Original Article

Perception of quality of life in patients with diabetic foot

João Luiz Vieira da Silva[1] (ID), Eduardo Machado Javorski[1] (ID), Raquel França Pereira[1] (ID), Rosângela Maria Saalfeld[1] (ID)

1. Universidade Federal do Paraná, Curitiba, Paraná, Brazil.

Abstract

Objective: Investigate the factors that influence the perception of quality of life in patients with diabetic feet, with and without ulcers in the lower limbs.

Methods: An observational cross-sectional study in 50 adult patients with type 1 and 2 diabetes mellitus, where sociodemographic, clinical, and treatment data were collected, and the Neuropathy Specific Quality Of Life (NEUROQOL) questionnaire was applied, which consists of 35 items that evaluate six domains related to quality of life. Comparisons were performed using appropriate statistical tests, considering the significance of $p < 0.05$.

Results: The mean age was 70 years, with 13 patients having a history of amputations, and 18 had foot ulcers. The domains significantly affected were sensorimotor symptoms, limitations in daily activities, interpersonal problems, and emotional distress. Patients with amputations or ulcers had higher scores, indicating poorer quality of life. Physical activity was associated with significantly better scores in several domains.

Conclusion: Patients with diabetic foot complications, such as amputations or ulcers, had a poorer quality of life, especially in the domains related to functionality and emotional well-being. Physical activity proved to be a relevant protective factor. Preventive and therapeutic strategies that promote mobility, health education, and adequate clinical management can contribute to improving the quality of life in individuals with diabetic feet.

Level of Evidence IV; Therapeutic studies - investigating the results of treatment; Case series.

Keywords: Diabetes Mellitus; Diabetic foot; Quality of life.

Introduction

Diabetes mellitus (DM) is defined as a heterogeneous metabolic disorder with hyperglycemia as its main aspect. Its main causes are disorders in insulin secretion or its effect, and it may even be a combination of both. The prevalence of diabetes is currently approximately 540 million people worldwide, and the estimate for 2045 is 783.2 million[1,2].

Among the many complications of DM, foot-related changes are particularly significant. Diabetic foot results from the neurological and vascular alterations caused by DM. The resulting loss of muscle mass and changes in bone structure lead to areas of excessive pressure on the feet, which are further exacerbated by skin dryness and impaired local circulation, delaying healing. This combination of factors creates an ideal environment for foot ulcer development, which, if not properly managed, can progress and require amputation as a life-saving measure[3].

Many patients experience a significantly poorer quality of life when they have foot problems caused by DM. Understanding the multifaceted aspects of the condition becomes important for both patients, in terms of strengthening their physical and mental health, and for health professionals, to promote a treatment more appropriate to the individual needs of each patient[4].

The objective of this study is to investigate the factors that influence the perception of quality of life in patients with diabetic feet, with and without ulcers in the lower limbs, in outpatient follow-up in a university hospital.

Methods

This is a cross-sectional observational study with a quantitative and qualitative approach. The target population consisted of 50 adult patients of both sexes with a confirmed diagnosis of DM type 1 or 2, followed at the Diabetic Foot Outpatient Clinic and the Medical Outpatient Service Three (SAM 3) of the Complexo Hospital de Clínicas da Universidade Federal do Paraná (CHC-UFPR). The study was approved by the Institutional Review Board under the number 78151524.6.0000.0096.

Data collection was performed from May to November 2024. The data collected from the questionnaires were recorded in an electronic database and stored for five years, as recommended by Resolution 466/12 of the National Health Council.

Inclusion criteria were age ≥ 18 years, any race/ethnicity/sex, with or without ulcers in the lower limbs, and a signed Informed Consent Form (ICF). The exclusion criteria were non-diabetic patients, diabetic patients < 18 years, patients who had some physical or mental condition that prevented them from answering the questionnaires, and those who did not agree to participate in the study.

Data collection involved the application of the Neuropathy Specific Quality of Life (NEUROQOL) questionnaire, which was created by Vileikyte et al.[5] and later translated into Portuguese and validated by Xavier et al.[6].

