THE IMPACT OF REGULAR FOOT EXERCISE ON BLOOD GLUCOSE REDUCTION IN TYPE II DIABETES PATIENTS: A CASE STUDY

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ABSTRACT

Elevated blood glucose levels in type II diabetes mellitus (DM) can lead to chronic complications, including cardiovascular, renal, and neurological disorders. The prevalence of type II DM in Indonesia continues to increase, particularly among older adults, many of whom face challenges in adhering to treatment. Non-pharmacological therapies, such as foot exercise, are considered beneficial in improving glycemic control and enhancing lower limb circulation. To describe the outcomes of implementing foot exercise as a nursing intervention for older adults with type II DM who experience unstable blood glucose levels in the working area of Panjang Public Health Center, Bandar Lampung. This case study involved two older adults diagnosed with type II DM. The intervention included foot exercise therapy conducted three times a week over six sessions, each lasting 15–20 minutes. The approach utilized family-centered nursing care with education and monitoring of blood glucose before and after each session. Subject I showed a reduction in random blood glucose levels from 232 mg/dl to 182 mg/dl after three sessions. Subject II experienced a decrease from 248 mg/dl to 189 mg/dl. The variation in reduction was influenced by factors such as medication adherence, presence of comorbidities (e.g., hypertension and diabetic neuropathy), and family involvement. Foot exercise therapy can effectively reduce blood glucose levels in older adults with type II DM. This intervention is recommended as a complementary nursing strategy in diabetes management.

Keywords: Foot Exercise, Hyperglycemia, Older Adults, Non-Pharmacological Therapy, Type II Diabetes Mellitus.

INTRODUCTION

Diabetes mellitus (DM) is a chronic disease that occurs when the pancreas does not produce enough insulin or when the body cannot effectively use the insulin it produces (PAHO, 2022). Globally, the number of people living with DM reached 422 million in 2014. This figure is projected to rise rapidly, especially in low- and middle-income countries. In 2019, diabetes was recorded as the ninth leading cause of death worldwide, with an estimated 1.5 million deaths directly caused by the disease (WHO, 2021).

The prevalence of diabetes among older adults has become a global health issue, with varying rates across different regions and populations (WHO, 2021). In the United States, more than 25% of individuals aged 65 years and above

are living with diabetes, highlighting the elderly population as a key driver of the diabetes epidemic (Laiteerapong & Huang, 2021). In South Korea, approximately 29.6% of adults aged 65 and older have diabetes, with many also suffering from comorbidities such as hypertension and hypercholesterolemia (Ko et al., 2023).

In Indonesia, according to the 2023 Indonesian Health Survey (SKI), the number of diagnosed diabetes cases reached 877,532. However, only 14,935 (1.7%) of these patients were receiving regular and controlled treatment. The highest prevalence was found in individuals aged 55 and above, accounting for 136,780 patients (KPKI, 2023). Nevertheless, this number reflects only a small fraction of the actual cases in Indonesia, as many individuals remain undiagnosed, particularly in low- and middle-income countries (IDF, 2021).

According to the 2018 Basic Health Research (RISKESDAS), the prevalence of DM in Indonesia reached 1,017,290 cases. Among these, 9.3% did not seek any form of treatment, 85.5% had never routinely checked their blood sugar levels, and 50.4% did not take diabetes medication—often believing they were already healthy and did not require further care. Lampung Province ranked among the top seven provinces with the highest number of DM cases, reporting 32,148 cases, while Bandar Lampung City alone contributed 3,878 cases (RISKESDAS, 2018).

According to data from the Lampung Provincial Health Office, the number of DM patients in Lampung in 2022 reached 89,981, with Bandar Lampung City having the highest number, at 18,644 cases. Local data obtained by the researcher from UPT Panjang Inpatient Public Health Center showed that in 2024, there were 1,348 Type II DM patients across eight sub-districts. The increasing prevalence of DM—particularly among older adults—is driven by rising life expectancy and lifestyle changes, posing a substantial burden on global public health systems (Yun et al., 2024). This age group is particularly vulnerable to a unique diabetes phenotype characterized by vascular disease, neuropathic complications, and mental dysfunction, all of which collectively increase the risk of disability and death (Chami & Khaled, 2022).

