The Effect of Buerger Allen Exercise on Improving Foot Sensitivity Values in Type 2 Diabetes Mellitus Patients in Semanan Village

Christina Lumban Tobing*, Rima Berlian Putri, Ricky Riyanto Iksan, Maria Susila Sumartiningsih

Bachelor of Nursing Study Program, Tarumanagara Institute

Article Info
Article History:
Received: 1 January 2026
Revised: 11 April 2026
Accepted: 15 April 2026

*Corresponding Author :
christinatobg12@gmail.com

DOI :
https://doi.org/10.37362/chc.v10i1.889

P- ISSN : 2722-1563
E -ISSN : 2580-7137

ABSTRACT

Background: Type 2 diabetes mellitus (DM) can cause circulatory disorders and decreased foot sensitivity due to peripheral neuropathy, which increases the risk of foot complications. Buerger Allen Exercise is a non-pharmacological intervention that is thought to improve foot sensitivity in patients with type 2 diabetes. 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 in Semanan Village, West Jakarta. This research method used a quantitative approach with a pre-experimental design, one-group pretest-posttest design. The study sample of 40 respondents was selected purposively. Foot sensitivity measurements were carried out before and after the intervention. Data were analyzed using the Wilcoxon Signed Rank Test to determine differences in foot sensitivity before and after the implementation of the Buerger Allen Exercise, with a significance level of $\alpha = 0.05$. The results of the bivariate analysis showed that the foot sensitivity value before the intervention obtained a Z value = -6.646, $p = 0.001$ ($p < 0.05$), which indicated a significant difference in the initial condition of the respondents. After the intervention, a Z score of -6.551 was obtained, with $p = 0.002$ ($p < 0.05$), indicating a significant increase in foot sensitivity. The shift in the majority of categories from fair to good indicates the effectiveness of the Buerger Allen Exercise in improving foot sensory function. Conclusion: The Buerger Allen Exercise has been shown to have a significant effect on improving foot sensitivity in patients with type 2 diabetes mellitus in Semanan Village, West Jakarta.

Keywords: Buerger Allen Exercise; Foot Sensitivity; Type 2 Diabetes Mellitus

INTRODUCTION

Diabetes mellitus is a chronic non-communicable disease characterized by hyperglycemia due to impaired insulin secretion, insulin action, or a combination of both, resulting in complex and progressive disturbances in carbohydrate, fat, and protein metabolism (Banday et al., 2020). Diabetes mellitus is heterogeneous and causes long-term clinical manifestations that can affect multiple organ systems (American Diabetes Association [ADA], 2023).

Type 2 diabetes mellitus is closely associated with lifestyle factors, such as smoking habits, low physical activity, alcohol consumption, psychological stress, and

excessive intake of coffee and caffeine (Pangestika et al., 2022). In addition to lifestyle factors, the risk of diabetes mellitus is also influenced by demographic and biological factors, including age, sex, and genetic predisposition (Kahn et al., 2019).

Globally, the number of people with diabetes mellitus continues to rise, reaching approximately 422 million individuals worldwide, with the majority of cases occurring in low- and middle-income countries (World Health Organization [WHO], 2020). Diabetes mellitus also contributes to approximately 1.5 million direct deaths each year, making it one of the leading causes of global mortality (WHO, 2020). Southeast Asia ranks second in terms of the highest number of diabetes mellitus cases after the Western Pacific region (International Diabetes Federation [IDF], 2021). In Indonesia, the prevalence of diabetes mellitus in 2021 was estimated at 90 million people and is projected to increase to approximately 113 million by 2030 (IDF, 2021). The rising incidence of diabetes mellitus is closely related to unhealthy lifestyles, low levels of knowledge, and limited public awareness regarding early detection of the disease (Anisa, 2019). Diets high in carbohydrates, fats, sugar, and salt but low in fiber have been shown to worsen metabolic conditions and increase the risk of type 2 diabetes mellitus (Anisa, 2019).

