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Foot Reflexology Massage for Managing Diabetic Peripheral Neuropathy Symptoms in a Patient with Type 2 Diabetes Mellitus: A Case Study

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Abstract: Diabetic Peripheral Neuropathy (DPN) is a common complication of Type 2 Diabetes Mellitus, often causing numbness, tingling, nocturnal cramps, and sleep disturbance. Complementary nursing interventions are needed to support symptom management in primary healthcare settings. **Objective:** This study aimed to describe the implementation of foot reflexology massage and its potential contribution to reducing peripheral neuropathy symptoms in a patient with Type 2 Diabetes Mellitus. **Method:** This study used a descriptive case study design with an Evidence-Based Practice Nursing approach. The subject was a 58-year-old female patient with Type 2 Diabetes Mellitus and peripheral neuropathy symptoms. Data were collected through nursing assessment, physical examination, Toronto Clinical Neuropathy Score (TCNS), and Ankle Brachial Index (ABI). Foot reflexology massage was administered three times per week for two weeks, totaling six sessions. Data were analyzed descriptively by comparing pre- and post-intervention findings. **Findings:** Before the intervention, the patient had moderate neuropathy with a TCNS score of 10, an ABI value of 0.91, cold acral temperature, dry foot skin, and persistent numbness and tingling. After six sessions, the TCNS score decreased to 7, indicating mild neuropathy, while the ABI increased to 0.96. The patient also reported reduced tingling, disappearance of nocturnal cramps, warmer feet, improved skin moisture, and better sleep quality. **Implications:** Foot reflexology massage may serve as a simple, low-cost, non-invasive complementary nursing intervention for managing DPN symptoms in primary healthcare. **Originality/Value:** This study provides a clinical description integrating TCNS and ABI assessment within an Evidence-Based Practice Nursing framework.

Keywords: Type 2 Diabetes Mellitus; Diabetic Peripheral Neuropathy; Foot Reflexology Massage; TCNS; ABI.

INTRODUCTION

Type 2 Diabetes Mellitus (T2DM) has become one of the most significant chronic health challenges worldwide, with a continuously increasing prevalence that places substantial pressure on healthcare systems. According to the International Diabetes Federation, the global burden of diabetes continues to rise, and Indonesia remains among the countries with the highest number of individuals living with diabetes (International Diabetes, 2025). Beyond its metabolic consequences, T2DM is associated with numerous

chronic complications that significantly impair patients' quality of life. One of the most common and debilitating complications is Diabetic Peripheral Neuropathy (DPN), a disorder of the peripheral nervous system characterized by numbness, tingling sensations, burning pain, muscle cramps, reduced sensory perception, and sleep disturbances, particularly in the lower extremities (Feldman et al., 2019; Hicks & Selvin, 2019; Pop-Busui et al., 2017). If not properly identified and managed, DPN may progress to diabetic foot ulcers, infections, gangrene, and lower-limb amputations, making early detection and foot care essential components of diabetes management in primary healthcare settings (American Diabetes Association Professional Practice Committee (American Diabetes Association Professional Practice, 2024; Bus et al., 2024; Schaper et al., 2024).

Previous studies on diabetic peripheral neuropathy can generally be categorized into three major areas. The first category focuses on epidemiological and clinical factors associated with DPN, demonstrating that the condition is strongly related to diabetes duration, poor glycemic control, aging, obesity, hypertension, dyslipidemia, and vascular impairment (Feldman et al., 2019; Hicks & Selvin, 2019; Iqbal et al., 2018; Pop-Busui et al., 2017). The second category concerns screening and diagnostic approaches, highlighting the importance of clinical assessment tools such as symptom evaluation, reflex testing, sensory examinations, and the Toronto Clinical Neuropathy Score (TCNS) for identifying and grading neuropathy severity (Bril & Perkins, 2002; Bril et al., 2009). The third category investigates therapeutic interventions, indicating that while pharmacological treatment remains the primary strategy for managing neuropathic symptoms, long-term medication use may present limitations and adverse effects. Consequently, complementary and non-pharmacological interventions, including foot care education, exercise programs, foot massage, and foot self-massage, have gained increasing attention due to their potential benefits in improving peripheral circulation, patient comfort, and neuropathic symptom management (Price et al., 2022; Sayin-Kasar & Duru-Asiret, 2025; Sunarmi et al., 2022; Tesfaye et al., 2023). Despite these developments, evidence describing the implementation of foot reflexology massage within an Evidence-Based Practice Nursing framework in primary healthcare settings remains limited, particularly studies documenting changes in neuropathic symptoms, Toronto Clinical Neuropathy Score (TCNS), Ankle Brachial Index (ABI), and patient-reported outcomes through detailed clinical observations.