The NEUROQOL has adequate internal consistency (Cronbach's Alpha Coefficient 0.94), consisting of 35 items that allow participants to answer how often and with what intensity foot problems affect their quality of life in relation to six domains: pain, loss/reduction of sensitivity, diffuse sensorimotor symptoms, limitations in activities in daily life, interpersonal issues and emotional distress. The final two items on the scale assess, respectively, the impact of foot problems on overall quality of life and overall quality of life rating. Depending on the type of question, an "X" is marked on a scale of 1 to 5, where 1 represents "never" or "not at all" and 5 represents "very or very much." After selecting the response for a given item, participants are also asked to indicate how much the content of this item represents a nuisance or how important it is on a scale of 1 to 3, with the answers 1 = not at all, 2 = little, and 3 = a lot. To obtain the weighted scores of each item of the respective domains, the value obtained in each item (1-5) is multiplied by the value attributed to the corresponding nuisance/importance (1-3). This multiplication provides the degree of impact for each item within the instrument. The total values for each domain are calculated as the mean of the weighted items of the respective domains and can vary from 1 to 15; that is, the highest value corresponds to a poorer quality of life.

In addition, structured interviews were conducted to collect sociodemographic, clinical, and treatment information. The questionnaire was applied during patient care at the outpatient clinic, in a private room, in the presence of the nurse responsible for the area, and, when present, a companion.

Patients were informed about all stages, objectives, benefits, and risks of the study and invited to participate in the study by signing the ICF.

For the descriptive analysis of quantitative variables, means, standard deviations, median, minimum, and maximum values were used. Categorical variables were described by absolute frequency and percentage. Regarding the questions with Likert scale response options (categorical variables), comparisons were made using Fisher's exact test or the Chi-square test. To compare the groups defined by demographic and clinical variable classifications, the scores of the NEUROQOL questionnaire domains (ranging from 1 to 15) were analyzed using the non-parametric Mann-Whitney test. P values < 0.05 were considered statistically significant. Data were analyzed using the IBM SPSS Statistics v. 29.0.0 (Armonk, NY: IBM Corp).

Results

The mean age was 70 years (± 10.6), the minimum 40 years, and the maximum 95 years. The mean time since diagnosis was 26 years (± 13.2), and 44 (88%) of patients had a follow-up time in the outpatient clinic of more than 24 months. Twenty-seven (54%) patients were female, 39 (78%) white, nine (18%) brown (*pardo*) and two (4%) black. As for marital status, 25 (50%) were married, 22 (44%) were divorced or widowed, and three (6%) were single. Regarding schooling, 26 (52%) had incomplete elementary school, 12 (24%) completed high school, five (10%) completed higher education, four (8%) completed elementary school, two (4%) had incomplete high school and one (2%) had no formal education. Thirty (60%) patients had monthly family income between one and three minimum wages, while 12 (24%) received more than three minimum wages and eight (16%) received up to one minimum wage. Regarding lifestyle at the time of the interview, 37 (74%) patients did not engage in physical activity, 28 (56%) denied being smokers, and 30 (60%) did not consume alcohol.

Forty-one (83.7%) patients with DM type 2 and nine (18%) patients with DM type 1 were identified. The self-reported mean capillary glycemia was 153.6 (± 51.2). Among the associated illnesses, systemic arterial hypertension was predominant in 42 (84%) patients, followed by dyslipidemia in 41 (82%) patients. Regarding the lesions, 38 (76%) patients had four or more non-ulcerated lesions, the most common being nail dystrophy (Figure 1) and calcaneal hyperkeratosis (Figure 2). In addition, 18 (36%) patients had ulcers (Figure 3), and 13 (26%) patients had some amputation (Figure 4).

Regarding mobility, 35 (70%) patients walked without assistance, eight (16%) required assistance to walk, and seven (14%) used a wheelchair.

The assessment of quality of life by domains is presented in Table 1.

