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THE EFFECT OF BUERGER ALLEN EXERCISE ON THE IMPROVEMENT OF FOOT SENSITIVITY IN DIABETES MELLITUS TYPE 2 PATIENTS AT THE Dr. DRAJAT PRAWIRANEGARA HOSPITAL

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ABSTRACT

Background: Diabetes mellitus (DM) is a metabolic disease characterized by increased blood glucose levels, caused by impaired insulin secretion or the inability of cells to utilize insulin properly. Buerger Allen Exercise (BAE) is a type of active exercise performed on the plantar area by utilizing the force of gravity, so that each movement must be carried out regularly. A number of studies have shown that physical exercise, including BAE can provide significant benefits for people with DM with impaired foot sensitivity. **The purpose:** of this study was to determine the effect of Buerger Allen Exercise on increasing foot sensitivity in patients with Type 2 Diabetes Mellitus at Dr. Drajat Prawiranegara Regional General Hospital. **Method:** This study uses a quantitative method with a Quasi Experiment design that is applied is Two Group Pre and Post Test, which involves two groups, namely the intervention group and the control group. **Results:** There is an effect of buerger allen exercise on improving foot sensitivity in patients with type 2 diabetes mellitus with a sig value <0.05, namely 0.000. **Conclusion:** The mean difference between the intervention and control groups on the right foot is 1.56. The difference between the left foot values between the intervention and control groups is 2.78. Indicates that there is a very significant difference between the intervention and control groups on both right and left feet. So that the intervention group that has been given Buerger Allen Exercise has an effect on the level of foot sensitivity of patients with diabetes mellitus.

Keywords: Diabetes Mellitus, Buerger Allen Exercise (BAE), Foot Sensitivity.

INTRODUCTION

Diabetes Mellitus (DM) is a chronic metabolic disease characterized by elevated blood glucose levels. This condition occurs either because body cells are unable to respond effectively to insulin or because the pancreas fails to produce an adequate amount of insulin. As a result, the utilization of glucose as an energy source becomes inefficient, leading to abnormally increased blood glucose levels (Suryati, I., Def P., 2019).

According to the International Diabetes Federation (IDF, 2021), diabetes is classified as a lifelong chronic disease. This condition arises due to impaired pancreatic function, which results in insufficient insulin production. Globally, it is estimated that more than 463 million people are affected by diabetes. In 2021, the number of people aged 20 years and older living with diabetes reached 537 million, accounting for approximately 10% of the global population. In Indonesia, 19.74 million people suffer from diabetes, placing the country fifth worldwide. With a population of 179.72 million, the prevalence of diabetes in Indonesia is estimated at 10.6% (International Diabetes Federation, 2021).

The prevalence of diabetes mellitus in Indonesia has reached 8.5%, which is equivalent to approximately 20.4 million individuals (Ministry of Health of the Republic of Indonesia, 2020). In Banten Province, 249,564 cases of diabetes mellitus were reported in 2023, with Tangerang City recording the highest number of cases (93,500), followed by Tangerang Regency (43,633) and South Tangerang City (52,488). Serang City reported 13,840 individuals with diabetes mellitus, while Cilegon City had a relatively lower number of cases (9,685) (Banten Health Office, 2023).

Peripheral neuropathy is a serious complication that frequently affects patients with diabetes. This condition can significantly reduce patients' quality of life due to damage to the peripheral nervous system, particularly in the lower extremities such as the feet. Therefore, appropriate interventions are required to address this problem, one of which is Buerger Allen Exercise (BAE).

Buerger Allen Exercise is a form of active exercise focused on the plantar area of the feet and utilizes the principle of gravity at each stage of movement. This exercise stimulates contraction and relaxation mechanisms of peripheral blood vessels through a series of systematic movements. The primary goal of Buerger Allen Exercise is to improve blood circulation to the extremities, especially in individuals with impaired peripheral circulation.

A study by Suryati et al. (2019) demonstrated that Buerger Allen Exercise had a significant effect on foot sensitivity in patients with diabetes mellitus, as indicated by the results of a dependent t-test (paired t-test) with a p-value of 0.000 (< 0.05). Similarly, findings from Suryani et al. (2021) showed a significant difference in the levels of diabetic neuropathy in the right and left feet between the two groups, with an independent t-test result of p = 0.000 (< 0.05). These findings suggest that Buerger Allen Exercise influences foot sensitivity levels in patients with diabetes mellitus and may reduce the risk of diabetic neuropathic complications. Furthermore, a study by Pratiwi Christa et al. (2021) indicated that regular fitness programs can help individuals with diabetes improve overall quality of life and reduce neuropathic symptoms.

