

Differences in the Effect of *Ankle Pumping* and *Kinesio Taping* on *Pitting Oedema* in Hypertensive Patients

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Submission : 2025-03-06; Accepted : 2025-03-12 ; Published : 2025-06-01

ABSTRACT

Introduction: Hypertension is the first cause of death in the world and the fifth leading cause of death in Indonesia. The Special Region of Yogyakarta (DIY) ranks as the fourth province with the highest prevalence of hypertension. A consistent increase in blood pressure is known as hypertension. One method of controlling hypertension is the consumption of *amlodipine*, a drug that increases capillary hydrostatic pressure and functions as an antihypertensive agent. This study aims to determine the difference in the effect of *ankle pumping* and *kinesio taping* on *pitting oedema* in hypertensive patients. **Methods:** This study is a *quasi-experimental* study with a *pretest and posttest two group design*. This study compares the treatment groups given *ankle pumping* and *kinesio taping*. Before treatment, both sample groups measured *pitting oedema* using a modified oedema ruler. Sampling in this study used *purposive sampling* technique. The data processing method in this study was descriptive analysis on age, body mass index (BMI), and pre and post *pitting oedema* values. Normality test using *sahiro wilk* test, hypothesis testing to test the difference between two groups using *wilcoxon signed-ranks* test and *mann whitney* test. **Results:** The results of pre and post values in groups 1 and 2 showed changes from degrees II and III down to degrees I and II. The sig value of $p = 0.000$ in *ankle pumping* exercises which means it can reduce *pitting oedema*, for a p value = 0.083 which means that in the installation of *kinesio taping* there is no decrease in *pitting oedema*. **Conclusion:** There is a difference in the effect of ankle pumping and kinesio taping on pitting oedema in hypertensive patients.

Keywords: *hypertension, pitting oedema, ankle pumping, kinesio taping*

ISSN 2722 – 9610
 E –ISSN 2722 - 9629

INTRODUCTION

Hypertension is the number one cause of death in the world and the fifth leading cause of death in Indonesia. Hypertension is a condition of chronically elevated blood pressure. If left untreated, hypertension can interfere with the function of other organs, such as the heart and kidneys. Hypertension is a degenerative disease (Wulandari *et al.*, 2023). The criteria for hypertension in the 2003 JNC VII diagnosis, namely with the results of systolic blood pressure measurements ≥ 140 mmHg with diastolic ≥ 90 mmHg. The risk of hypertension increases with age and is mostly suffered by the elderly. Risk factors such as age, gender, family history, high salt content, and lifestyle habits (e.g. smoking and

alcohol consumption) can cause blood pressure (Wirakhmi & Novitasari, 2021).

According to the World Health Organisation (WHO), around 972 million people in the world or 26.4% suffer from hypertension, and will increase to 29.2% by 2025. According to the Basic Health Research (Riskesdas, 2023), the prevalence of hypertension in Indonesia is 30.8%. Special Region of Yogyakarta, the prevalence of hypertension based on Basic Health Research data (Riskesdas, 2018) reached 32.86%, with a higher percentage in women (36.8%) and men (31.34%) (Rosmawati *et al.*, 2024)

The Special Region of Yogyakarta is the fourth province with the highest prevalence of hypertension in Indonesia (Dinas Kesehatan D. I.



Yogyakarta, 2022). The prevalence of hypertension in Sleman is close to the national figure of 34.11% (Somantri, 2022). Based on preliminary studies that have been conducted by researchers at Puskesmas Tempel 1, there are 399 hypertension patients who consume amlodipine. The results of the preliminary study the author obtained a place and research data at Posyandu Mawar Ngebong, Karanggawang, and Domban in the environment of Puskemas Tempel 1, Kabupaten Sleman.

Increased blood pressure in patients with hypertension is influenced by an unhealthy lifestyle. Lack of healthy behaviours, such as lack of exercise, smoking, and bad living habits, are the main risk factors for hypertension (Moonti et al., 2023). If not treated immediately and only left untreated, it will give complications. Hypertension increases the risk of diseases such as heart disease, kidney failure, diabetes mellitus, and stroke (Lukitaningtyas & Cahyono, 2023).

