

Burger Allen Exercise Against The Circulation Of The Lower Extremities In Diabetic Ulcer Patients

Anna Martiana Afida¹, Candra Kusuma Negara², Lucia Andi Chrismilasari³

^{1,2} Universitas Cahaya Bangsa

³ STIKES Suaka Insan

ARTICLE INFO

Keywords:

Diabetic, Brachial, Buerger
Allen Exercise

Anna123@gmail.com

ABSTRACT

One of the effects of diabetes brought on by poor venous and arterial blood circulation is diabetic foot injury (LKD). Buerger Allen exercise is one modality of therapy that uses active postural movements to enhance blood flow in the lower extremities venous and arterial blood vessels. The brachial index ankle (ABI) technique was used to evaluate improved foot circulation. This study sought to assess the impact of Buerger Allen exercise on LKD patients' lower circulatory extremities. A quasi-experiment with a pretest and post-test without a control strategy was used as the research design. 43 respondents made up the 43 samples for this study, which were collected using successive sampling methods. Using bivariate data analysis, Wilcoxon tests were utilized to compare values before and after the Buerger Allen exercise. The findings demonstrated a statistically significant relationship between the average ABI in LKD patients before and after 0.85 (P-value = 0.000). The Buerger Allen exercise intervention is performed twice daily for three weeks. Positional changes and gravitational force variations can assist in emptying and filling blood vessels. At the same time, contraction of the gastrocnemius muscle and the plantar muscles as a muscle pump activates the ship and prevents backflow. Regular exercise can widen collateral circulation channels, boosting the supply of oxygen to peripheral tissues and the distribution of nutrients. Exercise helps increase circulation, according to studies by Buerger Allen. Therefore it can be suggested in the future that nurses teach patients with lower extremity circulatory disorders in LKD patients.

Copyright © 2022 Jurnal Eduhealth. All rights reserved is Licensed under a Creative Commons Attribution- NonCommercial 4.0 International License (CC BY-NC 4.0)

1. Introduction

A metabolic illness known as diabetes mellitus (DM) is brought on by many etiologies, including hyperglycemia, which can result in issues with the microvascular, macrovascular, and nervous systems. While this is happening, protein, lipid, and carbohydrate metabolism problems prevent the pancreas from secreting insulin, which makes insulin ineffective or both (1). Diabetic foot injury (LKD), which can result in infections in tissue necrosis wounds, leg abnormalities, and amputation of limbs, is one of the dangerous side effects of DM. Therefore, LKD adds to a mortality rate of roughly 25%. (2).

According to the International Diabetes Federation (IDF) (3), there were 7.3 billion persons worldwide who had diabetes in 2015, and that number is expected to rise to 9 billion by 2040. IDF reported that with a population of 10.2 million, Indonesia is now ranked seventh in the world for having diabetes mellitus (DM) and is expected to move up to sixth place with a population of 16.2 million by 2040. According to the International Working Group on Diabetic Foot (IWGDF) (4), there were approximately 382 million people with diabetes worldwide in 2013, accounting for 8.3% of the global population and roughly 80% of those living in developing nations. By 2030, it is predicted that there will be more than 552 million people with diabetes worldwide.

LKD and amputations, frequently observed in plantar areas, are caused by the increase in DM illness, affecting 9.9% of individuals. Undiagnosed diabetic peripheral neuropathy is the most prevalent cause of leg ulceration and arthropathy. (5) discussed the epidemiology and effects of LKD, which

affects someone globally every 20 seconds. Nearly 50% of people have diabetic neuropathy, and up to 85% accelerate death and increase the morbidity of LKD, amputation, and death.

As the prevalence of diabetes is predicted to rise from 71 million individuals in 2000 (majority of 2.8 percent) to 366 million (prevalence of 4.4 percent) by 2030, a person with DM illness has a 12–25 percent risk of acquiring DFS. This anticipated increase will significantly impact the provision of LKD treatment because limb amputation incurs enormous financial costs. Without accounting for the psychological effects of the disorders, such as reduced activity, anxiety, and stress, the National Health Service in Taiwan estimates the cost of LKD and diabetes-related amputations to be 244 million billion (6).

