

## Knowledge and practice of diabetic foot care among diabetic patients in Libya

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### HOW TO CITE THIS

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**Abstract:** Effective knowledge and practice regarding diabetic foot care among diabetic patients are crucial in reducing the risk of complications of foot ulcers and amputations. This cross-sectional study evaluates the levels of knowledge and practice of diabetic foot standards of care among Libyan diabetic patients. Thus, a total of 481 Libyan patients participated in 2024. Data were collected through a validated self-designed questionnaire that assessed foot care knowledge and practice. Scores were assigned for each yes response, and a median score was calculated to categorize participants as having good or poor knowledge and practice. The association between socio-demographic and diabetes-related factors with knowledge and practice was analyzed using the Chi-square test. The findings revealed that 74.1% of the participants had poor knowledge about the standards of diabetic foot care and 72.0% demonstrated poor practice related to diabetic foot care. A significant association was found between variables such as age, gender, and diabetes duration with knowledge and practice ( $p < 0.05$ ). 36.2%, reported having received formal education on diabetic foot care. This study recommends enhancing educational efforts and increasing physician involvement in foot care strategies. The majority of Libyan diabetic patients demonstrate a lack of knowledge and poor practice regarding diabetic foot care, which increases their risk of foot ulcers and amputations. This situation highlights the urgent need for an enhanced educational campaign focused on foot hygiene and care, as well as increased involvement of healthcare providers to deliver clear practical guidance preventing and an early examination to avoid complications in clinical practice.

### Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder that presents a substantial public health challenge with a rising prevalence and associated complications leading to increased morbidity and mortality [1]. One of the most serious complications of DM is diabetic foot disease, which includes foot ulcers, infections, and, in severe cases, amputations [2]. Studies indicate that nearly 15%-25% of diabetic patients will develop a foot ulcer at some point in their lives, with a significant risk of lower extremity amputation if not managed appropriately [3, 4]. Besides, amputation occurs in more than 200,000 individuals per year [5]. In the United States, the prevalence of amputation is >200 patients each day [6]. In Libya, a study assessing long-term complications reported that 1.1%

of diabetic patients with type II had their legs amputated [7]. Patients with diabetic foot ulcers are 2.5 times at risk of death than diabetic patients without diabetic foot ulcers [8]. The risk of amputation can be controlled by elevating awareness and adopting care strategies and proper measures, such as educating patients about diabetes and frequent foot examinations. Adequate knowledge and practice regarding diabetic foot care play a crucial role in reducing the risk of foot complications. The International Working Group on the Diabetic Foot and the American Diabetes Association emphasize routine foot examinations, self-care practice, appropriate footwear, and early medical intervention as key strategies for preventing foot ulcers and related complications [5, 6]. However, gaps remain in knowledge and adherence to recommended foot care practices, particularly in low- and middle-income countries [7, 8]. Healthcare providers have a major role in reducing the risk of amputation. Indeed, a Libyan study demonstrated that on the topic of foot care, 51.8% of the participants stated they did know how to perform correct foot hygiene and 33.5% stated that drying should consist of passing a towel between their toes [3]. Female subjects had more knowledge than male subjects on the right footwear and the correct way of nail cutting. Regarding practice, the frequency of patients with good practice was 31.5%, and with poor practice was 68.5%. Libya faces challenges in diabetes management, with a rising prevalence of the disease due to lifestyle changes, urbanization, and an aging population. However, limited data are available regarding the knowledge and practice of diabetic patients concerning foot care. A lack of awareness, inadequate patient education, and low engagement in preventive care contribute to poor foot health outcomes were all observed [9, 10]. Psychosocial factors play a crucial role in adherence to diabetic foot care. Studies have highlighted the impact of depression and anxiety on self-care behaviors, indicating that psychological distress can negatively affect foot care routines and increase the risk of complications [11, 12]. Furthermore, inadequate rehabilitation and post-amputation care can lead to higher mortality risks among diabetic patients, underlining the importance of multidisciplinary care approaches [13, 14]. Evaluating the parameters such as dry, moisturize, and nail cutting, women showed a significant difference from men, with a high significance level in the three parameters. So, diabetic patients should be provided information about self-care of their feet by health care providers such as pharmacists and nurses to prevent and delay the onset of foot complications and improve the quality of life. Such educational intervention has a positive impact on the progression of diabetic complications. Understanding the level of knowledge and practice in patients is important to control diabetes and to delay the appearance of its complications. Where poor level of knowledge and practice are related to risk factors of amputation. Therefore, this study was aimed and designed to assess the knowledge and practice of foot care among Libyan diabetic patients, and to explore associations between demographic and disease-related factors with foot care knowledge and practice, thereby, providing insights into areas where healthcare interventions and educational programs can be improved [15, 16].

