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Implementation of Warm Foot Soak Hydrotherapy Reduces the Risk of Indefective Peripheral Perfusion in Hypertension Patients in the Family

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Abstract

Background: The risk of ineffective peripheral perfusion in hypertension occurs due to an increase in peripheral resistance due to a decrease in vascular elasticity, resulting in a decrease in blood circulation at the capillary level which can interfere with the body's metabolism. This can be controlled by non-pharmacological management by doing hydrotherapy with warm water foot soaks. This application will be successful by requiring the support of family members. Objective: To determine the application of warm foot immersion hydrotherapy to reduce the risk of ineffective peripheral perfusion in hypertensive patients in families. Methods: This study is a qualitative descriptive research with a case study strategy, using 2 participants, namely family members who experience hypertension in the family. The action is carried out 3 days for 15-20 minutes. Results: After hydrotherapy was carried out with warm water foot bath in both patients, the results were obtained in patient 1 the peripheral pulse strength was moderately increased radial pulse 84 x/min, brachial 82 x/min, posterior tibia 76 x/min, and dorsalis pedis 80 x/min, blood pressure decreased to 125/78 mmHg, mean arterial pressure decreased to 88, and CRT improved to < 2 seconds. Patient 2 obtained the results of a moderate increase in peripheral pulse strength of 84 x radial pulse / minute, brachial 80 x / minute , posterior tibia 68 x / minute, and dorsalis pedis 70 x / minute, blood pressure decreased to 130/79 mmHg, average arterial pressure decreased to 96, and CRT improved to < 2 seconds. Family members are able to apply warm water foot soak hydrotherapy to lower the risk of ineffective peripheral perfusion in hypertensive patients. Conclusions: Warm foot immersion hydrotherapy may lower the risk of ineffective peripheral perfusion in hypertensive patients in families.

Keywords: Hydrotherapy; Warm Water Foot Soak; Hypertension; Family; Peripheral Perfusion.

1. INTRODUCTION

Hypertension is a condition where systolic blood pressure is above normal, specifically greater than 140 mmHg, and diastolic blood pressure exceeds 90 mmHg. The causes of hypertension are divided into two types: primary and secondary hypertension. Primary or essential hypertension is a type where the cause is unknown or cannot be identified, such as aging, psychological stress, and heredity. Secondary hypertension, on the other hand, has identifiable causes, including kidney disease, thyroid disorders (hyperthyroidism), and medication factors (e.g., corticosteroids) (Manuntung, 2019).

World Health Organization (WHO) in 2019 reported that 1 billion people globally suffer from hypertension, with two-thirds of these cases found in low- and middle-income countries. Data from the Basic Health Research (Riskesdas) in 2018 showed an increase in hypertension prevalence in Indonesia from 25% to 34.1% in 2013, based on blood pressure measurements for individuals aged 18 years and older. According to the Health Department of Central Java Province, a recap of Non-Communicable Disease (NCD) cases in 2021

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showed hypertension accounted for the largest proportion of all reported NCDs, at 76.5%, making it a top priority for NCD control in Central Java. The recap of NCD cases in Magelang Regency reported 79,933 people with hypertension (Dinkes Kabupaten Magelang, 2022). Based on data from the Magelang Utara Health Center, in 2024, there were 1,800 cases of hypertension (Puskesmas Magelang Utara, 2024).

An increase in peripheral resistance (resistance in peripheral blood vessels) and blood volume are two causes of hypertension. The rise in peripheral resistance can occur due to reduced elasticity of blood vessels and fat accumulation on the blood vessel walls, which can impact perfusion or the blood supply to other tissues or organs. Stimulation of the sympathetic nervous system can also cause peripheral vasoconstriction to prevent further reduction in blood circulation. A decrease in cardiac output can lead to reduced tissue perfusion, resulting in peripheral perfusion issues (Goesalosna, 2019).

Foot immersion therapy in warm water can improve microcirculation in blood vessels and induce vasodilation. The effect of this therapy generates heat energy that dilates blood vessels and promotes blood circulation. It also stimulates the nerves in the feet, activating the parasympathetic nervous system, which can lead to changes in blood pressure. The heat from hydrotherapy with warm water increases blood flow to the skin by widening blood vessels, which enhances the supply of oxygen and nutrients to tissues, thus improving the circulatory system (Wibowo & Purnamasari, 2019).