A preliminary study conducted in 2025 at the Panjang Public Health Center in Bandar Lampung City revealed that while all DM patients were receiving pharmacological treatment, physical exercise programs were held only once a week and were not specifically tailored for people with diabetes. These sessions were general group exercises for the public, with the types of activities predetermined by the health center.

Physical activity that involves muscle contractions has been shown to increase insulin sensitivity, allowing the body to utilize more insulin to absorb glucose and convert it into energy (American Diabetes Association, 2022). Several studies have found that time constraints are a major barrier preventing DM patients from engaging in physical activity. Therefore, the Directorate of Non-Communicable Disease Prevention and Control (P2PTM) recommends simple and flexible activities that can be done anywhere—including during family time—such as diabetic foot exercises (Kemenkes, 2018).

According to Trisna & Musiana (2018), diabetic foot exercises have been proven to reduce blood glucose levels and improve the ankle-

brachial index (ABI) in DM patients. These exercises can enhance blood circulation, strengthen small foot muscles, prevent deformities, and help address the limited insulin availability in DM patients (Wahyuni, 2016). Arif (2020) found that foot exercises not only effectively lower blood glucose but also increase nitric oxide synthesis, arterial vasodilation, hemoglobin oxygen affinity, and blood viscosity—resulting in improved blood circulation, oxygen saturation, and tissue perfusion.

Foot exercises offer a simple, relaxing, and effective intervention that can be performed anywhere and at any time. These exercises primarily work by improving blood circulation, enhancing nutrient delivery to tissues, and strengthening muscles—thereby contributing to reduced blood glucose levels (Wibowo et al., 2024). A study by Andari et al. (2023) showed that performing foot exercises three times per week for 10–15 minutes over a one-month period significantly lowered postprandial blood glucose levels in patients with type 2 DM—from an average of 221.2 mg/dL to 216.4 mg/dL.

This is supported by findings from Rosyid & Angraini (2022), who observed significant reductions in blood glucose levels and improvements in sensory neuropathy in the lower limbs of diabetic patients after foot exercise interventions. Yulita et al. (2019) also reported significant reductions in neuropathy scores and blood glucose levels among patients who participated in foot exercise programs.

Collectively, these studies demonstrate the effectiveness of foot exercise as a non-pharmacological approach for managing hyperglycemia in type 2 DM. This accessible and practical intervention offers a promising strategy for improving glycemic control and reducing complications associated with diabetes. Based on this evidence, the researcher is interested in further examining the application of foot exercise in addressing unstable blood glucose levels among older adults with type 2 diabetes mellitus at the Panjang Public Health Center, Bandar Lampung City, in 2025.

LITERATURE REVIEW

The primary nursing diagnosis in DM patients is unstable blood glucose levels, typically indicated by signs of hyperglycemia in uncontrolled diabetes cases (TIM Pokja SDKI DPP PPNI, 2017). Over time, persistent hyperglycemia can cause serious damage to various body systems, especially the nerves and blood vessels (WHO, 2021). Key nursing interventions for patients with unstable blood glucose include physical exercise, dietary management, health education, and collaboration in administering diabetes medications (Tim Pokja SIKI DPP PPNI, 2018).

DM management can be achieved through both pharmacological and non-pharmacological therapies. Pharmacological management includes insulin injections and oral hypoglycemic agents, while non-pharmacological strategies involve weight management, physical exercise, and dietary control (Ruben et al., 2016). Effective diabetes management in older adults requires a holistic approach that includes personalized nutrition plans, user-friendly glucose monitoring technologies, and customized physical activity programs that consider mobility limitations and fear of injury (Yun et al., 2024).

METHODOLOGY

The research design used in this study is a case study, employing a descriptive method. This method aims to provide an objective overview of the situation and conduct a deeper analysis of nursing care for patients with type II diabetes mellitus experiencing unstable blood glucose levels. This study has received ethical approval with Ethical Approval No. 332/KEPK-TJK/V/2025"

This study was conducted at Panjang Public Health Center, Bandar Lampung, from 25 july 2025 to 31 July 2025. The intervention was carried out three times a week on two subjects who had been diagnosed with type II diabetes mellitus and were experiencing problems related to unstable blood glucose levels.