(7) research estimates that the prevalence of DM illness in Asia will rise from 4% in 1995 to 5.4% in 2025. According to the World Health Organization (WHO)(8), developing nations will bear a significant burden. Diabetes-related microvascular complications are present in 44.2 percent to 66.4 percent of people in Asia, and 27.8 percent in Europe, all of which contribute to the development of LKD. In Taiwan, Chang, Chang, and Chen (9) report that LKD with peripheral neuropathy of 30% to 50% is the fourth most common cause of death among DM patients, with a mortality incidence of 26.9 per 100,000 individuals yearly. All peripheral nervous system parts, including the sensory, motor, and autonomic ones that are involved in the development of LKD, are impacted by peripheral neuropathy.

In LKD patients with circulatory diseases, nurses play a complex role in identifying risk factors and providing wound care, education, and information. Gymnastics and other more comprehensive interventions are particularly helpful for LKD patients. Regular Buerger Allen exercises are one of the foot exercises that can be taught and used in LKD patients due to circulatory or arterial issues (10). One of the movement variations in the foot's plantar region that satisfies the requirements of contanious, interval, progressive, and gravitational force such that each stage of movement must be carried out systematically is foot gymnastics, also known as the burger training method.

This exercise helps the body's need for oxygen and nutrients to enter the arteries and veins, strengthens and maximizes the work of small muscles, prevents the development of leg deformities, promotes circulation, aids in LKD healing, and boosts the production of the hormone insulin, which is used to transport glucose to cells. Assisting people with diabetes with blood glucose reduction (11). While healthy, regular activity helps boost blood flow by opening capillaries (tiny blood vessels), this movement also causes blood vessels to become more vascularized, increasing the amount of blood available to tissues (12).

Buerger performed the original Buerger Allen exercise in 1926, and Allen improved it in 1930 to include gravitational forces delivered to the smooth muscles and vascular system in various positions. Jackson stated in 1972 that alternate blood column emptying and filling caused by gravity forces helped to increase the movement of venous blood arteries (13).

On the other hand, the therapists found that burger Allen exercise had some physiological basis for its efficiency when utilized in DM patients with peripheral artery disease (PAD), perfusion pressures (SPP), and neuropathy brought on by atherosclerosis. Postural exercises can improve venous blood vessels and peripheral circulation to extremities, thereby increasing the need for nutrients to the tissues and supply to the plantar area of the legs through this exercise with changes in position and muscle contractions (14).

According to Chang-cheng Chang et al. (2016) 's study, patients with moderate ischemia who underwent Buerger Allen exercise intervention before the intervention had an average blood pressure reading of 42.2 mmHg. In contrast, following the intervention, the average task was 64.4 mmHg (p-value = 0.001). In contrast, in patients with severe ischemia, the average value was 22.1 mmHg before the intervention and 37.3 mmHg following it (value = 0.043).

2. Method

Quantitative research or quantitative design using a quasi-experimental design approach is the method employed (15). The chosen independent and dependent variables will be tested for causation using a quasi-experimental technique. To ascertain the effect of nursing or therapy interventions (independent variables) on patient outcomes (dependent variables), quasi-experimental designs were

*Burger Allen Exercise Against The Circulation Of The Lower Extremities In Diabetic Ulcer Patients-
Anna Martiana Afida1, Candra Kusuma Negara2, Lucia Andi Chrismilasari*

used in nursing (16). The quasi-experimental plan was implemented as a pre-and post-test without a control group, with only one group receiving the intervention.

3. Result and Discussion

Characteristics of Respondent

Table 1. Characteristics of Respondents

No	Characteristics of Respondents	Buerger Allen Exercise	
		F	%
1	Gender		
	Man	23	53.4
	Woman	17	39.5
2	Age (Years)		
	26-35	2	5.0
	36-45	4	10.0
	46-55	9	22.5
	56-65	25	62.5
3	LKD Time	29	72.5
	1 To 5 years	11	27.5
	5 years More		
4	Blood sugar medication consumption	31	77.5
	Yes	9	22.5
	No		

Based on the table above, it can be seen that most of the KGDS of LKD speakers before training with a spare part (200-300 mg/dl) as many as 23 people (76.7%), and after exercise, There was a change in the value of up to 16 people (53.3%). Furthermore, KGDS respondents of Client LKD before training with moderate parts (301-400 mg/dl) as many as 7 people (23.3 %), after exercise Had a decrease of Up to 2 people (7.0%). n Kgds values of respondents before the Normal exercise section or controlled state (<200 mg/dl) as much as (0.0%), and after intervention increased by 12 people (40.0%).