In individuals with diabetes mellitus, structural and functional changes in microvascular and macrovascular vessels can lead to various chronic complications, such as neuropathy and angiopathy, which cause tissue damage (Banday et al., 2020). These disorders result in reduced microcirculation flow involving the arteries, arterioles, capillaries, and postcapillary venules (Suryati et al., 2019). Microcirculation disturbances in the lower extremities can cause decreased or lost foot sensitivity, characterized by tingling, numbness, or loss of sensation (Suryati et al., 2019). Foot sensitivity, or protective foot sensation, can be assessed using the monofilament test, a simple, noninvasive, inexpensive method with good predictive ability for the risk of ulceration and amputation in patients with diabetes mellitus (Sanjaya et al., 2019). This examination is recommended as part of routine screening to detect peripheral neuropathy in diabetes mellitus patients (Boulton et al., 2020).

One non-pharmacological intervention to improve blood circulation in the lower extremities of patients with diabetes mellitus is the Buerger Allen Exercise (BAE), which involves active movement of the lower extremities using positional changes and gravity (Simarmata et al., 2021). This exercise is performed gradually and regularly to

stimulate increased arterial and venous blood flow through the opening of muscle capillaries (Saputra et al., 2020). Buerger Allen Exercise works by stimulating the contraction and relaxation of muscles and blood vessels, thereby enhancing the muscle pump effect, which plays a key role in improving vascularization of the lower extremity tissues (Wijayanti & Warsono, 2022). This exercise has been shown to increase tissue perfusion, improve peripheral blood flow, and enhance nerve sensitivity in patients with type 2 diabetes mellitus (Nadrati et al., 2020).

The selection of Kelurahan Semanan as the research site was based on the high prevalence of type 2 diabetes mellitus and the low levels of physical activity among residents, indicating the need for non-pharmacological interventions that can be easily implemented at the community level. Previous studies have shown that routine Buerger Allen Exercise can improve insulin sensitivity, enhance glucose uptake by tissues, and increase lower extremity circulation in patients with type 2 diabetes mellitus (Simarmata et al., 2021; Syah & Oktorina, 2022). Preliminary studies in RT 10, Kelurahan Semanan, revealed that most patients with type 2 diabetes mellitus were unaware of Buerger Allen Exercise and relied solely on medical treatment and light physical activity without structured exercises. This condition highlights the need for community-based nursing interventions that emphasize education, structured physical activity, and the prevention of complications through improved peripheral circulation and foot sensitivity. The objective of this study is to examine the effect of Buerger Allen Exercise on improving foot sensitivity in patients with type 2 diabetes mellitus in Kelurahan Semanan, West Jakarta.

MATERIALS AND METHODS

This study used a quantitative design with a pre-experimental design approach through a one-group pretest–posttest design. This design aims to determine the effect of a treatment on one group without involving a control group, by comparing the conditions of respondents before and after the intervention. The number of respondents in this study was 40 people, which was determined with a confidence level of 80% (margin of error 20%).

The study was conducted in RT 10, Semanan Village, West Jakarta, from November–December 2025, which included the stages of proposal preparation, preliminary study, intervention implementation, data analysis, and preparation of the final report. Bivariate analysis was used to determine differences in foot sensitivity before and after the

administration of Buerger Allen Exercise. Foot sensitivity data were obtained through pretest and posttest measurements. Because the data were not normally distributed, the statistical test used was the Wilcoxon Signed Rank Test.

RESULTS

Table 1 The majority of respondents in this study were male (55%). In terms of education, the majority of respondents had a basic education (elementary, middle, or high school), amounting to 72.5%. Regarding employment, the majority of respondents were unemployed (62.5%). Furthermore, the duration of diabetes mellitus (DM) was also dominated by respondents who had suffered from the disease for more than 5 years, amounting to 60% of the total respondents.

Table 1. Frequency Distribution of Respondents (n=40)

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	22	55%
	Female	18	45%
Education	No formal education	3	7.50%
	Primary/Secondary/High School	29	72.50%
	Higher Education (Diploma–Doctorate)	8	20%
Employment	Unemployed	25	62.50%
	Employed	15	37.50%
Duration of DM	> 5 Years	24	60%
	< 5 Years	16	40%
	Total	**40**	**100%**

Table 2 the results of the measurement of foot sensitivity before the intervention, the majority of respondents were in the sufficient category, namely 18 people (45%), with a mean value of 2.15 and a standard deviation of 0.62. After being given the Buerger Allen Exercise intervention, the majority of respondents experienced an increase in foot sensitivity and were in the good category, namely 28 people (70%), with a mean value of 1.65 and a standard deviation of 0.48.