Based on the above background and phenomena, the researcher is interested in conducting a study entitled "The Effect of Buerger Allen Exercise on Foot Sensitivity in Patients with Type 2 Diabetes Mellitus at Dr. Drajat Prawiranegara Regional General Hospital, Serang." This study is expected to provide appropriate interventions and beneficial insights for the management of patients with diabetes mellitus.

MATERIALS AND METHODS

This study used a quantitative method with a Quasi-Experimental Two Group Pre and Post Test design, involving two groups: the intervention group and the control group. The study was conducted from March 3 to April 3, 2025, at Dr. Drajat Prawiranegara Hospital in Serang. The sampling technique used was purposive sampling, involving 18 respondents in the intervention group and 18 respondents in the control group who met the inclusion and exclusion criteria. The inclusion criteria were patients with Type 2 Diabetes Mellitus, both male and female who were hospitalized, patients who could communicate well, and patients without ulcers. The exclusion criteria were patients with chest pain or shortness of breath, experiencing depression, anxiety, or worry, patients who passed away, or patients unable to continue the exercises.

Data was collected by checking the sensitivity level of the patient's feet using a monofilament. The Buerger Allen Exercise technique procedure is as follows: Buerger Allen exercises require the DM patient to lie on their back for about three minutes. After that, raise the feet to a higher position for about three minutes at a 45° angle. After standing, the patient is asked to sit with their feet hanging off the side of the bed. The patient's feet should then be stretched down and bent up as far as possible. Perform this exercise for about three minutes. After that, bend the toes upward. Perform this exercise for about three minutes. After that, bend the toes upward. Perform this exercise for about three minutes. After doing these exercises, ask the patient to lie back on the bed and cover their entire body with a blanket for about three minutes. If the patient shows signs of fatigue, stop the intervention. This exercise is done for 20 minutes twice a day (morning and afternoon) at 9:00 AM and 3:00 PM for 5 days

RESULTS AND DISCUSSION

1. Univariate Analysis

Univariate analysis is used to present a descriptive overview of the frequency distribution and demographic characteristics of the participants. The information analyzed includes variables such as gender, age group, education level, duration of having diabetes, and the average score of Buerger Allen Exercise performance.

Table 1. Frequency Distribution of Respondents Based on Gender, Age, Occupation, Education, and Duration of Illness at RSUD Dr. Drajat Prawiranegara Serang (n=18)

No.	Variabel	Kelompok Intervensi		Kelompok Kontrol	
		F	%	f	%
1.	Jenis Kelamin				
	Laki-laki	8	44,4	9	50,0
	Perempuan	10	55,6	9	50,0
	Total	18	100%	18	100%

2.	Pendidikan				
	Tidak Sekolah	1	5,6	1	5,6
	SD	8	44,4	5	27,8
	SMP	1	5,6	4	22,2
	SMA	4	22,2	5	27,8
	Perguruan Tinggi	4	22,2	3	16,7
	Total	18	100%	18	100%
3.	Lama menderita				
	< 6 bulan	0	0	0	0
	> 6 bulan	18	100,0	18	100,0
	Total	18	100%	18	100%

Table 1 show it can be seen that most of the respondents in the intervention group were female, totaling 10 people (55.6%), while in the control group, the number of female and male respondents was evenly split, with 9 people each (50.0%). The highest education level in the intervention group was mostly elementary school (SD), with 8 people (44.4%), whereas in the control group, most had junior high or high school education, with the same number of respondents, 5 people each (27.8%). All respondents in both the intervention and control groups had more than 6 months, with each group consisting of 18 people (100%).

Table 2. Age Distribution of Respondents at Dr. Drajat Prawiranegara Serang General Hospital in 2025 (n=18)

No	Variabel	Mean	SD	Min-Max	95%CI
1.	Usia Kelompok Intervensi	52.00	11.752	30-65	46.15-57.84
2.	Usia Kelompok Kontrol	49.44	8.583	36-65	45.18-53.71

Table 2 show the average age of type 2 diabetes patients in the intervention group is 46.15 years to 57.84 years. The average age of type 2 diabetes patients in the intervention group is 45.18 years to 53.71 years.

