GENIUS JOURNAL
general nursing science journal
e-ISSN: 2723-7729
Vol. 7 No. 1 PP. 239-245 E-ISSN 2723-7729

Implementation of Buerger Allen Exercises on Foot Sensitivity in Patients with Diabetes Mellitus

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DOI: https://doi.org/10.56359/gj.v7i1.820

Abstract

Introduction: Diabetes mellitus is a chronic metabolic disease with a rapidly increasing global prevalence and is commonly associated with peripheral complications, including decreased foot sensitivity. Impaired peripheral circulation in patients with type 2 diabetes mellitus increases the risk of foot ulcers and other serious complications. Buerger Allen exercise is a non-pharmacological intervention that may improve peripheral blood flow and foot sensitivity through postural changes and muscle contractions. Therefore, this study aims to examine the effect of Buerger Allen exercise on foot sensitivity in patients with diabetes mellitus.

Objective: This study aimed to evaluate the effectiveness of Buerger Allen Exercise in improving foot sensitivity among patients with Diabetes Mellitus at Sejiran Setason Regional Public Hospital, West Bangka, in 2025.

Method: The study used a quantitative design with a quasi-experimental method, employing a pretest-posttest control group design with a total sample of 36 participants. The research involved two groups: an intervention group and a control group. Foot sensitivity was measured using the monofilament test before and after the intervention. The Buerger Allen Exercise therapy was carried out for five consecutive days, twice daily in the morning and afternoon.

Result: The results showed a significant difference in foot sensitivity levels after the intervention in the treatment group (p-value = 0.00; $p < 0.05$). This indicates that Buerger Allen Exercise is effective in improving foot sensitivity in Diabetes Mellitus patients.

Conclusion: It is recommended that this therapy be included as one of the nursing interventions in the management of Diabetes Mellitus at Sejiran Setason Regional Public Hospital, West Bangka.

Keywords: buerger allen exercise, diabetes mellitus, foot sensitivity

Introduction

According to the World Health Organization (WHO, 2020), diabetes is a chronic metabolic disease characterized by elevated blood glucose (or blood sugar) levels, which can lead to serious health problems such as heart, blood vessel, eye, kidney, and nerve damage. The most common type of diabetes is type 2 diabetes, which generally affects adults. This occurs when the body becomes resistant to insulin or does not produce enough insulin. In the last three decades, the incidence of diabetes has increased dramatically in many countries. Data shows that in 2022, the number of people with diabetes mellitus was 422 million, then increased the following year to 537 million, and increased again to 624 million in 2024.

Diabetes mellitus (DM) is categorized as a global disease that increased fourfold from 1980 to 2016. The World Health Organization (WHO) estimates that by 2025, the incidence will increase to 300 million people with diabetes with peripheral vascular complications (WHO, 2016). Data from the International Diabetes Federation (IDF) in 2017 revealed that Indonesia ranked 7th with a prevalence of 6.2%, with 90-95% having type 2 diabetes (IDF, 2017). The number of diabetes sufferers in Indonesia is estimated to have reached more than 10.8 million by 2020 due to changes in people's lifestyles, which tend toward consumerism and lack of physical exercise (PERKENI, 2020).

According to the 2023 Indonesian Health Survey prevalence data, diagnosed cases of diabetes mellitus among the Indonesian population of all ages reached 877,531 across all provinces. The prevalence of diabetes mellitus in the Bangka Belitung Islands Province in 2022 was 320,000, increasing to 47,630 in 2023 and then to 56,270 the following year (Indonesian Health Survey, Ministry of Health, 2023).

The 2023 Basic Health Research (Riskesdas) data reported an increase in the prevalence of diabetes mellitus in East Java province from 2021 to 2023, from 1.5% in 2013 to 2.0% in 2018, and the latest data in 2023 was 11.7%. (RISKESDAS, 2018). Meanwhile, diabetes mellitus (DM) cases in the Bangka Belitung Islands decreased from 2.5% to 1.8% in 2018, with a total of 5,592 cases (Ministry of Health, 2018).