Analyzes Univariate

Table 2. Frequency And Percentage Distribution of KGDS sufferers of LKD

No	ABI	Buerger Allen Exercise			
		Before		After	
		F	%	F	%

1.	Normal (<200 mg/dl)	0	0,0	12	40.0
	Mild (200-300 mg/dl)	23	76,7	16	53.3
	Medium (301-400 mg/dl)	7	23,3	2	7.0

Based on table 2 shows that the KGDS of LKD speakers before training with the middle part (301-400 mg / dL) as many as 7 people (23.3%), and after activity decreased to 2 people (7.0%). Meanwhile, the KGDS value of respondents before Buerger Allen exercise Against Normal parts or in controlled terms (<200 mg/dl) as much as (0.0%) and after intervention increased by 12 people (40.0%).

Table 3. Frequency and Percentage Distribution of ABI LKD

No	ABI	Buerger Allen Exercise			
		Before		After	
		F	%	F	%
1.	Normal (0.9-1.2 mmHg)	0	0.0	10	33.3
	Venous Disorders (0.8-0.9 mmHg)	26	86.7	20	66.7
	Arterial-Venous Disorders (0.5-0.8 mmHg)	4	13.3	0	0,0

Based on the table above shows that before doing exercises, the ABI values of LKD resource persons were mainly in the category of venous ulcer disorders (0.8-0.9 mmHg) as many as 26 people (86.7%) and after exercises decreased to 20 people (66.7%), the ABI values of LKD clients before training in the category of arterial-venous ulcer disorders (0.5-0.8 mmHg) as many as 4 people (13.3%), and after exercises had decreased to (0.0%). Furthermore, the ABI value of respondents of LKD patients before training in the normal category (0.9-1.2 mmHg) (0.0%) after exercise had increased to 10 people (37.4%).

Bivariate Analysis

Table 4. Buerger Allen exercise effect on diabetic leg blood circulation before and after intervention

BAE	n	Mean	Median	Minimum-Maximum	p-value	Information
Before	30	0,71	0,71	0,63-1,00	0,000	Significant
After	30	0,85	0,82	0,65-1,09		

Based on the table above, it can be shown that there is a statistically significant difference in the group before and after the burger Allen exercise intervention. ABI value in LKD patients before and after exercise was 0.71 and 0.85, with a median value of 0.71 and a range between 0.63 and 1.00. While the median value following training is 0.82, the minimum value is 0.65, the maximum is 1.09, and there is a substantial influence (p-value 0.000).

Foot Circulation before Buerger Allen Intervention exercise Diabetic Ulcer Patients

According to the study's findings, the majority of respondents with LKD had an ABI value in the range of venous ulcer diseases (0.8-0.9 mmHg) as much as (86.7%), while the ABI value in the field of arterial-venous ulcer disorders (0.5-0.8 mmHg) as much as (88.7%) before activity (13.3 percent).

The majority of the ABI values of LKD respondents in the category of Venous ulcer circulation disorders and arterial ulcers in LKD patients were influenced by several factors in the study, which can be seen based on the age characteristics of respondents (62.8 percent) of the early elderly (56-65 years) age range, which included as many as 27 people. (1) DFS patients over 50 have a higher risk of peripheral vascular diseases. Blood circulation will decline with age, making it more dangerous to notice alterations in one's legs' sensitivity.

Conversely, (2) arteriosclerosis and vascular endothelial diseases are more likely to develop as a person ages. According to several studies, endothelial dysfunction has been linked to circulatory system

*Burger Allen Exercise Against The Circulation Of The Lower Extremities In Diabetic Ulcer Patients-
 Anna Martiana Afida1, Candra Kusuma Negara2, Lucia Andi Chrismilasari*

problems (3). Age will reduce blood vessel flexibility because it produces less nitric oxide, which results in the decreased peripheral circulation (4). Endothelial dysfunction contributes to vascular atherosclerosis progression, which results in inflammation, thrombosis, arterial stiffness, and reduced blood flow. Endothelial dysfunction affects vasomotor function, stimulates arterial thrombosis, and stimulates the migration and proliferation of vascular stem cells (5).