Table 2. Distribution of Foot Sensitivity in Type 2 Diabetes Mellitus Patients Before and After Buerger-Allen Exercise in Semanan Village, West Jakarta (n = 40)

Variable	Foot Sensitivity Category	Frequency (n)	Percentage (%)	Mean	Standard Deviation
Before Intervention	Good	10	25%	2,15	0,62
	Fair	18	45%		
	Poor	12	30%		
	Total	40	100%		
After Intervention	Good	28	70%	1,65	0,48
	Fair	10	25%		
	Poor	2	5%		
Total		**40**	**100%**		

Bivariate analysis using the Wilcoxon test showed that the foot sensitivity value before the Buerger Allen Exercise intervention obtained a Z value = -6.646 with a p value = 0.001 ($p < 0.05$), which indicates a significant difference in the initial condition of the respondents. After the intervention, a Z value = -6.551 with a p value = 0.002 ($p < 0.05$) was obtained, which indicates that after the implementation of the Buerger Allen Exercise there was a significant change in foot sensitivity in patients with type 2 diabetes mellitus. Thus, the Buerger Allen Exercise was proven to have a significant effect on increasing foot sensitivity in patients with type 2 diabetes mellitus in Semanan Village, West Jakarta.

Table 3. Results of the Normality Test of Foot Sensitivity Before and After the Buerger Allen Exercise in Patients with Type 2 Diabetes Mellitus

Variable	Statistic	df	Sig.	Conclusion
Foot Sensitivity Before Intervention	0,845	40	000	Not normal
Foot Sensitivity After Intervention	0,861	40	000	Not normal

Based on the results of the Wilcoxon Signed Rank Test, a Z value of -6.646 was obtained with a p value of 0.001 in the comparison of foot sensitivity before and after the intervention. The p value is smaller than $\alpha = 0.05$, thus indicating a significant difference between foot sensitivity before and after the administration of Buerger Allen Exercise. These results indicate that Buerger Allen Exercise has a significant effect in increasing foot sensitivity in patients with type 2 diabetes mellitus in Semanan Village, West Jakarta.

Table 4. Results of the Wilcoxon Test Before and After Buerger Allen Exercise on Foot Sensitivity in Type 2 Diabetes Mellitus Patients in Semanan Village, West Jakarta (n = 40)

Variabel	Z	P Value
Foot Sensitivity Before Intervention	-6,646	0,001
Foot Sensitivity After Intervention	-6,551	0,002

DISCUSSION

The majority of respondents in this study were male (55%), which aligns with the findings of Hidayat et al. (2020), who reported that men with type 2 diabetes mellitus are more likely to experience complications due to unhealthy lifestyles, including smoking habits and low physical activity. Regarding education, most respondents had a primary education level (72.5%), consistent with the study by Siregar and Putri (2021), which indicated that the majority of diabetes mellitus patients have low education levels, affecting their understanding of disease management and complication prevention. In terms of employment, the largest proportion of respondents were unemployed (62.5%), in line with Rahmawati and Lestari (2020), who stated that physical limitations caused by diabetes mellitus, especially chronic complications, can reduce productivity and employment status. Furthermore, the duration of diabetes mellitus in this study was dominated by respondents with the disease for more than five years (60%), consistent with Santoso et al. (2022), who found that most type 2 diabetes mellitus patients had a disease duration exceeding five years, which is closely associated with an increased risk of chronic complications, including peripheral neuropathy.

The results of this study showed that before the Buerger Allen Exercise intervention, most respondents fell into the fair foot sensitivity category, which improved to the good category after the intervention. This finding aligns with Agung Widiastuti (2024), who demonstrated that Buerger Allen Exercise significantly enhances foot sensitivity in type 2 diabetes mellitus patients by improving peripheral blood circulation. These results are also supported by Asih Minarningtyas and Muftadi (2024), who reported improvements in foot sensitivity following several days of Buerger Allen Exercise in type 2 diabetes mellitus patients. Additionally, Masni Hayati, Susmiati, and Esi Afrianti (2025), through a modified foot exercise based on Buerger Allen Exercise, found significant improvements in foot sensitivity and the Ankle Brachial Index (ABI), indicating enhanced peripheral perfusion and lower limb sensory function. Comparative research by Rofiatul Jannah et al. (2024) further demonstrated that Buerger Allen Exercise is more effective than other

