

## BUERGER ALLEN EXERCISE ON THE RISK OF INJURY IN THE FEET OF DIABETES MELLITUS TYPE 2

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### ABSTRAK

Diabetes melitus merupakan penyakit metabolik kronis yang memerlukan perhatian medis dan penatalaksanaan mandiri untuk mencegah komplikasi ulkus diabetik. Latihan Buerger Allen merupakan latihan khusus yang bertujuan untuk meningkatkan sirkulasi pada kaki dengan memanfaatkan perubahan gravitasi dan kontraksi otot melalui gerakan aktif kaki sehingga terjadi peningkatan sirkulasi pada pembuluh darah perifer. Inlow's 60-second Diabetic Foot Screen Tool merupakan indikator penilaian terhadap risiko cedera kaki. Penelitian ini bertujuan untuk mengetahui pengaruh latihan Buerger Allen terhadap risiko cedera kaki pada pasien diabetes mellitus tipe 2 di puskesmas Masbagik. Metode penelitian ini menggunakan pre eksperimental dengan rancangan one group pretest-posttest design. Teknik pengambilan sampel adalah purposive sampling dengan jumlah sampel sebanyak 18 responden yang memenuhi kriteria inklusi dan eksklusi. Analisis data menggunakan analisis univariat dan bivariat. Nilai mean risiko cedera kaki responden penderita diabetes sebelum intervensi adalah 9,00 dengan standar deviasi 1,328 dan setelah intervensi meannya adalah 8,54 dengan standar deviasi 1,286. Hasil uji Wilcoxon menunjukkan nilai p: 0,000 yang berarti terdapat pengaruh latihan Buerger Allen terhadap risiko terjadinya ulkus kaki pada pasien diabetes tipe 2. Intervensi latihan Buerger Allen diharapkan dapat diterapkan sebagai bagian dari pengobatan dalam upaya mencegah komplikasi dari ulkus kaki diabetik pada pasien dengan diabetes mellitus tipe 2.

**Kata Kunci :** *Buerger Allen Exercise; Diabetes Mellitus; Resiko Luka kaki*

### ABSTRACT

*Diabetes mellitus is a chronic metabolic disease that requires medical attention and self-management to prevent diabetic ulcer complications. The Buerger Allen exercise is a special exercise that aims to increase circulation in the legs by utilizing changes in gravity and muscle contractions through active movement of the legs so that there is an increase in circulation in the peripheral blood vessels. Inlow's 60-second Diabetic Foot Screen Tool is an indicator for assessing the risk of foot injury. This study aims to determine the effect of the Buerger Allen exercise on the risk of foot injury in type 2 diabetes patients at the Masbagik Health Center. This research method used a pre-experimental design with a one group pretest-posttest design. The sampling technique was purposive sampling with a total sample of 18 respondents who met the inclusion and exclusion criteria. Data analysis used univariate and bivariate analysis. The mean risk of foot injury for diabetics before the intervention was 9.00 with a standard deviation of 1.328 and after the intervention the mean was 8.54 with a standard deviation of 1.286. The results of the Wilcoxon test showed a value of p: 0.000, which means that there is an effect of Buerger Allen exercise on the risk of foot ulcers in patients with type 2 diabetes. The Buerger Allen exercise intervention is expected to be applied as part of treatment in an effort to prevent complications from diabetic foot ulcers in patients with diabetes mellitus type 2.*

**Keywords:** *Buerger Allen Exercise; Diabetes Mellitus; Foot Wound Risk*

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## **INTRODUCTION**

Hyperglycemia, a condition caused by elevated blood glucose levels (hyperglycemia) as a result of deficiencies in insulin secretion, action, or both, is a hallmark of the metabolic illnesses known as diabetes mellitus (ADA, 2021). The prevalence of diabetes mellitus as a global issue keeps rising year after year both globally and in Indonesia. 10.5% (537 million persons) aged 20 to 79 worldwide will have diabetes in 2021, or 1 in 10 people worldwide. The number of diabetics is predicted to be 11.3% (643 million) in 2030 and 12.2% (783 million) in 2045 (IDF, 2021). In terms of the nation with the greatest number of DM patients, Indonesia was rated seventh; according to projections for 2040, it will move up to sixth place (PERKENI., 2019). According to the IDF, Indonesia is now ranked 7th in the world for diabetes mellitus (DM) and is at risk of developing complications from diabetic foot injury (DFI). Diabetes neuropathy affects approximately 50% of people and speeds up death, amputation, and DFI morbidity by up to 85% (Suryati, 2019).