2. Bivariate Analysis

Table 1. Shapiro-Wilk Normality Test

Kelompok Intervensi

Variabel	N	Levense Statistic	P-Value (Sig.)	95%CI
Pre Kaki Kanan	18	0,901	0,059	0,35-0,35
Post Kaki Kanan	18	0,966	0,711	0,34-0,34
Pre Kaki Kiri	18	0,936	0,250	5,88-7,34
Post Kaki Kiri	18	0,928	0,176	6,90-8,32

Kelompok Kontrol

Variabel	N	Levense Statistic	P-Value (Sig.)	95%CI
Pre Kaki Kanan	18	0,967	0,730	3,85-5,71
Post Kaki Kanan	18	0,941	0,306	4,66-6,34
Pre Kaki Kiri	18	0,947	0,384	2,93-5,07
Post Kaki Kiri	18	0,944	0,334	3,75-5,92

From these results, it can be concluded that the research data on the effect of Buerger Allen exercises on increasing foot sensitivity in type 2 diabetes patients is normally distributed because it is above the p-value >0.005.

Table 2. Paired Sample T-Test Before and After Intervention

Kelompok Intervensi

	N	Mean (SD)	Sig.(2-tailed)	95%CI

pre-test kaki kanan	18	6,11 (2,324)	0,000	1,305-0,584
post-test kaki kanan	18	7,06 (2,313)		
Pre-test kaki kiri	18	6,61(1,461)	0,000	1,295-0,705
Post-test kaki kiri	18	7,61 (1,420)		

Kelompok Kontrol

	N	Mean (SD)	Sig.(2-tailed)	95%CI
pre-test kaki kanan	18	4,78 (1,885)	0,000	1,008-0,437
post test kaki kanan	18	5,50 (1,689)		
Pre-test kaki kiri	18	4,00 (2,142)	0,000	1,089-0,577
Post-test kaki kiri	18	4,83 (2,176)		

The data analysis results using the paired T-test showed a value (sig. 0.000) < 0.05, which indicates that Buerger Allen Exercise has an effect on improving foot sensitivity in type 2 diabetes patients.

Table 3. Homogenity Test

	N	Levense Statistic	Sig.
Based on Mean	36	0.136	0,713

The homogeneity test results above show that the effect after performing Buerger Allen exercises got a significance of > 0.05, which is 0.713. So it is considered homogeneous, and therefore the bivariate statistical test used in this study is the Independent Sample T-test.

Table 4. Independet Sample Test

	Variabel	N	Mean	SD	Sig. (2-tailed)	95% CI
Post kanan	Intervensi	18	7,06	0,675	0,027	0,184-2,927
	Kontrol	18	5,50	0,675	0,028	0,179-2,932

	Variabel	N	Mean	SD	Sig. (2-tailed)	95% CI
Post kiri	Intervensi	18	7,61	0,612	0,000	1,533-4,022
	Kontrol	18	4,83	0,612		1,526-4,030

The results from the independent T-test data processing showed a significance value of 0.027 for the intervention group on the right leg, and a significance value of 0.028 for the control group post-test on the right leg. This means there is a difference between the intervention group given Buerger Allen exercise and the control group that did not receive the Buerger Allen exercise intervention.

DISCUSSION

1. Gender

   The results of the study show that in the intervention group, the majority of respondents were female. In contrast, in the control group, the proportions of male and female respondents were balanced, indicating an even distribution of gender within that group. This condition may have been influenced by the selection of the inpatient ward used as the research setting, as the ward serves patients of both genders simultaneously. This study is consistent with the research conducted by Harli and Kurnia (2023), which reported that 55.6% of respondents were female. The findings of this study are further supported by research from Jaya and Indra Frana (2023), who reported that 60% of their respondents were female, as well as by Suryani et al. (2021), who stated that in the intervention group, 68.4% of respondents were female. However, the results of this study are not consistent with the findings of Rahmi and Hidayatul (2022), which showed that the majority of respondents were male (52.6%).
2. Age

   The results of this study reveal that the majority of respondents with type 2 diabetes mellitus who experienced impaired foot sensitivity in the intervention group were in the age range of 56 to 65 years.

Meanwhile, in the control group, most respondents experiencing similar impairment were aged between 45 and 55 years. This difference in age ranges indicates variations in age characteristics between the two groups studied. This study is consistent with the research by Rahmi and Hidayatul (2022), which reported that most respondents were aged 56–65 years, totaling 19 individuals (47.4%). The findings of this study are further supported by research conducted by Paojah (2020), which stated that the majority of respondents were aged 56–65 years, totaling 14 individuals (31.8%). However, this study is not consistent with the research by Suryani et al. (2021), which reported that most respondents in the intervention group were aged 46–55 years, with a percentage of 57.9%.

