

Research Article**ASSESSMENT OF KNOWLEDGE, FOOT CARE PRACTICES, AND FOOT CARE EDUCATION AMONG PATIENTS WITH DIABETES MELLITUS**

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ABSTRACT

Background: Diabetes mellitus is a common and increasing global health problem, and Pakistan is among the countries with a high burden of diabetes. Diabetic foot ulcer is a preventable complication of diabetes that can result in significant morbidity, disability, and lower-limb amputation. Adequate knowledge and appropriate foot care practices, together with patient education, are important for preventing diabetic foot complications. However, limited evidence is available regarding these factors in the local context.

Objective: To assess the knowledge and foot care practices of patients with diabetes mellitus and to determine the association of previous foot care education with their knowledge and foot care practices.

Study Design: Cross-sectional study.

Duration and Place of Study: This study was conducted at Shaheed Benazir Bhutto Trauma and Emergency Response Institute Quetta from August 2025 to August 2026.

Methodology: Participants (n=200) were consecutively selected from the outpatient orthopaedic and diabetic clinics. The minimum calculated sample size was 246; a total of 200 participants were enrolled. The reason for this shortfall cannot be established from available records and is acknowledged as a limitation that may reduce statistical power, particularly in subgroup analyses. Written informed consent was obtained from all participants. Data were collected using a structured questionnaire adapted from the Diabetes Care Program of Nova Scotia. Internal consistency of the knowledge and practice scales was assessed using Cronbach's alpha, yielding coefficients of 0.82 and 0.78, respectively. Knowledge and practice scores were categorised

as Good, Satisfactory, or Poor. Logistic regression models examined attendance at a foot care education class as a predictor of good knowledge and good practice (each contrasted against the combined satisfactory and poor categories), adjusted for age, literacy level, diabetes duration, diabetes type, and history of foot ulceration.

Results: Of 200 participants, 58.0% were female and 74.0% had type 2 diabetes mellitus. Good knowledge was present in 25.0% of participants, while good foot care practices were reported by 15.0%. Approximately 49.0% had previously attended a foot care education class. In univariable analysis, class attendance was significantly associated with better knowledge ($\chi^2=7.55$, $df=2$, $p=0.023$), whereas the association with good practice did not reach statistical significance ($p=0.075$). After multivariable logistic regression adjusting for age, literacy level, diabetes duration, diabetes type, and history of foot ulceration, class attendance was independently associated with good knowledge (aOR=2.15, 95% CI: 1.12–4.12, $p=0.021$) and with good practice (aOR=1.95, 95% CI: 1.02–3.74, $p=0.043$).

Conclusion: Attendance at a foot care education class was independently associated with better knowledge and practice of diabetic foot care after controlling for key confounders. These findings support the integration of regular and structured foot care education into routine diabetes management.

Keywords: Diabetes mellitus; diabetic foot; foot care; knowledge; awareness; practice; patient education.

INTRODUCTION

Diabetes mellitus is a major public health challenge that continues to increase globally [1]. According to the 11th edition of the International Diabetes Federation (IDF) Diabetes Atlas, an estimated 589 million adults aged 20–79 years were living with diabetes mellitus worldwide in 2024, and this number is projected to increase to approximately 900 million by 2050 [2]. The burden of diabetes is particularly high in Pakistan, which has one of the highest reported prevalences of diabetes among adults worldwide [3].

Diabetic foot disease is one of the most serious complications of diabetes mellitus [4]. Peripheral neuropathy, peripheral arterial disease, and foot deformities increase the risk of foot ulceration and infection, which may subsequently lead to hospitalisation, lower-limb amputation, disability, and impaired quality of life [5]. Diabetic foot ulceration is an important precursor to lower-limb amputation, and a substantial proportion of patients with diabetes develop foot ulcers during their lifetime [6].

Many diabetic foot complications can be prevented or detected early through appropriate self-care practices, including daily inspection of the feet, proper foot hygiene, use of appropriate footwear, avoidance of walking barefoot, and prompt reporting of any foot abnormalities or injuries [7]. The adoption of these preventive measures is influenced by patients' knowledge, attitudes, and self-care practices and can be

strengthened through appropriate diabetes and foot care education. In resource-limited settings, where access to structured diabetes education and specialised diabetic foot care may be limited, improving patients' knowledge and self-care practices is particularly important [8].

