole); 6) have no other complications or comorbidities, and 7) be willing to be given a foot bath hydrotherapy treatment. Meanwhile, the exclusion criteria in this study were respondents who did not meet the requirements in the exclusion criteria and refused to be given foot soak hydrotherapy. Data on age, gender, occupation, education, length of work in a day, and length of taking hypertension drugs were analyzed descriptively to obtain frequency and percentage in each characteristic. Furthermore, blood pressure before and after treatment was statistically analyzed using a Paired T-Test test with a confidence level of 99% and a probability value ($p < 0.01$) with the help of SPSS Inc. version 25.0. The test was used to analyze the difference in the average blood pressure before and after as well as the magnitude of the decrease in blood pressure of systole and diastole in order to formulate conclusions and recommendations (Darwin et al., 2021).

RESULTS AND DISCUSSIONS

Characteristics of study respondents

Based on table 1, the characteristics of respondents in this study were obtained, totaling 37 respondents (n = 37). The age characteristics of respondents in this study were dominated by respondents aged 31-40 years, as many as 19 people (51.4%), then the sex characteristics were dominated by men, as many as 20 (54.1%). The respondents' jobs in this study mainly were independent entrepreneurs, as many as 15 people (40.5%), and the respondents' education was dominated by high school or vocational school graduates, as many as 13 people (35.1%). The characteristics of the length of work on a daily scale of each respondent varied; respondents in this study worked with a length of > 12 hours/day, and the characteristics of the length of consumption of hypertension drugs were dominated by respondents who had consumed the drug for 6-8 years as many as 14 people (37.8%) continuously and routinely according to the doctor's recommendation.

Table 1. Characteristics of study respondents (n= 37)

Characteristic	Frequency (f)	Percentage (%)
Age		
31-40 Years	19	51.4
41-50 Years	11	29.7
>50 Years	7	18.9
Gender		
Male	20	54.1
Female	17	45.9
Work		
Private sector employee	13	35.1
Entrepreneurial	15	40.5
Civil servants	9	24.3
Education		
Primary school	8	21.6
Junior high school	9	24.3
Senior High School/Vocational School	13	35.1
College	7	18.9
Length of work		
< 6 hours/day	12	32.4
6-12 hours/day	11	29.7
>12 hours/day	14	37.8
Duration of Consumption of Hypertension Drugs		

3-5 years	12	32.4
6-8 years	14	37.8
>8 years old	11	29.7

Distribution of blood pressure before and after treatment in patients with hypertension

The results of the study in table 2 showed differences in fraction and percentage differences in blood pressure before and after treatment in patients with hypertension in Dauhwaru Village, Jembrana. Before giving hydrotherapy treatment, soak the feet with warm water. The blood pressure of respondents tended to be high. It was dominated by systole blood pressure of 120-139 mmHg and diastole of 80-89 mmHg with a frequency of 21 respondents (56.8%) for systole and 34 respondents (91.9%), respectively, and entered the prehypertension category. Before the treatment, there was no blood pressure among respondents who fell into the average category and found two respondents (5.4%) who were included in the category of hypertension degree II with a systole value of >160 mmHg. Furthermore, after giving hydrotherapy treatment to soak warm water to 37 respondents for 20 minutes with a water level of 25 cm from the soles of the feet and a water temperature of 40 ° C, the results were significantly decreased. In the blood pressure examination after the treatment, 28 respondents (75.7%) had systole values that fell into the average category, while 22 respondents (59.5%) had diastole values that fell into the average category.

Table 2. Distribution of blood pressure before and after treatment in patients with hypertension

Category	Referral Value (mmHg)		Before treatment				After treatment			
	Sistole	Diastole	Sistole		Diastole		Sistole		Diastole	
			f	%	f	%	f	%	f	%
Usual	< 120	<80	0	0	0	0	28	75.7	22	59.5
Prehypertension	120-139	80-89	21	56.8	34	91.9	9	24.3	13	35.1
Degree I hypertension	140-159	90-99	14	37.8	3	8.1	0	0	2	5.4
Degree II hypertension	≥ 160	≥ 100	2	5.4	0	0	0	0	0	0