Efforts to overcome hypertension include pharmacological and non-pharmacological therapies (Handono, 2024). Pharmacological therapy is more widely used because it is faster in reducing hypertension. Amlodipine is one of the drugs prescribed to lower blood pressure. This drug works as an antihypertensive agent through the mechanism of action of Calcium Channel Blocker (CCB), which prevents the entry of calcium into the walls of blood vessels and heart cells. The use of amlodipine is generally restricted as it may cause oedema.

Pitting oedema that occurs due to amlodipine administration is caused by an increase in capillary hydrostatic pressure. Amlodipine has greater vasodilatory properties in arterioles, resulting in an increase in hydrostatic pressure in the precapillary and fluid transfer to the interstitial compartment (Tiyas & Hidayat, 2021). Pitting oedema is a pathophysiological condition characterised by fluid accumulation in the interstitial space due to an imbalance of hydrostatic and osmotic pressures. The mechanism involves increased capillary hydrostatic pressure, decreased plasma oncotic pressure, increased capillary permeability and lymphatic system dysfunction. The use of antihypertensive drugs such as amlodipine may

exacerbate this condition through its vasodilatory effect which increases capillary hydrostatic pressure (Tiyas, 2021).

Physiotherapy plays a role in the non-pharmacological management of hypertension by providing interventions to reduce pitting oedema from the effects of amlodipine consumption with several exercises, one of which is ankle pumping exercise and kinesio taping.

Ankle pumping exercises on the ankle are useful for muscle contraction which causes intracellular fluid to re-enter the blood vessels of the heart. Based on this mechanism, oedema will decrease and improve blood circulation. This exercise can be combined with a foot elevation position that utilises gravity techniques that increase circulatory flow, so that fluid in the interstitium will return to the veins so that oedema is reduced (Indah et al., 2024). Ankle pump exercises can help improve blood circulation in the distal area, increase blood flow, and reduce swelling (Kartikasari et al., 2024).

Kinesio taping is useful for providing stabilisation of human organs used in carrying out activities. This taping is used to help limit joint motion, reduce pain and inflammation (Yuliawan & Setiawan, 2019). Taping can provide comfort to the patient, allowing a wider range of joint motion due to its inherent elasticity (Karakoyun et al., 2024). Although taping is commonly applied in the management of sports injuries, the authors are interested in providing kinesio taping interventions against crab oedema.

METHODS

This study was *quasi-experimental* using a *pretest and posttest two group design* by comparing the treatment groups given *ankle pumping* and *kinesio taping*. Before treatment, both sample groups measured *pitting oedema* with a modified oedema ruler. The population in this study were hypertensive patients who consumed *amlodipine* in the Puskesmas Tempel 1 environment, totalling 65 patients in three posyandu, namely Posyandu Mawar Ngebong, Karanggawang, and Domban. Sampling in this study using *purposive sampling* technique is a sample determination technique by selecting samples among the population in accordance with



the inclusion and exclusion criteria. The sample must meet the inclusion criteria. The inclusion criteria in this study are as follows: respondents who are registered at the posyandu, respondents who have hypertension criteria with consumption of *amlodipine* drugs at a dose of 10mg / day within a period of 6 months, respondents aged 45-70 years, and respondents who are female. Exclusion criteria are as follows: pregnant women, ankle injuries, and fractures of the lower extremities. The sample totalled 32 which were divided into 2 groups by the researcher. The sample was determined through a series of *assessment* processes and measuring *pitting oedema* using a modified oedema ruler so that it represented the population.

The division of groups in the sample is taking a lottery with the aim of taking randomly which allows each subject to get the same treatment. Group 1 was given *ankle pumping* exercises while group 2 was given *kinesio taping*. Before treatment, the sample was first measured for *oedema pits* using a modified oedema ruler. *Ankle pumping* exercises in group 1 were performed 2-3 times for 7 days and *kinesio taping* 3 times for 7 meetings. After the treatment was given to group 1 and group 2, the measurement of *piting oedema* was carried out again to determine the impact before and after the intervention given.

The data processing method in this study is descriptive analysis of age, BMI, and pre and post *pitting oedema* values. Normality test to find out whether the independent and dependent variables are normally distributed or not using the *Saphiro Wilk Test*. Homogeneity test was conducted with *lavene's test*. Hypothesis testing in this study is to test the difference between 2 groups. If the data is not normal then tested with *Mann-whitney*, if the data is normal then tested with *Independent sample t-test*. This data analysis uses the SPSS computer programme.