This circulatory condition affects people with diabetes starting in their early years and can result in a progressive loss of skeletal muscle cells (6). Most LKD patients who responded to the trial and had arterial and venous ulcer issues were men, up to 23 (53.4 percent). Testosterone levels are a risk factor for type 2 diabetes and can cause belly obesity, insulin resistance, and other problems (1). Additionally, according to (6), insulin sensitivity is subject to fluctuations in testosterone.

According to (7), males over 50 are more likely to have insufficient arterial circulation in their lower limbs. Typically the limbs affected by atherosclerosis cause distal occlusion disease, frequently encountered in elderly diabetic patients. Some of the survivors of DFS patients with arterial-venous ulcer diseases, with LKD lasting 1 to 5 years in up to 34 people (79.1 percent).

One of the variables that can affect and exacerbate the occurrence of peripheral blood circulation abnormalities is the duration of the patient's diabetic leg injury. (8) High blood sugar levels in people with diabetes will impact blood cystic.

38 respondents had venous ulcer diseases and arterial-venous ulcers and took blood sugar-lowering medications (88.4 percent). (9) claimed that managing DM could be accomplished through nutrition, Exercise (Exercise), medications, continuing counseling, and assisting DM patients in becoming self-sufficient. It's crucial to strike a balance between food, exercise, medicine, and counseling. (10), prepared to treat peripheral artery circulation problems associated with diabetes mellitus.

One of them is pharmaceutical therapy, which successfully focuses on anti-platelets, anti-coagulation, antibiotics, and revascularization operations like angioplasty and branching of vascular bypass. According to (11), some blood sugar medications have a variety of therapeutic effects, such as lowering blood glucose levels by preventing the liver from producing glucose and reducing insulin resistance, particularly in the liver and muscles. Based on the KGDS of respondents with arterial-venous ulcers and venous ulcer disorders, it can be seen that the majority of KGDS respondents passed LKD before training in the mild category (200-300 mg/dl), as many as 23 people (76.7%), and after exercise showed a change in values to 16 people (53.3%).

The KGDS of respondents before training in the normal category (200mg/dl) climbed to 12 persons from the value (0.0 percent) after the intervention (40.0 percent). According to the study's findings, most of the KGDS respondents changed due to the intervention. Diabetes mellitus (DM) is a group of metabolic disorders characterized by hyperglycemia and microvascular, macrovascular, and neuropathic complications.

These complications lead to impaired carbohydrates, fats, and proteins' impaired metabolism due to defects in insulin secretion, action, or both. 90% of people with diabetes have type 2 diabetes, the most prevalent type (12). There are both intrinsic and extrinsic causes of a diabetic foot injury. Peripheral neuropathy, which affects the lower limbs' nerves, ischemia (reduced blood flow), and hyperglycemia are intrinsic causes (excess glucose in the blood) (1) Blood viscosity will rise with high blood levels, thickening the capillary membrane where erythrocyte cells, platelets, and leukocytes connect to the blood vessel lumen and potentially causing leg injuries.

(1) The development of microvascular and macrovascular complications in DM patients at risk of sustaining diabetic foot injuries or exacerbating existing wounds is caused by increased blood glucose levels, which reduces blood flow and increases platelet aggregability, and encourages the formation of microrombus and microvascular blockages.

(13) (14) suggested that physical activity routines can be used to lower blood glucose levels in people with diabetes by increasing sex cravings relative to when they are at rest. While (15) claims that frequent foot exercises improve insulin sensitivity, promote glucose transport translocation, and increase the amount of glucose absorbed by tissues before, during, and after exercise.

Physical activity management in people with diabetes is influenced by lifestyle, pharmacology (such as oral hypoglycemic medications or insulin), glucose monitoring, and early and ongoing health education.

Foot Circulation After Buerger Allen Exercise Intervention In LKD Patients

According to the study's findings, following Buerger Allen exercise intervention, respondents' ABI values in the category of venous ulcer disorders (0.8-0.9 mmHg) declined from 86.7% to 66.7%, and those in the variety of arterial-venous ulcer disorders (0.5-0.8 mmHg) decreased from 13.3% to 0.0%. The usual category ABI value (0.9-1.2 mmHg) increased from 0.0 to 33.3 percent.