3. Education
   According to Frana (2023), the majority of respondents had a senior high school education (65%). Most participants in the control group had completed secondary education, while most respondents in the intervention group had only completed primary education. However, the control group did not experience an improvement in foot sensitivity because they did not receive the Buerger Allen Exercise (BAE) intervention, whereas the intervention group received information and training on the BAE intervention, resulting in an improvement in foot sensitivity. This study is consistent with the findings of Suryani et al. (2021), which showed that in the intervention group, most respondents had a primary school education, with a percentage of 42.1%. These findings are further strengthened by the study conducted by Rahayu (2020), which reported that most respondents' highest level of education was primary school, totaling 8 individuals (53.33%). The results of this study are also supported by Husnul and Amriati (2022), who found that the majority of respondents had a primary school education, totaling 15 respondents (42.9%). However, the results of this study are not consistent with the findings of Jaya and Indra.
4. Suffered For A Long Time
   In both the intervention and control groups, the average was > 6 months. The results of this study are in line with the research by (Yeni Yulianti et al., 2021), which found that most had been suffering for >6 months, namely 66.7% or 12 respondents. This is supported by the results of the study by (Tanti Rahmawati, 2023), where most respondents had suffered from diabetes mellitus for >6 months, with 8 respondents (47.1%) affected.
5. The Effect of Buerger Allen Exercise on Improving Foot Sensitivity in Patients with Type 2 Diabetes Mellitus
   The differences were obtained from foot sensitivity measurement sheets conducted on patients with type 2 diabetes, then analyzed using statistical tests. There was a decrease in the average value in the intervention group. This change indicates that Buerger Allen exercise has an effect on improving foot sensitivity in patients with type 2 diabetes. Based on statistical analysis using the paired sample T-test, a difference in average foot sensitivity before and after the intervention was found in both the intervention and control groups. Each group showed changes, but the level of change differed significantly. In the intervention group, which received Buerger Allen Exercise, there was a meaningful increase in average foot sensitivity. The statistical test results showed a significant value (p-value) <0.000, which is far below the significance threshold of <0.05. This indicates that Buerger Allen Exercise has a positive effect on improving foot sensitivity in patients with type 2 Diabetes Mellitus.

CONCLUSION

Based on the research results on 'The Effect of Buerger Allen Exercise (BAE) on Increasing Foot Sensitivity in Type 2 Diabetes Mellitus Patients at RSUD Dr. Drajat Prawiranegara Serang in 2025,' the conclusions are as follows:

1. The distribution of respondents shows the characteristics of the respondents in this study, consisting of 18 people with type 2 diabetes who experienced foot sensitivity: most were female, totaling 10 people (55.6%), most were aged 51-65 years (72.2%), most had last education at elementary school level, totaling 8 people (44.4%), most patients were housewives, totaling 5 people (27.8%), and all had diabetes for more than 6 months, totaling 18 people (100%).
2. The average foot sensitivity score before being given the Buerger Allen Exercise (BAE) intervention in type 2 diabetes patients (pre-test) for the right foot was 6.11 with a standard deviation of 2.32 and a minimum-maximum value of 0-9. The (pre-test) left foot score was 6.61 with a standard deviation of 1.46, and a minimum-maximum value of 4-9. The (post-test) right foot score was 7.06 with a standard deviation of 2.31, and a minimum-maximum value of 1-10. The (post-test) left foot score was 7.61

with a standard deviation of 1.42, with a minimum-maximum value of 5-10. This is influenced by age and the duration of having the condition.

3. The average foot sensitivity score before intervention in the control group of type 2 diabetes patients (pre-test) for the right foot was 4.78 with a standard deviation of 1.86 and a minimum-maximum range of 1-8. The left foot (pre-test) score was 4.00 with a standard deviation of 2.14 and a minimum-maximum range of 0-7. The right foot (post-test) score was 5.50 with a standard deviation of 1.68 and a minimum-maximum range of 2-8. The left foot (post-test) score was 4.83 with a standard deviation of 2.17 and a minimum-maximum range of 1-8. This was influenced by age and the duration of the disease.
4. The average difference between the intervention and control groups for the right foot is 1.56. The difference for the left foot between the intervention and control groups is 2.78. This shows that there is a very significant difference between the intervention and control groups for both the right and left feet. So, the intervention group that received Buerger Allen Exercise has an effect on the sensitivity level of the feet in patients with diabetes.

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