This research was conducted after the issuance of an Ethical Certificate Universitas 'Aisyiyah Yogyakarta Number: 4168/KEP-UNISA/I/2025.

RESULTS

Sample Characteristics

The research samples obtained can be described several characteristics of the research sample including age, Body Mass Index (BMI), and pre and post *piting oedema* values as follows:

Table 1. Age of Respondents

Age	Frequenc y	Percentage (%)
55-65 Years	17	53,1
>65 Years	15	46,9
Total	32	100

Based on table 1, the age criteria in this study, respondents aged 55-65 years had a percentage of 53.1% and respondents aged > 65 years had a percentage of 46.9%.

Table 2. BMI of Respondents

IMT	Frequency	Percentage (%)
Skinny	4	12,5
Normal	8	25
Obesity	20	62,5
Total	32	100

In Table 2, the sample criteria based on body mass index were mostly obese with a percentage of 62.5%.

Table 3. Pre *pitting oedema* score

Group	Degrees	Frequency	Percentage (%)
1	II	13	81,3
	III	3	18,8
2	II	15	93,3
	III	1	6,3

Table 4. Post *pitting* values

Group	Degrees	Frequency	Percentage (%)
1	I	13	81,3
	II	3	18,8
2	I	5	31,3
	II	11	68,8

Based on tables 3 and 4, the pre and post *piting oedema* values are different with pre *piting oedema* values interpreted as degrees II and III in groups 1 and 2, while the post *piting odema*



interpretation values decrease to degrees I and II in groups 1 and 2.

Normality Test

Table 5. Normality Test

	Kelompok	Sig	Keterangan
Pre Piting Oedema	Kelompok 1	0,000	Tidak Normal
	Kelompok 2	0,000	Tidak Normal
Post Piting Oedema	Kelompok 1	0,000	Tidak Normal
	Kelompok 2	0,000	Tidak Normal

The results of the distribution normality test are shown in table 5 above, Group 1 who performed ankle pumping exercises before the intervention had $p=0.000$ ($p<0.05$), which means the data was not normally distributed and group 2 who performed kinesio taping before the intervention had $p=0.000$ ($p<0.05$) which means the data was not normally distributed and after the intervention so that the test for the hypothesis used the Wilcoxon signed rank test.

Homogeneity Test

Table 6. Homogeneity Test

	Variables	Mean	Sig
PrePitting Oedema	Group 1	17,50	0,564
	Group 2	15,50	
Post Pitting Oedema	Group 1	11,00	0,015
	Group 2	22,00	

The results of Levene's test for homogeneity showed that groups 1 and 2 were

homogeneous with a pitting oedema value before intervention of 0.032 with $p>0.05$ and 0.117 after intervention, respectively.

Hypothesis Test 1 and 2

Table 7. Wilcoxon signed ranks test

Variables	Sig	Mean
Pre Kel 1 and Post Kel 1	0,000	8,50
Pre Kel 2 and Post Kel 2	0,083	2,00

Hypertensive patients who consume amlodipine before and after the intervention, there is a significant effect of ankle pumping exercise on reducing pitting oedema. From the test results obtained $p=0.000$ which means $p<0.05$, so H_a is accepted and H_o is rejected. The test obtained $p=0.083$ means $p>0.05$ so that H_a is rejected and H_o is accepted. It can be concluded that there is no significant effect on the installation of kinesio taping on reducing pitting oedema in hypertensive patients who take amlodipine before and after the intervention.

Hypothesis Test 3

Table 8. Mann Whitney test

Variabel	Sig.	Keterangan
Pre Pitting Oedema	0,032	Homogen
Post Pitting Oedema	0,117	Homogen



The distribution of data both in the measurement of pitting oedema before and after the intervention was not normal, hypothesis test 3 using mann whitney showed that the distribution of data in groups 1 and 2 was not normal. This test aims to compare pitting oedema after intervention in group 1 and group 2, because the data is homogeneous or has the same population variance, so the values are compared from group 1 and group 2. The results show that there is a statically significant difference between the two groups, with a value of $p=0.015$.

