

DIABETIC FOOT EXERCISE FOR BLOOD GLUCOSE INSTABILITY IN TWO OLDER ADULTS WITH TYPE 2 DIABETES MELLITUS: A CLINICAL CASE REPORT

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Abstract

Background: Older adults with type 2 diabetes mellitus are vulnerable to blood glucose instability and lower-extremity complaints, including stiffness, numbness, and tingling. Diabetic foot exercise is a simple non-pharmacological nursing intervention that may support peripheral circulation, muscle activity, and glucose utilization. **Objective:** This clinical case report aimed to describe the implementation, feasibility, short-term clinical response, and outcome variation of diabetic foot exercise as an adjunctive nursing intervention in two older adults with type 2 diabetes mellitus in a nursing-home setting. **Case Summary:** This report describes two anonymized male residents of a nursing home in Cirebon, Indonesia, who had type 2 diabetes mellitus and the nursing diagnosis of unstable blood glucose level related to insulin resistance. Case 1 was a 69-year-old man with recurrent nocturia, fatigue, difficulty walking with a walker, foot stiffness and numbness, and random blood glucose of 421 mg/dL. Case 2 was a 73-year-old man with foot stiffness and tingling, nocturia, fatigue, hunger, anxiety regarding blood glucose elevation, hypertension history, and random blood glucose of 205 mg/dL. **Investigation and Diagnosis:** Both cases were assessed through nursing interview, physical examination, vital signs, medication review, and serial random blood glucose monitoring. **Management:** Diabetic foot exercise was implemented once daily for three consecutive days, 10-15 minutes per session, after routine pharmacological therapy. The intervention was combined with monitoring, education regarding diet and exercise adherence, and collaboration for antidiabetic medication. **Outcome:** In Case 1, random blood glucose decreased from 421 to 206 mg/dL; symptoms of stiffness and numbness persisted and the nursing problem was not fully resolved. In Case 2, random blood glucose decreased from 205 to 105 mg/dL and foot stiffness/tingling improved; the nursing problem was considered resolved. **Conclusion:** Diabetic foot exercise was feasible as an adjunctive nursing intervention in this nursing-home context; however, the observed short-term improvements should be interpreted cautiously because both patients continued pharmacological therapy and other nursing care during the observation period.

Keywords: blood glucose instability; case report; diabetic foot exercise; older adult; type 2 diabetes mellitus

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by hyperglycemia due to impaired insulin secretion, insulin action, or both (World Health Organization, 2024). In older adults, physiological changes, reduced physical activity, comorbid illness, and inconsistent dietary patterns can increase vulnerability to unstable blood glucose levels (Federation, 2025). In addition to the risk of acute and chronic complications, older adults with diabetes frequently report lower-extremity symptoms such as stiffness, numbness, tingling, weakness, and impaired mobility (Kementerian Kesehatan Republik Indonesia, 2024). These symptoms can reduce independence and increase anxiety regarding disease progression (Antoro, 2023).

Nursing management for diabetes requires pharmacological collaboration, blood glucose monitoring, education, and feasible self-care interventions (Antoro, 2023). Diabetic foot exercise is a structured sequence of ankle, toe, and lower-leg movements performed in a sitting position (Kementerian Kesehatan Republik

Indonesia, 2024). It is intended to strengthen small foot muscles, improve joint flexibility, promote peripheral circulation, reduce lower-extremity discomfort, and support glucose utilization by active muscles (Kementerian Kesehatan Republik Indonesia, 2024).

Although previous applied studies have reported blood glucose reduction after diabetic foot exercise, most reports have focused on short-term implementation and have provided limited discussion of geriatric characteristics, functional status, mobility limitations, and contextual nursing-home factors that may influence patient outcomes. In older adults living in residential care facilities, the feasibility and response to diabetic foot exercise may vary according to baseline glucose level, mobility, lower-extremity symptoms, medication regimen, diet, and ability to perform the exercise movements. This creates a clinical gap in understanding how diabetic foot exercise can be adapted and interpreted as part of gerontological nursing care rather than as a stand-alone intervention.

The two cases were selected because both patients lived in the same nursing-home setting and had type 2 diabetes mellitus with unstable blood glucose levels, but they differed in baseline random blood glucose, mobility status, lower-extremity complaints, medication regimen, and symptom response. The novelty of this report lies in describing the clinical reasoning and practical nursing lessons from two comparable but clinically different older adults. This clinical case report aimed to describe the implementation, feasibility, short-term clinical response, and outcome variation of diabetic foot exercise as an adjunctive nursing intervention in two older adults with type 2 diabetes mellitus in a nursing-home setting.