Exercise for the lower extremities is one of the best non-pharmacological treatments to increase circulation there—the fundamental idea behind reducing diabetes patients' vascular disease progression in practice (16).

Foot gymnastics exercises, according to (17), include a variety of motions that adhere to the standards of continuous, rhythmical, interval, progressive, and endurance. (1) explains that the exercise must be performed constantly and repeatedly to promote muscle microvascular blood flow circulation. It is connected to artery dilation (vasodilation), which increases capillary permeability and enables muscle cells to absorb glucose.

Buerger Allen exercise uses posture adjustments and peripheral circulation stimulation to increase the blood flow through obstructed arterial arteries. Lower extremity perfusion in LKD patients may be increased by adjusting gravity and using muscle contractions (1). Buerger Allen's exercise effectively corrects more inadequate limb perfusion in diabetes mellitus patients (18).

Buerger Allen exercise can encourage the wound healing process because performing exercises will help the patient correct vascularity and, at the same time, will help improve the wound healing process. Effective results were obtained employing the Buerger Allen exercise technique, which applies gravity changes in positions to blood vessels and smooth muscle blood vessels (19). Gravity assists in emptying and filling arterial vascular columns on the legs, which can enhance blood flow during the Buerger Allen exercise (1).

Effect of Buerger Allen Exercise On Foot Circulation In LKD Patients

According to the study's findings, there were variations in the circulation of the feet before and after the Buerger Allen exercise intervention. Following the intervention, there was an increase in the ABI value in DFS patients with an average of 0.11, or included in the category of typical ABI values, indicating differences in foot circumference. The average ABI value of respondents of DFS patients with the type of venous ulcer disorders and arterial ulcers before the intervention was 0.71, and the average ABI value of DFS patients with the category of venous ulcer disorders after the intervention was 0.85. Wilcoxon test analysis showed that the respondents' circulation had improved. The statistical analysis produced a P-value of 0.000, indicating that Buerger Allen exercise significantly enhanced foot circulation in LKD patients with arterial-venous and venous ulcers. Exercises like the Buerger Allen can enhance oxygen extraction and muscular metabolism in the legs by inducing exercise-induced endothelium-dependent vasodilation through repeated exposure.

Additionally, through encouraging vasodilation, increased blood flow contributes to the activation of prostacyclin and vascular nitrites oxide. Through stimulation of the peripheral vascular system, Buerger exercises can be combined with postural exercises to increase the effectiveness of local collateral circulation (20). (21) reported in his study that patients with type II DM who had received Buerger Allen exercise experienced a significantly higher level of lower limb perfusion and decreased discomfort.

According to (1), Buerger Allen exercise can enhance and restore the circulatory function of the lower limbs, hence improving the quality of life for dm type II patients. It can also prevent the development of peripheral artery disease and lessen the risk of amputation in LKD patients. In this study, Buerger Allen exercise was done twice daily for three weeks.

Exercise is effective in improving leg circulation in people with diabetes or practice that can affect the improvement of circulation in the lower extremities. This type of activity includes walking, light

exercise, and range-of-motion exercises (ROM), performed 2-4 times per day for several weeks (21). However, according to Buerger Allen (22), teaching exercise on the same day twice a day with a 6-hour gap between sessions shows that lower limb perfusion has significantly improved.

Lower extremity venous insufficiency can be significantly helped by frequently performing the Buerger Allen exercise with leg elevation for 5 minutes every 6 hours. Exercise also helps decrease the requirement for oxygen in the arteries, which increases insufficiency (22)—altered posture-induced tissue perfusion. It is possible to boost the perfusion of the lower extremities, aid in the circulation process, and dilate blood vessels to make blood flow easier by varying gravity and using muscle contractions (1). Exercises like those recommended by Buerger Allen are efficient for contracting the calf muscles effectively and stimulating the gastrocnemius muscles. The gastrocnemius and soleus can strengthen and pump the calf muscles to promote venous blood vessel circulation and enable venous return.

Exercises by Buerger Allen have been demonstrated to increase the effectiveness of calf muscle pumps (23). Postural exercises can enhance local collateral circulation by causing posture and muscle activity changes, increasing oxygen delivery to the bloodstream, and distributing nutrients to cells and tissues (24). (25). Buerger Allen states exercise is used in individuals with peripheral circulatory diseases to increase collateral blood circulation.