DISCUSSION

The sample in this study was female. In general, women have higher estrogen levels than men. The hormone *oestrogen* can affect fluid retention in the body, thus increasing *pitting oedema*. Hormonal changes during the menstrual cycle can exacerbate the condition. Women are at risk of having a higher percentage of body fat than men. fat tissue stores more fluid which has contributed to the risk of *pitting oedema* (Gerds *et al.*, 2022). In addition, the discussion of sample distribution based on sample characteristics is as follows:

Characteristics of Respondents Based on Age

This study is in line with (Aisya *et al.*, 2023) which explains that respondents with age >56 years are more at risk of suffering from hypertension than <56 . This is in accordance with the theory that says that above 55 years, the artery wall will experience thickening due to the accumulation of callogen substances in the muscle layer so that the blood vessels will narrow.

Age is a factor that greatly influences hypertension because with increasing age, the higher the risk of hypertension. The cause is influenced by natural changes in the body that affect the heart, blood vessels, and hormones (Lukitaningtyas & Cahyono. , 2023) Along with age, the left ventricular wall and corpus callosum thicken and the elasticity of blood vessels decreases (Tasalina Y. P. *et al.*, 2024). From this study it can be concluded that a person aged 55 years and over has biological, physical, and mental changes that are prone to various diseases. Physical conditions that are susceptible to various diseases due

to lack of endurance in the face of external influences, because of this can be attacked by various diseases.

Characteristics of Respondents Based on Body Mass Index (BMI)

This study is in line with (Astuti *et al.*, 2021) which explains obesity is the main risk of hypertension. A person who is overweight is 1.99 times more likely to suffer from hypertension. This is because body mass index (BMI) is a measurement of obesity. Excess weight or obesity is one of the risk factors for hypertension, considered to be an independent factor which means it is not influenced by other risk factors. Obesity can occur due to an imbalance between energy intake that the body stores in the form of fat. A bad lifestyle is one of the factors for someone experiencing obesity (Tiara, 2020).

The mechanisms involved in obesity to hypertension involve sympathetic activity of the nervous system and renin angiotensin aldosterone as well as the occurrence of endothelial dysfunction and abnormalities in renal function which greatly affect the onset of hypertension and in obesity there is a decrease in peripheral resistance while sympathetic nerves increase (Rahmadhani, 2021). From several existing studies and the condition of patients at the research site, it can be concluded by researchers that obesity is a major factor in the occurrence of hypertension. Obesity increases the risk of hypertension from several mechanisms with an increase in blood volume and an increase in sympathetic nerves that worsen the body's metabolism so that other diseases occur such as cholesterol and diabetes.

Characteristics of Respondents Based on Pre and Post Pitting Oedema Values

Pre and post pitting oedema values with intervention treatment of 2 groups, namely group 1 with ankle pumping exercises and group 2 with kinesio taping. From the interventions given, there are differences in results, namely ankle pumping exercises are more effective than kinesio taping. This happens because there are differences in exercise doses and factors that affect age and BMI. In ankle pumping, the exercises given are combined with 30 ° foot elevation, can be done independently without supervision after providing education to patients and families. This is in line with research (Jafar & Budi, 2023) which explains that ankle pumping exercise is



one of the efforts to reduce crab oedema. This exercise aims to improve blood circulation, an effective step because it will cause a muscle pump effect so as to encourage extracellular fluid to enter the blood vessels and return to the heart. Ankle movement can restore blood circulation from the distal part. In research (manawan & Rosa, 2021) explains the mechanism in increasing nervous system regulation in reducing pitting oedema. Muscle contractions that utilise blood vessels in muscle contractions to improve nervous system regulation and 30° foot elevation that utilises the gravity system.

Group 2 was given an intervention with kinesiio taping. In this study, the installation of kinesiio taping pre and post values had changes and no changes. Pre degree II value 15 patients and degree III 1 patient. After the intervention was carried out, the II value of 11 patients with 10 patients remained at the second degree value, while 1 patient experienced a decrease in value from degree III to degree II, and the value in degree I was 5 patients. From the results of pre and post values on the installation of kinesiio taping which decreased pitting odema there were 6 patients and 10 patients there was no decrease in piting oedema.