Hypertension problems will persist if patients do not adhere to regular treatment. Hypertension is a disease that cannot be cured but can be controlled to maintain normal blood pressure, and this requires lifestyle changes toward healthier habits. Family support is crucial in providing treatment and care for family members with hypertension. Families serve as the frontline of healthcare, enhancing community health. A healthy family leads to a healthy community (Dewi & Rahmawati, 2019).

The role of families in caring for hypertensive family members involves carrying out five tasks of family health maintenance: the ability to recognize health problems, make appropriate decisions, care for sick family members, modify the environment, and utilize available healthcare facilities (Friedman & Bowden in Salamung et al., 2021).

2. LITERATURE REVIEW

Hypertension occurs due to vasoconstriction of blood vessels and circulation disturbances, which subsequently extend into the brain, leading to an increase in blood vessel pressure within the brain. Two main causes of hypertension are the increase in peripheral

resistance (resistance in peripheral blood vessels) and increased blood volume. The rise in peripheral resistance can occur due to a reduction in blood vessel elasticity and the accumulation of fat in blood vessel walls, which in turn can impact the perfusion or blood supply to other tissues or organs in the body. Stimulation of the sympathetic nervous system can also cause peripheral vasoconstriction, aiming to prevent further reduction in blood circulation. A decrease in cardiac output can lead to reduced tissue perfusion, resulting in issues with peripheral perfusion (Goesalosna, 2019). Uncontrolled hypertension can lead to a risk of reduced blood circulation at the capillary level, which can disrupt the body's metabolism, in line with the Indonesian Nursing Diagnosis Standards (SDKI) where the main nursing problem that may arise is the risk of ineffective peripheral perfusion as indicated by hypertension (Tim Pokja SDKI DPP PPNI, 2017).

If ineffective peripheral perfusion is not addressed, it can lead to increased blood pressure, which can have severe consequences, including various complications or even sudden death due to rising blood pressure. These complications can result in degenerative diseases such as stroke, myocardial infarction, kidney failure, encephalopathy (brain damage), and hypertensive retinopathy (Kurnia, 2020).

The management of hypertension can be categorized into pharmacological and non-pharmacological therapies. Pharmacological therapy for treating hypertension includes several classes of medications such as thiazide diuretics, adrenergics, ACE inhibitors, angiotensin II blockers, calcium antagonists, and vasodilators (Utaminingsih, 2015). While pharmacological therapy is effective in lowering blood pressure, it can cause side effects such as headaches, dizziness, fatigue, liver dysfunction, heart palpitations, and nausea (Lalage, 2019). In addition to pharmacological therapy, patients also receive non-pharmacological therapy, which involves lifestyle modifications such as quitting smoking, avoiding alcohol, reducing salt and fat intake, maintaining an ideal body weight, and engaging in physical exercise (Ferayanti, 2017).

Non-pharmacological therapy, in addition to lifestyle modification, can be complemented by the application of complementary therapies such as hydrotherapy, specifically foot immersion therapy, as a therapeutic measure to prevent the risk of ineffective peripheral perfusion (Lalage, 2019). Hydrotherapy is a treatment method that uses water to achieve therapeutic effects naturally, which can alleviate pain and is a "low-tech" therapy that relies on the body's response to water (Dilianti et al., 2017). Hydrotherapy has a relaxing effect on the body, stimulates the release of endorphins, suppresses adrenaline levels, and can lower blood pressure when performed regularly (Nurpratiwi & Novari, 2021).

One form of hydrotherapy is foot immersion in warm water, which naturally has physiological effects that can enhance blood circulation (Ferayanti et al., 2017).

Foot immersion in warm water can improve microcirculation of blood vessels and induce vasodilation. The effect of this therapy generates heat energy that dilates blood vessels, facilitating blood circulation and stimulating nerves in the feet to activate parasympathetic nerves, thus causing changes in blood pressure. The heat from hydrotherapy with warm water is used to increase blood flow to the skin by widening blood vessels, which enhances oxygen and nutrient supply to tissues, leading to improvements in the circulatory system (Wibowo & Purnamasari, 2019).

