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Original Article

Assessment of the Knowledge and Quality of the Practice of Proper Foot Care in Iranian Patients With Type 2 Diabetes

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ABSTRACT

Background: Uncontrolled diabetes can lead to a high rate of complications. Diabetic foot ulcer (DFU) leads to significant morbidity. However, DFU can be prevented and managed through foot care education for patients.

Objectives: The current study aimed to evaluate the knowledge and practice routines of patients with type 2 diabetes (T2DM) regarding foot care.

Methods: A questionnaire was designed to obtain patients' demographic data, evaluate their risk for a foot ulcer, and assess their level of knowledge and practice about daily foot care. After confirming the validity and reliability of the questionnaire, 200 T2DM patients were interviewed.

Results: The mean age was 61.1±11.7 years, and 64% were males. Forty-five percent of patients were previously educated regarding foot care. More than 50% of patients answered questions correctly. Calculations demonstrated the mean score of knowledge and practice as 6.3±2 (out of 11) and 14.2±3.4 (out of 20), respectively. There was no correlation between the patient's age, gender, or history of previous DFU and their knowledge and practice level. However, patients' higher level of education or employment status was associated with a higher level of knowledge and practice than their other respective groups.

Conclusion: In this study, patients had a medium to low level of foot care knowledge and a medium to a high level of daily foot care practice. However, these results also emphasize the importance of the need for organized and structured educational programs for diabetic patients regarding diabetic foot care.

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Introduction

Among the pathophysiological effects of diabetes on the body, feet are associated with the highest rate of complications [1]. Diabetic foot ulcer (DFU) has been one of the primary reasons for lower extremity amputation [2]. Therefore, DFU is considered one of the most debilitating and disabling consequences of diabetes. The morbidity and costs of treating complications related to DFU in diabetic patients are tremendously high and associated with high personal, social, medical, and economic costs [3-5]. The hospitalization costs for these patients can be almost four times compared to those without DFU [4]. Studies also have shown that all types of DFU are associated with high morbidity and mortality rates [6, 7]. As many as 20 per 100,000 diabetic patients are reported to require major amputation of lower extremities in the total population [8-12]. In developed countries, like the Netherlands and the UK, the preoperative mortality rate of DFU patients was 9% and 10-15%, respectively, and the 3-year survival rate for these patients has been 50% and 59%, in Italy and Sweden, respectively [7, 13-16]. Furthermore, DFU has been introduced as a crucial contributing factor to patients' quality of life and a significant emotional burden to their caregivers [5, 17].

A few etiologies have been proposed to cause DFU, such as neuropathy, peripheral arterial disease, improper biomechanics, and foot deformity. Other contributing factors include poor diabetes management, duration of diabetes, vision impairment, and old age [18-20]. Neuropathy is one of the most critical risk factors for DFU. Although the lack of neuropathy is associated with a lower risk of DFU, these patients are also at risk of developing DFU, usually due to inadequate education on foot self-care [21].

DFU can be prevented and managed through a few crucial interventions, including patient education on regular foot investigation, detecting patients at high risk for DFU and proper footwear, and modifying their risk factors [22]. Considering the high rate of mortality and morbidity associated with DFU and the importance of daily foot care for preventing this complication, the current study was designed to evaluate the level of knowledge and routine practices of patients with type 2 diabetes (T2DM) regarding foot care in the Iranian population.

Material and Methods

In this cross-sectional study, 200 patients were enrolled. Inclusion criteria were individuals with a diagnosis of T2DM for at least six months and referring to a diabetic foot clinic affiliated with the Tehran University of Medical Sciences (TUMS). Those who had difficulties with communication or understanding the questionnaire were excluded from the study. The Research Ethics Committee of the Institute of Pharmaceutical Sciences, TUMS approved the study protocol. Written informed consent was obtained from patients before participation. Data were collected anonymously. All the principles outlined in the Helsinki Declaration were followed during the investigation.