According to Riskesdas, the prevalence of diabetes mellitus increased dramatically in Indonesia from 2013 to 2018 – from 2.0% to 3.4%. West Nusa Tenggara has 19,247 DM patients, which represents 1.6% of all DM patients in Indonesia (Widiastuti, 2020). The number of diabetes mellitus cases at the Puskesmas has risen steadily over the past three years, from 259 cases in 2019 to 349 cases in 2020 to 756 cases in 2021 (Data Puskesmas, 2021). Untreated DM can cause complaints of tingling, burning, or numbness in the feet. These symptoms can then progress to retinopathy, nephropathy, and neuropathy complications, which can result in decreased foot sensitivity and diabetic foot wounds (Suryati, et al, 2019). Diabetic foot sores are a risky complication of DM that can result in infections, foot abnormalities, and even amputation of limbs (Suryati, et al, 2019). Angiopathy, neuropathy, and infection are the key risk factors for the development of diabetic ulcers. Peripheral neuropathy will result in a loss or reduction in pain perception in the feet, causing the feet to sustain trauma without any feeling, which leads to foot ulcers.

One of the main risk factors for ulcers is loss of sensation or decreased sensitivity of the foot, but there are other risk factors as well, including uncontrolled hyperglycemia, age over 40, individuals with a history of ulcers or amputations, and diminished pulse. peripheral pulse and smoking history (Suryati, et al., 2019). Microcirculation flow involving arteries, arterioles, capillaries, and post capillary venules is the root cause of neuropathy. Controlling blood sugar levels and activity (exercise) can help avoid, delay, and decrease the progression of diabetes problems (Ramayanti, 2022). One of the four key pillars in the therapy of diabetes mellitus is physical activity (PERKENI., 2019). The elements of physical activity are crucial for controlling diabetes because they can lower blood glucose levels by enhancing insulin sensitivity and boosting glucose uptake by the muscles (Nopriani, et al., 2021). Physical exercise can improve blood flow to the lower limbs and delay the onset of peripheral vascular disease in people with diabetes mellitus by involving a variety of joint motions or stretching in all directions. In order to boost the usage of glucose in cells, physical exercise can also make insulin receptors in active muscles more sensitive (Nur, et al., 2021). The Buerger Allen Exercise is a form of physical activity for people with diabetes mellitus.

Buerger Allen Exercise is a form of active movement in the plantar area that applies gravity, therefore each stage of movement must be carried out regularly (Suryati, et al, 2019). Good and regular movements can help increase arterial and venous blood flow by opening small blood vessels in the muscles (capillaries). This movement from the Buerger Allen Exercise can increase the vascularization

of blood vessels so that it can increase blood supply in the tissues and prevent the occurrence of diabetic foot ulcers (Suryati, et al., 2019). With the presence of leg exercises in the form of the Buerger Allen Exercise in Diabetes Mellitus patients, it can increase the supply of blood flow to the feet so that the changes in leg sensitivity increase. As a result, the effect of the Buerger Allen Exercise is effective in increasing the sensitivity of the feet of type 2 DM sufferers (Suryati, et al., 2019). Buerger Allen Exercise can increase permeability in contracting muscles and insulin receptors will be more abundant and more sensitive, thus improving blood circulation and increasing foot sensitivity and reducing the risk of ulcers on the feet. Another study by (Nadrati, 2020), stated that there was an effect of Buerger Allen Exercise in DM sufferers on ABI values, where the average ABI value between the intervention group after being given Buerger Allen Exercise was higher than the average ABI value in the group. control. The Buerger Allen Exercise done consistently can relieve and improve peripheral perfusion disorders in the legs of DM patients. The effects felt by DM sufferers after doing the Buerger Allen Exercise are increased ability to walk, reduced pain (intermittent claudication), reduced tingling, reduced edema. limbs which can be assessed from the increasing adequacy of peripheral circulation from changes in the value (ABI) of the Ankle Brachial Index (Salam, 2020). In previous research, the Buerger Allen Exercise intervention was aimed only at seeing an increase in foot sensitivity and Ankle Brachial Index (ABI) scores without identifying whether or not there was a decrease in the risk of diabetic ulcers.

