ORIGINAL ARTICLE
International Journal of Biomedical Nursing Review 2024, Volume 3, Number 1: 21-25
P-ISSN: 2963-1556, E-ISSN: 2962-4703

THE EFFECT OF FOOT EXERCISES ON BLOOD FOOT SENSITIVITY AND GLUCOSE LEVELS PATIENTS WITH TYPE 2 DIABETES MELLITUS: CASE REPORT

Sita Irnadianis Irfada[1*], Annas Sumeru[2]
[1]Program Profesi Ners, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto
[2]Department of Nursing, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto

*Correspondence Author:
Sita Irnadianis;
Program Profesi Ners, Faculty of Health Sciences, Jenderal Soedirman University, Purwokerto.
sita.irfada@mhs.unsoed.ac.id

Received: 15-02-2023
Approved: 13-06-2023
Published: 02-01-2024

ABSTRACT

Introduction: Diabetes mellitus (DM) is a chronic disease in the form of a metabolic disorder characterized by blood sugar that exceeds normal limits. DM can cause various complications, and the most common is peripheral neuropathy. Management of type 2 DM sufferers includes supporting treatment. **Purpose**: This case study aims to determine the effect of foot exercise on foot sensitivity and blood sugar levels. **Methods**: The given implementation is based on Evidence-Based Nursing (EBN) and foot exercises are nursing interventions that can be used. Foot exercise intervention is carried out for 15-20 minutes once a day. Foot sensitivity was measured using monofilament based on Northern Devon Healthcare (2014) and blood glucose levels using Easy Touch GCU. Results were evaluated by monitoring foot sensitivity and blood sugar levels measured before and after the procedure for 6 consecutive days. **Conclusion:** There was a change in sensitivity and blood sugar levels after the foot exercise intervention was given.

Keywords: DM type 2, sensitivity, blood sugar levels, and foot exercise.

Citation: Irfada, S. I. & Sumeru, A. 2024. 'The Effect of Foot Exercises on Blood Foot Sensitivity and Glucose Levels Patients with Type 2 Diabetes Mellitus: Case Report'. *International Journal of Biomedical Nursing Review*. 3(1). p21-25. https://doi.org/10.20884/1.ijbnr.2024.3.1.10684

INTRODUCTION

Diabetes mellitus is a non-communicable disease whose incidence continues to increase in the world, including in Indonesia. Indonesia is in 5th position with the highest number of diabetes sufferers after America and Pakistan. *International Diabetes Federation* notes out of 5 people with diabetes (81%) live in low and middle-income countries. In 2035, it is estimated that there will be 14.1 million diabetes mellitus sufferers in Indonesia (Sari et al., 2020). There are several types of diabetes mellitus and type 2 diabetes mellitus is the most common type, accounting for around 90% of all diabetes mellitus cases (IDF, 2017).

Chronic hyperglycemia in type 2 diabetes mellitus, which occurs long before the diagnosis is made, causes oxidative stress and reduces antioxidant enzymes which can cause endothelial dysfunction and complications of diabetes mellitus (Román-Pintos et al., 2016). Diabetic neuropathy is one of the most common complications in diabetes sufferers. The most common diabetic neuropathy found in people with diabetes mellitus is peripheral neuropathy. More than 40% of type 2 diabetes mellitus patients experience diabetic peripheral neuropathy (Putri & Waluyo, 2020). Diabetic peripheral neuropathy predisposes to ulcers and gangrene of the feet which require appropriate treatment and great expense. So, to prevent diabetic ulcers, appropriate and fast management is needed.

Treatment as early as possible in diabetes patients can prevent diabetic foot complications and amputation. In type 2 DM patients, physical exercise is the main treatment to control blood glucose levels (Li et al. 2023). One of the physical exercises recommended for DM patients is diabetic foot exercises. Foot exercises are exercises carried out by diabetes mellitus patients to prevent injuries and help improve blood circulation in

the feet. Diabetic foot exercises are activities or exercises that involve moving the muscles and joints of the feet (Sanjaya, Yanti, and Puspita, 2019). Foot exercises can help improve blood circulation and strengthen the small muscles of the feet (Sujianto 2018). A study conducted by Sanjaya, Yanti & Puspita (2019) stated that there is a significant influence of diabetic foot exercises on foot sensitivity in type 2 DM patients. This is because the movements in diabetic foot exercises cause the leg muscles to contract so that they can increase cell sensitivity to blood glucose. This is because high blood glucose levels in the blood can be used by muscles and reduce blood glucose levels (Sujianto, 2018).

