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Original article

Knowledge and practice of foot self-care among patients with diabetes attending primary healthcare centres in Kuwait: A cross-sectional study

Fatemah M. Alsaleh^{a,*}, Khaled S. Albassam^a, Zahra K. Alsairafi^a, Abdallah Y. Naser^b

^a Department of Pharmacy Practice, Faculty of Pharmacy, Kuwait University, Kuwait

^b Department of Applied Pharmaceutical Sciences and Clinical Pharmacy, Faculty of Pharmacy, Isra University, Amman, Jordan

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ABSTRACT

Background: Diabetes mellitus is a major public health issue and is the main cause of morbidity and mortality worldwide. At the time of diagnosis, many patients with type 2 diabetes (T2D) have one or two risk factors for diabetic foot diseases, such as diabetic peripheral neuropathy (DPN) and diabetic foot ulcers (DFUs). Patients can overcome such complications through good knowledge and practice of foot self-care. This study aims to evaluate the knowledge and practice of foot care among patients with diabetes mellitus attending primary healthcare centres (PHCs) in Kuwait and to identify those at risk for developing DPN.

Methods: A cross-sectional study was conducted using a pre-tested self-administered questionnaire. The questionnaire included questions on demographic characteristics and patients' knowledge and practices of foot care. Adult patients (aged 21 and above) with a diagnosis of diabetes mellitus for at least 1 year were randomly selected from PHCs located in the five governorates of Kuwait. Data were analysed using SPSS, version 26.

Results: A total of 357 patients participated in this study, giving a response rate of 87.3%. The overall mean knowledge score of foot care was 12.7 ± 2.7 (equals 81.3%). Most patients ($n = 283$, 79.3%) showed good knowledge. In comparison, less than one-third of patients ($n = 110$, 30.8%) practiced good foot care. The overall mean score of patients' practices was 55.7 ± 9.2 (equals 64.0%). Approximately 17.4% of the patients had a higher risk of developing DPN. University students had lower odds of having good knowledge about foot care [OR: 0.19 (95%CI: 0.04–0.86)]. On the other hand, patients who reported having diabetes for a long duration (10 years and above) [OR: 1.88 (95%CI: 1.11–3.18)] and patients who did not have any other comorbidities [OR: 0.49 (95%CI: 0.26–0.90)] had higher odds of having good foot care knowledge. Patients who were on oral hypoglycaemic agents (OHAs) only had lower odds [OR: 0.63 (95%CI: 0.39–1.00)] of practicing good foot care. Patients who reported having diabetes for a duration between 5 to less than 10 years [OR: 1.75 (95%CI: 1.06–2.90)] and those who are on a diet only [OR: 1.76 (95%CI: 1.06–2.94)] had higher odds of practicing good foot care. Patients who were using combination therapy with OHAs and insulin had a higher risk [OR: 2.67 (95%CI: 1.11–6.41)] of developing DPN. On the other hand, patients who reported that they did not have a previous history of foot ulcer had a lower risk of developing DPN [OR: 0.21 (95%CI: 0.09–0.47)].

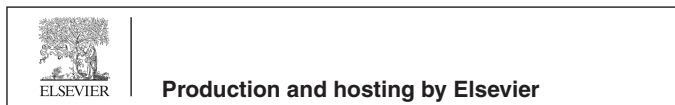
Conclusion: The knowledge of patients with diabetes regarding foot care is rated as good, while their self-practice is considered satisfactory. To improve the foot care knowledge and self-care practice of patients, healthcare providers (HCPs) need to support patients through educational programmes and appropriate training.

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* Corresponding author at: Department of Pharmacy Practice, Faculty of Pharmacy, Kuwait University, PO Box 24923, Safat 13110, Kuwait.

E-mail address: fatemah.alsaleh@ku.edu.kw (F.M. Alsaleh).

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1. Introduction

Diabetes mellitus is a major public health issue and is the main cause of morbidity and mortality worldwide (IDF, 2019; Alhyas et al., 2011, 2012). At the time of diagnosis, it has been estimated that more than 10% of patients with type 2 diabetes (T2D) have one or two risk factors for foot diseases, such as diabetic peripheral neuropathy (DPN). Globally, 6.3% of patients with diabetes have a diabetic foot ulcer (DFU), a serious diabetic complication that can lead to lower limb amputations and mortality, with a higher prevalence in males and in patients with T2D (Zhang et al., 2016; Ndir et al., 2010; Muller et al., 2002). Although not all diabetic foot disorders can be prevented, the incidence of DFUs is higher among patients who do not practice proper diabetic foot care (Chellan et al., 2012). It has been reported that a lack of knowledge and inadequate attention to foot care is prevalent among patients with diabetes worldwide. For instance, around 50% of patients in Brazil lacked knowledge of foot care hygiene (Policarpo et al., 2014). In Saudi Arabia, poor knowledge and practices of foot care were reported among patients living in Jeddah (Gaows and Alzahrani, 2019) and Najran (Solan et al., 2017). Previous research has shown that patients with a lower level of knowledge about foot care have poor footwear choices and poor detection of ulcerations (Pourkazemi et al., 2020; Qadi and Alzahrani, 2011). With this in mind, patients in India lacked knowledge of their foot hygiene, signs of abnormalities during foot inspection, and the ideal footwear that should be worn (Gopal and Ponnappa, 2017). Previous studies in patients with diabetes mellitus addressed the importance of patients' attitudes, perceptions and knowledge about the disease and its complications and highlighted their significance to the success of management and prevention of serious complications (Naser et al., 2019; Ku and Kegels, 2014).

Many factors contribute to poor foot self-care knowledge and practice among patients with diabetes. Li et al. (2014) reported that lack of knowledge about foot care and poor self-care behaviours were influenced by patient's educational level, diabetes duration, periodic foot inspections and education about diabetes complications. In Kuwait, patients, specifically smokers and insulin users, with low income, low education, and long-term diabetes showed more diabetic foot complications (Al-Ali et al., 2015). On the other hand, patients visiting an outpatient diabetic clinic in a Saudi hospital had a good educational level and favourable attitudes towards their foot care, although many showed a lack of attention to the instructions and information regarding appropriate footwear (Al-Hariri et al., 2017). It has been demonstrated that the process of diabetic foot complications is highly relevant to the patient's capability to undertake diabetes foot self-care responsibilities; hence, patient education and motivation are crucial. With this in mind, good patient knowledge and practices are significantly associated with a reduced risk of developing DFUs (Pourkazemi et al., 2020; Goweda et al., 2017).