CASE PRESENTATION

The case data were anonymized. No patient name, medical record number, exact date of birth, full address, or facial image is reported.

Case 1

A 69-year-old male nursing-home resident with physician-diagnosed type 2 diabetes mellitus for approximately two years complained that his blood glucose often increased during routine medical visits. He reported nocturia 3-5 times per night, sleep disturbance, fatigue, and bilateral foot stiffness and numbness that limited prolonged activity. He required a walker for ambulation. He denied a family history of diabetes and reported poor dietary control in the past. Current medications documented in the case record included acarbose 100 mg three times daily with meals, metformin three times daily after meals, and insulin therapy documented as insulin degludec 70% before meals. Initial vital signs were blood pressure 122/61 mmHg, pulse 87 beats/minute, respiratory rate 20 breaths/minute, temperature 36.6°C, and random blood glucose 421 mg/dL.

Case 2

A 73-year-old male nursing-home resident with physician-diagnosed type 2 diabetes mellitus for approximately one year reported elevated blood glucose during routine physician visits, bilateral foot stiffness and tingling, easy fatigue, increased hunger, and nocturia more than three times per night. He could walk without an assistive device for approximately 30 minutes. He had a five-year history of hypertension and no known family history of diabetes. He reported limited knowledge regarding management of elevated blood glucose and felt anxious when blood glucose increased. Current medications included glimepiride 2 mg once daily in the morning and amlodipine 5 mg once daily for hypertension. Initial vital signs were blood pressure 138/82 mmHg, pulse 100 beats/minute, respiratory rate 20 breaths/minute, temperature 36.6°C, and random blood glucose 205 mg/dL.

CLINICAL REASONING

The main clinical problem in both cases was unstable blood glucose level related to insulin resistance, supported by prior physician diagnosis of type 2 diabetes mellitus, elevated random blood glucose, nocturia, fatigue, hunger, and lower-extremity complaints. The nursing assessment also considered mobility limitation, possible peripheral neuropathic symptoms, anxiety, knowledge deficit, and possible non-adherence to dietary recommendations. Hypoglycemia was not supported because neither patient reported sweating, tremor, dizziness, or altered consciousness during assessment, and measured blood glucose values were elevated or within the monitored post-intervention range. Acute infection or foot ulcer was not identified in the available case data because no fever, wound, or local inflammatory signs were documented. The final nursing focus was therefore blood glucose instability with supportive management of lower-extremity symptoms and self-care education (Persatuan Perawat Nasional Indonesia, 2017).

DIAGNOSTIC ASSESSMENT

Diagnostic assessment was based on interview, physical examination, vital signs, medication review, and random capillary blood glucose monitoring. Baseline random blood glucose was measured before the first diabetic foot exercise implementation. During the three intervention days, random blood glucose was documented after routine medication and after the diabetic foot exercise session. The exact timing in relation to meals, including whether the measurement was preprandial or postprandial and the number of hours after eating, was not consistently recorded in the source case study. Therefore, the glucose values are interpreted as short-term monitoring data rather than standardized measures of glycemic control. No HbA1c, fasting blood glucose, two-hour postprandial glucose, renal function test, lipid profile, neurological examination score, ankle-brachial index, or imaging result was available in the source case study; this limitation is considered when interpreting outcomes.

Table 1. Summary of relevant baseline diagnostic findings

Variable	Case 1	Case 2	Clinical interpretation
Age/sex	69-year-old male	73-year-old male	Older adults with type 2 diabetes mellitus
Main complaints	High blood glucose, nocturia 3-5 times/night, fatigue, foot stiffness and numbness	High blood glucose, nocturia >3 times/night, fatigue, hunger, foot stiffness and tingling, anxiety	Symptoms consistent with blood glucose instability and lower-extremity discomfort
Mobility	Uses walker; limited activity due to stiffness/numbness	Walks without assistive device for approximately 30 minutes	Baseline mobility differed between cases
Blood pressure	122/61 mmHg	138/82 mmHg	Case 2 had a history of hypertension
Pulse/respiration/temperature	87/min; 20/min; 36.6°C	100/min; 20/min; 36.6°C	No fever documented
Random blood glucose before intervention	421 mg/dL	205 mg/dL	Both elevated at baseline; Case 1 more severe
Medication documented	Acarbose, metformin, insulin therapy	Glimepiride; amlodipine for hypertension	Pharmacological therapy continued during nursing intervention
Timing of glucose measurement	Baseline value before exercise implementation; follow-up values after medication and exercise session; meal timing not consistently documented	Baseline value before exercise implementation; follow-up values after medication and exercise session; meal timing not consistently documented	RBG was used for short-term monitoring only and was not equivalent to standardized fasting, postprandial, or HbA1c-based evaluation