The questionnaire was comprised of two sections. The first section included the socio-demographic and disease data, including age, gender, marital, occupational, and educational status, duration of diabetes, drug history, smoking status, and risk category for DFU. The risk classification of the patients for DFU was based on the system developed by the international working group on the diabetic foot (IWGDF), which classifies patients into four groups based on the presence of neuropathy, foot deformity, peripheral arterial disease, and history of ulceration or amputation [22]. Considering the IWGDF Risk Classification System, category 0 featured individuals with DM and without the loss of protective sensation (LOPS) and peripheral artery disease (PAD), category 1 featured individuals with LOPS regardless of deformities on their feet, as indicated by physical examination; category 2 featured individuals evaluated with PAD irrespective of its association with LOPS, and category 3 encompassed individuals with DM where their medical history listed ulcerations or amputations [23].

The second section contained 10 (total score of 11) and 18 questions (total score of 18) to evaluate the patients' knowledge and quality of practice regarding foot care, respectively. The scores with more than 80%, 60-80%, and less than 60% of total scores were considered as high, intermediate, and low levels of knowledge or practice.

Eight endocrinologists assessed the content validity of the questionnaire. The questionnaires' face validity and reliability were evaluated in a pilot study, using pre-test and post-test on 20 patients. The Cronbach alpha coefficient was 0.87 suggesting good internal consistency reliability for the scale. Using the finalized questionnaire, the investigator interviewed the study participants at a diabetic foot clinic.

Statistical analysis

Data were analyzed using SPSS software, version 21. The Kolmogorov-Smirnov test was used to test the normal distribution of the data. Normally distributed continuous variables are presented with Means±SD and compared with an independent t-test and one-way analysis of variance. Skewed variables are presented with median and interquartile ranges (IQRs) and compared with the Kruskal-Wallis and Mann-Whitney U tests. Categorical data were tested using the Chi-square and Fisher's exact test. A two-sided P less than 0.05 indicated statistical significance.

Results

There were 128 males (64%). The Mean±SD age was 61.1±11.2 (range 21-83 years), and the Mean±SD duration of diabetes was 13.7±8.8 years, (range 1-43 years). More than half of the individuals were undergraduates (43.5%) or uneducated (13%). Most of the participants were non-smokers (77.5%). The majority of patients (57%) were taking insulin, and 89% were classified as groups 2 and 3 for the associated risk of developing DFU by IWGDF. The comprehensive demographic and disease characteristics of study participants are shown in Table 1.

Results revealed that 134 patients (67%) were adequately educated regarding the characteristics of proper shoes. Fewer individuals (44%) knew about the appropriate shoe materials, and more patients (93%) knew the correct indications for medical shoes and the frequency of changing socks (76.5%). More than half of patients knew the appropriate detergent for washing their feet (56%), learned the correct method for trimming the nails (59%), and answered correctly about the frequency of visiting the physician (51%). However, the majority of patients (88%) knew the proper water temperature for washing their feet. The least knowledge (32.5%) belonged to the correct site of applying cream or ointment on the feet.

Figures 1 and 2 show the percentage of patients giving the correct or wrong answers to each question evaluating type 2 diabetic patients' practice and knowledge of foot care. DFU associated risk factors were cigarette smoking in 126 patients (63%), high blood sugar in 121 patients (60.5%), high blood pressure in 148 patients (74%), hyperlipidemia in 159 patients (79.5%), foot numbness in 93 patients (46.5%), foot deformity in 77 patients (38.5%), history of DFU in 104 patients (52%), and peripheral vascular disease in 89 patients (44.5%). Also, 109 patients (55.9%) reported prior education about foot care.

Classification of patients' knowledge and practice regarding foot care indicated that 81(40.5%) patients had poor knowledge, 84(42%) had medium knowledge, and 35(17.5%) had good knowledge regarding foot care. Regarding patients' practice toward their foot care, only 35(17.5%) patients had poor practice, while 63(31.5%) and 102(51%) had medium and good practice, respectively. The Mean±SD for patients' knowledge and practice was 6.35±1.97 (range 1.75-10.5) and 14.19±3.40 (range 4.75-20.50), respectively.