Abbreviation: f = frequency; % = percentage; mmHg = millimeters of mercury

Paired T-test results on blood pressure before and after treatment

Based on the results of the *Paired T-test*, the difference in systolic blood pressure before and after treatment obtained a t value of 11,790 with a probability of Sig. (2-tailed) 0.000 less than $p < 0.01$; thus, there is a very noticeable difference between systolic blood pressure before and after being given hydrotherapy treatment soak warm water in hypertension sufferers in Dauhwaru Village, Jembrana, with a systolic blood pressure reduction value of 124.3 mmHg. Furthermore, the results of the *Paired T-test* test difference in diastolic blood pressure before and after treatment obtained a t value of 6,365 with a probability of Sig. (2-tailed) 0.000 smaller than $p < 0.01$; thus, there is a very noticeable difference between diastolic blood pressure before and after being given hydrotherapy treatment in wet feet in warm water in hypertension sufferers in Dauhwaru Village, Jembrana, with a diastolic blood pressure reduction value of 0.622 mmHg with a level of confidence of 99%.

Table 3. Paired T-test results on blood pressure before and after treatment

Blood pressure	Mean ± SE	99% Confidence Interval of the Difference		Correlation	t	df	Sig. (2-tailed)
		Lower	Upper				
		Systole before * after	1.243±0.641				
Diastole before* after	0.622±0.594	0.356	0.887	0.269	6.365	36	0.000**

Description: ** = Very significant different ($p < 0.01$).

Efficacy of Hydrotherapy Soak Feet in Lowering Blood Pressure of Hypertension Sufferers

Hypertension becomes a non-communicable disease often experienced by people in their teens to the elderly (Kumar et al., 2021). This disease occurs not only due to genetic factors but can be mediated by factors of habits, lifestyle, and the surrounding environment (Ministry of Health, 2019). In a fast-paced era, the presence of this disease is increasing, especially experienced by individuals who work with heavy loads and activities that can trigger an increase in blood pressure (Campbell et al., 2022). In addition, increasing a person's age allows for a drastic increase in blood pressure, resulting in other diseases such as coronary heart disease, stroke, and cardiovascular disorders (Brunt et al., 2016). The occurrence of hypertension is caused by a decrease in the elasticity of blood vessels, the narrowing of the walls of blood vessels, and high blood viscosity, which can cause blood not to flow appropriately to aggravate the performance of the heart, as a result of which there is an increase in blood pressure both systole and diastole (Angraini et al., 2021; Fadlilah et al., 2020; Hartinah et al., 2019; Rowland, 2014).

The age factor is the cause of many health problems experienced by a person, and increasing age impacts decreasing body functions and physiology which triggers hypertension (Widiyanto et al., 2021). Furthermore, gender is reported to be a contributing factor to the occurrence of hypertension (Parker et al., 2018). The results showed that the dominance of hypertension was experienced by male respondents caused by an increase in the hormone testosterone, the habit of individual men who worked harder than women, excessive physical activity, and individual habits such as smoking, alcohol, lack of exercise were the triggers for hypertension. The study's results align with Ambarwati et al. (2020) and Irawan (2017), which revealed that male respondents dominated the percentage of hypertension incidence. However, these results are inversely proportional to the Bali Provincial Health Office report, which states that the prevalence of hypertension in women is higher than in males. It occurs as a result of the high prevalence of women entering menopause which results in decreased levels of the hormone estrogen, estradiol and changes in androgen hormones that trigger vascular instability and result in hypertension (Anagnostis et al., 2020; Bali Health Department, 2021; Coylewright et al., 2008).