In Kuwait, the public healthcare system is divided into primary, secondary, and tertiary care. Primary care is delivered through general and specialized polyclinics distributed over the five healthcare regions (Al-Jahra, Capital, Hawalli, Al-Farwaniya and Al-Ahmadi). Secondary care is provided through seven general hospitals, while tertiary care is delivered through 12 specialized centres (Bureau, 2017). To better understand how patients with diabetes cope and manage their foot care, this study aims to assess knowledge and practices of foot care and to estimate the risk for developing DPN among patients with diabetes mellitus attending primary healthcare centres (PHCs). This will help to identify the current level of knowledge and self-care practice among patients, to assist in developing effective educational programmes and foot complication prevention strategies. Moreover, identifying patients at risk for developing DPN is crucial to support them with the appropriate

foot care education to prevent serious future complications (e.g., foot ulcers and amputations).

2. Material and methods

2.1. Study design, setting, and population

A cross-sectional study was conducted using a pre-tested self-administered questionnaire. The study population comprised adult patients (aged 21 years and above) with a diagnosis of diabetes for at least 1 year, who were treated in diabetes specialized PHCs. The exclusion criteria were not consenting to participate, patients younger than 21 years old, newly diagnosed patients (<1 year), pregnant women, or those with apparent cognitive or physical disabilities that interfere with independent foot care behaviour.

2.2. Study instrument

Pre-designed pre-tested questionnaire tools were used to collect data for this study. The questionnaire is composed of 60 items and is divided into four parts. The first part consists of 16 items to assess patients' knowledge of foot care using questions derived from the literature. Nine items were selected from the same questionnaire used by Pollock et al. (2004) (the same questions were used excluding questions 1 and 8). The remaining seven items were derived from the diabetic foot care education recommendations by the American College of Foot and Ankle Surgeons (ACFAS) (ACFAS, 2020). The second part is composed of 29 items adopted from the Nottingham Assessment of Functional Foot Care (NAFF), which is a validated instrument to assess the practice of foot care among patients with diabetes. The measure could be used as an outcome measure in clinical research and it has an acceptable internal consistency and good retest reliability (Lincoln et al., 2007). The third part was adopted from the validated Michigan Neuropathy Screening Instrument (MNSI) (patient history part; 15 items), which is a well-known screening instrument to detect neuropathy and is designed to be used in an outpatient setting by primary care or other providers. It consists of self-administered "yes or no" questions on foot sensation including pain, numbness, temperature sensitivity and a brief physical assessment (completed by the HCPs) (Moghtaderi et al., 2006). The last part of the questionnaire included patients' demographics (six questions) and medical information (eight questions).

The questionnaire was distributed in both English and Arabic. The Arabic version was validated by back translation using the parallel blind technique. This method involves two translators independently translating the questionnaire into the target language and comparing the translations for any discrepancies and then agreeing on one version (Hambleton and Patsula, 1998). For this purpose, the assistance of a certified professional translation service was sought.

2.3. Ethical approval

Ethical clearance from the Ministry of Health (MOH) and the Health Sciences Centre (HSC), Kuwait University, Kuwait, was obtained before data collection. The study was conducted during the period from February 2018 to July 2018.

2.4. Sample size calculation

According to the statistics obtained from the Kuwaiti MOH during the initial fieldwork, there are 84 diabetes specialized PHCs in Kuwait, and the total number of annual follow-up visits to those diabetes clinics was 991,540 in 2017. Using the Raosoft® sample

size calculator, with a margin of error of 5% and a confidence interval of 95%, a minimum sample of 384 should be targeted. Assuming a response rate of 80%, a larger sample size was sought.

2.5. Sampling strategy, sample recruitment, and data collection

The PHCs that provide outpatient diabetes clinics were selected using a stratified and random sampling technique. The stratification was performed at the level of the main five health regions of Kuwait (Al Jahra, Capital, Hawalli, Al Farwaniya and Al Ahmadi), which was followed by a random selection of the PHCs from each health region. Based on the size of the population in each health region, a proportional number of patients from every PHC was calculated.

Patients waiting for their regular follow-up appointments at the PHCs were approached by the principal investigator and were invited verbally, after checking their eligibility to take part in the study. Those who agreed to participate were provided with a copy of the questionnaire to be completed and returned on the same day. If any patients were illiterate and unable to write, the questionnaire was completed with the assistance of the researcher. To ensure the reliability of the obtained data, the primary investigator introduced him/herself as a researcher who was independent and separate from the healthcare team. Before providing the questionnaire, the aim of the study, confidentiality, and anonymity of the presented data were clearly explained. The right to withdraw from the study was also assured. Patients were also assured that their participation would not impact the care they receive.

A pilot study was initially carried out to check the clarity of the questionnaire and the feasibility of the study procedures. For this purpose, 15 questionnaires were distributed over three PHCs selected randomly from different governorates (i.e., one PHC from Al Jahra, one PHC from Capital, and one PHC from Al Ahmadi). The pilot study ended with no major modifications. However, only one minor modification was introduced in question “5” of the medical information part of the questionnaire: “Which of the following treatment regimens do you follow to treat diabetes?”. The answer to this question was originally designed to select one appropriate answer out of seven options (diet only; oral hypoglycaemic agents (OHAs) only; insulin only; combined OHAs and insulin; and others). This was changed after the pilot to allow for the selection of more than one possible treatment option.

2.6. Statistical analysis

The statistical analyses were performed using the Statistical Package for Social Science (SPSS) software, version 26. Responses to the knowledge questions (16 items) were re-coded on a categorical scale (scored 0 to 1) according to the proportion of correct answers. “Yes” responses to questions 1 to 12 were considered correct and hence were counted as 1. For questions 13, 14, and 16, “daily” or “always” responses were counted as 1. Lastly, the “warm” response to question 15 was counted as 1. The overall level of knowledge was considered good if patients had $\geq 70.0\%$ score (i.e., 11 or more correct answers out of 16 questions), satisfactory if the score was 50.0–69.0% (i.e., 8–10 correct answers), or poor if the score was $< 50.0\%$ (i.e., 7 or less correct answers). The scoring system used in the current study for knowledge questions (correct answer = 1 score, incorrect answer = 0 score) and the cut-off values as good ($\geq 70.0\%$), satisfactory (50.0–69.0%) or poor ($< 50.0\%$) were done based on similar studies from the literature (Magbanua and Lim-Alba 2017; Desalu et al., 2011; Pollock et al., 2004).