This is supported by a study by Oktavianti & Insani (2022) titled "Blood Pressure Reduction Through Warm Foot Bath Therapy in Hypertension," which found that after applying foot bath therapy at 39-40°C for 15 minutes, there was a reduction in systolic blood pressure by 12.5 mmHg and diastolic blood pressure by 10 mmHg. The statistical analysis of this study revealed a p-value of 0.0005 ($p < 0.005$), indicating a significant effect of the warm foot bath therapy on reducing blood pressure in hypertensive patients.

The Magelang Utara Health Center, located at Jalan Ahmad Yani No. 244 Kedungsari, Magelang City, is a primary health facility offering outpatient services including general health checks, dental and oral exams, maternal-child health and family planning services, immunizations, pediatric care, laboratory services, and emergency services (Dinkes Kota Magelang, 2022).

3. METHODS

This study employs a qualitative descriptive research design with a case study approach, focusing on the application of warm foot-soaking hydrotherapy to prevent the risk of ineffective peripheral perfusion in hypertensive patients. The case study approach is used to investigate and comprehensively study client problems to gain a deep understanding of hypertensive patients, aiming to address peripheral perfusion issues effectively.

The case study focuses on implementing warm foot-soaking hydrotherapy as a preventive measure for the risk of ineffective peripheral perfusion in hypertensive patients. The subjects of the study include two patients experiencing the nursing problem of a risk for ineffective peripheral perfusion. The subjects are described in terms of their biodata, medical/nursing history, including their chief complaints. This research was conducted in the working area of the North Magelang Public Health Center, Magelang City.

Peripheral perfusion measurements in this case study are guided by the *Indonesian Nursing Outcome Standards* (SLKI), which include assessments of peripheral pulse strength, skin pallor, capillary refill, extremity temperature, systolic and diastolic blood pressure, and mean arterial pressure. These parameters are used to document the outcomes of the intervention.

4. RESULTS

The case study was conducted in the working area of the Magelang Utara Health Center, Magelang City. The Magelang Utara Health Center oversees four auxiliary health centers, namely Kramat Utara, Kramat Selatan, Potrobangsan, and Wates Auxiliary Health Centers. It provides outpatient medical services, including general check-ups, dental and oral examinations, maternal and child health (MCH)/family planning (FP) and immunization, child and IMCI (Integrated Management of Childhood Illness) examinations, laboratory services, and emergency services (Magelang City Health Office, 2022). The research for this case study was carried out at the Magelang Utara Main Health Center, located at Jalan Ahmad Yani No. 244 Kedungsari, Magelang City.

In 2024, there were 1,800 cases of hypertension recorded in the top 20 Non-Communicable Diseases at the health center, making it the third most common condition. In June, there were 253 hypertension patients visiting the health center. The study involved two respondents with family hypertension issues within the working area of the Magelang Utara Health Center. The respondents were selected based on inclusion criteria defined by the researchers, detailed in Table 1.

Table 1. Inclusion Criteria Assessment Results

No	Inclusion Criteria	Mrs. S	Mrs. I
1	Diagnosed with hypertension	√	√
2	Lives with family	√	√
3	Aged ≥ 45 years	√	√
4	No wounds on feet	√	√
5	Regularly visits the health center	√	√
6	Takes antihypertensive medication regularly	√	√
7	Willing to participate as respondents	√	√

Both respondents met the inclusion criteria and were selected as subjects for the case study. The nursing assessments for both respondents are summarized in Table 2.

Table 2. Nursing Assessment Results

Assessment	Mr. S	Mr. I
Gender	Female	Female
Age	68 years old	74 years old
Address	Pajangan	Ngembik Lor
Occupation	Homemaker	Homemaker
Ethnicity	Javanese	Javanese
Religion	Islam	Islam
Education	Elementary School	Elementary School
Family Composition	Lives with two children, their spouses, and two grandchildren.	Lives with her eighth child, their spouse, and a grandchild.
Family Type	Kin-Network Family	Kin-Network Family
Family Development	Stage VI (family with adult children)	Stage VI (family with adult children)
Medical History	No hereditary diseases	Hypertension history from parents

Medical Therapy

Both respondents received Amlodipine 10 mg once daily orally to control blood pressure. They adhered to the medication regimen every evening.