The correlation between patients' knowledge and practice towards foot care and their socio-demographic characteristics and history of DFU is demonstrated in Table 2. These results showed that gender and history of DFU did not correlate with patients' knowledge and quality of foot care. At the same time, their educational level and occupational status significantly impacted their level of knowledge and quality of foot care. Our results also indicated that age did not correlate with patients' knowledge and practice (P>0.05).

Discussion

This study was designed to investigate the T2DM patients' level of knowledge and quality of practice regarding foot care. The results indicated that the patients had medium to poor knowledge regarding foot care, while their quality of actual foot care was rated as medium to high. Proper patient foot care education plays an essential role in preventing catastrophic complications. About 10%-15% of diabetic patients experience foot ulcers at least once in their lifetime.

Foot neuropathy, ischemia, and infection might develop DFU as a diabetes complication [5, 16, 24, 25]. Studies have shown that 49%-58% of the complications related to DFU are preventable [26]. A systematic review indicated that increasing foot care knowledge and T2DM self-care management programs have a positive impact on self-care behaviors and health outcomes [27].

Diabetic foot is more prevalent in males than in females [28]. As the results of this study indicated, most of our patients were male. These findings are similar to other studies in developing countries [26, 29, 30]. However, Iranian studies had the majority of women in their populations [31, 32, 33]. Nonetheless, gender has no significant impact on the knowledge and practice of patients. The results of our study also confirm these results. The patients with diabetic foot are older, had a lower body mass index, and longer diabetic duration, and they also reported hypertension, diabetic retinopathy, and smoking history more than patients without diabetic foot [28].

Table 1. Descriptive statistics for demographic and some medical status (smoking, medications in use, and the risk for diabetic foot ulcer) of type 2 diabetic patients (n=200)

Variables		No. (%)
Gender	Female	72(36)
	Male	128(64)
Marital Status	Single	16(8)
	Married	184(92)
Educational status	Illiterate	26(13)
	Under diploma	87(43.5)
	Diploma	63(31.5)
	University	24(12)
Occupation	Household	55(27.5)
	Unemployed	20(10)
	Employed	49(24.5)
	Retired	76(38)
Smoking status	Smoker	20(10)
	Non-Smoker	155(77.5)
	Former Smoker	25(12.5)
Anti-hyperglycemic	Oral agent	86(43)
	Insulin+Oral agent	35(17.5)
	Insulin	79(39.5)
Risk for DFU*	Group 0	13(6.5)
	Group 1	60(30)
	Group 2	118(59)
	Group 3	9(4.5)

*DFU: Diabetic Foot Ulcer

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IWGDF Risk Classification System, category 0 featured individuals with diabetes mellitus and without loss of protective sensation (LOPS) and peripheral artery disease (PAD); category 1 featured individuals with LOPS regardless of deformities on their feet, as indicated by physical examination; category 2 featured individuals evaluated with PAD regardless of its association with LOPS; and category 3 featured individuals with diabetes mellitus where their medical history listed ulcerations or amputations.

A higher percentage of smokers (29.1%) in patients that develop diabetic foot ulceration is well-documents [28, 34]. Smoking is a risk factor for diabetic foot ulcers because daily tissue hypoxia may cause vascular and neuropathic disorders in the lower extremities of diabetic patients. Fortunately, the majority of the population in the current study were non-smokers (10% smokers), with a similar report of 9.5% smokers in a previous Iranian study [32]. The prevalence of current daily cigarette smoking among Iranian adults in 2016 was 9.7% [35], which is less prevalent than in American and European countries [28]. One of our study strengths is that patients were categorized into four groups based on their risk for developing DFU. They were mostly in group 2 and group 1 (59% and 30%, respectively).