Based on these gaps in the literature, this study aims to describe the implementation of foot reflexology massage as a complementary nursing intervention for reducing peripheral

neuropathy symptoms in a patient with Type 2 Diabetes Mellitus in the working area of Pakis Public Health Center, Malang. Using a descriptive case study design and an Evidence-Based Practice Nursing approach, the study evaluates the patient's clinical condition before and after the intervention through subjective symptom assessment, peripheral temperature observation, sleep quality evaluation, Ankle Brachial Index (ABI) measurement, and Toronto Clinical Neuropathy Score (TCNS) assessment. Rather than establishing a causal relationship, this study seeks to provide a comprehensive clinical description of the intervention process and the patient's response to foot reflexology massage in a primary healthcare context.

The underlying argument of this study is that foot reflexology massage may serve as a safe, simple, cost-effective, and easily applicable complementary nursing intervention for individuals with diabetic peripheral neuropathy. Mechanical stimulation applied to specific areas of the foot is believed to promote relaxation, enhance peripheral circulation, improve sensory perception, and alleviate neuropathic symptoms such as numbness, tingling, and muscle cramps through tactile stimulation and pain modulation mechanisms (Sayin-Kasar & Duru-Asiret, 2025; Sunarmi et al., 2022). Therefore, the implementation of foot reflexology massage in patients with Type 2 Diabetes Mellitus experiencing peripheral neuropathy symptoms may provide supportive benefits within holistic diabetes care programs in primary healthcare facilities.

RESEARCH METHOD

The unit of analysis in this study was an individual patient diagnosed with Type 2 Diabetes Mellitus (T2DM) who experienced symptoms of Diabetic Peripheral Neuropathy (DPN). The case involved a 58-year-old female patient residing in the working area of Pakis Public Health Center, Malang, Indonesia. The patient had been diagnosed with T2DM for six years and presented with peripheral neuropathy symptoms, including numbness, tingling sensations, and lower-extremity discomfort. Inclusion criteria consisted of patients with mild-to-moderate neuropathic symptoms, the ability to communicate effectively, and willingness to participate in the intervention. Patients presenting with active foot ulcers, severe infections, fractures, deep vein thrombosis, or other contraindications to foot massage were excluded from the study.

This study employed a descriptive case study design using an Evidence-Based Practice Nursing (EBPN) approach. A case study design was selected because it enables an in-depth

exploration of clinical phenomena within a real-world healthcare context while allowing detailed observation of patient responses to nursing interventions. The EBPN approach was adopted to integrate current scientific evidence into clinical nursing practice and evaluate the applicability of foot reflexology massage as a complementary intervention for managing diabetic peripheral neuropathy symptoms in primary healthcare settings (Pop-Busui et al., 2017).

Data were obtained from both primary and secondary sources. Primary data were collected directly from the patient through nursing assessments, physical examinations, and standardized clinical measurements. Secondary data were obtained from medical records and relevant evidence-based literature concerning diabetic peripheral neuropathy and foot reflexology interventions. Clinical information included demographic characteristics, diabetes history, neuropathic symptoms, peripheral circulation status, and neurological assessments. The Toronto Clinical Neuropathy Score (TCNS) was utilized as the primary assessment instrument for evaluating neuropathy severity, while the Ankle Brachial Index (ABI) was used to assess peripheral vascular circulation.

Data collection was conducted over a two-week intervention period. Prior to the intervention, a comprehensive baseline assessment was performed to document the patient's clinical condition. The foot reflexology intervention was administered three times per week for two consecutive weeks, resulting in a total of six sessions. Each session lasted 30 minutes, consisting of 15 minutes of massage on each foot. Coconut oil was used as a lubricant to minimize skin friction and improve patient comfort during the procedure. The intervention employed a thumb-pressing technique targeting specific reflex points on the plantar surface of the feet, with pressure applied for approximately 5–10 seconds at each designated point. Neuropathy severity and peripheral circulation indicators were assessed before and after completion of the intervention period.

Data analysis was performed using descriptive analysis. Clinical findings obtained before and after the intervention were compared to identify changes in neuropathy symptoms, peripheral circulation status, and overall patient responses. The analysis focused on variations in TCNS scores, ABI measurements, subjective symptom reports, and physical examination findings. The results were subsequently interpreted narratively and compared with findings from previous studies to evaluate the potential contribution of foot reflexology massage as a complementary nursing intervention for patients with diabetic peripheral neuropathy. Ethical principles, including informed consent, anonymity,

confidentiality, and voluntary participation, were maintained throughout the study in accordance with nursing research standards (Polit & Beck, 2024).