Based on the results of a preliminary study conducted by researchers using interview methods and questionnaires related to DM management obtained at the Community Health Center on December 17 2021, it was stated that patients who visited were still given medication as well as diet education and regular exercise as a form of physical exercise, but not all DM sufferers came. to take part in this activity and the Buerger Allen Exercise has never been done. One of the key elements in the prevention of diabetes mellitus are activities like sports. The Buerger Allen exercise is one of the interventions that can be employed, and effective health interventions necessitate the involvement of nurses and the community in implementing preventive measures as early as feasible. Patients with type 2 DM who receive therapy along with Buerger Allen exercise should experience an increase in sensitivity that lowers their risk of foot injury. The goal of this study was to determine the risk of foot injuries in people with type 2 diabetes mellitus and to examine how the Buerger Allen Exercise affected that risk.

## **RESEARCH METHODS**

This study used a pre-experimental design with a one group pretest-posttest design. The one group pretest-posttest design consists of three steps, namely giving a pretest that measures the dependent variable, conducting experiments on the subjects and conducting a posttest again to measure the dependent variable. The research was conducted in June 2022 at the East Lombok Masbagik Health Center. Patients with diabetes mellitus at the Masbagik Health Center in East Lombok made up the entire study population (January-March 2022) totaling 138 people with a total sample of 18 people who were determined according to the inclusion criteria, namely type 2 DM patients without diabetic wounds, age > 35 years, no joint disorders, cardiovascular and neurological disorders, no changes in physiological function (dyspnea or chest pain), and no depression, worry and anxiety. The Buerger Allen Exercise was carried out for 10-12 minutes 2x a day (morning and evening) for 5 days, carried out by the researcher as the exercise instructor. The instrument in this study used a questionnaire sheet containing the identity and characteristics of the respondents (age, gender, duration of DM and family history of DM).

The instrument for identifying the risk of foot injuries uses the inlow's 60-second Diabetic Foot Screen Tool questionnaire from (Diabetic Care, 2011) with the results of measuring the results of the

examination: no risk (0-6), moderate injury risk (7-12), risk of serious injury (13-19) and very severe (20-25) and standard operating procedures (SOP) for the Buerger Allen Exercise intervention. Furthermore, the data were analyzed by univariate and bivariate. To define the characteristics of the respondents (age, gender, length of DM suffering, and family history of DM), data analysis with univariate was used. To investigate the impact of the Buerger Allen Exercise intervention on the risk of foot injuries in individuals with type 2 diabetes mellitus, a bivariate analysis using the Wilcoxon statistical test was performed.

## RESULTS AND DISCUSSION

**Table.1 Characteristics of Type 2 DM Respondents at the Masbagik Health Center in East Lombok (n=18)**

Characteristics	Frequency (f)	Percentage (%)
<b>Age</b>		
<45 years old	3	16,7
>45 years old	15	83,3
<b>Gender</b>		
Male	7	38,9
Female	11	61,1
<b>Long Suffering DM</b>		
<5 Years	16	88,9
>5 Years	2	11,1
<b>DM Family History</b>		
Have a History of DM	9	50
No History of DM	9	50

Based on table 1, it can be seen that the characteristics of the most respondents are age > 45 years, 15 respondents (83.3%), female sex, 11 respondents (61.1%), duration of suffering from DM <5 years, 16 (88.9%) and family history of DM as many as 9 respondents (50%).