Another determinant that results in hypertension is that work and the length of work in a day can affect the incidence of hypertension. Respondent's work in research is dominated by independent entrepreneurs and is followed by private employees. In addition, the average working time of respondents reached > 12 hours/day, which may be the cause of hypertension due to fatigue at work, stress, the burden of tasks done is quite dense, and a short rest period results in muscles contracting and tense and the heart works harder which triggers an increase in blood pressure (Colligan & Higgins, 2006; Hulens et al., 2018; Riou et al., 2020). These results are in line with research conducted by Nascimento et al. (2019) and Saxena et al. (2018), which reveals that the length of time a person works in a day, the level of stress, general mental disorders, and fatigue will increase which increases hormones and oxidative stress, triggering hypertension. Furthermore, this study was dominated by respondents who consumed drugs reaching 6-8 years, indicating that hypertension drugs have low effectiveness in lowering the blood pressure of hypertension sufferers (Zhou et al., 2019). Research by Ding et al. (2020) and Mills et al. (2020) showed that hypertension could be triggered by the length of time an individual takes drugs which have implications for the incidence of Alzheimer's and increase the risk of cardiovascular diseases, including hypertension. Most individuals who take the drug longer result in cardiovascular diseases that have a fatal impact, including death (Fuchs & Whelton, 2020).

The incidence of hypertension does not escape the educational factor that is a factor in a person obeying treatment or not. In this study, respondents had a high school or vocational education background, classified as secondary education. Previous research revealed that the higher the education, the more adherence to treatment would increase (Shi et al., 2019); these results revealed that the high incidence of hypertension is possible because of the lack of knowledge and literacy of the community in preventing the incidence of hypertension including habitual and socio-

cultural. This is in line with the results of research that shows that people with hypertension in Dauhwaru Village, Jembrana, do not know that using foot bath hydrotherapy can lower blood pressure. All respondents have never done foot-soaking hydrotherapy, so this study seeks to introduce and improve people's literacy in applying therapy independently. Several studies state that the effect of foot soak hydrotherapy has a positive impact on lowering the blood pressure of people with hypertension (Almassmoum et al., 2018; An et al., 2019). In addition, the effect provided by this water therapy is to increase muscle relaxation and reduce tension due to many factors (Devkate et al., 2016; Mooventhan & Nivethitha, 2014; Tochiyara, 2022). The results showed that administering hydrotherapy with warm water with a temperature of 40 °C and a water level of 25 cm for 20 min significantly reduced respondents' blood pressure. The results align with previous studies that reveal warm water has therapeutic effects on human health, including stabilizing the blood pressure of people with hypertension (Júnior et al., 2020; Murwidi & Abdullah, 2019; Sudaryati & Adnyana, 2018).

The mechanism of action of hydrotherapy soaking feet warm water in lowers blood pressure through a conduction process that transfers the heat of water into a person's body through the nerve tissue contained in the feet during immersion (Angell, 2017; Zamunér et al., 2019). In this process, there is a dilation and strengthening of the ligamentous muscles, which contributes to an increase in the elasticity of blood vessels, a decrease in muscle tension, and the entire nerve undergoes vasodilation, including the walls of blood vessels (Becker, 1994; Devkate et al., 2016). As a result, the blood flow of the heart, the whole body, and vice versa become smooth. Furthermore, the warmth of the water can affect the baroreceptors found in the arteries and aortic archus, which will be delivered to the nerve fibers of the brain to stimulate systole pressure which has implications for the occurrence of ventricular muscle strain and ventricular muscle vasodilation (Angell, 2017; Brunt et al., 2016). The nerve that works is the *Autonomic Nervous System* (ANS) which is allegedly the primary regulator of the heart's work activity, including heart rate and arterial pressure. Furthermore, when blood vessels undergo vasodilation, blood flow throughout the body becomes smooth (Ainslie, 2020; Juarez, 2020) and balancing the bioregulator function of the body which has an impact on reducing systole and diastole blood pressure (Júnior et al., 2020; Kumar et al., 2021; Linhares et al., 2020; Valado et al., 2022). Thus, hydrotherapy foot baths can be used as a companion treatment in lowering blood pressure in people with hypertension, especially in Dauhwaru Village, Jembrana.

CONCLUSION

The administration of foot soak hydrotherapy to people with hypertension in Dauhwaru Village, Jembrana, is efficacious in lowering systolic and diastolic blood pressure. Systolic blood pressure decreased by 124.3 mmHg and diastolic by 0.62.2 mmHg. In the future, further research and comprehensive education are needed by related parties to develop and introduce foot soak hydrotherapeutic methods in all community health centers (Puskesmas) as an integrated program to reduce hypertension cases.

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