Table 3. Identification of Peripheral Perfusion Issues

No	Peripheral Perfusion Problem	Mrs. S	Mrs. I
1	Decreased peripheral pulse strength	√	√
2	Pale skin		√
3	Capillary refill time (CRT) > 2 seconds	√	√
4	Cool extremities		√
5	Increased systolic blood pressure	√	√
6	Increased diastolic blood pressure	√	√
7	Increased mean arterial pressure	√	√
8	Decreased skin turgor		√

The analysis revealed that both respondents were at risk of ineffective peripheral perfusion due to hypertension, with 62% criteria met.

Condition After Treatment

Evaluations were conducted after each session of warm water foot soak hydrotherapy. The final evaluations for both patients, Mrs. S and Mrs. I, were carried out on April 20, 2024. The purpose of these evaluations was to assess the effectiveness of warm water foot soak hydrotherapy in reducing the risk of ineffective peripheral perfusion in hypertensive patients. Observations focused on outcomes related to the risk of ineffective peripheral perfusion, as detailed in the following tables:

Table 4. Peripheral Perfusion Observations for Mrs. S

Peripheral Perfusion	**Day 1**	**Day 2**	**Day 3**
	Pre	Post	Pre
Peripheral Pulse Strength:			
Radial	60	68	74
Brachial	62	70	70
Posterior Tibial	58	62	52
Dorsalis Pedis	60	62	68
Systolic Blood Pressure (mmHg)	141	139	130
Diastolic Blood Pressure (mmHg)	79	78	80
Mean Arterial Pressure (mmHg)	99	98	97
Capillary Refill Time (CRT)	4 s	3 s	3 s

In Mrs. S, improvements were observed in peripheral pulse strength, reduced systolic and diastolic blood pressure, a decrease in mean arterial pressure, and improved capillary refill time (<2 seconds).

Table 5. Peripheral Perfusion Observations for Mrs. I

Peripheral Perfusion	**Day 1**	**Day 2**	**Day 3**
	Pre	Post	Pre
Peripheral Pulse Strength:			
Radial	68	78	76
Brachial	64	68	74
Posterior Tibial	64	64	60
Dorsalis Pedis	62	68	62
Systolic Blood Pressure (mmHg)	140	131	140
Diastolic Blood Pressure (mmHg)	90	91	90
Mean Arterial Pressure (mmHg)	110	104	110
Capillary Refill Time (CRT)	3 s	2 s	3 s

In Mrs. I, improvements were similarly observed, with increased peripheral pulse strength, reduced systolic and diastolic blood pressure, decreased mean arterial pressure, and improved capillary refill time (<2 seconds).

Table 6. Peripheral Perfusion Analysis

No	**Indicator**	**Mrs. S (Pre-Post)**	**Mrs. I (Pre-Post)**
1	Peripheral Pulse Strength	$2 \rightarrow 4$	$2 \rightarrow 4$
2	Systolic Blood Pressure	$1 \rightarrow 4$	$1 \rightarrow 4$
3	Diastolic Blood Pressure	$1 \rightarrow 5$	$1 \rightarrow 5$
4	Mean Arterial Pressure	$3 \rightarrow 4$	$2 \rightarrow 4$
5	Capillary Refill Time	$1 \rightarrow 5$	$2 \rightarrow 5$

Description:

1 : Decreased

2 : Slightly Decreased

3 : Moderate

4 : Slightly Increased

5 : Increased

The application of warm water foot soak hydrotherapy effectively reduced the risk of ineffective peripheral perfusion in hypertensive patients over three consecutive days. Improvements included increased peripheral pulse strength, reduced blood pressure, decreased mean arterial pressure, and improved capillary refill time (<2 seconds). Warm water foot soak therapy is concluded to be effective in addressing the risk of ineffective peripheral perfusion in hypertensive patients.

5. DISCUSSION

The study found that both respondents were female. Women are more prone to hypertension, influenced by estrogen levels. Estrogen decreases as women enter menopause, leading to vascular constriction and elevated blood pressure, making them more susceptible to hypertension (Kusumawati et al., 2016).

The comprehensive nursing assessments highlighted the family composition, development stage, and health history of each respondent, providing valuable context for understanding their individual risk factors and needs. Respondent 2, with a family history of hypertension, demonstrated a potential genetic predisposition, further emphasizing the importance of effective preventive measures like hydrotherapy.