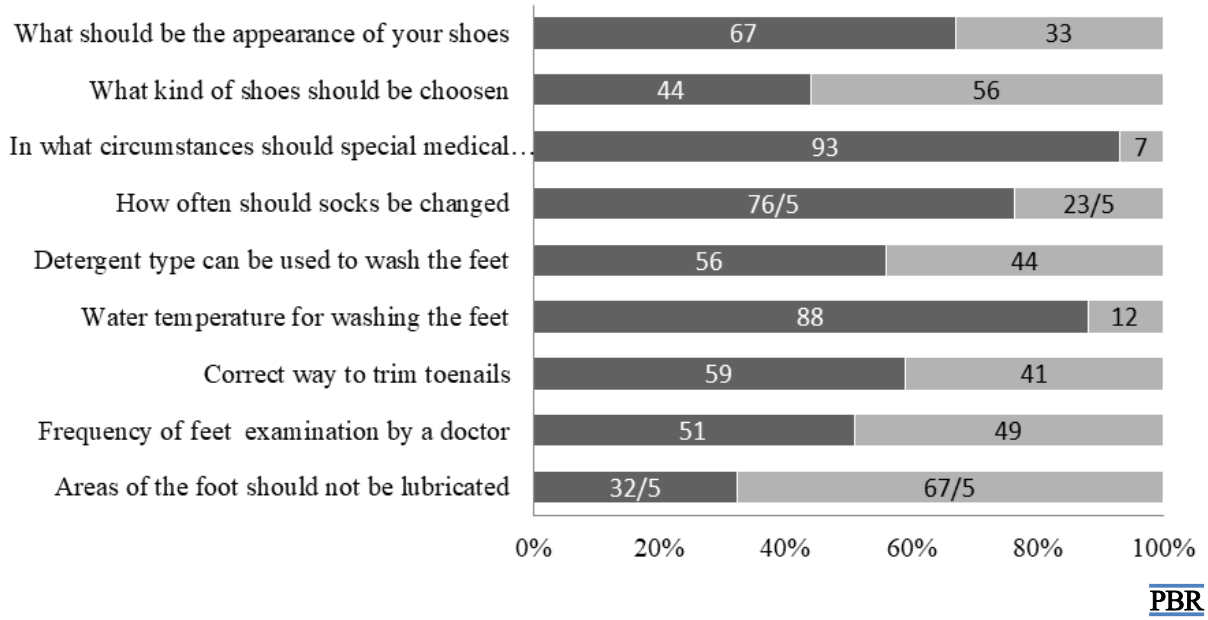

Figure 1. Evaluating type 2 diabetic patients' knowledge of foot care (n=200)