THERAPEUTIC INTERVENTION

Both patients received diabetic foot exercise as an adjunct to routine pharmacological therapy. The exercise was delivered once daily for three consecutive days, 10-15 minutes per session, after medication administration. The three-day observation period followed the available educational case-study schedule and was consistent with several applied case-based reports that implemented diabetic foot exercise over three consecutive days. This duration was intended to evaluate immediate feasibility, safety, patient participation, and short-term monitoring response; it was not intended to determine sustained glycemic control or long-term improvement of lower-extremity symptoms. The nursing intervention included identifying possible causes of hyperglycemia, monitoring blood glucose, monitoring signs and symptoms of hyperglycemia, educating patients about diet and exercise adherence, and teaching the diabetic foot exercise sequence. The exercise was performed in a sitting position with both feet touching the floor. Movements included toe extension and flexion, alternating heel and forefoot lifting, ankle rotation with toes or heels raised, knee extension with toe movement, dorsiflexion toward the face, bilateral leg extension, ankle forward-backward movement, circular ankle movement as if writing numbers in the air, and paper/cloth manipulation using the toes where feasible. The intervention was stopped or modified if pain or excessive fatigue occurred; no adverse event was documented (Persatuan Perawat Nasional Indonesia, 2018).

THERAPEUTIC SEQUENCE

The sequence was consistent for both cases: baseline assessment, confirmation of readiness and comfort, implementation of diabetic foot exercise, post-intervention symptom inquiry, random blood glucose monitoring, and planning for independent continuation. Pharmacological therapy was not changed by the researcher; medication use was continued according to the physician's plan. The main difference between cases was performance quality: Case 1 continued to have stiffness and numbness that limited movement, whereas Case 2 showed progressive improvement in movement and comfort.

CASE TIMELINE

Table 2. Clinical case timeline

Time	Clinical event	Investigation	Treatment	Outcome
Day 0 / baseline	Case 1 assessed with nocturia, fatigue, foot stiffness/numbness, and walker use. Case 2 assessed with nocturia, fatigue, hunger, foot stiffness/tingling, and anxiety.	Baseline RBG measured before the first exercise implementation: Case 1 421 mg/dL; Case 2 205 mg/dL. Exact timing relative to meals was not documented.	Medication review, nursing assessment, and education plan.	Nursing diagnosis: unstable blood glucose level related to insulin resistance.
Day 1	First diabetic foot exercise session, 10-15 minutes.	RBG documented after routine medication and exercise session: Case 1 348 mg/dL; Case 2 132 mg/dL. Exact postprandial interval was not documented.	Exercise after routine medication; symptom monitoring.	Both cases reported persistent foot symptoms; glucose decreased in both cases.
Day 2	Second exercise session.	RBG documented after routine medication and exercise session: Case 1 306 mg/dL; Case 2 176 mg/dL. Exact postprandial interval was not documented.	Exercise repeated; dietary education reinforced.	Case 1 still stiff/numb. Case 2 glucose increased from day 1; this was considered possibly related to reported dietary variation in case notes, but no structured dietary intake assessment was conducted.

Time	Clinical event	Investigation	Treatment	Outcome
Day 3	Third exercise session and final short-term observation.	RBG documented after routine medication and exercise session: Case 1 206 mg/dL; Case 2 105 mg/dL. Exact postprandial interval was not documented.	Exercise repeated; independent practice encouraged.	Case 1 improved glucose but problem not fully resolved due to persistent symptoms. Case 2 symptoms improved and problem was considered resolved. Three-day observation was used to assess short-term feasibility only.
Follow-up plan	Continue self-care in the nursing home.	Ongoing glucose and symptom monitoring recommended, ideally with standardized timing and additional parameters when available.	Diabetic foot exercise 10-15 minutes, at least 3 times per week, with diet adherence and routine medication.	Planned maintenance of glucose control and foot comfort.