The Bangka Belitung Islands Provincial Health Office reported a continued increase in diabetes mellitus cases in 2022, reaching 28,555 cases. Based on 2023 data, the number of diabetes mellitus cases in the Bangka Belitung Islands region reached 28,559, with 29,995 receiving healthcare services (Bangka-Belitung Islands Provincial Health Profile, 2023).

Every person with diabetes mellitus receives standard healthcare services. Regency/City governments are obligated to provide standard healthcare services to all diabetes mellitus (DM) patients aged 15 years and older as a secondary prevention measure within their jurisdictions within a one-year period. According to data from the West Bangka Health Office, the number of people with diabetes mellitus in 2023 was 3,968 (West Bangka Regency Health Profile, 2023).

Data from the Sejiran Setason Regional General Hospital, West Bangka, showed that the number of cases of diabetes mellitus in 2022 was 221. In 2023, this number increased to 229. In 2024, the number of diabetes mellitus cases decreased to 203. Suboptimal management and prevention can lead to acute and chronic complications in diabetes mellitus patients, one of which is decreased foot sensitivity. Regular application of Buerger Allen exercises can effectively help improve tissue perfusion in the feet, thereby increasing foot sensitivity in diabetes mellitus patients at the Sejiran Setason Regional General Hospital, West Bangka.

Buerger Allen exercises are a type of exercise performed by lowering the extremities to accelerate wound healing. In addition, this exercise also prioritizes activities using postural changes and peripheral circulation stimulated by gravity modulation and applying muscle

contractions. This can improve perfusion in the lower extremities and can reduce pain in the lower extremity area of type II Diabetes mellitus sufferers, can increase blood supply to the extremities and potentially cause the formation of new vascular structures, so it can help the healing process of diabetic wounds. Regular application of Buerger Allen exercises is effective in helping improve tissue perfusion in the foot area so that foot sensitivity can increase in people with Diabetes mellitus (Firdaus, et al. 2024).

The increase in foot sensitivity among respondents demonstrates that the Buerger Allen Exercise affects foot sensitivity in people with diabetes mellitus. This increase in foot sensitivity is due to the respondents' regular participation in the Buerger Allen Exercise and its correct execution. Performing the Buerger Allen Exercise causes the leg muscles to contract, increasing muscle metabolism. This results in the dilation of blood vessels in the feet, improving blood circulation and increasing glucose utilization in metabolism, thus improving foot sensitivity (Suryati et al., 2019).

To address arterial insufficiency in the lower limbs, the Buerger Allen Exercise combines a shift in gravity in a fixed position and a muscle pump, which involves foot care to soften the muscles in the blood vessels. By inducing relaxation of vascular smooth muscle and dilation of blood vessels, the blood pump that induces dorsiflexion and plantar flexion can stimulate the endothelium to produce or release nitric oxide, resulting in smooth blood flow to the periphery of the foot. Buerger Allen Exercise can empty and fill the blood column and increase blood flow through the blood vessels, which can occur optimally if posture and gravity adjustments are made (Novitasari, 2024).

Research by Firdaus (2024) indicates that Buerger Allen exercise is a therapeutic modality performed with a variety of active postural movements in the plantar area. Through Buerger Allen exercise, which stimulates muscle contractions, changes in position, and postural training, it can play a role in venous blood flow and lower extremity circulation. This study aims to determine the effectiveness of Buerger Allen exercise in improving foot sensitivity in patients with type II diabetes mellitus. This study aims to determine the benefits and can apply Buerger Allen exercise as an effort to improve vascularization and prevent diabetic ulcers. An initial survey and interviews with Diabetes Mellitus program holders on November 25, 2024, regarding the management of Diabetes Mellitus only involved medication therapy; there was no Buerger Allen Exercise management.

Objective

This study aimed to evaluate the effectiveness of Buerger Allen Exercise in improving foot sensitivity among patients with Diabetes Mellitus at Sejiran Setason Regional Public Hospital, West Bangka, in 2025.

Method

This study employed a quantitative research design using a quasi-experimental approach with a pretest–posttest control group design. The study was conducted in 2025 at Sejiran Setason Regional Public Hospital, West Bangka. The population consisted of patients diagnosed with Diabetes Mellitus who received treatment at the hospital. A total of 36 participants were selected using a purposive sampling technique based on predetermined inclusion and exclusion criteria. The inclusion criteria included patients diagnosed with Diabetes Mellitus, experiencing decreased foot sensitivity, able to communicate well, and willing to participate in the study. Patients with severe complications, foot ulcers, or conditions that limited mobility were excluded from the study.