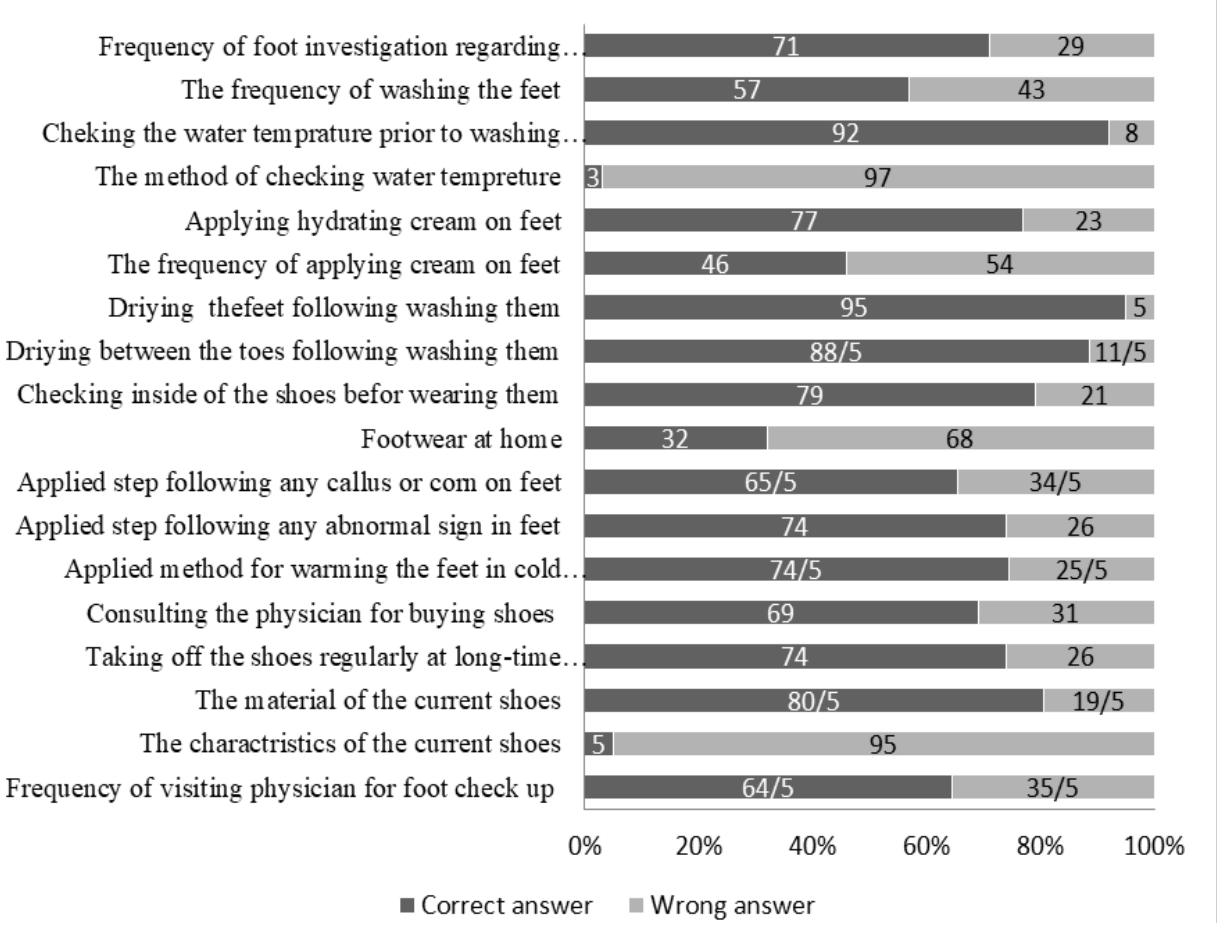

Figure 2. Evaluating type 2 diabetic patients' practice regarding foot care (n=200)

Table 2. Correlation of patients' socio-demographic characteristics and diabetic foot history and their knowledge and practice towards foot care

Variables		Knowledge		Practice	
		Mean±SD	P	Mean±SD	p
Gender	Male	6.52±2.02	0.053	13.80±3.56	0.42
	Female	6.03±1.84		13.78±2.84	
Education	Illiterate	6.00±1.36	0.002	12.34±3.12	0.0009
	Under diploma	5.96±2.06		13.02±3.59	
	Diploma	6.49±1.80		14.70±2.66	
	University	7.73±2.04		15.77±2.5	
Occupation	Housewife	6.34±2.09	0.011	13.81±3.71	0.0009
	Unemployed	5.00±1.97		10.95±2.62	
	Employed	6.43±1.68		14.28±2.48	
	Retired	6.65±1.94		14.21±3.33	
History of diabetic foot ulcer	No	6.52±1.80	0.363	14.27±3.09	0.053
	Yes	6.16±2.13		13.29±3.47	

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Patients with diabetes are at risk for injuries to their insensate feet, if not recognized and if preventive foot care is not implemented [36]. Up to 50% of diabetic peripheral neuropathy may be asymptomatic. More than 80% of our study population had some grade of neuropathy, foot deformity, and peripheral arterial disease. The prevalence of neuropathy (35.5%), foot deformity (10.8%), and PAD (17.6%) in some developing countries was found lower than our result [30]. These differences may arise from the difference between the ethnicities and age differences between these two populations. The mean age in the study by Resnick et al. was 44 years, while we had a relatively older patient population (61.1 years). The prevalence of neuropathy seemed to be higher in older patients with diabetes [37].

We observed that unemployed patients had less knowledge base and lower practice quality than employed patients. The studies performed in other developing countries by Viswanathan et al. and Somroo et al. in India and Hasnina et al. in Pakistan also showed that education positively affects their knowledge and practice [26, 38, 39]. A recent Turkish study found that patients good at foot care had higher education status (P<0.001), were more likely to live in a city (P<0.001), and had a higher income (P<0.001) [40]. These findings also confirm the results of Khamesh et al. regarding the effect of education on Iranian patients' knowledge [32].