## Materials and methods

This cross-sectional study was conducted in Tripoli, Libya, over three months from January to March 2024, using non-randomized convenient sampling. The study included 481 Libyan patients aged 16 years and older who were diagnosed with diabetes mellitus. Exclusion criteria comprised refusal to participate or non-Libyan nationality. A diabetic foot care questionnaire self-designed by the investigators consisted of 15 binaries yes or no questions assessing knowledge of diabetic foot care principles and practice related to foot examination, footwear habits, and skin/nail care. Each yes response earned two points, and the total scores were compared to the median. Scores above the median were categorized as good, while those below were classified as poor. The questionnaire was validated with a previous study [1]. Ethical approval was obtained from the ethics committee of the University of Tripoli (UoT-2023). Also, verbal agreement with patients was obtained before collecting data and interviewing.

*Statistical analysis:* The variables were analyzed using the Chi-square test to determine the significant difference between age, gender, and disease duration. The descriptive statistics provided mean, frequency, and percentage were used. The SPSS version 21 was utilized for data analysis.

## Results and discussion

*Demographic detail and insights of the participants:* In **Table 1**, the average age of the participants was 52.2 years, with a range from 16 years to 90 years. The age categories captured in the study included 16 years - 30 years, which likely represents a small proportion of younger diabetic patients, often associated with Type 1 diabetes (T1D). The 31 years 40 years category likely includes a moderate proportion of working individuals with DM. The largest number of diabetic patients were in the age group 41 years - 60 years, with 30.2% aged 41 years - 50 years and 28.0% aged 51 years - 60 years, reflecting a high prevalence of Type 2 diabetes (T2D) in this age group. Patients aged more than 60 years category consist of retired individuals, indicating long-term DM and possibly age-related complications. In terms of gender distribution, males accounted for 54.7% of the participants, while females made up 45.3%. This suggests a balanced gender distribution, though, there is a slightly higher representation of males.

**Table 1:** Sociodemographic distribution of Libyan diabetic patients

Variable	Frequency	Percentage
<b>Age: Mean age: 52.25±14.6</b>		
≤20 years	24	04.9
21-30 years	32	06.5
31-40 years	58	11.8
41-50 years	148	30.2
51-60 years	137	28.0
≥61 years	91	18.5
<b>Gender</b>		
Male	263	54.7
Female	218	45.3
<b>Occupation</b>		
Employee	287	59.7
Student	38	07.9
Retired	156	32.4

Female participants had slightly better knowledge scores than male participants. This could be due to differences in attentiveness to self-care or health literacy, potentially influenced by cultural or societal factors. Regarding occupational status, 59.7% of the participants were actively working while 32.4% were retired indicating a significant proportion of older individuals who are no longer working, likely due to long-term diabetes and age-related disabilities or restrictions. 7.9% of the participants were students, primarily aged 16 years - 25 years, which typically includes those managing T1D or early-onset T2D. Employed individuals might have better access to healthcare benefits or structured medical consultations compared to retired or unemployed participants. However, long working hours or limited availability due to work obligations could diminish some employed participants' engagement in foot care. When examining the types of DM, 87.3% of participants had T2D, which aligns with the high prevalence of this condition in adults and older individuals. In contrast, 7.9% had T1D, likely representing the younger demographic, such as students and young adults aged 16 years - 30 years. Other forms of diabetes, such as gestational diabetes or secondary diabetes, were not reported in the study.

In **Table 2**, the median duration of diabetes among the participants was 8.6 years. In terms of diabetes duration, 38.4% of the participants had been diagnosed for 10 years or less, indicating that this group may include newly diagnosed cases or young adults in earlier stages of the condition. Conversely, 61.6% had been diagnosed for >10 years, representing patients managing long-term diabetes and likely experiencing more complications or requiring specialized care. In terms of treatment types, 56.3% of the participants were on oral antidiabetic drugs (OADs), commonly used with T2D. Insulin therapy was used by 25.0% of the participants, which may include those with advanced T2D or T1D. Other treatments, such as combination therapy (OADs and insulin) or non-standard treatments, were not mentioned but could be present within this cohort. The overwhelming majority had T2D, which is consistent with global trends, particularly in adult and older age groups. Patients with T1D likely formed a smaller subset (students and young adults), where different challenges should be emphasized (e.g., navigating foot care alongside insulin management).