The participants were divided into two groups: an intervention group and a control group, each consisting of 18 respondents. Prior to the intervention, both groups underwent an initial assessment (pretest) to measure baseline foot sensitivity.Foot sensitivity was assessed using the 10 g monofilament test, which is a standardized and widely used instrument to evaluate peripheral neuropathy in patients with Diabetes Mellitus. Measurements were conducted by trained researchers following standardized procedures to ensure consistency and accuracy.

The intervention group received Buerger Allen Exercise therapy, which was administered for five consecutive days, performed twice daily (in the morning and afternoon). The exercise consisted of a series of postural changes involving elevation, dependency, and horizontal positioning of the lower extremities combined with ankle dorsiflexion and plantar flexion movements to stimulate peripheral circulation. Each exercise session was conducted under supervision to ensure correct technique and participant safety. Meanwhile, the control group received standard hospital care without the addition of Buerger Allen Exercise.

After completion of the intervention period, foot sensitivity in both groups was reassessed using the same monofilament test (posttest). The collected data were then analyzed to determine differences in foot sensitivity before and after the intervention, as well as differences between the intervention and control groups. Statistical analysis was performed using appropriate parametric or non-parametric tests based on data distribution, with a significance level set at $p < 0.05$.

Result

Table 1. Average Foot Sensitivity Levels Before and After Buerger Allen Exercise Therapy in the Intervention Group (n=8)

Variabel	***Mean***	**SD**	**SE**	**P *value***
Sensitivity Level Before	5.87	743	192	0.000
Sensitivity Level After	9.93	258	067	

Table 1 shows that the average foot sensitivity level before Buerger Allen Exercise therapy in the intervention group was 5.87 (Neuropathy), while the average foot sensitivity level after Buerger Allen Exercise therapy in the intervention group was 9.93 (No Neuropathy). The results of the analysis showed that there was a significant difference in the average level of foot sensitivity before and after Buerger Allen Exercise therapy in the intervention group with a p value of 0.000 (p value $<\alpha$ 0.05), so H0 was rejected, meaning there was a difference in the average (mean) level of foot sensitivity before Buerger Allen Exercise therapy with the average (mean) level of anxiety after Buerger Allen Exercise therapy.

Table 2. Average Foot Sensitivity Levels in the Control Group

Variabel	***Mean***	**SD**	**SE**	**P *value***
Sensitivity Level Before	7.50	2.121	500	0.668
Sensitivity Level After	7.56	2.064	487	

Table 2 shows that the average foot sensitivity level before Buerger Allen Exercise therapy in the control group was 75.0 (neuropathy), while the average foot sensitivity level

after Buerger Allen Exercise therapy in the control group was 75.6 (neuropathy). The analysis revealed no significant difference in the average pressure sensitivity level before and after Buerger Allen Exercise therapy in the control group with a p-value of 0.668 (p-value > α 0.05). Therefore, Ha was rejected, indicating no difference in the average foot sensitivity level before Buerger Allen Exercise therapy and the average anxiety level after Buerger Allen Exercise therapy.

Table 3. Differences in Average Foot Sensitivity Levels Before and After Buerger Allen Exercise Therapy in the Intervention Group and the Control Group

Variabel	Group	*Mean*	SD	SE	P *value*
Level	Group 1	7.33	2062	2.268	0.16
Before	Group 2	5.78	383	2.765	
Level	Group 1	9.78	2.121	411	0.00
After	Group 2	9.89	2.064	333	

Table 3 shows that the foot sensitivity level before Buerger Allen Exercise therapy in the intervention group was 7.33 (neuropathy), while in the control group it was 5.78 (neuropathy).

The analysis results showed no significant difference in the level of foot sensitivity before the intervention group with Buerger Allen Exercise therapy and the control group because the p value was 0.16 (p value> α 0.05), so Ha was rejected, meaning there was no difference in the average (mean) level of foot sensitivity in the intervention group before Buerger Allen Exercise therapy and the average (mean) level of foot sensitivity before the control group.