OUTCOME AND FOLLOW-UP

In Case 1, random blood glucose decreased from 421 mg/dL at baseline to 348 mg/dL on day 1, 306 mg/dL on day 2, and 206 mg/dL on day 3. The total reduction from baseline to day 3 was 215 mg/dL, and the average day-to-day reduction documented in the case study was 71.7 mg/dL. However, the patient continued to report foot stiffness and numbness, and the exercise movements were not optimal. The nursing problem was therefore not fully resolved. In Case 2, random blood glucose decreased from 205 mg/dL at baseline to 132 mg/dL on day 1, increased to 176 mg/dL on day 2, and decreased to 105 mg/dL on day 3. The total reduction from baseline to day 3 was 100 mg/dL, and the average day-to-day reduction documented in the case study was 33.3 mg/dL. The patient reported improved comfort and reduced stiffness/tingling, and the nursing problem was considered resolved. Because the RBG measurements were not standardized according to meal timing and both patients continued pharmacological therapy, these changes should be interpreted as short-term clinical observations rather than evidence of a direct causal effect of diabetic foot exercise. Both patients were advised to continue diabetic foot exercise independently for 10-15 minutes at least three times per week, while maintaining diet adherence and routine medical therapy.

DISCUSSION

This two-case report suggests that diabetic foot exercise was feasible in a nursing-home setting and could be integrated with routine monitoring, education, and pharmacological collaboration. Both cases showed a decrease in random blood glucose after three consecutive days of integrated nursing management that included diabetic foot exercise. However, the clinical interpretation should be cautious because the intervention was implemented alongside ongoing antidiabetic medication, dietary education, routine nursing monitoring, and without a control condition. Therefore, the observed changes should be interpreted as temporally associated with the overall care process rather than as a causal effect of diabetic foot exercise alone.

The findings of this case report are consistent with previous applied studies and case-based reports showing that diabetic foot exercise may help reduce blood glucose levels in patients with type 2 diabetes mellitus. (Mustofa, E. E., Purwono, J., 2022) reported that diabetic foot exercise performed for three consecutive days with a duration of 10-15 minutes per session reduced blood glucose from 381 mg/dL to 263 mg/dL. Similarly, Indriyani et al. (2023) found that diabetic foot exercise performed for four consecutive days reduced blood glucose from 266 mg/dL to 130 mg/dL (Indriyani, E., & Dewi, 2023). Pratiwi et al. (2021) also reported a reduction in blood glucose from 395 mg/dL to 185 mg/dL after diabetic foot exercise was implemented for three consecutive days (Pratiwi, D., Nurhayati, S., & Purnomo, 2021). These previous findings provide a relevant comparison for the present cases, in which Case 1 showed a reduction from 421 mg/dL to 206 mg/dL

and Case 2 showed a reduction from 205 mg/dL to 105 mg/dL after three days of observation. Nevertheless, these comparisons should be interpreted carefully because study designs, baseline glucose levels, medications, dietary patterns, and timing of glucose measurement may differ across reports.

The possible mechanism underlying the observed short-term improvements is that lower-extremity muscle activity during diabetic foot exercise may increase glucose uptake by skeletal muscles, improve peripheral circulation, maintain joint flexibility, and reduce lower-extremity discomfort. The movements involved in diabetic foot exercise, such as toe flexion and extension, ankle rotation, heel and forefoot lifting, and leg extension, stimulate repeated muscle contraction. This process may support glucose utilization when combined with medication adherence, dietary regulation, and routine monitoring. However, the present report cannot separate the specific contribution of exercise from medication effects, meal variability, baseline glucose differences, spontaneous fluctuation of RBG, or other daily activities.

Outcome variation was clinically important in this report. Case 1 had a much higher baseline random blood glucose level and greater mobility limitation, as shown by walker use and persistent foot stiffness and numbness. These geriatric and functional factors may have reduced exercise quality and contributed to incomplete nursing problem resolution despite substantial glucose reduction. In contrast, Case 2 had a lower baseline blood glucose level, better mobility, and progressive improvement in foot stiffness and tingling. The increase in blood glucose on the second day in Case 2 was described in the case notes as possibly related to dietary variation; however, no structured dietary intake assessment, food record, or calorie/carbohydrate analysis was conducted. Therefore, dietary influence should be interpreted as a possible contributing factor rather than a confirmed cause. This issue supports the importance of integrating family or caregiver support and nursing roles in improving adherence to blood glucose control (Antoro, 2023).

These observations indicate that diabetic foot exercise should not be viewed as a stand-alone therapy. It should be integrated into a comprehensive nursing care plan that includes blood glucose monitoring, medication adherence, dietary education, exercise education, foot care, and individualized assessment of mobility and neuropathic symptoms. For older adults in residential care settings, diabetic foot exercise has practical value because it is simple, low-cost, can be performed in a sitting position, and can be adjusted to the patient's functional capacity. Nevertheless, future case reports should include standardized foot assessment, HbA1c measurement, fasting or postprandial glucose measurement with clear timing, dietary intake records, medication adherence evaluation, and longer follow-up to strengthen clinical interpretation.