Responses to the questions of the NAFFC (29 items) were re-coded on a categorical scale (scored 0 to 3) according to the frequency of occurrence of foot care behaviour, where a score of “3” represents the best behaviour and a score of “0” represents the

poorest behaviour of foot care. The overall practice of foot care was considered good if patients had a score $\geq 70.0\%$ (i.e., 61 and above total score out of a maximum score of 87), satisfactory if the score was 50.0–69.0% (i.e., 43 to 60 total score out of 87), or poor if the score was $< 50.0\%$ (i.e., 42 or less total score out of 87). The scoring system and cut-off values used in the NAFFC for practice questions were done based on the tool guidelines and similar studies from the literature which used NAFFC tool for assessing patients’ practice of foot care (Magbanua and Lim-Alba, 2017; NAFFC, 2015; Desalu et al., 2011).

Responses to the 15 items of the third part of the study instrument (the MNSI-patient history part) were re-coded on a categorical scale (scored 0 to 1) according to the proportion of correct answers. “Yes” responses to items 1–3, 5, 6, 8, 9, 11, 12, 14 and 15 were counted as 1, while “No” responses to items 7 and 13 were each counted as 1. Items 4 and 10 were measures of impaired circulation and asthenia, respectively, and hence were not included in the total score (i.e., maximum total possible score is 13). A total score of ≥ 7.0 was considered abnormal, whereas scoring < 7.0 was normal. Guidelines for the scoring and cut-off values were followed using instrument owner’s guidelines and similar studies in the literature (Khawaja et al., 2018; Al-Kaabi et al. 2014; Brown et al., 1994; Feldman and Stevens, 1994).

The descriptive analysis was reported as mean (\pm standard deviation [SD]) for normally distributed quantitative variables and as median (interquartile range [IQR]) for non-normally distributed quantitative variables. Categorical data were reported as frequency (percentage). Logistic regression was used to estimate odds ratios (ORs) with 95% confidence intervals (CIs) for predictors of good knowledge and good practice of foot care. Logistic regression models were carried out using the above-mentioned cut-off points for good knowledge (a total score of 11 or above) and good practices (a total score of 61 and above). Concerning the risk of developing DPN, the cut-off point was a total score of 7 or above. A two-sided p-value < 0.05 was considered statistically significant.

3. Results

3.1. Medical information and demographic characteristics

A total of 409 questionnaires were distributed to the eligible patients from the PHCs that were randomly selected from the five health districts of Kuwait, of which 357 agreed to participate, giving a response rate of 87.3%: Al-Farwaniya (n = 110), Hawalli (n = 80), Al-Jahra (n = 61), Capital (n = 58) and Al-Ahmadi (n = 48). Patients’ demographics and medical information are shown in Table 1. Most participants in the study sample were male (n = 189, 52.9%), Kuwaitis (n = 302, 84.6%) and college graduates (diploma (n = 98, 27.5%); bachelor’s (n = 143, 40.1%); and postgraduate (n = 16, 4.5%). The median age was 50.0 years old (IQR: 38.00–58.50), with a range of 21–82 years old. Regarding patients’ medical information, 81.0% of patients (n = 289) had T2D, with nearly half of them having a diabetes duration of ≥ 10 years (n = 168, 48.6%). Most patients were using OHAs (n = 228, 63.8%) to manage their diabetes; however, only 41.4% of patients (n = 121) achieved the target glycaemic control (HbA1c $< 7\%$), as indicated by the American Diabetes Adonisation (ADA) guidelines (ADA, 2020). Most patients reported that they did not receive foot care education (n = 273, 76.5%) and did not have a previous history of foot ulcer (n = 309, 86.6%).

3.2. Assessment of the current knowledge of foot care

With a maximum possible score of 16, the overall mean knowledge score was 12.7 ± 2.7 (equals 81.3%). The range of the patients’

Table 1
Demographics and medical information of the patients in the study (n = 357).

Characteristics	n (%)
Age	
21 to 34 years	73 (20.4)
35 to 49 years	93 (26.1)
50 to 64 years	155 (43.4)
65 years and above	36 (10.1)
	Median 50 years (IQR: 38.00–58.50)
Gender	
Male	189 (52.9)
Female	168 (47.1)
Nationality	
Kuwaiti	302 (84.6)
Non-Kuwaiti*	55 (15.4)
Educational status	
Illiterate	12 (3.4)
Secondary/High school	88 (24.7)
Diploma	98 (27.5)
Bachelor's	143 (40.1)
Postgraduate	16 (4.5)
Occupational status	
Employed (government/private)	205 (57.4)
Retired	124 (34.7)
Non-employed**	21 (5.9)
University students	7 (2.0)
Type of diabetes	
T1D	68 (19.0)
T2D	289 (81.0)
Duration of diabetes[^]	
1 to <5 years	91 (26.3)
5 to <10 years	87 (25.1)
10 years and above	168 (48.6)
	Median 9 years (IQR: 4.00–14.00)
Last HbA1c value^{^^}	
<7%	121 (41.4)
7% and above	171 (58.6)
	Mean ± SD (7.4 ± 5.4)
Last time HbA1c value was measured^{^^^}	
<3 months	184 (69.2)
3 to <6 months	37 (13.9)
6 to <12 months	26 (9.8)
12 months or more	19 (7.1)
Treatment regimen	
OHAs only	144 (40.3)
Diet + OHA	84 (23.5)
Insulin only	54 (15.1)
OHA + insulin	49 (13.7)
Diet only	11 (3.1)
Combined diet + OHA + insulin	10 (2.8)
Diet + insulin	5 (1.4)
Previous foot ulcer(s)	
Yes	48 (13.4)
No	309 (86.6)
Other chronic conditions	
Yes [^]	112 (31.4)
No	245 (68.6)
Received foot care education	
Yes ^{^^}	84 (23.5)
No	273 (76.5)

N: number of patients; IQR: interquartile range; T1D: type 1 diabetes; T2D: type 2 diabetes.

^^^Received information from PHC (n = 77, 21.6%) (e.g., from doctors (n = 56, 15.7%), from nurses (n = 7, 2%), hospital (n = 3, 0.8%), and Internet (n = 3, 0.8%). Numbers do not add to the total due to missing data.

* Other nationalities include Saudi (n = 15, 4.2%), Bidoon (n = 13, 3.6%), Indian (n = 2, 0.6%), Bangladeshi (n = 1, 0.3%), Iranian (n = 2, 0.6%), Yemeni (n = 5, 1.4%), Egyptian (n = 14, 3.9%), Lebanese (n = 1, 0.3%), Syrian (n = 2, 0.6%).