**Table 2 Average Risk of Foot Injury (Inlow's 60-Second Diabetic Food Screen) Before and After the Buerger Allen Exercise Intervention**

Risk of Foot Injury (Inlow's 60-second Diabetic Food Screen)	Mean	Median	SD
Pre-test (Buerger Allen Exercise)	9.000	32.4	1.328
Post-test (Buerger Allen Exercise)	8.544	30.76	1.286

Table 2 above shows the average risk of foot injuries in patients with type 2 DM before the Buerger Allen Exercise intervention with a mean value of 9,000, median 32.4 and standard deviation (SD) of 1,328 and after the Buerger Allen Exercise intervention, the mean value is 8,544, median 30.76 and standard deviation (SD) 1.286. These results indicate that there is a change in the average risk value of leg injuries after being given the Buerger Allen Exercise intervention which is lower than the average risk value of leg injuries before being given the Buerger Allen Exercise intervention.

### Data Normality Test

Prior to the bivariate test, the data normality test was carried out using the Shapiro Wilk test, where the results of the normality test for the risk of leg injuries before the Buerger Allen Exercise

intervention were obtained p value = 0.011 and after the Buerger Allen Exercise intervention was obtained p value = 0.006, which means that the p value <0.05 so it can be concluded that the data are not normally distributed and the Wilcoxon statistical test was carried out.

**Table 3 Results of the Wilcoxon analysis on the risk of leg injuries (Inlow's 60-Second Diabetic Food Screen) before and after the Buerger Allen Exercise (n=18)**

	N	Mean Rank	<i>p value</i>
Negative Ranks	18 <sup>a</sup>	9.50	
<b>Post-test -Pre-test</b> Positive Ranks	0 <sup>b</sup>	.00	0.000
Ties	0 <sup>c</sup>		
Total	18		

Table 3 above shows that the results of the Wilcoxon test obtained a negative rank 18, which means that out of 18 respondents the post-test foot injury risk value was smaller than the pre-test, positive ranks 0 means that there were no respondents with an increased post-test leg injury risk value and ties. 0, which means that no respondent has the same risk of foot injury before and after the Buerger Allen Exercise intervention. The mean rank value is 0.00, meaning that the average post-test leg injury risk is smaller than the pre-test, and the p value is 0.000 (<0.05), which means that there is a significant effect of the Buerger Allen Exercise intervention on the patient's leg injury risk DM Type 2.

The majority of responders (83.3%) with diabetes mellitus were older than 45 years of age. This is consistent with studies by (Suryati, et al., 2019) which found that the capacity of pancreatic beta cells to generate insulin declines with age. Age above 30 years is a risk factor for type 2 diabetes because it causes a decline in the anatomy, physiology, and biochemistry of the body. Typically, diabetes mellitus develops after the age of 45. At this age, aging starts to take place, which lowers the pancreatic beta cells' capacity to make insulin and leads to glucose intolerance. People with diabetes mellitus tend to be female (61.1% of the population). Females suffer more from diabetes mellitus than males and females are more at risk of experiencing a decrease in foot sensitivity, this is caused by a decrease in the hormone estrogen due to menopause. As a result of menopause's reduction in the hormone estrogen, women are more likely than men to develop diabetes mellitus and experience a loss in foot sensitivity. Progesterone helps utilise fat as energy and works to normalize blood sugar levels, while estrogen primarily boosts fat storage and keeps blood sugar levels in check (Suryati, et al., 2019). With an average of 4 years (88.9%), the average respondent has had DM for less than or equal to 5 years. According to the findings of a study by (Suryati, et al., 2019) respondents who had just received a diagnosis of diabetes or had had the disease for less than five years were more likely to develop foot ulcers. Since diabetes mellitus is frequently undetected and is believed to start 5 years before a diagnosis is established, instances that go undiagnosed result in early morbidity and mortality. It is important to screen DM patients for the prevention of complications since someone who has recently encountered DM is more likely to experience problems and have them develop quickly, so they are only noticed or realized after difficulties occur.

One of the risk factors for diabetes mellitus is a family history of the disease; among those with diabetes mellitus, up to 9 respondents (or 50%) have a history of the disease. The gene that causes DM can be inherited from one's parents; typically, DM patients have relatives who also have the condition. According to data, there is a six-fold increased risk of having diabetes in people whose moms and fathers had the disease (Yulianti, 2021). In the case of type 2 diabetes, lifestyle factors, such as never exercising, are what cause the disease rather than genetics. Healthless lifestyles and a

lack of physical activity increase the likelihood of acquiring Type 2 Diabetes Mellitus, even though those who have genetic risk factors are more likely to do so than those who do not.