At the end of the questionnaire, the patients answered two questions about overall quality of life (questions 28 and 29). The frequencies and percentages of patient's responses to these two final questions are presented in Table 2.

Figure 1. A 68-year-old female patient with DM type 2, insulin-dependent, presenting with toenail deformities associated with nail dystrophy.

Figure 2. A 76-year-old female patient with DM type 2, on metformin and dapagliflozin (Forxiga®), presenting with calcaneal hyperkeratosis.

From the responses obtained for each of the demographic and clinical variables analyzed, as well as for the domain scores and the overall score, the null hypothesis that the scores are the same for all variable classifications was tested against the alternative hypothesis that the scores differ. Among all analyses, three variables stood out: amputation, physical activity, and ulcer, in which statistically significant differences were found in the quality of life domains (p < 0.05).

The results showed a significant difference between patients with and without amputation in the domains of limitations in daily activities, interpersonal problems, emotional distress, and overall quality of life. In these domains, it was observed that the mean scores were higher for patients with amputation, indicating a poorer quality of life for this group (Table 3).

Figure 3. A 69-year-old male patient with DM type 2, on metformin and dapagliflozin (Forxiga®), presenting an ulcer in the plantar region of the left hallux (3A) and left calcaneal region (3B).

Patients who did not practice physical activity had worse scores in sensorimotor symptoms, limitations in daily activities, interpersonal problems, emotional distress, and overall quality of life (Table 4). Their mean scores were higher in all domains, indicating poorer quality of life; however, this difference was not statistically significant in pain and loss/reduction of sensitivity domains.

Figure 4. A 60-year-old female patient, DM type 2, insulin-dependent, with several years of evolution, presenting with gangrene of the right second toe (4A) and postoperative status (4B).

Table 1. Quality of life scores by domains and overall assessment

Domain	n	Mean	Median	Minimum	Maximum
Pain	50	4.8	4.1	1	15
Loss/reduction of sensitivity	50	5.2	3.7	1	15
Sensorimotor symptoms	50	9.3	9.7	4.7	15
Limitations in daily activities	50	8.2	9.0	1	15
Interpersonal problems	50	8.0	8.6	1	15
Emotional distress	50	5.5	4.8	1	13
Overall	50	6.3	6.4	1.6	12

*Higher values indicate poorer quality of life, ranging from 1 to 15.

Table 2. Overall quality of life

Questions	Classification	n	%
Question 28 Overall, my foot problems greatly decreased my quality of life	Very much	13	26%
	Very	12	24%
	Moderately	8	16%
	A little	8	16%
	Not at all	9	18%
Question 29 Overall, I rate my quality of life as:	Excelent	3	6%
	Very good	5	10%
	Good	23	46%
	Fair	16	32%
	Poor	3	6%

*Percentages represent the perception of quality of life related to diabetic foot (response 28) and the overall perception of quality of life (response 29).

On the other hand, patients with ulcers had worse scores in sensorimotor symptoms, limitations in daily activities, interpersonal problems, emotional distress, and overall quality of life (Table 5).

Table 3. Association of amputation and quality of life

Domain*	Amputation	n	Mean	Median	Minimum	Maximum	p*
Pain	No	37	5.0	4.6	1	15	
	Yes	13	4.1	3.6	1.6	8	0.413
Loss/reduction of sensitivity	No	37	4.8	3.7	1	14	
	Yes	13	6.3	5	1	15	0.657
Sensorimotor symptoms	No	37	8.8	9	4.7	15	
	Yes	13	10.5	10.7	4,7	15	0.100
Limitations in daily activities	No	37	6.8	7.5	1	15	
	Yes	13	12.2	15	3	15	0.001
Interpersonal problems	No	37	6.8	6.5	1	15	
	Yes	13	11.6	12	5.8	15	0.001
Emotional distress	No	37	4.9	4	1	13	
	Yes	13	7.0	7.9	2	13	0.046
Overall	No	37	5.8	5.4	1.6	12	
	Yes	13	7.6	7.4	4.5	10.3	0.025

*Higher values indicate poorer quality of life, ranging from 1 to 15; Mann-Whitney non-parametric test, p < 0.05.