For the level of foot sensitivity after, based on the above, it also showed that the level of foot sensitivity after Buerger Allen Exercise therapy in the intervention group was 9.78 (neuropathy), while in the control group it was 9.89 (no neuropathy). The analysis results showed a significant difference in the level of foot sensitivity after between the Buerger Allen Exercise therapy intervention group and the intervention group because the p value was 0.00 (p value < α 0.05), so H0 was rejected, meaning there was a difference in the average (mean) level of foot sensitivity in the intervention group after Buerger Allen Exercise therapy and the average (mean) level of foot sensitivity in the control group.

Discussion

Foot sensitivity is a stimulus in the soles of the feet that is affected by nerves and causes various problems called neuropathy. Increased reactivity of the lower extremities will lead to increased red blood cell aggression, slowing blood circulation and resulting in impaired blood circulation (Rusandi et al., 2015). Meanwhile, according to Rohana (2014), foot sensitivity increases the sensitivity of body cells to insulin, thereby lowering blood sugar and fat levels. Echeverry (2007) in Damilis (2013) added that one complication of diabetes mellitus is neuropathy, which can cause decreased foot sensitivity in diabetic patients. Therefore, foot sensitivity is a complication of diabetes mellitus caused by high insulin levels, which disrupts blood circulation in the feet, leading to a lack of stimulation in the soles of the feet.

Buerger-Allen exercises are a type of exercise performed by lowering the extremities to accelerate wound healing. Furthermore, these exercises prioritize activities using postural changes and peripheral circulation stimulated by gravity modulation and muscle contraction.

This can improve perfusion in the lower extremities and reduce pain in those with type II diabetes mellitus. It can also increase blood supply to the extremities and potentially lead to the formation of new vascular structures, thus aiding the healing process of diabetic wounds. Regular application of Buerger-Allen exercises is effective in helping improve tissue perfusion in the feet, thereby increasing foot sensitivity in those with diabetes mellitus (Firdaus et al., 2024).

The improved results of the 10g monofilament test in participants indicate that Buerger-Allen exercises are effective in reducing the risk of diabetic neuropathy in adults with diabetes mellitus. The increase in 10g monofilament inspection values is likely due to respondents continuing to participate in Buerger-Allen exercises and performing them correctly and consistently. Buerger-Allen exercises cause the muscles in the feet to contract, increasing the metabolic rate, which is why this occurs. Increased blood flow and larger blood vessels in the feet can lead to increased foot sensitivity (Suryani et al., 2021).

According to researchers, Buerger Allen Exercise has the potential to be an effective and economical intervention to improve tissue perfusion and foot sensitivity in patients with diabetes mellitus. This exercise can stimulate collateral vasodilation, improve microblood flow, and ultimately increase the delivery of oxygen and nutrients to peripheral nerve tissue. Several studies have shown that after 2–4 weeks of Buerger Allen Exercise intervention, there is an increase in tissue capillarity, a decrease in tingling and numbness symptoms, and an increase in the monofilament score (a measure of foot sensitivity). This suggests that this exercise can slow the progression of diabetic neuropathy and improve patients' quality of life. However, the effectiveness of Buerger Allen Exercise has not been widely proven through large-scale clinical trials and long-term trials. Furthermore, there are challenges in patient compliance, especially in the elderly, because this exercise requires guidance and consistency.

Conclusion

Based on the results of this study and discussions with 36 respondents regarding the effect of Buerger Allen Exercise on foot sensitivity in patients with diabetes mellitus at Sejiran Setason Regional Hospital in 2025, there was a significant effect on foot sensitivity before and after Buerger Allen Exercise in the intervention group of patients with diabetes mellitus at Sejiran Setason Regional Hospital in 2025.

There was a difference in the average foot sensitivity levels before and after Buerger Allen Exercise therapy in the intervention group and the control group in patients with diabetes mellitus at Sejiran Setason Regional Hospital in 2025.

Conflict of Interest

No declare.

Acknowledgement

The author would like to express his deepest gratitude to God, his parents, his family, his supervisors, his examiners, all the university leaders, his friends, and all those involved in the process of compiling this research.

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