With a mean value of 9.00 prior to the intervention and a mean of 8.54 following the Buerger Allen Exercise intervention, the respondents' average risk of foot injury decreased. Injury to the feet can result from people's habits and behavior, such as not keeping their feet clean and not wearing footwear when engaging in activities. If an advanced diabetic foot issue is not treated effectively, it might lead to amputation of the limb (Katuuk, 2017). A significant contributor to morbidity, impairment, mortality, and disability in people with diabetes mellitus is the presence of sores and other issues on the feet (Ramayanti, 2022). To avoid foot ulcers, it's crucial to take good care of your feet. Prevention measures will lessen the likelihood that DM patients will experience foot issues. People with diabetes can practice good foot hygiene, nail and skin care, regular foot exams, and the use of appropriate footwear to prevent future foot issues (Astuti, et al., 2020). The researcher found that respondents rarely took care of their feet, such as keeping their feet clean, caring for their nails, cutting their nails and rarely doing regular foot checks at health services and rarely doing physical activity, causing an increased risk of foot injuries. respondent has suffered from DM for more than 4 years and the respondent has just been diagnosed with DM. The results of observations of respondents were that there was a delay in examining DM which was one of the causes and when exactly the time the patient had DM was often.

According to the Wilcoxon test results, the Buerger Allen Exercise intervention reduced the risk of foot injuries in individuals with type 2 diabetes mellitus by 18 percent, with a p value of 0.000 (0.05). According to research (Sanjaya, et al., 2019) physical activity, particularly foot workouts, will assist boost blood flow in the leg area, which will help stimulate the nerves in the feet to receive stimulation. The study's findings corroborate this research. Therefore, performing the Buerger Allen exercise can help persons with diabetes mellitus boost their foot sensitivity and blood flow in their feet. (Ramayanti, 2022) However, exercise must be performed constantly and regularly to enhance the circulation of muscle microvascular blood flow. Vasodilation, which is the enlargement of the arteries, and enhanced capillary permeability, which permits muscle cells to take up glucose, are related to this (Jannaim, 2018).

Exercises like those recommended by Buerger Allen have been shown to improve lower limb perfusion in those with diabetes mellitus. Patients who underwent the Buerger Allen Exercise for type 2 DM showed a marked improvement in lower extremity perfusion and a decrease in discomfort. Exercises for the legs increase blood flow by allowing gravity to alternately empty the veins and replenish the arterial columns on the legs (Jannaim, 2018). To lessen the occurrence of diabetes mellitus problems, proper care is required. One of them is engaging in physical activity or participating in sports, which can enhance the consumption of glucose by active muscles and lower blood sugar levels (Suryati, et al., 2019). In addition to increasing blood flow to the lower limbs to avoid peripheral artery disease in patients with diabetes mellitus, physical activity entails a variety of joint motions or stretching in all directions. The utilization of glucose by cells can be increased by physical exercise by raising the sensitivity of insulin receptors in working muscles (Suryati, et al., 2019). The Buerger Allen exercise has a beneficial effect on circulation, increases blood flow, enhances walking capacity, lowers necrosis, prevents embolism, discomfort, and cyanosis in blood vessels, according to research by (Chang, et al., 2016). The results of the observations of the researchers found that at the beginning before the research was carried out the respondents preferred to sit on the terrace of the house rather than do physical activities, but after the Buerger Allen Exercise action the respondents were more enthusiastic about doing physical activities such as leg exercises or walking which can help stimulate the feet diabetics and prevent the occurrence of neurological disorders,

blood vessel disorders, foot deformities and prevent the risk of foot injuries. The results of the research on the Buerger Allen Exercise intervention can reduce the risk of diabetic foot ulcers, so it is hoped that it can become one of the non-pharmacological nursing interventions that can be applied to health services, especially in Community Health Centers which are the first level of health services by providing education to patients and families.

## SUGGESTIONS

In an effort to prevent diabetic ulcers, it is hoped that the Buerger Allen Exercise intervention will become one of the non-pharmacological nursing interventions that can be used in health services, particularly at the Puskesmas level of care, which is the first level of care.

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