Table 4. Association of physical activity and quality of life

Domain*	Physical activity	n	Mean	Median	Minimum	Maximum	p*
Pain	No	37	5.1	4.4	1	15	
	Yes	13	3.8	3.7	1	7.3	0.232
Loss/reduction of sensitivity	No	37	5.8	4.7	1	15	
	Yes	13	3.3	2	1	10.3	0.296
Sensorimotor symptoms	No	37	10	10.3	4.7	15	
	Yes	13	7.2	6.3	4.7	15	0.008
Limitations in daily activities	No	37	9.4	9	1	15	
	Yes	13	4.7	2.5	1	12	0.003
Interpersonal problems	No	37	9.4	10.8	1	15	
	Yes	13	4.3	3	1	10.3	< 0.001
Emotional distress	No	37	6.5	6.6	1	13	
	Yes	13	2.4	2	1	7.4	< 0.001
Overall	No	37	7.1	7.4	2.1	12	
	Yes	13	3.9	3.3	1.6	6.4	< 0.001

*Mann-Whitney non-parametric test, p < 0.05.

Table 5. Association of ulcer and quality of life

Domain	Ulcer	n	Mean	Median	Minimum	Maximum	p*
Pain	No	32	4.9	4.3	1	15	
	Yes	18	4.5	4	1	11.3	0.746
Loss/reduction of sensitivity	No	32	4.3	3.7	1	14	
	Yes	18	6.8	5.5	1	15	0.411
Sensorimotor symptoms	No	32	8.4	7.8	4.7	15	
	Yes	18	10.7	10.3	4.7	15	0.025
Limitations in daily activities	No	32	7	7.5	1	15	
	Yes	18	10.3	12.3	1	15	0.026
Interpersonal problems	No	32	7	7	1	15	
	Yes	18	9.9	11.3	1	15	0.028
Emotional distress	No	32	4.8	4	1	13	
	Yes	18	6.7	7.9	1	13	0.048
Overall	No	32	5.7	5.5	1.6	12	
	Yes	18	7.4	7.4	2	12	0.036

*Mann-Whitney non-parametric test, p < 0.05.

Discussion

Studies show that most diabetic patients with foot ulcers are between 50 and 79 years old, and advanced age and long time living with diabetes increase the risk of foot complications, including amputations[7,8]. A study conducted in South Korea revealed that patients of low socioeconomic status with diabetic foot ulcers had significantly higher rates of amputation and mortality[9].

Our study revealed a patient profile consistent with the literature: older individuals (mean age of 70 years) with a long-standing diagnosis (mean of 26 years), predominance of type 2 DM (83.7%), low socioeconomic status (38 patients with family income up to three minimum wages) and educational status (31 patients until complete elementary school), high number of foot injuries (38 patients with four or more injuries) and prolonged follow-up at the outpatient clinic (44 patients with more than 24 months of follow-up).

A 2019 systematic review identified 31 studies using questionnaires related to diabetes, validated for Brazilian Portuguese, that covered various populations and areas of interest. Specifically, regarding quality of life, seven questionnaires were identified[10]. The NEUROQOL questionnaire used in this study stands out for being directed at people who present signs and symptoms of peripheral diabetic neuropathy, marking the first documented application in Brazilian studies following the validation of its translation version.

In the study by Xavier et al.[6] (2011), which translated the NEUROQOL questionnaire, the first application of this questionnaire was conducted to verify its properties. The evaluation included 50 patients with a mean age of 56 years and low education, a different pattern from the original study performed in North America and the United Kingdom in these aspects. Thus, it was found that the questionnaire had properties that allowed it to be used as a valid instrument. However, due to the variety of cultures and realities in the different regions of Brazil, it would be necessary to conduct a second phase to confirm the questionnaire's ability to evaluate patients.