RESEARCH RESULT

Table 1. Evaluation of Blood Glucose Levels in Subject I

No.	Day/Date	Random Blood Glucose Level Before Foot Exercise Therapy	Random Blood Glucose Level After Foot Exercise Therapy	Difference	Description
1	Friday, July 25, 2025	232 mg/dL	202 mg/dL	30 mg/dL	Decreased
2	Saturday, July 26, 2025	233 mg/dL	216 mg/dL	17 mg/dL	Decreased
3	Monday, July 28, 2025	207 mg/dL	182 mg/dL	15 mg/dL	Decreased

Table 2. Evaluation of Blood Glucose Levels in Subject II

No.	Day/Date	Random Blood Glucose Level Before Foot Exercise Therapy	Random Blood Glucose Level After Foot Exercise Therapy	Difference	Description
1	Tuesday, July 29, 2025	248 mg/dL	224 mg/dL	24 mg/dL	Decreased
2	Wednesday, July 30, 2025	228 mg/dL	201 mg/dL	27 mg/dL	Decreased
3	Thursday, July 31, 2025	210 mg/dL	189 mg/dL	21 mg/dL	Decreased

Based on tables 1 and 2, it is evident that there was a decrease in blood glucose levels after implementing nursing interventions involving laughter therapy for both subjects over a period of 3 days.

DISCUSSION

The researcher conducted a comprehensive assessment of the two subjects, Mrs. Sry and Mrs. P, through direct interviews with the clients and their families, observations, and physical examinations. Subject I, Mrs. Sry, is a 64-year-old woman with a 5-year history of diabetes mellitus (DM). She reported classic DM symptoms such as fatigue, frequent tingling, excessive thirst, and frequent urination. Her vital signs showed a blood pressure of 140/90 mmHg, pulse rate of 85 beats per minute, respiratory rate of 20 breaths per minute, body temperature of 36.5°C, and a random blood glucose level of 232 mg/dL. Subject II, Mrs. P, also 64 years old, has lived with DM for 10 years and has a history of hypertension since her youth. Her complaints included frequent thirst and hunger, nocturia, weakness, and tingling in her legs. Her vital signs were blood pressure 140/80 mmHg, pulse 90 beats per minute, respiratory rate 20 breaths per minute, temperature 36.5°C, and blood glucose level 248 mg/dL.

According to the TIM Pokja SDKI DPP PPNI (2017), both subjects presented similar symptoms such as nocturia, weakness, tingling in the legs, and elevated blood glucose levels, consistent with typical type II diabetes mellitus manifestations. Maria (2021) notes that type II DM is often characterized by polyuria, polydipsia, polyphagia, weight loss, and peripheral neuropathy causing tingling and weakness. Both subjects exhibited fluctuating glucose levels: Mrs. Sry's random blood glucose ranged between 150 mg/dL and 312 mg/dL over the past five years, while Mrs. P's ranged from 160 mg/dL to 353 mg/dL over ten years. These fluctuations can be attributed to factors such as medication adherence, diet, and physical activity levels.

This finding aligns with Putra (2023), who identified significant relationships between blood glucose control and factors such as age, gender, therapy type, and diabetes duration among type II DM patients. Notably, most patients over 45 years old, female, and on non-insulin therapies experienced uncontrolled blood glucose. Mrs. P's longstanding hypertension likely exacerbates her blood glucose instability compared to Mrs. Sry, who has no hypertension history. This concurs with a systematic review by Utomo (2018), which highlights hypertension, age, genetics, dyslipidemia, physical inactivity, smoking, and stress management as risk factors influencing DM onset and control.

Both subjects are older adults and have family histories of DM, with Mrs. Sry's family history including DM and Mrs. P's including both DM and hypertension. Making et al. (2023) emphasize that family history and older age increase type II DM risk up to fourfold compared to those without such history, consistent with Utomo et al. (2020) systematic review findings. Despite regular healthcare visits and adherence to prescribed medications, both subjects' blood glucose levels remained above normal limits. This correlates with their nutritional status: Mrs. Sry is overweight, and Mrs. P is obese. Harsari et al. (2018) found that obesity contributes to insulin resistance by disrupting metabolism due to excess adipose tissue, a key factor in type II DM pathophysiology (American Diabetes Association, 2022). Insulin resistance reduces the body's response to insulin, diminishing medication efficacy (Triastuti et al., 2020). Unhealthy diets and lack of physical activity further worsen glucose

control and may necessitate medication adjustments over time (Almaini & Heriyanto, 2019; Harsari et al., 2018). Both subjects consume their medications as prescribed but lack consistent diet control and physical activity, indicating a crucial role for nurses as advocates and collaborators to support integrated therapy and lifestyle