** Non-employed includes those with no job.

[^] Numbers do not add to the total due to missing data.

^{^^} Other conditions include: Asthma (n = 9), Arthritis (n = 1), Dyslipidaemia (n = 19), Thyroid (n = 15), Sinusitis (n = 1), Crohn's Disease (n = 2), Hypertension (n = 63), Cardiovascular Disease (n = 10), Iron Deficiency Anaemia (n = 2), Inflammatory Bowel Syndrome (n = 1), Gastric Ulcer (n = 1), Psoriasis (n = 1), Systemic Lupus Erythematosus (n = 1), Kidney Disease (n = 4), Protein S Deficiency (n = 1), and Depression (n = 1), in which they are occurring alone or in combination.

knowledge score was 3 to 16. The overall knowledge score of patients in this study showed that the majority (n = 283, 79.3%) had good knowledge, (n = 56, 15.7%) had satisfactory knowledge, and (n = 18, 5.0%) had poor knowledge of diabetic foot care.

The majority of patients (n = 204, 57.1%) were unaware that they should inspect their feet for problems daily, and almost half of the study sample (n = 178, 49.9%) were unaware of how often they should inspect the inside of their footwear to look for objects or torn lining that could harm their feet. More than one-third of the study sample (n = 126, 35.3%) did not know that the water temperature should be checked every time they wash their feet. Similarly, one-third of patients (n = 118, 33.1%) were unaware that they should moisturize their feet but not between the toes (Table 2). University students had lower odds of having good knowledge about foot care [OR: 0.19 (95%CI: 0.04–0.86)], p < 0.05. On the other hand, patients who reported having diabetes for a long duration (≥10 years) [OR: 1.88 (95%CI: 1.11–3.18)] and patients who did not have any other comorbidities [OR: 0.49 (95%CI: 0.26–0.90)] had higher odds of having good knowledge about foot care, p < 0.05 (Table 3).

3.3. Assessment of the current practice of foot care

Using the NAFFC that consists of 29 items (with a maximum possible score of 87), the overall mean score of patients' foot care practice in this study was 55.7 ± 9.2 (equals 64.0%), with a minimum score of 20 and a maximum score of 84. The foot care practices among most patients (n = 219, 61.3%) in this study were satisfactory, where they provided correct answers to 50.0–69.0% of practice questions. In comparison, less than one-third of patients

Table 2
Patients' responses to questions related to knowledge of foot care (n = 357).

Knowledge questions	Correct (n, %)	Wrong (n, %)
Antidiabetic medications should be taken regularly to prevent complications.	355 (99.4)	2 (0.6)
Caring for the feet is important because patients with diabetes may NOT feel minor injury in their feet.	345 (96.6)	12 (3.4)
Caring for the feet is important because wounds and infections may NOT heal quickly in patients with diabetes.	342 (95.8)	15 (4.2)
Caring for the feet is important because patients with diabetes may get a foot ulcer.	334 (93.6)	23 (6.4)
Patients should consult a doctor if their feet have redness, blisters, cuts, or wounds.	330 (92.4)	27 (7.6)
How often do you think that your feet should be washed?	317 (88.8)	40 (11.2)
Feet should be completely dried after washing.	296 (82.9)	61 (17.1)
Patients with diabetes must NOT walk barefoot (without slippers/shoes) both inside and outside the house.	294 (82.4)	63 (17.6)
Socks should be changed every day.	294 (82.4)	63 (17.6)
Toenails should be trimmed straight across.	277 (77.6)	80 (22.4)
Patients should not smoke because smoking causes poor circulation affecting the feet.	270 (75.6)	87 (24.4)
What temperature of water do you think that you should wash your feet in?	268 (75.1)	89 (24.9)
Patients with diabetes should moisturize their feet daily, but NOT between toes.	239 (66.9)	118 (33.1)
The temperature of the water should be checked before washing feet.	231 (64.7)	126 (35.3)
How often do you think that you should inspect the inside of your footwear for objects or torn lining?	179 (50.1)	178 (49.9)
How often do you think that you should inspect your feet?	153 (42.9)	204 (57.1)

Table 3
Predictors of good knowledge and practices concerning foot care and risk of developing diabetic neuropathy.