The results of the questionnaires used in this study showed a significant impact on the patient's quality of life, particularly in domains related to sensorimotor symptoms, limitations in daily activities, interpersonal problems, and emotional distress. This impact was more evident among patients with amputations, foot ulcers, and lack of physical activity.

Studies indicate that diabetic patients in need of amputation report emotional distress, economic stress, body image disorders, reduced mobility, and physical limitations that often lead to loss of independence[11,12], which can indirectly affect their interpersonal relationships. In line with evidence from previous studies, the results of this study indicate that patients with amputations due to diabetic complications had higher scores in most domains of the quality of life questionnaire. There was statistical significance in four of the six domains analyzed: sensorimotor symptoms, limitations in daily activities, interpersonal problems, and emotional distress, as well as the overall assessment, indicating poorer quality of life in these patients.

Regarding foot ulcers, the study by Byrnes et al.[13] (2024) provides a detailed analysis of the relationship between diabetic foot ulcers and quality of life. This multicenter cross-sectional study evaluated health-related quality of life in patients with various health conditions related to diabetic foot ulcers, including those with healed, uninfected, infected, hospitalized, and amputated ulcers. Among the patients participating in the study, it was observed that all health conditions related to diabetic foot ulcers resulted in a significant reduction in quality of life, with the greatest reductions noted in patients with infected ulcers. The data from our study corroborate these results, as the 18 (36%) patients with foot ulcers had poorer quality of life. These patients had higher scores in the domains related to sensorimotor symptoms, limitations in daily activities, interpersonal problems, emotional distress, and overall assessment compared to patients without ulcers.

The practice of physical activity has a positive impact on the quality of life of people with diabetic foot, as shown by several studies. International guidelines recommend exercise programs targeting the foot and ankle in individuals at risk of developing the disease, with evidence of improvements in the functionality of these regions and in gait biomechanics[14]. In addition, higher exercise volumes are associated with benefits such as improved plantar microcirculation and reduced plantar tissue stiffness, without increasing the risk of ulcers[15]. Among the patients in our study, only 13 (26%) practiced regular physical activity, and these individuals had lower scores in all domains of the quality of life questionnaire, suggesting that their quality of life was better than those who did not practice physical activity, which agrees with the data in the literature.

As a limitation of our study, it is worth noting that the application of the NEUROQOL questionnaire was challenging for the patient population treated at the outpatient clinic due to the complexity of some questions, particularly those related to the concept of quality of life. This factor may explain the results observed in the last two questions of the instrument. Although most participants indicated that foot problems greatly decreased their quality of life (question 28), they still rated their overall quality of life as good (question 29).

The present study reinforces the importance of deepening knowledge about the quality of life in patients with diabetic foot, emphasizing the need for personalized interventions to mitigate the negative impacts of diabetic foot on overall health and well-being. Other relevant correlations, which were not explored in this study, can be investigated in future studies.

Conclusion

Our study demonstrated that the quality of life of diabetic patients treated at the diabetic foot outpatient clinic of

CHC-UFPR is significantly affected by diabetes-related complications, such as ulcers and amputations. These complications are associated with deterioration in functional and emotional well-being domains, including sensorimotor symptoms, limitations in daily activities, and emotional distress.

Furthermore, the lack of physical activity was identified as a significant risk factor negatively impacting multiple domains of quality of life. These findings reinforce the importance of interventions that promote mobility and health education, highlighting the protective role of physical activity in managing patients with diabetic foot.

Authors' contributions: Each author contributed individually and significantly to the development of this article: JLVS *(https://orcid.org/0000-0002-9038-2895), and EMJ *(https://orcid.org/0009-0007-0000-6241), and RFP *(https://orcid.org/0009-0003-4643-631X) , and RMS *(https://orcid.org/0000-0002-7928-0273) Conceived and planned the activities that led to the study, interpreted the results of the study, participated in the review process and approved the final version and wrote the article. All authors read and approved the final manuscript. *ORCID (Open Researcher and Contributor ID) iD.