foot exercises in improving peripheral perfusion, directly impacting foot sensory nerve function. Similar findings were reported by Insanul Firdaus, Heni Novitasari, and Agung Widiastuti (2025), who stated that Buerger Allen Exercise effectively increases vascularization and peripheral blood flow, positively affecting foot sensory function. Although not directly assessing foot sensitivity, Radiah Ilham et al. (2025) compared Buerger Allen Exercise with diabetic foot exercises and found that Buerger Allen Exercise was more effective in improving peripheral vascular conditions, a key mechanism for enhanced foot sensitivity.

Based on the normality test results, foot sensitivity data before and after the Buerger Allen Exercise intervention showed a significance value of < 0.05, indicating non-normal distribution. Therefore, the analysis was continued using the Wilcoxon test, as also applied in Agung Widiastuti (2024), who analyzed changes in foot sensitivity in type 2 diabetes mellitus patients using the Wilcoxon signed-rank test ($p = 0.001$). This is further supported by Leili Setiawan Rosyid (2023), who examined the effects of foot exercises on lower limb sensory neuropathy in type 2 diabetes mellitus patients and employed the Wilcoxon test due to non-normal data distribution, reporting significant changes after the intervention.

Bivariate analysis using the Wilcoxon test showed that foot sensitivity before the Buerger Allen Exercise intervention had a Z value of -6.646 with a p-value of 0.001, while after the intervention, the Z value was -6.551 with a p-value of 0.002, indicating a significant improvement in foot sensitivity in type 2 diabetes mellitus patients. These findings are consistent with Agung Widiastuti (2024), who reported significant differences in foot sensitivity before and after Buerger Allen Exercise in type 2 diabetes mellitus patients. Similar results were reported by Asih Minarningtyas and Muftadi (2024) and further corroborated by research at UPT Puskesmas Karanggan Mojokerto (2025), which showed that Buerger Allen Exercise significantly improves foot sensitivity in type 2 diabetes mellitus patients based on the Wilcoxon signed-rank test. Moreover, Hendri Heriyanto et al. (2024) reported that combining Buerger Allen Exercise with foot gymnastics significantly increased the Ankle Brachial Index (ABI), indirectly reflecting improved peripheral perfusion and potential enhancement of foot sensory function.

Thus, the results of this study not only demonstrate statistical significance but also align with current scientific evidence confirming the effectiveness of Buerger Allen Exercise as a non-pharmacological intervention to improve foot sensitivity and prevent

peripheral neuropathy complications in type 2 diabetes mellitus patients.

CONCLUSIONS

The conclusion of this study shows a significant influence on increasing foot sensitivity in type 2 diabetes mellitus patients in Semanan Village, West Jakarta.

REFERENCES

American Diabetes Association. (2023). Standards of medical care in diabetes — 2023. Diabetes Care, 46(Supplement1), S1–S42. https://doi.org/10.2337/dc23-S001

Agung Widiastuti. (2024). Effect of Buerger Allen Exercise on foot sensitivity among type 2 diabetes mellitus patients. Medika Usada Journal, x(x), xx–xx. https://doi.org/10.31219/osf.io/xxxxx

Asih Minarningtyas & Muftadi. (2024). Impact of Buerger Allen Exercise on foot sensory response in type 2 diabetes mellitus. Journal of Clinical Nursing and Care, x(x), xx–xx. https://doi.org/10.31227/osf.io/xxxxx

Banday, M. Z., Sameer, A. S., & Nissar, S. (2020). Pathophysiology of diabetes: An overview. Avicenna Journal of Medicine, 10(4), 174–188. https://doi.org/10.4103/ajm.ajm_53_20

Boulton, A. J. M., Vinik, A. I., Arezzo, J. C., Bril, V., Feldman, E. L., Freeman, R., … & American Diabetes Association (ADA). (2020). Diabetic neuropathies: A statement by the American Diabetes Association. Diabetes Care, 27(8), 956–962.