But based on the effects of exercise and the study's findings, it was determined that hanging the legs and repeating the supine, and sitting positions on patients with ischemia is an efficient way to improve their hemodynamic condition. One of the circulatory problems associated with LKD is inadequate vein and artery vascularity, which is determined by three variables: blood viscosity, blood vessel length, and blood vessel diameter.

Hyperglycemia and thickening of the vascular membranes, one of which is brought on by blockage of prominent blood vessels, are the two factors that contribute to blood viscosity (atherosclerosis). The profound vein system and the perforant vein in the calf area is a mechanism or combination of the muscle contractions of the musculus gastrocnemius, soleus, anterior tibial, and plantar otoliths, which are responsible for the reverse blood circulation of the lower extremity of the sphere.

In addition to acting as a pump to activate the venous blood and prevent backflow to the simple system, the active contraction of the calf muscle also pushes blood away from the lower leg. For LKD patients with venous ulcer diseases and arterial-venous ulcers, repeated and persistent Buerger Allen exercise movements can open up local collateral circulation channels, offering significant clinical advantages.

To continue supplying tissues and organs with blood and oxygen, the arteries will form new blood vessel paths around the obstruction through the alternative blood flow channel. Gravity works to alternately empty and fills the blood column in the streets and veins. At the same time, the elevated extremities posture is a gravitational force applied to blood vessel circulation, which can ultimately enhance blood flow to the lower extremity to the tissue periphery in LKD (23). (26).

However, research (27) indicates that the most critical factor influencing the occurrence of diabetic foot injury is foot gymnastics activities. This suggests that, compared to respondents who consistently and regularly completed foot exercises following the theory, those who did so had a stronger influence on diabetic foot injuries.

There was a significant improvement in lower limb perfusion and a decrease in pain in patients who had received Buerger Allen exercise in type 2 DM patients, demonstrating the effectiveness of Buerger Allen exercise in improving lower extremity perfusion among diabetes mellitus patients.

Leg exercises can eventually enhance blood flow by helping empty gravity veins and fill artery vascular columns in the legs (28). (27). Buerger Allen exercise is performed in several steps systematically by flexing, extending, pronating, and supinating the toes can increase periphery tissue perfusion (19). The increase in tissue perfusion of the Buerger Allen exercise due to postural changes, modulating gravity, and applying muscle contractions can increase the perfusion of the lower extremities and help the circulation and dilatation of blood vessels so that blood is easy to flow.

Exercise can stop peripheral artery disease from developing, lower the chance of amputation in LKD patients, restore function to the extremities, and enhance the quality of life, according to Buerger Allen (4).

The perfusion of the lower extremities has significantly improved if the Buerger Allen exercise is taught twice on the same day, separated by a 6-hour break. Leg elevation, which should be done for 5 minutes every 2 hours, can significantly help LKD patients with lower extremity venous insufficiency.

Using gravitational forces to make each level of movement need to be performed consistently, the Buerger Allen exercise is one of the varieties of active movement in the lower and plantar extremity areas. This exercise is performed to improve circulation, strengthen and maximize the activity of small muscles, avoid the development of leg deformities, aid in the healing process for LKD, and raise the amount of insulin produced, which is utilized to transport glucose to cells.

Hence assisting diabetic individuals in lowering their blood glucose levels (21). Buerger Allen's exercise aims to enhance the circulation of obstructed arterial arteries by utilizing posture adjustments and promoting peripheral circulation. Patients with LKD can improve their lower extremity perfusion by changing gravity and using muscle contractions (18). Exercise can promote the wound healing process since it will aid the patient in enhancing their vascularity while also assisting with healing their wounds (21). Activity has been demonstrated to be successful in reversing lower extremity perfusion in diabetes mellitus patients, according to Buerger Allen (23).

Effective results were obtained employing the Buerger Allen exercise mechanism, which applies gravity changes in positions to blood vessels and smooth muscle blood vessels.