Despite the importance of preventive foot care, limited information is available regarding the level of foot care knowledge and practices among patients with diabetes mellitus in the local population [9,10]. Assessing patients' knowledge and current foot care practices, as well as examining the relationship between previous foot care education and these practices, may help identify gaps in patient education and inform the development of appropriate educational interventions. The present study was therefore conducted to assess the knowledge and foot care practices of patients with diabetes mellitus and to determine the association of previous foot care education with their knowledge and foot care practices.

METHODOLOGY

Study Design and Setting

This was a cross-sectional survey conducted in the outpatient orthopaedic and diabetic clinics at Shaheed Benazir Bhutto Trauma and Emergency Response Institute Quetta from August 2025 to August 2026. serves as a major tertiary referral centre, the study population largely comprised patients with established diabetes-related complications referred from the surrounding region.

Sample Size and Sampling Technique

The sample size was calculated using OpenEpi software based on an estimated prevalence of 20% for adequate foot care knowledge or practice, a 5% margin of error, and a 95% confidence interval, yielding a minimum required sample of 246 participants. A total of 200 participants were enrolled. The reason for falling short of the calculated minimum of 246 cannot be established with certainty from the available records; the most plausible explanation is that fewer patients met all eligibility criteria than anticipated during the study period, although time constraints of the recruitment window may also have contributed. This shortfall may have reduced statistical power, particularly for subgroup analyses, and is acknowledged as a limitation. Consecutive sampling was used.

Eligibility Criteria

Inclusion criteria: Individuals of either gender aged 18 years or above with an established clinical diagnosis of type 1 or type 2 diabetes mellitus, confirmed by medical history and laboratory investigations including HbA1c, who provided written informed consent.

Exclusion criteria: Critically ill patients and individuals with severe cognitive impairment or diagnosed severe psychological disorders were excluded.

Data Collection Instrument, Adaptation, and Pilot Testing

Data were collected using a structured questionnaire derived from the Diabetic Foot Care Questionnaire developed by the Diabetes Care Program of Nova Scotia (2009) [11]. The tool was translated into Urdu and back-translated into English to verify cultural and linguistic appropriateness. Content and face validity were assessed by a panel of expert orthopaedic surgeons and endocrinologists.

The questionnaire comprised four sections: (i) sociodemographic and clinical variables; (ii) history of foot problems; (iii) foot care practices; and (iv) foot care education history.

A pilot study was conducted with 30 diabetic patients before commencement of the main study. The pilot confirmed that questions were clearly understood; minor language revisions were made to the footwear examination items based on participant feedback. Internal consistency was assessed using Cronbach's alpha, yielding coefficients of 0.82 for the knowledge scale (15 items) and 0.78 for the practice scale (15 items).

Scoring and Categorisation

Each scale comprised 15 items, with one mark awarded per correct response, giving a maximum possible score of 15 per scale. Percentage scores were classified as Good ($\geq 70\%$; score ≥ 11), Satisfactory (50–69%; score 8–10), and Poor ($< 50\%$; score < 8). These threshold values were consistent with those used in the original instrument [11].

Statistical Analysis

Data were analysed using SPSS software, version 20. Categorical variables are reported as frequencies and percentages; continuous variables are presented as mean $\pm$ standard deviation. Chi-square tests were used for univariable analyses of categorical outcomes.

Multivariable binary logistic regression was performed to examine the independent association of previous foot care class attendance with the likelihood of having good knowledge and good practice (each defined as a binary outcome: good versus the combined satisfactory and poor categories, with the combined satisfactory/poor category as the reference). Separate models were fitted for each outcome. Adjustment variables were selected a priori based on clinical relevance and included age, literacy level, diabetes duration, diabetes type, and history of foot ulceration or amputation. Results are reported as adjusted odds ratios (aOR) with 95% confidence intervals (CI). A two-sided p value ≤ 0.05 was considered statistically significant.

RESULTS

The study enrolled 200 patients aged 18 years and above. The mean age was 52.4 ± 11.2 years, mean duration of diabetes was 8.6 ± 5.3 years, and mean HbA1c was $8.4 \pm 1.8\%$. The majority of participants

were female (58.0%). Type 2 diabetes mellitus accounted for 74.0% of cases and type 1 for 26.0%, confirmed by history and glycaemic profiles. Table 1 describes the sociodemographic and clinical characteristics of the study participants.