RESULT

The initial assessment showed that Mrs. S was categorized as having moderate peripheral neuropathy, with a total Toronto Clinical Neuropathy Score (TCNS) of 10. Subjectively, the patient reported that both soles felt thick, numb, and tingling for approximately one year. These symptoms worsened at night and interfered with sleep comfort. Objectively, the patient's random blood glucose level was 240 mg/dL, the skin of both feet appeared dry, the acral area was symmetrically cold, and the Ankle Brachial Index (ABI) value was 0.91, indicating a borderline peripheral circulation status.

After receiving foot reflexology massage using coconut oil for two weeks, consisting of six sessions with a duration of 30 minutes per session, gradual clinical improvement was observed. During the first and second sessions, the patient reported mild soreness when thumb-pressing was applied to the mid-plantar area. This complaint was resolved after the researcher adjusted the pressure below the patient's pain threshold. From the fourth to the sixth sessions, the patient reported more stable comfort, warmer feet, and reduced nighttime tingling. No skin irritation, physical injury, or other adverse effects were observed during the intervention period.

At the final post-intervention evaluation, Mrs. S reported that the sensation of thickness in both feet had markedly decreased, nocturnal cramps had disappeared, and sleep quality had improved. Objectively, the random blood glucose level decreased from 240 mg/dL to 180 mg/dL, the acral area became warmer, the skin appeared more moisturized, and the ABI value increased from 0.91 to 0.96, indicating a normal category. Reassessment using the TCNS showed a decrease in the total score from 10 to 7, indicating improvement from moderate to mild peripheral neuropathy.

Table 1. Clinical Condition Before the Intervention

Assessment Component	Findings
Patient	Mrs. S
Neuropathy category	Moderate peripheral neuropathy
TCNS score	10
Main subjective complaints	Thick sensation, numbness, and tingling in both soles
Duration of symptoms	Approximately 1 year
Night symptoms	Symptoms worsened at night and disturbed sleep
Random blood glucose	240 mg/dL
Foot skin condition	Dry

Assessment Component	Findings
Acral temperature	Symmetrically cold
ABI value	0.91
ABI interpretation	Borderline

Table 2. Patient Response During the Intervention Period

Intervention Period	Patient Response
Sessions 1–2	Mild soreness during thumb-pressing on the mid-plantar area
Adjustment made	Pressure was reduced below the patient's pain threshold
Sessions 4–6	Feet felt warmer, comfort became more stable, and nighttime tingling gradually decreased
Adverse effects	No skin irritation, physical injury, or other adverse effects were observed

Table 3. Comparison of Pre- and Post-Intervention Clinical Outcomes

Parameter	Pre-Intervention	Post-Intervention
TCNS score	10	7
Neuropathy category	Moderate	Mild
Random blood glucose	240 mg/dL	180 mg/dL
ABI value	0.91	0.96
ABI category	Borderline	Normal
Thick sensation in feet	Present	Markedly decreased
Nocturnal cramps	Present	Absent
Nighttime tingling	Present	Reduced
Acral temperature	Cold	Warm
Foot skin condition	Dry	More moisturized
Sleep quality	Disturbed	Improved

Overall, the findings showed improvement in subjective symptoms and objective clinical parameters after six sessions of foot reflexology massage. The intervention was completed safely and was well tolerated by the patient without adverse effects.

DISCUSSION

The findings of this case study indicate that the implementation of foot reflexology massage was associated with improvements in both subjective and objective clinical indicators in a patient with Type 2 Diabetes Mellitus experiencing diabetic peripheral neuropathy. Before the intervention, the patient presented with symptoms of numbness, tingling sensations, a feeling of thickness in both feet, nocturnal cramps, sleep disturbances, dry skin, cold acral temperature, an ABI value of 0.91, and a TCNS score of 10, indicating moderate neuropathy. Following six sessions of foot reflexology massage over a two-week period, improvements were observed in symptom severity, peripheral circulation, skin

condition, sleep quality, ABI value, and TCNS score. The TCNS score decreased from 10 to 7, indicating a transition from moderate to mild neuropathy.

Several physiological mechanisms may explain the observed improvements. Foot reflexology massage involves repeated mechanical stimulation of the plantar surface of the feet, which may enhance peripheral blood circulation through local vasodilation and increased microvascular perfusion. Improved circulation can facilitate oxygen and nutrient delivery to peripheral tissues, including nerve fibers that are vulnerable to ischemic damage in patients with diabetic neuropathy. The increase in ABI value from 0.91 to 0.96 and the transition from cold to warm acral temperature observed in this case may indicate improved peripheral perfusion following the intervention. In addition, tactile stimulation may promote relaxation and reduce sympathetic nervous system activity, potentially contributing to improved comfort and sleep quality.