The ages of the two respondents were 68 and 74 years. Age is a significant factor influencing hypertension. As individuals age, the regulation of calcium metabolism becomes impaired, leading to increased calcium levels in the blood (hypercalcemia), which results in thicker blood. Calcium deposits in blood vessel walls (atherosclerosis) cause vessel narrowing, thereby increasing blood pressure. Aging also reduces arterial elasticity; arteries become less flexible and more rigid, which diminishes blood flow volume. This condition is exacerbated by atherosclerosis, further raising blood pressure (Muhamadun, 2010).

Both respondents belonged to kin-network families, characterized by multiple families living together and sharing resources. The number of family members living with hypertensive clients influences their recovery process, as more family members provide support, care, and attention to aid the client's recovery (Sulistyana, 2017). Family support for both respondents involved fulfilling the five family health maintenance tasks.

The family developmental stage of both respondents was Stage VI (families with adult children). The role of their children significantly influenced family dynamics, particularly in decision-making and focusing attention on the ill family members. The children of Ny. S and Ny. I regularly accompanied them for monthly check-ups at the health center.

Data collection was conducted by observing peripheral perfusion before and after the application of warm foot soak hydrotherapy. Indicators of the risk of ineffective peripheral perfusion included capillary refill time (CRT) > 2 seconds, decreased peripheral pulse, increased blood pressure, pale skin color, cold extremities, reduced skin turgor, and increased arterial pressure (SLKI DPP PPNI Task Force, 2018). These indicators were observed in both respondents, Ny. S and Ny. I, who experienced hypertension. Before hydrotherapy was applied, the assessment showed reduced peripheral pulse strength, increased systolic and diastolic blood pressure, increased mean arterial pressure, and CRT > 2 seconds.

The researcher applied non-pharmacological circulation therapy using warm foot soak hydrotherapy for both respondents. Hydrotherapy is a treatment method utilizing water to achieve natural therapeutic effects, alleviate pain, and is a “low-tech” therapy approach that relies on the body’s response to water (Dilianti et al., 2017).

Hydrotherapy has a relaxing effect, stimulating the release of endorphins and suppressing adrenaline production (Nurpratiwi & Novari, 2021). Warm foot soaking naturally improves blood microcirculation and induces vasodilation. This therapy produces heat energy, which dilates blood vessels, improves circulation, and stimulates nerves in the feet to activate the parasympathetic nervous system, thereby lowering blood pressure. Heat conduction from the warm water to the body causes vasodilation and reduces muscle tension (Wibowo & Purnamasari, 2019).

The application utilized warm water, which has physiological effects such as increasing skin blood flow by dilating blood vessels during vessel stiffness. This process enhances oxygen and nutrient supply to tissues, improving the circulatory system. The tools used included a sphygmomanometer, water thermometer, towels to cover the feet during soaking (effective in maintaining water temperature due to their wide and thick surface), and a basin as a container for the warm water and foot soaking. The basin’s wide surface ensured comfort for the feet (Wibowo & Purnamasari, 2019).

Soaking feet at a temperature of 39-40°C for 15-20 minutes proved effective in influencing blood vessels, facilitating vasodilation (Wibowo & Purnamasari, 2019). The intervention was performed for three consecutive days, with one session daily. Research by Imam et al. (2023) indicated that warm foot soak therapy over three days effectively lowered blood pressure in hypertensive patients.

The hydrotherapy intervention was carried out for three consecutive days, with one session daily lasting 15-20 minutes at a temperature of 39-40°C. The results were evaluated daily after implementation. Data collection included observing peripheral perfusion before

and after hydrotherapy, measuring peripheral pulse strength, systolic and diastolic blood pressure, mean arterial pressure, and CRT. The application of warm foot soak hydrotherapy demonstrated its influence in reducing the risk of ineffective peripheral perfusion. Therefore, warm foot soak hydrotherapy can be utilized as a non-pharmacological therapy for hypertensive patients to prevent the risk of ineffective peripheral perfusion.

The interventions provided showed significant changes before and after the application of warm foot soak hydrotherapy. For Ny. S, before the intervention, her blood pressure was 141/79 mmHg, with a radial pulse of 60 beats/min, brachial pulse of 62 beats/min, posterior tibial pulse of 58 beats/min, dorsalis pedis pulse of 60 beats/min, mean arterial pressure of 99, and CRT of 4 seconds. After the intervention, her blood pressure decreased to 139/78 mmHg, radial pulse increased to 68 beats/min, brachial pulse to 70 beats/min, posterior tibial pulse to 62 beats/min, dorsalis pedis pulse to 62 beats/min, mean arterial pressure to 98, and CRT to 3 seconds.