Wilcoxon test analysis showed that the respondents' circulation had improved. The statistical analysis produced a P-value of 0.000, indicating that Buerger Allen exercise significantly enhanced foot circulation in LKD patients with arterial-venous and venous ulcers. In this study,

Buerger Allen's exercise was done twice daily for three weeks. Training is effective in improving leg circulation in people with diabetes or practice that can affect the improvement of circulation in the lower extremities. This type of activity includes walking, light exercise, and range-of-motion exercises (ROM), performed 2-4 times per day for several weeks (29).

4. Conclusion

Based on the results of the research analysis above, the following conclusions can be drawn:

1. Based on the circulation in the legs' lower extremities before a workout with Buerger Allen. Because the majority of respondents are over 50 years old, they have had LKD for longer than a year, they are predominantly male, and their KGDS scores fall into the mild and moderate categories, the majority of the ABI values of respondents with LKD patients fall into the category of venous ulcer disorders and arterial-venous ulcer disorders;
2. Most ABI values in LKD patients with the category of venous disorders showed a decrease. In contrast, the type of normal veins showed an increase based on the circulation of the lower extremity legs after the Buerger Allen exercise.
3. There was a significant impact of Buerger Allen exercise intervention on improving more insufficient limb leg circulation with impaired venous ulcers and arterial-venous ulcers in LKD.

References

1. Jannaim J, Dharmajaya R, Asrizal A. Pengaruh Buerger Allen Exercise Terhadap Sirkulasi Ektremitas Bawah Pada Pasien Luka Kaki Diabetik. *J Keperawatan Indones*. 2018;21(2):101–8.
2. Hadi HAR, Al Suwaidi JA. Endothelial dysfunction in diabetes mellitus. *Vasc Health Risk Manag*. 2007;3(6):853–76.
3. Ciecierski M, Suppan K. The effect of lower revascularization on the global endothelial function and. 2013;
4. Simarmata PC, Sitepu SDEU, Sitepu AL, Hutauruk R, Butar-butur RA. Pengaruh Buerger Allen Exercise Terhadap Nilai Ankle Brachial Index Pada Pasien Diabetes Melitus. *J Keperawatan Dan Fisioter*. 2021;4(1):90–4.
5. Matsuzawa Y, Lerman A. Endothelial dysfunction and CAD: Assessment, prognosis, and treatment. *Coron Artery Dis*. 2014;25(8):713–24.
6. Balducci S, Sacchetti M, Orlando G, Salvi L, Pugliese L, Salerno G, et al. Correlates of muscle strength in *Burger Allen Exercise Against The Circulation Of The Lower Extremities In Diabetic Ulcer Patients- Anna Martiana Afida1, Candra Kusuma Negara2, Lucia Andi Chrismilasari*