**Table 2:** Diabetes type, duration, and antidiabetics among the participants

	Frequency	Percentage
Type of diabetes		
Type 1	38	7.9
Type 2	420	87.3
No data	23	4.5
Duration of diabetes		
<5 years	39	8.0
6-10 years	149	30.4
11-15 years	141	28.8
≥16 years	125	25.5
No data	36	7.3
Treatment of diabetes		
Insulin	122	25
Oral anti-diabetes	271	56.3
Insulin and oral ant, diabetes	88	18.2
Smoking history		
Yes	88	18.3
No	367	76.3
Previous smoke	26	5.4
Receiving foot education		
Yes	174	36.2
NO	307	63.8

Regarding smoking status, 18.3% of the participants had a history of smoking, this group remains at higher risk for foot complications due to smoking-related vascular issues, while 76.3% reported having never smoked. This relatively low smoking rate suggests that smoking may not be a significant contributing factor to diabetic complications, such as vascular damage, in this study population.

*Socio-economic or other demographics:* While socio-economic status (income, educational level, etc.) is not directly mentioned, however, these factors may play a critical role: The lack of knowledge and sub-optimal practices among participants could indicate a broad socio-economic disparity limiting access to education and healthcare resources. Urban vs. rural disparity may also be a potential factor if location differences were measured (not mentioned in this study). The study primarily consisted of individuals with T2D, reflecting global trends, particularly among adults and older age groups. Those with T1D represented a smaller subset, typically students and young adults, who face unique challenges, such as balancing foot care with insulin management. Furthermore, employed individuals tended to have better access to healthcare benefits and structured medical consultations

than retired or unemployed participants. However, long working hours or job-related commitments may limit some employed individuals' ability to engage in proper foot care. Finally, while 18.3% of the participants reported a smoking history, this group is still at an increased risk for foot complications due to smoking-related vascular issues, making it essential for intervention strategies to address this risk factor.

**Knowledge score:** In **Table 3**, 74.1% of the participants scored below the median for knowledge (poor knowledge score). 36.2% of the participants reported ever receiving education related to diabetic foot care, for instance, critical areas such as moisturizing the feet (25.2%), self-foot examination (27.7%), and proper nail cutting (27.2%) were poorly addressed. 9.8% used proper sock quality, and 22.9% were aware of footwear quality. This suggests that education on preventive measures and hygiene is limited or not routinely available for the participants.

**Table 3:** Knowledge of the participants regarding diabetic foot care

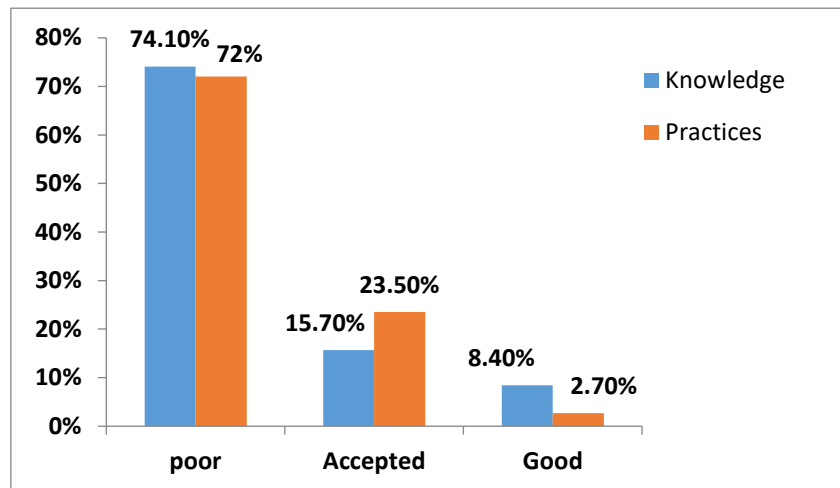
	Frequency	Percentage
Information given or diabetic foot education		
Yes	150	31.2
No	331	68.8
Moistering the foot		
Yes	121	25.2
No	360	74.8
Self-foot examination		
Yes	133	27.7
No	348	72.3
Nail cut		
Yes	131	27.2
No	350	72.8
Quality of socks		
Yes	47	9.8
No	434	90.2
Quality of shoes		
Yes	110	22.9
No	371	77.1
Walking bare-foot		
Yes	108	22.5
No	373	77.5