Variable	OR (95%CI) of having good foot care knowledge	§AOR (95%CI) of having good foot care knowledge	OR (95%CI) of having good foot care practices	§AOR (95%CI) of having good foot care practices	OR (95%CI) of DPN risk	§AOR (95%CI) of DPN risk
Demographic characteristics						
Age						
21 to 34 years (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
35 to 49 years	0.73 (0.42–1.28)	0.93 (0.45–1.93)	0.89 (0.53–1.50)	0.81 (0.41–1.57)	1.09 (0.47–2.55)	1.36 (0.42–4.42)
50 to 64 years	1.55 (0.91–2.63)	1.54 (0.76–3.12)	1.07 (0.68–1.68)	0.87 (0.47–1.60)	1.24 (0.58–2.65)	1.22 (0.41–3.63)
65 years and above	0.91 (0.40–2.08)	1.03 (0.38–2.75)	0.85 (0.40–1.83)	0.74 (0.30–1.84)	0.64 (0.15–2.81)	0.70 (0.12–4.00)
Gender						
Male (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
Female	1.40 (0.83–2.35)	1.44 (0.84–2.33)	0.86 (0.55–1.36)	0.84 (0.53–1.33)	0.57 (0.26–1.26)	0.51 (0.23–1.14)
Educational status						
Illiterate (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
Secondary/High school	1.02 (0.56–1.86)	0.41 (0.05–3.48)	0.99 (0.59–1.67)	1.26 (0.31–5.13)	0.62 (0.23–1.66)	0.23 (0.04–1.43)
Diploma	0.94 (0.53–1.67)	0.36 (0.4–3.02)	1.36 (0.83–2.23)	1.57 (0.39–6.31)	1.44 (0.64–3.21)	0.44 (0.08–2.46)
Bachelor's	0.85 (0.51–1.42)	0.38 (0.05–3.20)	0.80 (0.50–1.27)	1.07 (0.27–4.30)	1.06 (0.49–2.30)	0.34 (0.06–1.92)
Postgraduate	1.87 (0.42–8.43)	0.85 (0.07–10.96)	1.02 (0.35–3.01)	1.27 (0.23–7.02)	–	–
Occupational status						
Non-employed (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
Employed (government/private)	0.97 (0.58–1.62)	1.37 (0.69–2.69)	1.05 (0.66–1.65)	0.99 (0.55–1.76)	0.91 (0.42–1.94)	0.80 (0.30–2.14)
Retired	1.23 (0.71–2.13)	1.01 (0.47–2.13)	1.05 (0.65–1.68)	1.16 (0.63–2.16)	1.59 (0.74–3.42)	2.11 (0.74–6.04)
University student	0.19 (0.04–0.86)*	0.19 (0.04–0.95)*	0.90 (0.17–4.69)	0.82 (0.15–4.64)	–	–
Medical history related variables						
Type of diabetes						
T1D (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
T2D	1.36 (0.73–2.52)	1.30 (0.61–2.76)	1.19 (0.66–2.13)	1.36 (0.67–2.76)	0.89 (0.35–2.29)	0.67 (0.21–2.07)
Duration of diabetes						
1 to <5 years (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
5 to <10 years	0.60 (0.34–1.05)	0.61 (0.34–1.08)	1.75 (1.06–2.90)*	1.81 (1.08–3.04)*	0.63 (0.23–1.69)	0.58 (0.21–1.60)
10 years and above	1.88 (1.11–3.18)*	1.85 (1.04–3.28)*	0.80 (0.51–1.26)	0.78 (0.48–1.27)	0.93 (0.43–1.97)	1.00 (0.43–2.30)
Last measured HbA1c value						
<7% (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
7% and above	0.61 (0.35–1.09)	0.59 (0.33–1.06)	0.97 (0.81–1.17)	0.66 (0.41–1.06)	0.99 (0.72–1.34)	3.52 (1.18–10.55)*
Treatment regimen						
Diet only (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
OHAs only	0.99 (0.59–1.67)	1.02 (0.59–1.75)	0.63 (0.39–1.00)*	0.62 (0.38–1.01)	1.05 (0.49–2.27)	1.06 (0.47–2.38)
Insulin only	1.03 (0.50–2.10)	1.10 (0.51–2.35)	0.84 (0.44–1.60)	0.80 (0.41–1.58)	0.63 (0.18–2.15)	0.65 (0.18–2.36)
Combined diet + OHAs + insulin	2.40 (0.30–19.23)	2.10 (0.26–17.33)	0.55 (0.12–2.65)	0.58 (0.12–2.86)	–	–
Diet + OHAs	0.79 (0.44–1.42)	0.76 (0.42–1.40)	1.76 (1.06–2.94)*	1.73 (1.02–2.94)*	0.84 (0.33–2.13)	0.74 (0.28–1.95)
Diet + insulin	0.39 (0.06–2.35)	0.46 (0.07–3.04)	3.44 (0.57–20.85)	3.32 (0.51–21.48)	–	–
OHAs + insulin	1.40 (0.63–3.13)	1.26 (0.55–2.89)	1.10 (0.58–2.10)	1.19 (0.61–2.31)	2.67 (1.11–6.41)*	2.87 (1.13–7.29)*
Having previous foot ulcer(s)						
Yes (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
No	1.51 (0.75–3.03)	1.42 (0.70–2.91)	0.87 (0.46–1.67)	0.84 (0.43–1.63)	0.21 (0.09–0.47)***	0.20 (0.08–0.47)***
Having other chronic conditions						
Yes (Reference category)	1.00	1.00	1.00	1.00	1.00	1.00
No	0.49 (0.26–0.90)*	0.51 (0.26–0.99)*	0.86 (0.53–1.39)	0.80 (0.48–1.35)	0.73 (0.33–1.60)	0.63 (0.26–1.51)

OHAs: oral hypoglycaemic agents; OR: odds ratio; CI: confidence interval; HbA1c: glycosylated haemoglobin type 1AC; T1D: type 1 diabetes; T2D: type 2 diabetes. N.B.: Regression models were conducted separately for each outcome (good knowledge, good practices and DPN risk) of interest and grouped in the same table.

* p < 0.05.

*** p < 0.001.

§ Multiple logistic regression adjusted for Age, gender and educational level.

(n = 110, 30.8%) showed good foot care practice, and only a minority of them (n = 28, 7.8%) had poor practices.

Regarding habits of feet/shoe inspection and consistency of using footwear (Table 4), results from this study showed that 45.9% (n = 164) of patients check their feet once daily and 16.5% (n = 59) of them inspect their feet more than once a day. Only a minority of patients rarely or never check their shoes before putting them on (n = 96, 26.9%), while more than half of patients either rarely or never check their shoes before taking them off (n = 188, 52.7%). The study also showed that most of the patients (n = 277, 77.6%) never walked barefoot outside the house. Most patients showed the positive practice of not wearing shoes without socks (n = 213, 59.7%) and changing their socks at least daily (n = 311, 87.1%). As to the frequency of washing of feet, most patients (n = 241, 67.5%) washed their feet more than once a day followed by at least once a day (n = 85, 23.8%). With regards to the practice of drying the feet after washing, less than half of the

sample (n = 165, 46.2%) often check that their feet are dry after washing. Regardless, the majority either always or often dried in between their toes (n = 255, 71.4%). Nearly one-third of the study sample either never or rarely (i.e., once a month) apply moisturizers on their feet (n = 112, 31.3%); however, the majority either never or rarely (i.e., once a month) put moisturizing cream in between their toes (n = 210, 59.7%). Trimming of toenails is another practice of foot care, in which 49.0% (n = 175) of patients cut their toenails about once a month followed by 31.7% (n = 113) who cut their toenails about once a week (Table 4).

Regarding type of footwear (Table 5), most patients either rarely or never wear sandals (n = 236, 66.1%), pointed-toe shoes (n = 253, 70.9%) or flip-flops/mules (n = 214, 60.0%). On the other hand, 37.8% of patients (n = 135) rarely or never wear slippers, and 45.4% (n = 162) wear sports shoes most of the time. The NAFFC also comprised questions regarding foot protection and management of foot problems. Patients in this study showed good habits

Table 4
Patients' responses to practice questions about inspection of feet/footwear, consistency of wearing footwear, and caring for feet (n = 357).