For Ny. I, before the intervention, her blood pressure was 140/90 mmHg, with a radial pulse of 68 beats/min, brachial pulse of 64 beats/min, posterior tibial pulse of 64 beats/min, dorsalis pedis pulse of 62 beats/min, mean arterial pressure of 110, and CRT of 3 seconds. After the intervention, her blood pressure decreased to 131/91 mmHg, radial pulse increased to 78 beats/min, brachial pulse to 68 beats/min, posterior tibial pulse to 64 beats/min, dorsalis pedis pulse to 68 beats/min, mean arterial pressure to 104, and CRT to less than 2 seconds.

The application of warm foot soak hydrotherapy is one of the non-pharmacological treatments that can be used for hypertensive patients to improve blood circulation, reduce blood pressure, promote relaxation, and increase capillary permeability, thereby preventing the risk of ineffective peripheral perfusion (Dilianti et al., 2017). Hydrotherapy is a form of therapy that uses warm water as a modality. Water is an ideal medium for recovery, and scientifically, warm water has physiological effects on the body, such as relaxation of joints and improved blood circulation (Kusumawati et al., 2018). Hydrotherapy has a relaxing effect on the body, stimulating the release of endorphins and suppressing adrenaline (Nurpratiwi & Novari, 2021).

Soaking feet in warm water naturally improves blood vessel microcirculation and induces vasodilation. The effect of this therapy generates heat energy that dilates blood vessels and promotes blood circulation, also stimulating nerves in the feet to activate the parasympathetic nervous system, leading to changes in blood pressure. The heat from the warm water in hydrotherapy is used to enhance blood flow to the skin by dilating blood

vessels, especially when the vessels are stiff, which increases oxygen and nutrient supply to the tissues and improves the blood circulation system (Wibowo & Purnamasari, 2019).

The warm foot soak hydrotherapy was administered for three consecutive days, with one session per day lasting 15-20 minutes, and the water temperature ranged between 39-40°C. The results were evaluated daily after implementation. Before the therapy, the clients' blood pressure was measured. The implementation was supervised by the researcher each day.

Research supporting the case study of warm foot soak hydrotherapy application includes a study by Imam et al. (2023), where this therapy was applied to two hypertensive respondents. The results showed a decrease in blood pressure in both respondents, with the average blood pressure reduction before and after the hydrotherapy foot soak being 7/3 mmHg for the first respondent and 5/5 mmHg for the second respondent. This suggests that warm foot soak therapy can help lower blood pressure in hypertensive patients.

The evaluation of the development of the ineffective peripheral perfusion risk problem in this case study was assessed using an observation sheet for ineffective peripheral perfusion before and after the application of warm foot soak hydrotherapy, referring to the SLKI 2019 guidelines. Peripheral perfusion refers to the inadequate blood flow in distal blood vessels to support tissue function. The researcher assessed the success of the warm foot soak hydrotherapy intervention using peripheral perfusion outcomes (SLKI DPP PPNI Task Force, 2019).

The peripheral perfusion of both respondents in this case study showed improvement, which means that peripheral perfusion increased after the warm foot soak therapy was applied. Thus, it can be concluded that warm foot soak hydrotherapy is effective in addressing the issue of ineffective peripheral perfusion in hypertensive patients. The application of this therapy was effective in improving ineffective peripheral perfusion, as evidenced by the reduction in blood pressure, increased peripheral pulse strength, improved capillary refill time, and decreased mean arterial pressure.

Hypertension will continue to emerge if the therapy provided by the client is irregular. As we know, hypertension is a chronic condition that cannot be cured but can only be controlled to maintain normal blood pressure. Therefore, it must be accompanied by lifestyle changes towards a healthier way of life (Ulinnuha, 2018). This requires the willingness of family members to provide independent care and treatment for a family member suffering from hypertension. Family support is essential, especially in the care of the client.

Significant family support has an impact on the healing process for hypertensive patients. The family serves as the primary support in maintaining health and plays a role in providing health care practices, such as caring for a sick family member. Family members require support as it makes the client feel valued and cared for (Friedman, 2010).