DIAGNOSTIC CHALLENGE

The main diagnostic challenge was the limited objective assessment. Blood glucose was measured using random capillary values rather than fasting glucose, two-hour postprandial glucose, or HbA1c. In addition, the timing of RBG measurement in relation to meals was not consistently documented. The lower-extremity symptoms were compatible with diabetic neuropathic complaints, but no standardized neuropathy score, monofilament test, vibration test, or vascular assessment was documented. Therefore, the report focuses on nursing assessment and short-term response rather than definitive diagnostic classification of neuropathy or vascular disease. Transparent reporting of these limitations is important in case reports to avoid overinterpretation (Gagnier, J. J, 2013).

LIMITATION

This report has several limitations. It included only two cases, had a three-day intervention period, used random blood glucose monitoring, and did not include long-term follow-up. The three-day period was sufficient only to describe feasibility and immediate clinical observation, not to establish sustained glycemic control or long-term improvement in lower-extremity symptoms. The exact timing of RBG measurement relative to meals was not consistently documented. Dietary intake, medication adherence, and physical activity outside the intervention were not controlled or measured using standardized tools. Because both patients

continued pharmacological therapy and received nursing education and monitoring, the observed glucose reductions cannot be attributed solely to diabetic foot exercise.

LEARNING POINTS

1. Diabetic foot exercise can be taught as a simple adjunctive nursing intervention for older adults with type 2 diabetes mellitus and unstable blood glucose levels in residential care settings.
2. Baseline glucose level, mobility limitation, lower-extremity symptoms, medication regimen, and functional ability may influence short-term outcomes.
3. Random blood glucose monitoring helps nurses evaluate short-term response, but the timing of measurement in relation to meals and medication must be clearly documented.
4. Diabetic foot exercise should be integrated with medication adherence, dietary education, foot care, and individualized assessment rather than used as a stand-alone therapy.
5. Future reports should include standardized foot assessment, HbA1c, clearly timed fasting or postprandial glucose measurements, dietary records, and longer follow-up.

CONCLUSION

Diabetic foot exercise was feasible as an adjunctive nursing intervention for two older adults with type 2 diabetes mellitus in a nursing-home setting. During the three-day observation period, both cases showed improved short-term random blood glucose values, while lower-extremity symptom response differed between patients. The first case showed substantial glucose reduction but persistent foot symptoms and incomplete problem resolution, whereas the second case showed improved glucose values and lower-extremity comfort. Because both patients continued antidiabetic medication and received other nursing interventions, the glucose changes cannot be attributed solely to diabetic foot exercise. This case report highlights the importance of individualized gerontological nursing care, careful documentation of glucose measurement timing, and integration of exercise with medication adherence, dietary education, and ongoing monitoring.

ETHICAL CLEARANCE

According to institutional confirmation from Sekolah Tinggi Ilmu Kesehatan Cirebon, formal ethical clearance was not required for this anonymized clinical case report because it was prepared from a completed educational case study, involved a limited number of cases, did not include experimental procedures beyond routine nursing care documentation, and did not present any identifiable patient information. The case data were reported anonymously, without patient names, medical record numbers, full addresses, exact dates of birth, facial images, or other personal identifiers. Written informed consent for publication was obtained from the patients, and confidentiality was maintained throughout the reporting process. If required by the journal, an institutional exemption letter can be provided as supporting documentation.

PATIENT CONSENT

Written informed consent for publication of this anonymized clinical case report was obtained from the patients. The manuscript does not include patient names, medical record numbers, full addresses, exact dates of birth, facial images, or other identifiable personal information. Patient confidentiality was maintained throughout the reporting and publication process.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest related to the writing and publication of this article.

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AUTHORS' CONTRIBUTION

ENA contributed to data collection and initial case documentation. NTW contributed to conceptualization, nursing analysis, supervision, and manuscript revision. PO and S contributed to supervision, clinical analysis, and manuscript revision. All authors reviewed and approved the final version before submission.

DATA AVAILABILITY

Supporting data are not publicly available because they contain confidential patient information. De-identified data may be available from the corresponding author upon reasonable request and subject to institutional permission.

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LIST OF ABBREVIATIONS

BP = blood pressure; DM = diabetes mellitus; HbA1c = glycated hemoglobin; RBG = random blood glucose; SDKI = Standar Diagnosis Keperawatan Indonesia; SIKI = Standar Intervensi Keperawatan Indonesia; SLKI = Standar Luaran Keperawatan Indonesia; T2DM = type 2 diabetes mellitus.

FIGURE AND TABLE LEGENDS

Table 1. Summary of relevant baseline diagnostic findings. Table 2. Clinical case timeline. No clinical image or figure is included in this manuscript.

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