Based on the description above, the author is interested in implementing nursing in the form of diabetic foot exercises to determine the effect on foot sensitivity and blood sugar levels in patients with type 2 diabetes mellitus.

METHOD

This research is a descriptive research approach with a case study method compiled from nursing care reports using the nursing process and based on Evidence-Based Nursing (EBN). The case study was conducted on 16-20 October 2023 in Banteran Village. The subject of this case study is a 37-year-old client with type 2 diabetes mellitus. Data collection was carried out by observation and documentation. Data presentation uses tables along with narratives to explain the results obtained in the case study.

The implementation procedure is to first explain to the patient the purpose of providing physical exercise with foot exercises, namely to increase foot sensitivity and reduce blood glucose levels in diabetes mellitus. Foot exercise physical training is carried out once a day for 6 days, then agree on a time and place to do foot exercise physical training. Before and after doing foot exercises, all clients will be examined or tested for foot sensitivity using the monofilament 10g test, and blood glucose levels checked using the Easy Touch GCU.

RESULT

Case Report

The assessment carried out on October 16 2023 revealed subjective data, namely that the client complained that his left leg often felt numb and uncomfortable. Clients also say they often feel hungry and thirsty. The client said that since being exposed to DM, he often wakes up at night to urinate. Furthermore, the objective data obtained was that the mucosa looked dry, and the results of the examination showed BP: 128/87 mmHg Pulse: 78 x/minute, and RR: 19 x/minute. BW: 67 kg, TB: 158, GDS 406 mg/dl. Skin: skin is slightly dry, and skin turgor is not elastic. Extremities: upper and lower extremities can be moved in all directions, cool acral, and CRT > 3 seconds. Sensitivity measurement using monofilament, right foot 8/10, left foot 6/10. Based on the data analysis carried out, it was found that the nursing problem of Ineffective Peripheral Perfusion (D.0009) was related to a decrease in arterial flow, characterized by capillary filling > 3 seconds, the acral felt cold, decreased skin turgor, monofilament results for the right leg were 8/10 and the left leg was 6/10. Instability of Blood Glucose Levels (D.0027) is related to insulin resistance characterized by dry mouth, increased thirst, and GDS levels of 406 mg/dl (PPNI 2017).

The intervention given by the diagnosis raised is hyperglycemic management (I.03115) by providing diabetic foot exercises (PPNI, 2018). Foot exercises are activities or exercises carried out by diabetes mellitus patients to prevent injuries and help improve blood circulation in the feet. Research conducted by Rahman, Maryuni & Rahmadhani (2021) found an increase in the sensitivity of type 2 DM sufferers after doing leg exercises. Apart from that, a study conducted by Yulianti & Armiyati (2023) showed that there was a 26% reduction in blood sugar levels after diabetic foot exercises.

Table 1. Results of Blood Glucose Levels

Day	Measurement results	
	Before	After
Day 1	406 mg/dl	393 mg/dl
Day 2	396 mg/dl	387mg/dl
Day 3	299 mg/dl	273 mg/dl
Day 4	302 mg/dl	287 mg/dl

Day	Measurement results	
	Before	After
Day 5	368 mg/dl	313 mg/dl
Day 6	271 mg/dl	264 mg/dl

Table 2. Foot Sensitivity Results

Day	Measurement results			
	Right foot		Left foot	
	Pre	Post	Pre	Post
Day 1	8/10	8/10	6/10	6/10
Day 2	8/10	8/10	6/10	6/10
Day 3	8/10	9/10	6/10	7/10
Day 4	9/10	9/10	7/10	7/10
Day 5	9/10	9/10	7/10	7/10
Day 6	9/10	9/10	7/10	8/10

The results of the evaluation of the nursing intervention carried out for 6 days were an improvement in peripheral perfusion and blood sugar levels with the criteria for capillary refill results from 2 (moderately worsened) to 4 (moderately improved), acral 2 (moderately worsened) to 5 (improved), skin turgor 3 (moderate) to 4 (moderately improved), sensation 2 (moderately decreased) to 4 (moderately increased), and complaints of tiredness/lethargy 3 (moderate) to 4 (moderately decreased) and blood glucose levels 5 (worsened) to 4 (quite improved). The criteria for the success of the intervention in this case study were an increase in sensitivity and a decrease in blood sugar levels.