Family support is provided by performing the five family tasks in health care maintenance (Friedman & Bowdan in Salamung, 2021). This was proven with both respondents, Ny. S and Ny. I, whose families were familiar with hypertension and could recognize its signs and symptoms. The families were able to make decisions, such as bringing the client to the health center for monthly checkups.

The families were capable of taking care of their hypertensive relatives by following a low-sodium diet and applying warm foot soak hydrotherapy. They also maintained a healthy home environment by ensuring cleanliness and comfort. The clients' living environments appeared neat, comfortable, and clean. The family also utilized health facilities, such as the Puskesmas Magelang Utara, for the client's regular monthly check-ups, and the client had BPJS health insurance coverage.

The observation of peripheral perfusion criteria was based on standard outcome criteria. The results obtained by the researcher for both respondents, Ny. S and Ny. I, included increased peripheral pulse strength, with improvements of 2 beats for both respondents. The systolic blood pressure improved by a decrease of 3 points, and the diastolic blood pressure improved by a decrease of 4 points. The mean arterial pressure for client 1 improved by a decrease of 1 point and for client 2, it decreased by 2 points. Capillary refill time (CRT) improved in client 1 with a decrease of 4 seconds and in client 2 with a decrease of 3 seconds. The analysis of the results for both respondents can be concluded that the warm foot soak hydrotherapy can reduce the risk of ineffective peripheral perfusion.

However, the results for peripheral perfusion in this study were not as optimal, as there were challenges during the implementation. First, the researcher had difficulty adjusting the schedule with the respondents, as they often had religious activities outside their village. On one occasion, the respondent was in a hurry to attend a religious gathering, which led to the intervention being less than optimal.

A study by Oktavianti & Insani (2022) showed that the intervention resulted in a reduction of systolic blood pressure by 12.5 mmHg and diastolic blood pressure by 10 mmHg. A paired T-Test resulted in a p-value of 0.0005 ($p < 0.005$), indicating a significant effect of the warm foot soak therapy on reducing blood pressure in hypertensive patients.

6. CONCLUSION

The results of the study show that the application of warm foot soak hydrotherapy can reduce the risk of ineffective peripheral perfusion, thereby preventing the occurrence of this problem. The family has been able to perform one of the five family tasks, which is caring for a family member in addressing the risk of ineffective peripheral perfusion in hypertension through the application of warm foot soak hydrotherapy.

7. LIMITATION

This study has several limitations that should be considered to improve the validity and generalizability of the findings. First, the sample size used is limited, involving only two respondents, Mrs. S and Mrs. I. This small sample size restricts the ability to apply the findings to a larger population. Therefore, further research with a larger number of respondents is needed to confirm the results obtained. Additionally, this study did not consider external factors that could influence the results, such as the environmental conditions at the research site or psychological factors of the respondents that may have affected their comfort or response to the therapy. For instance, levels of anxiety or stress experienced by the individuals could have impacted the effectiveness of the therapy provided.

The intervention duration, which was only for 3 consecutive days with 15-20 minutes per session, is also a limitation. Although this duration is sufficient to observe short-term changes in blood pressure and peripheral perfusion, it does not provide information on the long-term effects of warm water foot hydrotherapy. Research involving a longer intervention period and further follow-up would provide a clearer picture of the long-term effects of this therapy. Moreover, peripheral perfusion was only measured using specific physical indicators such as blood pressure, pulse rate, and capillary refill time. While these indicators are relevant, this method of measurement does not fully capture the condition of peripheral perfusion, which could be influenced by other factors not assessed in this study.

Another limitation is the lack of a comparison between the application of warm water foot hydrotherapy and other management methods, both non-pharmacological and pharmacological, which limits the ability to assess the effectiveness of this therapy relative to other methods in managing hypertension and the risk of ineffective peripheral perfusion.

Lastly, this study did not conduct further evaluation to assess changes in blood pressure and peripheral perfusion after the intervention. Longer follow-up would allow the researcher to evaluate whether the reduction in blood pressure and improvement in peripheral perfusion recorded can be sustained in the long term. To improve the quality of this research,

future studies should involve a larger sample size, stricter control of external variables, and measurements conducted over a longer period to assess the effectiveness of warm water foot hydrotherapy in managing hypertension and improving peripheral perfusion.

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