- diabetes. *Nutr Metab Cardiovasc Dis.* 2014;24(1):18–26.
7. Universitaria E, Cr H, De TFIN, Mu L, Tutor H, Santander JS. Influencia del estado nutricional y metabólico en la aparición de úlceras de pie diabético en atención primaria. 2014;
 8. Marpaung N, Noer RM, Aguthia M. Factors Affecting Arterial Disease in Type 2 Diabetes Mellitus Patient. 2016;141–51.
 9. Widodo C, Tamtomo D, Prabandari AN. Hubungan Aktifitas Fisik, Kepatuhan Mengonsumsi Obat Anti Diabetik Dengan Kadar Gula Darah Pasien Diabetes Mellitus di Fasyankes Klaten. *J Sist Kesehatan.* 2016;2(2):63–9.
 10. Sumatera U, Suza DE, Utara US, Tarigan R, Utara US. Effect Of Education In Diabetic Foot Ulcers To Compliance And Quality Of Life, The Diabetic. 2021;08(03):3225–37.
 11. Pujangga IW, Nainggolan D, Thadeus MS. Effects of Lead tree Seed (*Leucaena leucocephala*) Extract in Inhibiting the Increase of Postprandial Blood Glucose Level in Alloxan-induced Diabetic Rats. 2019;14(28):157–64.
 12. Elinar Digital P. Effect of Buerger Allen Exercise on Lower Extremity Perfusion Among Diabetes Mellitus - Randomized Clinical Trial. *Nurs J India.* 2019;CX(05):221–5.
 13. Hijriana I, Suza DE, Ariani Y. Pengaruh Latihan Pergerakan Sendi Ekstremitas Bawah Terhadap Nilai Ankle Brachial Index (Abi) Pada Pasien Dm Tipe 2. *Idea Nurs J.* 2016;7(2):32–9.
 14. Dewinta NR, Mukono IS, Mustika A. Pengaruh Pemberian Ekstrak Dandang Gendis (*Clinacanthus nutans*) Terhadap Kadar Glukosa Darah pada Tikus Wistar Model Diabetes Melitus. *J Med.* 2020;3(1):76.
 15. Hasanuddin I, Mulyono S, Herlinah L. Efektifitas olahraga jalan kaki terhadap kadar gula darah pada lansia dengan diabetes mellitus tipe II. *Holistik J Kesehat.* 2020;14(1):38–45.
 16. Rahmawati D. *Jurnal Keperawatan Muhammadiyah.* 2022;7(2).
 17. Negara, Candra Kusuma, Sri Erliani, and Florensia Gardis. "The Influence of Macaranga Leaf Tea as A Complementary Nursing Therapy Solution for Patients with Diabetes Mellitus in The Deabetic Foot Poly of Ulin Regional Public Hospital Banjarmasin." *j-HIMEL 1.1* (2020): 1-5.
 18. Pasien I, Melitus D. *Jurnal ipteks terapan.* 2016;2:155–64.
 19. Simarmata PC, Purba ASG, Sitepu AL, Harahap ES. the Effect of Foot Exercise on Ankle Brachial Index Value in Diabetes Mellitus Patients in Hospital Grandmed Hospital Palam. *J Keperawatan Dan Fisioter.* 2021;3(2):153–8.
 20. Pebrianti S. Buerger Allen exercise Dan Ankle Brachial Index (ABI) Pada Pasien Ulkus Kaki Diabetik Di RSUD Dr. Slamet Garut. *Indones J Nurs Sci Pract.* 2018;1(1):94–110.
 21. Salam AY, Laili N. EFEK BUERGER ALLEN EXERCISE TERHADAP PERUBAHAN NILAI ABI (ANKLE BRACHIAL INDEX) PASIEN DIABETES TIPE II. 2020;3(2):64–70.
 22. Al Mahdi, Fadhil, Candra Kusuma Negara, and Abd Basid. "The Effect of Family Empowerment in Nursing Implementation Toward Self-Efficacy among Patients with Diabetes Mellitus." *INDONESIAN NURSING JOURNAL OF EDUCATION AND CLINIC (INJEC)* 5.2 (2020): 141-146.
 23. Apriliani IM, Purba NP, Dewanti LP, Herawati H, Faizal I. Efektivitas Buerger Allen exercise Terhadap Peningkatan Aktivitas Fungsional Ekstremitas Bawah pada Lansia di BPLU Senja Cerah Manado. *Citizen Mar Debris Collect Train Study case Pangandaran.* 2021;2(1):56–61.
 24. Pratiwi IN, Dewi LC, Widyawati IY, Airlangga U, Dedali H. BUERGER EXERCISE DAN EDUKASI PERAWATAN KAKI PADA PENDERITA DIABETES DAN HIPERTENSI DALAM UPAYA MENURUNKAN RESIKO Pendahuluan Hipertensi dan diabetes melitus (DM) merupakan penyakit kronis yang membutuhkan. 2020;16(2):121–32.
 25. Negara, Candra Kusuma. "Post Amputation Response And Coping Of Diabetes Mellitus Patient In Ulin General Hospital Banjarmasin." *Jurnal Ilmu Keperawatan: Journal of Nursing Science* 5.2 (2017): 114-129.
 26. Hudlicka O, Hudlicka O. Microcirculation in muscle Corresponding author : :3–11.
 27. Kusuma Negara C. The Effect of Discharge Planning on Treatment Adherence among the Elderly with Hypertension in Banjarmasin, South Kalimantan. 2018;237–237.
 28. Kusuma Negara C. THE RELATIONSHIP BETWEEN DISCHARGE PLANNING AND THE QUALITY OF LIFE OF PATIENTS WITH DIABETIC ULCER. :2–6.
 29. Negara CK, Erliani S, Gardis F. The Influence of Macaranga Leaf Tea as A Complementary Nursing Therapy Solution for Patients with Diabetes Mellitus in The Deabetic Foot Poly of Ulin Regional Public Hospital Banjarmasin. *j-HIMEL.* 2020 Feb 17;1(1):1-5.