DISCUSSION

The foot exercise intervention was given for 6 consecutive days by assessing the results of the pre- and post-intervention evaluation. Similar to previous research conducted bySuarniati, Hasanuddin & Nasriani (2021) Foot exercises are given once a day for six days. The results of the intervention are then seen pre and post-intervention. This is the same as what was done by Ramadhan & Mustofa (2022) namely, the intervention was carried out for 6 days and GDS measurements were carried out pre and post-intervention. Meanwhile, research conducted by Vira et al. (2023) carried out foot exercise intervention for 3 days with a duration of 30 – 45 minutes. However, the assessment of intervention results was not assessed pre and post-intervention but was assessed after day 3.

The average decrease in glucose levels in clients was 20.8 mg/dl. The results of this research are research conducted by Ramadhan & Mustofa (2022)which showed that there was a decrease in blood glucose levels after the foot exercise intervention of 28 mg/dl. Another study conducted by Nurlinawati (2018) explained that there was a significant effect of leg exercises on reducing blood sugar levels with a p-value = 0.027 ($p < 0.05$). This is by the theory which states that diabetic foot exercises can help smooth and improve blood circulation in the feet. Through movements in diabetic foot exercises, the leg muscles will contract, thereby increasing the sensitivity of cells to blood glucose so that blood glucose levels that are high in the blood can be used by the muscles (Sanjaya, Yanti & Puspita 2019).

Increased foot sensitivity was only visible on the 3rd day. The results of the last evaluation, the client's sensitivity increased by 1 on the right leg and 2 on the left leg. In the right foot, the sensitivity started from 8/10 to 9/10, and in the left foot initially 6/10 to 8/10. This is by research Sanjaya, Yanti & Puspita (2019) which shows that there is an increase in foot sensitivity in type 2 DM sufferers after doing foot exercises, namely that initially the average foot sensitivity was 14.77 which increased to 17.31. The evaluation results in this study were the same as research conducted by Ingram (2020) who explained that the foot exercise intervention at the first meeting had not resulted in a change in foot sensitivity, but an increase in sensitivity was seen after the 3rd meeting. The more consistently the intervention is carried out, the more visible the change in sensitivity in the client's feet will be. By studies conducted bySuarniati, Hasanuddin & Nasriani (2021) state that the effectiveness of leg exercises can be seen when they are implemented according to standard leg exercise movements and by paying attention to the frequency, intensity, and duration of the exercise given.

A study conducted byAstuti, Fandizal & Sani (2021) explained that the management of foot exercises to increase foot sensitivity was characterized by increasingly better CRT results, decreased acral that felt cold, and an increase in the Ankle Brachial Index (ABI). By this research, the evaluation results show that there are signs of increased foot

sensitivity with CRT values from initially 4 seconds to 2 seconds, and the acral no longer feels cold. Research conducted by Astuti, Fandizal & Sani (2021) shows that the reduced risk of neuropathy in DM patients can be seen through the ABI value. ABI is calculated by dividing the systolic pressure at the ankle by the systolic blood pressure at the arm. So, in individuals who experience impaired blood circulation in the legs, leg blood pressure will be found to be lower than arm blood pressure (Wahyuni 2015). So when the ABI value in DM sufferers is in normal condition, blood circulation to the extremities is also in good condition so that foot sensitivity is good.

Foot exercises can help improve blood circulation to the lower extremities. Smooth blood circulation due to leg exercises allows blood to deliver more oxygen and nutrients to body cells. Diabetic foot exercises performed on the soles of the feet, especially in the area of the problematic organ, will provide stimulation to the nerve points connected to the pancreas so that they become active, thereby producing insulin through the nerve points located on the soles of the feet and this will prevent complications on the feet (Fadlilah, Sucipto & Rahil 2019). Therefore, performing diabetic foot exercises is effective in reducing GDS levels and increasing foot sensitivity in Type 2 DM patients.

REFERENCES

Astuti, Y., Fandizal, M. & Sani, D.N. 2021, 'Pengaruh Terapi Senam Kaki Diabetik Terhadap Penurunan Resiko Neuropati Pada Klien Dengan Diabetes Melitus', *Jurnal Akademi Keperawatan Husada Karya Jaya*, vol. 7, no. 1, pp. 9–14.

Fadlilah, S., Sucipto, A. & Rahil, N.H. 2019, 'Effectiveness of diabetic foot exercises using sponges and newspapers on foot sensitivity in patients with diabetes mellitus', *Belitung Nursing Journal*, vol. 5, no. 6, pp. 234–8.