Practice questions	Answer	n	%
Do you examine your feet?	More than once a day	59	16.5
	Once a day	164	45.9
	2–6 times a week	46	12.9
	Once a week or less	88	24.6
Do you check your shoes before you put them on?	Often	133	37.3
	Sometimes	128	35.9
	Rarely	57	16.0
	Never	39	10.9
Do you check your shoes when you take them off?	Often	42	11.8
	Sometimes	127	35.6
	Rarely	101	28.3
	Never	87	24.4
Do you walk around the house barefoot?	Often	57	16.0
	Sometimes	105	29.4
	Rarely	73	20.4
	Never	122	34.2
Do you walk outside the house barefoot?	Often	8	2.2
	Sometimes	22	6.2
	Rarely	50	14.0
	Never	277	77.6
Do you wash your feet?	More than once a day	241	67.5
	Once a day	85	23.8
	Most days a week	18	5.0
	A few days a week	13	3.6
Do you check if your feet are dry after washing?	Often	165	46.2
	Sometimes	125	35.0
	Rarely	49	13.7
	Never	18	5.0
Do you dry between your toes?	Always	145	40.6
	Often	110	30.8
	Sometimes	69	19.3
	Rarely/Never	33	9.2
Do you use moisturizing cream on your feet?	Daily	143	40.1
	About once a week	102	28.6
	About once a month	39	10.9
	Never	73	20.4
Do you put moisturizing cream between your toes?	Daily	65	18.2
	About once a week	79	22.1
	About once a month	50	14.0
	Never	163	45.7
Are your toenails trimmed?	About once a week	113	31.7
	About once a month	175	49.0
	Less than once a month	63	17.6
	Never	6	1.7

in terms of foot protection against exposure to burns and managing foot problems, if any (Figs. 1 and 2). Patients who were on OHAs only had lower odds [OR: 0.63 (95%CI: 0.39–1.00)] of having good practice of foot care, $p < 0.5$. Patients who reported having diabetes for a duration between 5 to less than 10 years [OR: 1.75 (95%CI: 1.06–2.90)] and those who are on a diet and OHAs [OR: 1.76 (95%CI: 1.06–2.94)] had higher odds of having good practice of foot care, $p < 0.05$ (Table 3).

3.4. Prevalence and risk factors for DPN

Most patients (n = 295, 82.6%) had a risk score of < 7.0 , indicating having no lower neuropathic symptoms and hence low risk of developing DPN. In comparison, of those with a risk score of ≥ 7.0 (n = 62, 17.4%), most of them had at least one symptom of DPN. The most frequently reported symptoms in patients with DPN were pain with walking and numbness, which were present in 59.7% (n = 213) and 53.2% (n = 190) of patients, respectively. In

Table 5
Patients' responses to practice questions regarding type of footwear (n = 357).

Practice questions	Answer	Frequency	%
Do you wear sandals?	Most of the time	43	12.0
	Sometimes	78	21.8
	Rarely	89	24.9
	Never	147	41.2
Do you wear slippers?	Most of the time	93	26.1
	Sometimes	129	36.1
	Rarely	64	17.9
Do you wear trainers (sport shoes)?	Most of the time	71	19.9
	Sometimes	162	45.4
	Rarely	129	36.1
Do you wear shoes with lace, Velcro or strap fastenings?	Most of the time	93	26.1
	Sometimes	134	37.5
	Rarely	69	19.3
	Never	61	17.1
Do you wear pointed-toe shoes?	Most of the time	21	5.9
	Sometimes	83	23.2
	Rarely	93	26.1
	Never	160	44.8
Do you wear flip-flops or mule shoes?	Most of the time	50	14.0
	Sometimes	93	26.1
	Rarely	96	26.9
	Never	118	33.1
Do you break in new shoes gradually?	Always	85	23.8
	Most of the time	112	31.4
	Sometimes	88	24.6
Do you wear artificial fibre socks? (e.g., nylon)	Rarely/Never	72	20.2
	Most of the time	32	9.0
	Sometimes	92	25.8
	Rarely	90	25.2
Do you wear seamless socks/stockings/tights?	Never	143	40.1
	Often	65	18.2
	Sometimes	116	32.5
	Rarely	74	20.7
Do you wear shoes without socks/stockings/tights?	Never	102	28.6
	Never	213	59.7
	Rarely	73	20.4
	Sometimes	44	12.3
Do you change your socks/stockings/tights?	Often	27	7.6
	More than once a day	66	18.5
	Daily	245	68.6
	4–6 times a week	25	7.0
	<4 times a week	21	5.9

contrast, the least reported symptoms were a history of one or more toe amputations and loss of sensation in cold/hot water, which were seen in 2.2% (n = 8) and 7.0% (n = 25) of patients, respectively (Table 6). Patients who were using combination therapy of OHAs and insulin had a higher risk [OR: 2.67 (95%CI: 1.11–6.41)] of developing DPN, $p < 0.05$. On the other hand, patients who reported that they did not have a previous history of foot ulcer had a lower risk of developing DPN [(OR: 0.21 (95%CI: 0.09–0.47)], $p < 0.001$ (Table 3).

4. Discussion

The management of diabetes largely relies on patients embracing skills and knowledge to carry out daily self-care responsibilities. Therefore, diabetes self-management education and support

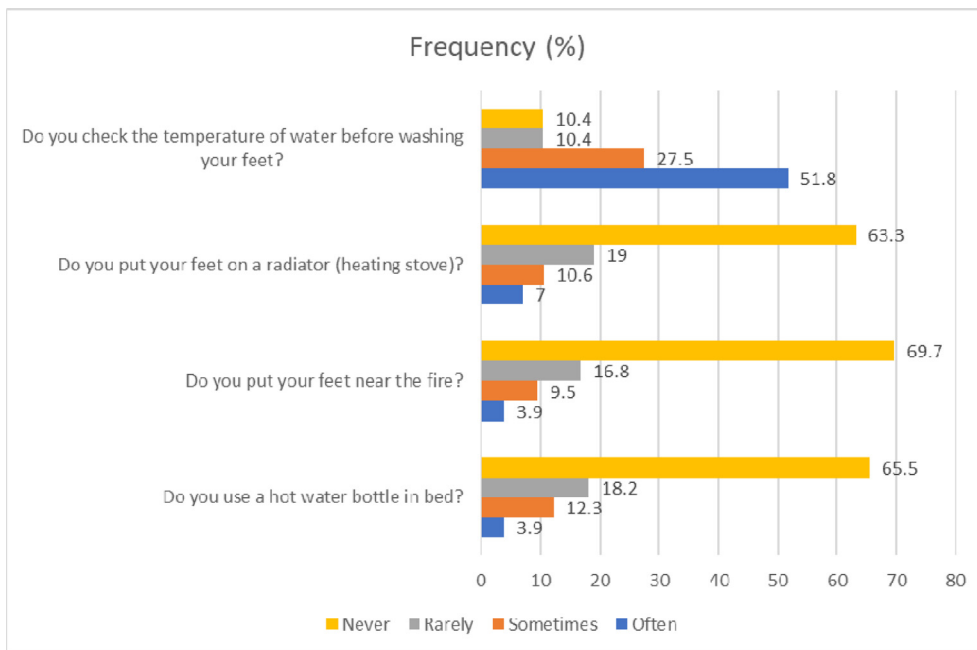


Fig. 1. Patients' responses to practice questions about the habit of feet protection against high temperature (n = 357).