**Practice of diabetic foot care:** In **Table 4**, the study found that practices related to diabetic foot care were largely inadequate across various parameters, with a few areas indicating satisfactory responses. 72.0% of the participants scored below the median for diabetic foot care practices. However, 67.6% of the participants reported performing self-foot examinations at least occasionally. 49.1% of the patients sought surgical consultations for foot lesions, indicating moderate awareness of the need for medical care. Meanwhile, 36.0% of the participants undertook self-treatment for abnormal skin lesions. In terms of footwear practice, 53.6% of the participants wore regular shoes; however, 3.7% wore rubber shoes and 41.4% wore prescribed medical shoes. 30.6% of the participants received advice from physicians regarding the use of medical shoes. Recommendations for wide shoes were given to 16.0% of the patients, and 5.2% utilized insoles as recommended by their physicians. 2.5% of the participants used specially designed sock materials regarding sock practice. Regarding lesion management, there was a poor reliance on home treatments for lesions, with 8.9% reporting such practice. 9.3% consulted podiatrists for foot care needs. The engagement of physicians was limited, with 26.0% of the participants being asked about their foot condition by their diabetes physicians, and merely 22.0% receiving routine clinical foot examinations.

**Table 4:** Practice of the participants regarding diabetic foot care

Variable	Frequency	Percentage
<b>Self-foot examination</b>		
Yes	325	67.6
No	154	32.0
<b>Times of foot examination</b>		
All time	126	26.2
Some time	174	36.2
No	181	37.6
<b>Walking para foot</b>		
Yes	054	11.2
NO	224	46.6
Some time	201	41.8
<b>Examine the shoes before wearing them</b>		
Yes	145	30.2
No	336	69.9
<b>Type of shoes</b>		
Normal shoes	258	53.6
Rubber shoes	018	03.7
Medical shoes	199	41.4
<b>Wearing normal shoes as advised by the physician</b>		
Yes	033	06.9
No	448	93.1
<b>Use of special types of=socks materials</b>		
Yes	012	02.5
No	469	97.5
<b>Wearing medical shoes advised the physician</b>		
Yes	147	30.6
No	334	69.4
<b>Wearing wide shoes advised by the physician</b>		
Yes	077	16.0
No	404	84.0
<b>Use insole inside the shoes as advised by the physician</b>		
Yes	025	05.2
No	456	05.2
<b>Self-treated any abnormal skin lesion</b>		
Yes	173	36.0
No	304	63.2
<b>For any foot lesion use home treatment</b>		
Yes	043	08.9
No	438	91.1
<b>For any foot lesion go to a diabetes consultation</b>		
Yes	217	45.1
No	264	54.9
<b>For any foot lesion go to a surgical consultation</b>		
Yes	236	49.1
No	245	50.9
<b>For any foot lesion go to a podiatrist consultation</b>		
Yes	045	09.3
No	436	90.6
<b>The diabetes physician asks you about your feet</b>		
Yes	125	26.0
No	314	65.3
Sometimes	042	08.6
<b>A diabetes physician examines your feet</b>		
Yes	106	22.0
No	350	72.8
Sometimes	025	5.2

A troubling 90.2% of the participants were not using proper socks, and 77.1% were unaware of appropriate footwear. Addressing these issues is essential to prevent foot ulcers and injuries. The rate of consultations with podiatrists was alarmingly low at 9.3%, while 26.0% of diabetes physicians routinely inquired about or examined patients' feet. This presents an opportunity to enhance proactive medical engagement in managing diabetic foot issues more effectively. Although 67.6% of participants reported conducting self-foot examinations, there remains potential for greater adoption of other critical preventive behaviors. 30.2% regularly examined their shoes, and 25.2% took the time to moisturize their feet. 36.2% of the participants had received formal education on diabetic foot care, which underscores the need for improved knowledge and practice in this area.