International Diabetes Federation. 2017, *IDF diabetes atlas Eighth edition 2017*.

Li, C., Wang, W., Ji, Q., Ran, X., Kuang, H., Yu, X., Fang, H., Yang, J., Liu, J., Xue, Y., Feng, B., Lei, M. & Zhu, D. 2023, 'Prevalence of painful diabetic peripheral neuropathy in type 2 diabetes mellitus and diabetic peripheral neuropathy: A nationwide cross-sectional study in mainland China', *Diabetes Research and Clinical Practice*, vol. 198, no. January, p. 110602.

Ningrum 2020, 'Perubahan Sensitivitas Kaki pada Diabetes Melitus Tipe 2 Setelah dilakukan Senam Kaki', *Journal of Telenursing Volume*, vol. 2507, no. February, pp. 1–9.

Northern Devon Healthcare 2014, 'Podiatry Services Screening of the Diabetic Foot How to use of a 10g Monofilament', *Lyndon White 0890*, pp. 1–2.

Nurlinawati 2018, 'Pengaruh Senam Kaki Diabetes Terhadap Perubahan Kadar Gula Darah pada Penderita Diabetes Melitus di Wilayah Kerja Puskesmas Simpang Sungai Duren Kabupaten Muaro Jambi', *Jurnal Ilmiah Ilmu Terapan Universitas Jambi*, vol. 1, no. 1, pp. 430–9.

PPNI, T.P.S.D. 2017, Standar Diagnosis Keperawatan Indonesia, 1st edn, Dewan Pengurus Pusat Persatuan Perawat Nasional Indonesia, Jakarta.

PPNI, T.P.S.D. 2018, Standar Intrvensi Keperawatan Indonesia, 1st edn, Dewan Pengurus Pusat Persatuan Perawat Nasional Indonesia, Jakarta

Putri, R.N. & Waluyo, A. 2020, 'Faktor Resiko Neuropati Perifer Diabetik Pada Pasien Diabetes Melitus Tipe 2 : Tinjauan Literatur', *Jurnal Keperawatan Abdurrab*, vol. 3, no. 2, pp. 17–25.

Ramadhan, D. & Mustofa, A. 2022, 'Penurunan Gula Darah Pasien Diabetes Melitus Tipe 2 Dengan Terapi Senam Kaki Diabetes', *Ners Muda*, vol. 3, no. 1.

Román-Pintos, L.M., Villegas-Rivera, G., Rodríguez-Carrizalez, A.D., Miranda-Díaz, A.G. & Cardona-Muñoz, E.G. 2016, 'Diabetic polyneuropathy in type 2 diabetes mellitus: Inflammation, oxidative stress, and mitochondrial function', *Journal of Diabetes Research*, vol. 2016.

Sanjaya, P.B., Yanti, N.L.P.E. & Puspita, L.M. 2019, 'Pengaruh Senam Kaki Diabetik Terhadap Sensitivitas Kaki pada Pasien DM Tipe 2', *Community of*

Publishing in Nursing (COPING), vol. 7, no. 2, pp. 97–102.

Sari, Y., Upoyo, A.S., Isworo, A., Taufik, A., Sumeru, A., Anandari, D. & Sutrisna, E. 2020, 'Foot self-care behavior and its predictors in diabetic patients in Indonesia', *BMC Research Notes*, vol. 13, no. 1, pp. 4–9.

Suarniati, S., Hasanuddin, F. & Nasriani, N. 2021, 'Penerapan Senam Kaki Pada Pasien Diabetes Melitus', *Alauddin Scientific Journal of Nursing*, vol. 2, no. 1, pp. 32–40.

Sujianto, U. 2018, 'Modul Senam Kaki Pelatihan Educator', *Universitas Diponegoro Semarang*, pp. 1–11.

Vira, N.Y., Febriana, D., Program, M., Pendidikan, S., Ners, P., Keperawatan, F., Syiah, U., Keilmuan, B., Gerontik, K., Keperawatan, F. & Syiah, U. 2023, *Penerapan Terapi Senam Kaki Diabetes Pada Lansia Dengan Diabetes Melitus : Suatu Studi Kasus*, vol. VII, pp. 75–81.

Wahyuni, T.D. 2015, 'Ankle Brachial Index (Abi) Sesudah Senam Kaki Diabetes Pada Penderita Diabetes Melitus Tipe 2', *Jurnal Keperawatan*, vol. 85, no. 6, pp. 232–232.