References

1. Petersmann A, Müller-Wieland D, Müller UA, Landgraf R, Nauck M, Freckmann G, et al. Definition, Classification and Diagnosis of Diabetes Mellitus. Exp Clin Endocrinol Diabetes. 2019;127(S 01):S1-S7.

2. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB, et al. IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. Diabetes Res Clin Pract. 2022;183:109119. Erratum in: Diabetes Res Clin Pract. 2023;204:110945.

3. BRASIL. Manual do pé diabético: estratégias para o cuidado da pessoa com doença crônica [Internet]. Ministério da Saúde: Secretaria de Atenção à Saúde; 2016 [cited 2023 Aug 20]. Available from: http://www.as.saude.ms.gov.br/wp-content/uploads/2016/06/manual_do_pe_diabetico.pdf.

4. Coffey L, Mahon C, Gallagher P. Perceptions and experiences of diabetic foot ulceration and foot care in people with diabetes: A qualitative meta-synthesis. Int Wound J. 2018;16(1):183-210.

5. Vileikyte L, Peyrot M, Bundy C, Rubin RR, Leventhal H, Mora P et al. The development and Validation of a Neuropathy - and Foot Ulcer-Specific Quality of Life Instrument. Diabetes Care. 2003;26(9):2549-55.

6. Xavier ATF, Foss MC, Junior WM, dos Santos CB, Onofre PTBN, Pace AE . Cultural adaptation and validation of the Neuropathy - and Foot Ulcer – Specific Quality of Life instrument (NeuroQol) for Brazilian Portuguese - Phase 1. Rev. Latino-Am. Enfermagem. 2011;19(6):1352-61.

7. Yao Y, Chen L, Qian Y. Age Characteristics of Patients With Type 2 Diabetic Foot Ulcers and Predictive Risk Factors for Lower Limb Amputation: A Population-Based Retrospective Study. J Diabetes Res. 2024;2024:2380337.

8. Al-Rubeaan K, Al Derwish M, Ouizi S, Youssef AM, Subhani SN, Ibrahim HM, et al. Diabetic foot complications and their risk factors from a large retrospective cohort study. PLoS One. 2015;10(5):e0124446.

9. Ha JH, Jin H, Park JU. Association between socioeconomic position and diabetic foot ulcer outcomes: a population-based cohort study in South Korea. BMC Public Health. 2021;21(1):1395.

10. Bottino LG, Madalosso MM, Garcia SP, Schaan BD, Teló GH. Diabetes-Specific Questionnaires Validated in Brazilian Portuguese: A Systematic Review. Arch Endocrinol Metab. 2020;64(2):111-20.

11. Pedras S, Vilhena E, Carvalho R, Pereira MG. Quality of Life Following a Lower Limb Amputation in Diabetic Patients: A Longitudinal and Multicenter Study. Psychiatry. 2020;83(1):47-57.

12. McDonald S, Sharpe L, Blaszczynski A. The psychosocial impact associated with diabetes-related amputation. Diabet Med. 2014;31(11):1424-30.

13. Byrnes J, Ward L, Jensen S, Sagoo M, Charles D, Mann R, et al. Health-related quality of life in people with different diabetes-related foot ulcer health states: A cross-sectional study of healed, non-infected, infected, hospitalised and amputated ulcer states. Diabetes Res Clin Pract. 2024;207:111061.

14. van Netten JJ, Sacco ICN, Lavery L, Monteiro-Soares M, Paton J, Rasmussen A, Raspovic A, et al. Clinical and biomechanical effectiveness of foot-ankle exercise programs and weight-bearing activity in people with diabetes and neuropathy: A systematic review and meta-analysis. Diabetes Metab Res Rev. 2024;40(3):e3649.

15. Ren W, Duan Y, Jan YK, Ye W, Li J, Liu W, et al. Effect of Exercise Volume on Plantar Microcirculation and Tissue Hardness in People With Type 2 Diabetes. Front Bioeng Biotechnol. 2021;9:732628.