**Figure 1:** Knowledge and practice scores of the overall participants

The current study identified significant relationships between demographic variables and knowledge/practice concerning diabetic foot care. Older participants demonstrated a better understanding of and adherence to diabetic foot care practice ( $p < 0.05$ ). A significant association with knowledge was noted in gender, as women scored slightly higher in awareness and understanding. A longer duration of diabetes correlated with improved knowledge and practice related to foot care ( $p < 0.05$ ). The findings underscore significant gaps in knowledge and compliance with diabetic foot care. Most of the participants lacked awareness about critical strategies such as self-examination, moisturizing, and wearing protective footwear. Education and encouragement by healthcare providers, specifically diabetologists, play a pivotal role in improving outcomes. The association of demographic factors like age and disease duration with knowledge suggests targeted intervention strategies could be employed for at-risk groups. Diabetic foot care is a critical aspect of diabetes management, and it requires a multifaceted approach that involves patients, healthcare providers, and policymakers. The literature review highlights the importance of patient education, self-care practice, and healthcare provider engagement in preventing diabetic foot ulcers and amputations [17, 18]. Patient education is a crucial component of diabetic foot care, as it empowers patients to take charge of their foot health. Studies have shown that patients who receive education on foot care are more likely to practice good foot care habits, such as daily foot inspections, proper footwear, and seeking medical attention promptly if they notice any foot problems [3, 4]. However, the literature suggests that patient education alone is not sufficient to prevent diabetic foot ulcers and amputations. Healthcare providers must be engaged in the process, providing regular foot exams, identifying high-risk patients, and providing timely interventions [5, 6]. Self-care practices, such as daily foot inspections and proper footwear, are also essential for preventing diabetic foot ulcers and amputations. Studies have shown that patients who practice good self-care habits are less likely to develop foot ulcers and amputations [7, 8]. However, the literature also suggests that self-

care practices are influenced by various factors, including patient knowledge, motivation, and access to healthcare services [15, 16]. Healthcare provider engagement is also critical in preventing diabetic foot ulcers and amputations. Studies have shown that healthcare providers who are knowledgeable about diabetic foot care and engage in regular foot exams can identify high-risk patients and provide timely interventions [17, 18]. However, the literature suggests that healthcare provider engagement is influenced by various factors, including knowledge, attitude, and workload [13, 14]. Thus, diabetic foot care is a complex issue that requires a multifaceted approach involving patients, healthcare providers, and policymakers. Key components include patient education, self-care practice, and healthcare provider engagement. However, the literature indicates that these components are influenced by various factors, such as patient knowledge, motivation, and access to healthcare services, along with healthcare providers' knowledge, attitudes, and workload. To prevent diabetic foot ulcers and amputations, healthcare providers must be knowledgeable about diabetic foot care and conduct regular foot examinations. Patients should also be educated on proper foot care and encouraged to practice good self-care habits. Policymakers must ensure that healthcare services are accessible and affordable for all patients, especially those in high-risk populations. Psychological factors such as depression and anxiety can adversely affect self-care practices, leading to a higher risk of foot complications. Therefore, addressing these psychosocial aspects is crucial in developing effective interventions [15, 16]. Furthermore, post-amputation care and rehabilitation play a significant role in improving outcomes, emphasizing the need for holistic management strategies [19, 20].

*Conclusion:* The majority of diabetic patients in Libya demonstrate a lack of knowledge and poor practice regarding diabetic foot care, which increases their risk of complications. This situation highlights the urgent need for enhanced educational campaigns focused on foot hygiene and care, as well as increased involvement of healthcare providers to deliver clear and practical guidance. Additionally, there should be systematic measures for early examination and prevention of complications in clinical practice.

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**Author contribution:** NMR adapted the questionnaire and data collection. AKH performed data interpretation. MR & NMR drafted the manuscript, reviewed the data, and revised it. All the authors approved the final version of the manuscript and agreed to be accountable for its contents.

**Conflict of interest:** The authors declare the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

**Ethical issues:** The authors completely observed ethical issues including plagiarism, informed consent, data fabrication or falsification, and double publication or submission.

**Data availability statement:** The raw data that support the findings of this article are available from the corresponding author upon reasonable request.

**Author declarations:** The authors confirm that they have followed all relevant ethical guidelines and obtained any necessary IRB and/or ethics committee approvals.