Desalu et al. also came up with similar results regarding the impact of demographic factors on participants' practice and knowledge. They concluded that the low socio-economic status of patients was associated with inadequate knowledge and lower quality practice of foot care [30]. It has been previously discussed that the socioeconomic status of people affects their level of health and the quality of their behavior toward health issues [41]. In some countries, such as India, socio-economic status affects patients' foot care as lower-income patients tend to walk barefoot [42]. In our study, unemployment, and consequently no monthly income and lower education were correlated with less knowledge and lower quality practice for foot self-care.

Additionally, the history of previous DFU did not affect patients' knowledge and practice for foot care. This finding confirms the importance of proper education for such patients to prevent the recurrence of foot ulceration and associated complications.

Less than 20% of our population study had good knowledge regarding foot care. Khamesh et al. reported that 40% of the patients investigate their feet properly, 42% know the proper method of trimming the nails (compared to 59% of the patients in our study), and 62% walk barefoot [32]. Thus, diabetic patients in Tehran

seem to be more educated about trimming nails. Likewise, Gondal et al. also reported that the Pakistani patients in their study also wore inappropriate shoes [43]. They reported that 34% were examining their feet daily, 78% were aware of callus and other foot injuries, 48% were aware of the proper method of trimming the nails (compared to 59% of patients in our study), 62% were using appropriate shoes, and only 68% were on regular follow-ups [43]. The observed differences between our results and those of Gondal et al. might be secondary to the differences between the numbers of patients in these populations. As mentioned in the results section, 55.9% of our participants had former education regarding foot care. The study performed by Khamesh et al. in 2007 in Tehran reported this value to be 30% [43]. Sixty-three percent of the patients in the current study believed that smoking has a role in DFU, while more than 50% of the patients in the mentioned study did not know the effects of smoking on DFU [32].

As previously reported, 40% of Iranian patients examine their feet and 30% inspect the interior of their shoes daily [32]. Thus, the patients in our study had better practices in these regards (79% and 71%, respectively). A higher rate of unawareness of the importance of checking the interior of the shoes (61.4%), characteristics of proper footwear (89.2%), and not wearing properly sized shoes (88.6%) were reported from other developing countries [30].

The patients' knowledge in the present study was concluded to be medium/less than medium. In contrast, a Turkish study [40] revealed that 29.5% of patients had bad foot care and 70% had moderate to good foot care. Nigerian patients' knowledge was medium/good in about 50% of the society, and 78.2% of their patients had poor knowledge about foot care [30]. Also, an Indian study reported insufficient knowledge of the patients regarding foot care [38]. Likewise, a study in Pakistan found that 30% of patients with diabetes have good knowledge of foot care [26]. However, patients' quality of foot care practice in our study was medium/above average. According to a recent report by Aalaa et al. [33], foot self-care was acceptable among Iranian women; however, there is a need for proper interventions to improve this health behavior. Other studies have concluded less acceptable practices and mostly poor practice quality [30, 39, 26].

Conclusion

This study investigated the knowledge and quality of foot care practice in Iranian patients with T2DM. The population surveyed in the current research seems to have higher scores than similar studies and improved knowledge and quality of practice compared to earlier studies in Iran. However, this population's general education on foot care requires more attention and a structured program. Healthcare providers should be careful to properly educate their patients and dedicate centers and establish specific educational programs to prevent the debilitating complications associated with diabetic foot ulcers. Further investigations in other cities of Iran and studying the proper methods of foot care education are encouraged.

Ethical Considerations

Compliance with ethical guidelines

The Research Ethics Committee of the Institute of Pharmaceutical Sciences (Tehran University of Medical Sciences (TUMS)) approved the study protocol. Written informed consent was obtained from patients before participation. Data were collected anonymously. All the principles outlined in the Helsinki Declaration were followed during the investigation.

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Authors' contributions

Conceptualization, study design and data analysis: Mania Radfar, Mohammad Reza Mohajeri Tehrani; Data collection: Faraz Ghayoumi: Drafting the initial manuscript: Faraz Ghayoumi, Mohammad Reza Mohajeri Tehrani; All authors have accepted responsibility for the entire content of this submitted manuscript and approved submission.

Conflict of interest

The authors declare no conflicts of interest.

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