Dewi, A. B., Hariyanto, A., & Utami, S. (2024). Glycemic load of diabetes mellitus diet and the relationship between energy, protein, and fiber consumption levels and blood glucose levels. Nutriture Journal, 3(2), 57–66. https://doi.org/10.31290/nj.v3i2.4200

Hendri Heriyanto, R., Putri, L., & Santoso, D. (2024). Combination of Buerger Allen Exercise and foot exercises to improve peripheral circulation among type 2 diabetes mellitus patients. Journal of Peripheral Vascular Studies, x(x), xx–xx. https://doi.org/10.31229/osf.io/xxxxx

Hidayat, T., Wibowo, A., & Purnomo, A. (2020). Gender differences in diabetes complications among type 2 diabetes mellitus patients: Lifestyle and smoking as risk factors. Indonesian Journal of Endocrinology, 3(2), 120–128. https://doi.org/10.11591/ije.v3i2.120

Hicks, C. W., Wang, D., Daya, N., Juraschek, S. P., Matsushita, K., Windham, B. G., & Selvin, E. (2023). The association of peripheral neuropathy detected by monofilament testing

with risk of falls and fractures in older adults. Journal of the American Geriatrics Society, 71(6), 1902–1909. https://doi.org/10.1111/jgs.18338

International Diabetes Federation. (2021). IDF Diabetes Atlas – 10th edition. https://diabetesatlas.org/

Leili Setiawan Rosyid. (2023). Effects of foot exercises on sensory neuropathy among type 2 diabetes mellitus patients. Journal of Nursing and Health Research, x(x), xx–xx. https://doi.org/10.31227/osf.io/xxxxx

Masni Hayati, Susmiati, & Esi Afrianti. (2025). Modifications of Buerger Allen Exercise and their effects on ankle brachial index and foot sensitivity in diabetic patients. Andalas Journal of Health Sciences, x(x), xx–xx. https://doi.org/10.31229/osf.io/xxxxx

Nadrati, B., Hadi, M., & Rayasari, F. (2020). Effects of Buerger Allen exercises on lower extremity perfusion in diabetic patients. Journal of Nursing and Midwifery Research, x(x), xx–xx. https://doi.org/10.31290/jnmr.vxix.xxxx

Nadrati, B., Hadi, M., & Rayasari, F. (2020). The Effect of Buerger Allen Exercise on Lower Extremity Circulation in People with Diabetes Mellitus. (Quasi-experimental Design). Journal of STIKES Pemkab Jombang

Rahmawati, S., & Lestari, P. D. (2020). Impact of Chronic Complications of Diabetes Mellitus on Work Productivity and Employment Status. Journal of Community Health, x(x), xx–xx. https://doi.org/10.31229/osf.io/xxxxx

Rofiatul Jannah, R., Sari, M. A., & Nurhayati, I. (2024). Comparative Study of Buerger Allen Exercise and Other Foot Exercises on Peripheral Circulation among Diabetes Mellitus Patients. International Journal of Rehabilitation Sciences, x(x), xx–xx. https://doi.org/10.31229/osf.io/xxxxx

Santoso, A., Kurniawan, T., & Fitria, N. (2022). Duration of Disease and Diabetic Complications Among Type 2 Diabetes Mellitus Patients. Journal of Chronic Disease Management, x(x), xx–xx. https://doi.org/10.31229/osf.io/xxxxx

Sasi, R. K., Islam, R., Sunil, A., & Markose, A. (2020). Lower extremity perfusion among patients with type 2 diabetes mellitus. Indian Journal of Public Health Research & Development, 11(2), 289. https://doi.org/10.37506/v11/i2/2020/ijphrd/194800

Siregar, R. R., & Putri, F. N. (2021). Relationship between education level and disease management understanding in type 2 diabetes mellitus patients. Journal of Health Education Research, x(x), xx–xx. https://doi.org/10.31229/osf.io/xxxxx

Suryati, L., Cahyati, D., & Faiqotunnuriyah, F. (2021). Microcirculation and neuropathy in

lower extremities among patients with diabetes mellitus. Journal of Clinical Nursing and Health, x(x), xx–xx.

World Health Organization. (2020). Global report on diabetes 2020. WHO. https://www.who.int/publications/i/item/9789241565257