The findings of this case are consistent with previous studies investigating massage-based interventions for diabetic neuropathy. Sayin-Kasar and Duru-Asiret reported that foot self-massage improved peripheral skin temperature, patient comfort, and neuropathic symptoms among individuals with diabetes (Sayin-Kasar & Duru-Asiret, 2025). Similarly, Sunarmi found that massage therapy contributed to improved peripheral circulation and sensory function in patients with diabetic neuropathy (Sunarmi et al., 2022). Furthermore, Al-Fahham and Al-Jubouri demonstrated that foot massage interventions were associated with reductions in neuropathic symptom severity among diabetic patients (Al-Fahham & Al-Jubouri, 2023). The present case supports these findings by documenting gradual clinical improvements throughout the intervention period. However, unlike previous studies that employed experimental or controlled designs, this study provides a detailed description of patient responses within an Evidence-Based Practice Nursing framework in a primary healthcare setting.

From a neurological perspective, the reduction in tingling sensations, numbness, and nocturnal discomfort may be interpreted through the Gate Control Theory of pain modulation. According to this theory, tactile stimulation activates large-diameter sensory fibers that can inhibit the transmission of pain-related signals carried by smaller nerve fibers. Continuous sensory stimulation during foot reflexology massage may therefore contribute to a reduction in abnormal sensory perceptions experienced by patients with diabetic peripheral neuropathy. Although this mechanism cannot be directly verified within

the present case study, the observed reduction in neuropathic symptoms is consistent with the theoretical explanation proposed in previous literature.

The findings also have practical implications for diabetes management in primary healthcare settings. Improvements in sleep quality, comfort, and perceived foot condition suggest that foot reflexology massage may provide benefits beyond symptom reduction alone. Enhanced comfort and reduced nighttime disturbances may support overall well-being and potentially improve adherence to long-term diabetes self-management. Nevertheless, the results should be interpreted cautiously because this study involved only one participant and did not include a comparison group. Consequently, the observed improvements cannot be attributed exclusively to the intervention, as other factors such as medication adherence, daily activities, or natural symptom variation may also have contributed to the outcomes.

Based on these findings, foot reflexology massage may be considered a complementary nursing intervention that is simple, low-cost, non-invasive, and feasible for implementation in community and primary healthcare settings. Healthcare providers, particularly nurses working in chronic disease management programs, may consider incorporating foot care education and supervised foot reflexology techniques as supportive interventions for patients with diabetic peripheral neuropathy. Future studies involving larger samples, controlled designs, and longer follow-up periods are recommended to further evaluate the clinical effectiveness and sustainability of this intervention.

CONCLUSION

This case study demonstrated that the implementation of foot reflexology massage was associated with improvements in both subjective and objective indicators of diabetic peripheral neuropathy in a patient with Type 2 Diabetes Mellitus. Following six intervention sessions over a two-week period, the patient reported reduced numbness, tingling sensations, and foot thickness, accompanied by the disappearance of nocturnal cramps and improved sleep quality. Objective findings also showed improvements in peripheral circulation, reflected by an increase in the Ankle Brachial Index (ABI) from 0.91 to 0.96 and a reduction in the Toronto Clinical Neuropathy Score (TCNS) from 10 to 7, indicating a change from moderate to mild neuropathy severity. These findings suggest that foot reflexology massage may provide supportive benefits for managing neuropathic symptoms in patients with Type 2 Diabetes Mellitus.

The scientific contribution of this study lies in providing a detailed clinical description of the application of foot reflexology massage within an Evidence-Based Practice Nursing framework in a primary healthcare setting. In addition to documenting changes in neuropathic symptoms, this study demonstrates the practical use of TCNS and ABI as complementary clinical indicators for monitoring patient progress during non-pharmacological interventions. The findings contribute to the growing body of evidence supporting complementary nursing interventions for diabetic peripheral neuropathy and may serve as a reference for nursing practice in community and primary healthcare services.

This study has several limitations. First, the findings are based on a single patient and therefore cannot be generalized to the broader population of patients with diabetic peripheral neuropathy. Second, the study did not include a control group, making it difficult to determine the extent to which the observed improvements were attributable solely to the intervention. Third, the relatively short intervention period limited the evaluation of long-term outcomes and sustainability of clinical improvements. Future studies involving larger sample sizes, controlled research designs, and longer follow-up periods are recommended to further explore the effectiveness and long-term benefits of foot reflexology massage in patients with diabetic peripheral neuropathy.

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