Blood Glucose Levels

According to the SLKI Working Group Team (Tim Pokja SLKI DPP PPNI, 2018), evaluation involves comparing the outcomes of implemented actions against predetermined criteria and standards to assess success. If the results show partial or no success, a new nursing care plan must be developed. Evaluation in family nursing covers several domains, including cognitive (knowledge), affective (emotional), and psychomotor aspects. It is defined as a nursing care decision based on the client's goals and the observed behavioral responses (Bakri, 2021).

In both subjects, foot exercise therapy consistently triggered a decrease in random blood glucose levels (RBG) after each session. Subject I demonstrated reductions ranging from 15 mg/dL to 30 mg/dL, while Subject II experienced decreases between 21 mg/dL and 27 mg/dL. This data clearly shows that foot exercise effectively helps lower blood glucose levels in both individuals, confirming its physiological benefits in diabetes management (American Diabetes Association, 2022; Wibowo et al., 2024). The reduction is attributed to muscle contractions during exercise, which improve insulin sensitivity and glucose uptake from the blood, while also enhancing circulation (Arif, 2020).

Although foot exercise yielded positive results for both subjects, differences existed in the daily reduction ranges and the speed of achieving stability in managing family care tasks (TUK), especially in handling complaints and overall blood glucose stabilization. For Subject I, during the initial TUK 5 evaluation (use of healthcare services), Ny. Sry questioned the necessity of taking metformin (2x500 mg daily) when asymptomatic, and observations indicated that she did not finish her prescribed medication. This suggests non-adherence to pharmacological treatment. While foot exercise helped reduce blood glucose levels post-intervention, poor medication adherence can hinder long-term glycemic control. Diabetes medications are intended to work synergistically with lifestyle changes to maintain glucose within target ranges. Without regular medication intake, blood sugar fluctuations may be greater or take longer to stabilize, despite exercise efforts.

Initial RBG levels (before foot exercise) for both subjects showed a decreasing trend day by day, indicating overall improvement. Subject I's readings started at 232 mg/dL, then 233 mg/dL, and finally 207 mg/dL. Subject II began higher at 248 mg/dL, then 228 mg/dL, and 210 mg/dL. Although both showed improvement, Subject II started with slightly higher values and had a tendency for a larger absolute reduction early on. These differences may reflect individual biological variability, including disease duration, initial severity of diabetes, baseline insulin resistance, or genetic factors influencing therapy response (American Diabetes Association, 2022).

Differences in reported symptoms also offer insights. Subject II initially reported numbness and weakness, indicative of diabetic neuropathy. This

complication suggests a more complex clinical picture that may require more time to show overall improvement compared to symptoms like thirst and hunger alone. While foot exercise is effective for neuropathy, physiological responses and recovery timelines can vary (Rosyid & Angraini, 2022).

In summary, although foot exercise is an effective intervention for reducing RBG in both subjects, differences in medication adherence (notably Subject I's potential non-compliance), physiological response variability, and early complications in Subject II help explain the differing pace and nuances in blood glucose reduction and family care management. This highlights the importance of a holistic, individualized approach to diabetes care, where pharmacology, lifestyle modifications, and family support must be integrated for optimal outcomes.

CONCLUSIONS

This study successfully provided an objective description of the implementation of nursing care through foot exercise interventions in older adults with type II diabetes mellitus who experienced unstable blood glucose levels. The findings showed that foot exercise, carried out consistently, contributed to a reduction in random blood glucose levels in both subjects. Furthermore, the descriptive case study approach enabled a deeper analysis of factors influencing patient outcomes, including medication adherence, comorbidities, and family involvement in care.

Overall, these findings highlight the critical need for a holistic, patient-centered diabetes management plan that integrates medication adherence, tailored physical activity, dietary control, and family support. Nurses play a vital role as advocates and collaborators in promoting such integrated care to improve health outcomes and quality of life in older adults with type 2 diabetes mellitus.

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