The difference in the effect of changes in pre and post degree values is in age and body mass index. There were 10 patients who did not experience a decrease in pitting oedema with an age range of 55-65 years and a body mass index in the obese category. This is explained in research (Nayanti et al., 2020) 55-65 years of age experience a decrease in skin elasticity which affects the effectiveness of kinesiio taping and its adhesion, lymphatic system function and blood circulation which decreases at that age which affects the body's ability to reduce excess fluid.

Research (Gufron et al., 2022) explains in patients with the obese category there is no effect of kinesiio taping because excessive fat distribution can interfere with the effectiveness of kinesiio taping. Fat accumulation changes the structure of the tissue under the skin which affects the flow of lymphatic fluid, which slows down fluid flow and can worsen pitting oedema.

In Hypothesis 1, the test results show that there is an effect of ankle pumping exercises on reducing pitting oedema in hypertensive patients who consume amlodipine drugs. The results of this study are supported by research (Manawan & Rosa, 2021) with effective ankle pumping exercises to reduce pitting

oedema because it will cause a muscle pump effect so that it will encourage extracellular fluid to enter the blood vessels and return to the heart. The pumping movement of the is able to re-accelerate blood circulation from the distal part. This can result in reduced swelling due to smooth blood circulation. ankle pumping exercises should be done in combination with elevation. Elevation of the foot utilises gravity by increasing venous return by reducing pressure on the veins to reduce oedema pits. Elevating the foot or elevation 30 ° higher than the position of the heart so that blood flows back to the heart which results in an increase and reduces pressure in the veins and increases backflow to the heart. (Kartikasari et al., 2024)

The physiological mechanism of ankle pumping to reduce pitting oedema is the activation of the muscle pump that contracts the gastrocnemius muscle, in this ankle pumping movement pushes venous blood and lymphatic fluid upwards through blood vessels and lymphatic channels. Increased venous return increases the flow of blood from the legs back to the heart. With this movement can help capillary permeability so that it helps prevent fluid leakage into the tissue and prevent pitting oedema (Prima JK et al., 2019)

Hypothesis 2 test there is no effect of kinesiio taping on reducing pitting oedema in hypertensive patients who consume amlodipine drugs. The results of this study are supported by research (Yulianawan & Setiawan, 2019) on the basis that kinesiio taping provides injury protection and rehabilitation. Kinesiio taping is used to help muscle performance, help limit joint motion, reduce injury recovery time, and reduce pain and inflammation and swelling. Kinesiio taping aims to pull the skin layer which allows space between the dermis and muscles to relieve pressure on lymphatics and blood vessels and improve lymphatic drainage in the ankle area (Daris et al., 2021). In future studies it is important to conduct periodic evaluations of the effectiveness of kinesiio taping.

In hypothesis test 3 there are differences in the effect of the interventions given. According to the author of the research that has been carried out within 7 days, the results show that the more effective exercise performed by pitting oedema patients who take omolodipine is ankle pumping exercise combined with 30 ° foot elevation in group 1 performed 2-3



times for 7 days because ankle pumping exercises are done actively to contract the gastrocnemius muscle with down and up ankle movements and 30 ° foot elevation with the mechanism of returning blood circulation from the foot back to the heart. Kinesio taping was applied to group 2 with a dose of 3 meetings for 7 days. With the installation of kinesio taping, it is less effective in pitting oedema patients because kinesio taping only helps stabilise by applying pressure. In this condition there is a buildup of fluid not caused by injury or inflammation but from problems with the lymphatic system and blood flow circulation.

CONCLUSIONS

The results showed that ankle pumping exercise had a significant effect in reducing pitting oedema in hypertensive patients with a test result of $p=0.000$ which means $p<0.05$. This effectiveness indicates that ankle pumping is able to reduce fluid accumulation in the patient's lower extremities. In contrast, kinesio taping did not show a significant effect on reducing pitting oedema with a test obtained $p=0.083$, meaning $p>0.05$. This is thought to be because kinesio taping is more effective in stabilising and compressing injury or inflammation, while pitting oedema in hypertensive patients is more related to lymphatic and circulatory system dysfunction. Therefore, there is a significant difference in the effectiveness of reducing pitting oedema between ankle pumping and kinesio taping in hypertensive patients, with ankle pumping showing more effective results with a p value of 0.015.

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