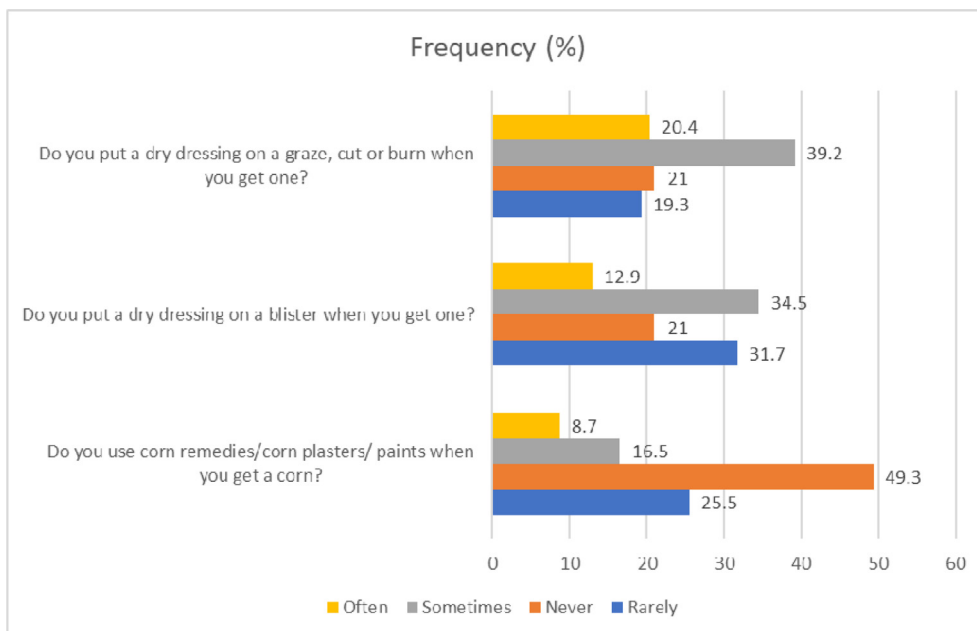


Fig. 2. Patients' responses to practice questions regarding managing foot problems (n = 357).

(DSME) is an essential component of diabetes management (ADA, 2020). In Kuwait, there is a paucity of data regarding knowledge and practice of foot care among patients with diabetes (Al-Ali et al., 2015). This study is the first to evaluate the risk of developing DPN among patients with diabetes visiting PHCs and to assess their knowledge and practices regarding foot care, using validated pre-tested tools.

A total of 357 patients, with a response rate of 87.3%, participated in the present study. The median age of the patients was 50 years old (min. 21, max. 84), and the median duration of diabetes was 9 years, which was comparable to that of the studies

by Al-Kaabi et al. (2014) and Saber and Daoud (2018). In the current study, 79.3% of patients showed good foot care knowledge, while 15.1% and 5.0% had satisfactory and poor knowledge of diabetic foot care, respectively. Similar results were demonstrated in studies done in the Philippines (Magbanua and Lim-Alba, 2017) and India (George et al., 2013), where good knowledge was reported by 82.7% and 75% of patients, respectively. In contrast, only a minority of patients in a study done in Iraq had a good knowledge score (32.8%) (Saber and Daoud, 2018). The difference may be attributed to the fact that the majority of the study sample in Kuwait were at least college graduates, which might have

Table 6
Patients' responses to MSNI-patient history score (n = 357).

DPN Risk questions	Patients with abnormal symptoms	
	n	%
Are your legs and/or feet numb?	190	53.2
Do you ever have any burning pain in your legs and/or feet?	130	36.4
Are your feet too sensitive to touch?	149	41.7
Do you ever have any prickling feelings in your legs and/or feet?	174	48.7
Does it hurt when the bed covers touch your legs and/or feet?	52	14.6
When you get into the tub or shower, are you able to tell the hot water from the cold water?	25	7.0
Have you ever had an open sore on your foot?	59	16.5
Has your doctor ever told you that you have diabetic neuropathy?	74	20.7
Are your symptoms worse at night?	125	35
Do your legs hurt when you walk?	213	59.7
Are you able to sense your legs/feet when you walk?	32	9.0
Is the skin on your feet so dry that it cracks open?	90	25.2
Have you had an amputation?	8.0	2.2

DPN: diabetic peripheral neuropathy.

reflected positively on their knowledge and awareness compared to the study sample in Iraq where 28.8% of them were from rural areas and had significantly lower knowledge compared to their peers from an urban area, $p < 0.5$. Accordingly, most patients were aware of the importance of regular use of anti-diabetic drugs to prevent complications (99.4%), that people with diabetes may not feel foot injuries (96.6%), may not heal quickly from foot wounds and infections (95.8%), and are prone to foot ulcers (93.6%). The least correct measure that the patients knew was the importance of the daily inspection of feet or inside of footwear for any problems, as reported by 42.9% and 50.1%, respectively. This could be reasoned by the fact that only 23.5% of patients in the current study received foot care education.

University students in our study showed lower odds of being knowledgeable about appropriate foot care compared to others. It could be justified that they are in better health and disease-free, which is why they might not have sought or received education related to foot care from any healthcare professionals. Additionally, the level of knowledge might differ as per the university subject that the surveyed students are studying. A previous study in Saudi Arabia reported a high level of knowledge (score of 55.5 out of 68, equals 80%) about foot care among medical students (Abdulwassii et al., 2020). Concerning participants who reported having diabetes for a long duration (≥ 10 years) and those who did not have any other comorbidities, we found that they showed better knowledge about foot care. This could be as aforementioned due to the high level of education among our study sample, as 72.2% of them reported having a diploma or higher degree. Confirming the findings of our study concerning the positive association between duration of diabetes and level of knowledge about foot care, previous studies have reported that a longer duration of diabetes was associated with better knowledge about the disease and appropriate foot care (Chiwanga and Njelekela, 2015; Khamseh et al., 2007). Participants who did not have any other comorbidities could have adopted a better lifestyle and daily practices. For example, they could be non-smokers, well-educated, and following a healthy lifestyle. Usually, healthy people seek information continuously to protect themselves from having a chronic disease or any other sort of illness. This could explain our findings, as we found participants who did not have any other comorbidities had better foot care knowledge.

Regarding the overall diabetic foot self-care practice of the study's participants, only 28% had good foot care practice, while

61.3% and 7.8% showed satisfactory and poor scores of foot care practices, respectively. Similar results were shown in the study in the Philippines, which also used the NAFFC to assess the foot care practices, where 22.4% of patients had good practice, but 71.2% and 6.4% showed satisfactory and poor scores, respectively (Magbanua and Lim-Alba, 2017). The lower rates of good foot care practice in the current study could be attributed to the low percentage of patients (13.4%) with a history of foot ulcers, as the history of foot wound has been reported to be a significant predictor of foot care behaviour (Yildirim Usta et al., 2019). Also, the current study showed that patients who are on OHAs only were the least likely people to have good foot care practice, while those who reported having diabetes for 5 to less than 10 years and those who are on a diet only were more likely showing good foot care practices.

Regardless that patients in this study had the least knowledge score with regards to the frequency of foot inspection (42.9%), responses showed that the majority of patients (n = 190, 62.4%) do inspect their feet daily (i.e., once or more a day). This can be explained by the fact that most patients were Kuwaitis (84.6%) and hence Muslims; therefore, washing feet as a pre-prayer requirement (i.e., 5 times a day for the 5 prayers) may have helped them to observe their feet frequently. This was also confirmed by their practice, where 67.5% of patients reported that they wash their feet more than once a day and 23.8% washed them once a day. Regarding the practice of drying the feet after washing, 165 (46.2%) patients often check whether their feet are dry after washing, while the majority either always or often dried in between their toes (n = 145, 40.6% and n = 110, 30.8%, respectively). In contrast, in a study done in Ethiopia, 59.1% and 69.3% of patients never had a habit of drying their feet and between toes, respectively (Seid and Tsige, 2015). Most patients in the current study used a moisturizer and applied it between toes and only less than half (45.7%) avoided such practice. In comparison, more than half of patients (54%) in the study in the Philippines (Magbanua and Lim-Alba, 2017) and 79.2% of patients in Ethiopia (Seid and Tsige, 2015) avoided applying a moisturizer between toes. This practice of patients in Kuwait could be explained by the nature of dry weather and very high temperatures, which led the majority of patients to use moisturizers and to apply them to the whole foot, including between the toes. Concerning the practice of walking barefoot, the current study shows that only 34.2% of patients (n = 122) do not walk barefoot inside the house, while the majority (n = 277, 77.6%) have never walked barefoot outside the house. This is in contrast to the study in Ethiopia where the majority of patients (n = 230, 73.5%) have never walked barefoot around the house, which is higher than patients in Kuwait, whereas walking barefoot outside the house was almost the same (n = 259, 82.7%) (Seid and Tsige, 2015). This can be explained by the fact that houses in Kuwait are usually furnished with carpets where patients may not need footwear.

Although diabetes complications, including DPN, were considered to develop years after diagnosis and inadequate glycaemic control, there is increasing evidence that DPN can develop early (i.e., within the first 12 months of diagnosis) (Pafili et al., 2018; Tesfaye and Selvarajah, 2012). The prevalence of DPN in the sample of patients in this study (17.4%) was relatively similar to that of the study done in Jordan (16.5%), which also used the MNSI-patient history part (Khawaja et al., 2018). This contrasts with results from other studies in the Middle East where a lower percentage of patients met the MNSI questionnaire criteria for the diagnosis of DPN; 10.4% and 7.4% of the patients were abnormally symptomatic (MSNI-history score ≥ 7.0) in the UAE (Al-Kaabi et al., 2014) and KSA (Al-Geffari, 2012), respectively. The most common symptoms of DPN in this study were numbness and pain with walking, which

were present in more than 50% of patients. This is consistent with the study in Jordan where the majority expressed symptoms of numbness and pain with walking.

4.1. Strengths and limitations of the study

An adequate sample was recruited, giving a response rate of 85.5%. The data collection instruments used were adopted from previously validated and standardized tools. For the knowledge part of the questionnaire, questions were designed from previous studies and ACFAS recommendations of foot care. Another strength is the random selection of the PHCs from the different governorates of Kuwait.

On the other hand, there are some limitations. Firstly, the shortage of time for data collection (3 months; from February to April 2019) allowed us to achieve 93.0% (n = 357) of our target sample. Secondly, the exclusion of the physical investigation part of the MNSI. This was due to the fact that this was a student graduation project with a limited time scale, hence obtaining the approval and cooperation of physicians from different PHCs to carry out the physical investigation component of the questionnaire was cumbersome and not guaranteed, thus it was avoided. Regardless, the MNSI patient history part can be used alone to predict the presence of DPN (Feldman et al., 1994), which was confirmed with the instrument's owners before the start of the study. Conducting a similar study in Kuwait in the future using both components of the MSNI (patient history and physical examination) will be vital.

Multicollinearity is a problem when using logistic regression analysis. It is defined as high correlations among predictor variables. Multicollinearity is leading to unreliable and unstable estimates of regression coefficients. There should be no high correlations (multicollinearity) among the predictors. This can be assessed by a correlation matrix among the predictors. In our study, out of the 10 independent variables that we were interested in exploring their association with our outcome(s), only two were significantly correlated (age and having comorbidities history) with type of diabetes ($p \leq 0.001$), which implicate low level of multicollinearity, however, our results should be interpreted carefully.

4.2. Implications for clinical practice

Results of this study showed that there is a gap between patients' knowledge and their practice of foot self-care. Providing target patients (e.g., university students, those using OHAs only, and those at high risk of developing DPN) with skills and competencies to undertake foot self-care is vital. This can be achieved through developing educational programmes with regular follow-ups to check patients' adherence to the given instructions. Pharmacists can play a major role, with the primary care physicians, in providing this education and assessment of patients.

5. Conclusions

The current level of foot care knowledge among patients with diabetes is good, whereas the practice of foot care is satisfactory. Healthcare providers should identify gaps and support better foot care practices among patients by engaging them in educational programmes.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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