Table 1: Sociodemographic and Clinical Characteristics

Characteristic	n	%
Gender		
Female	116	58.0
Male	84	42.0
Education / Literacy		
Secondary school graduate or above	44	22.0
Primary school graduate	116	58.0
Unable to read or write	40	20.0
Occupation		
Housewife	94	47.0
Manual labourer	42	21.0
Office worker	36	18.0
Student or unemployed	28	14.0
Medication use		
Regular use	134	67.0
Irregular use	46	23.0
No medication use (diet-managed or discontinued)*	20	10.0
Awareness of normal blood glucose range		
Yes	140	70.0
No	60	30.0
Type of Diabetes Mellitus		
Type 1 (confirmed by clinical records)	52	26.0
Type 2	148	74.0
Duration of Diabetes (years)		
Less than 5	68	34.0

5 to 10	82	41.0
More than 10	50	25.0

*Participants with no medication use were either managed by diet alone, had discontinued medication, or had incomplete treatment information.

Table 2 presents the overall grades for knowledge and practice.

Table 2: Overall Knowledge and Practice Grading

Grading	Knowledge n (%)	Practice n (%)
Good ($\geq 70\%$)	50 (25.0)	30 (15.0)
Satisfactory (50–69%)	72 (36.0)	94 (47.0)
Poor ($< 50\%$)	78 (39.0)	76 (38.0)

Table 3 summarises the past and current history of foot problems. A history of foot ulceration (defined as ever having a clinically confirmed ulcer) was present in 35.0% of participants, while a prior amputation was reported in 25.0%. Active ulceration at the time of recruitment was clinically confirmed in 34.0% of participants. These figures reflect the tertiary referral profile of the study setting and may not be representative of the general diabetic population.

Table 3: Past and Current Foot Problem History

Parameters	n	%
Past History		
Foot ulcer (ever)	70	35.0
No history of foot ulcer	130	65.0
Amputation (ever)	50	25.0
No history of amputation	150	75.0
Sore or cut on foot or leg (past)	80	40.0
No history of sore or cut	120	60.0
Current History		
Active ulcer (clinically confirmed)	68	34.0
No active ulcer	132	66.0

Blood on socks	40	20.0
No blood on socks	160	80.0
Calluses present	92	46.0
No calluses	108	54.0

Table 4 shows general daily foot care practices reported by participants.

Table 4: General Daily Foot Care Practices

Practice	n	%
Examine feet daily	154	77.0
Does not examine feet daily	46	23.0
Able to reach bottom of foot	154	77.0
Unable to reach bottom of foot	46	23.0
Wash feet every day	192	96.0
Does not wash feet every day	8	4.0
Dry well between the toes	78	39.0
Does not dry well between toes	122	61.0
Use moisturising cream on feet	124	62.0
Does not use moisturising cream	76	38.0
Cuts own toenails	150	75.0
Does not cut own toenails	50	25.0
Wears suitable shoes	78	39.0
Does not wear suitable shoes	122	61.0
Wears suitable socks	124	62.0
Does not wear suitable socks	76	38.0

Table 5 presents preventative foot care behaviours.

Table 5: Preventative Foot Care Behaviours

Practice	n	%
Soaks feet	62	31.0

Does not soak feet	138	69.0
Tests water temperature before immersion	98	49.0
Does not test water temperature	102	51.0
Uses medicated products for corns/warts/calluses	60	30.0
Does not use medicated products	140	70.0
Moisturises between toes	68	34.0
Does not moisturise between toes	132	66.0
Walks around barefoot	68	34.0
Does not walk barefoot	132	66.0
Wears shoes without socks	106	53.0
Does not wear shoes without socks	94	47.0
Inspects shoes before wearing	128	64.0
Does not inspect shoes	72	36.0
Uses hot water bottle or heating pad on feet	36	18.0
Does not use heating devices on feet	164	82.0
Sits with legs crossed	80	40.0
Does not sit with legs crossed	120	60.0
Smoker	60	30.0
Non-smoker	140	70.0

Table 6 details foot care educational exposures reported by participants.

Table 6: Foot Care Educational Exposures

Education Method	n	%
Previously attended a foot care education class	98	49.0
Did not attend foot care class	102	51.0
Received handouts on foot care	68	34.0
Did not receive foot care handouts	132	66.0
Received handouts on appropriate footwear	58	29.0
Did not receive footwear handouts	142	71.0

Would like to receive health education	166	83.0
Would not like health education	34	17.0

Table 7 summarises the univariable associations between foot care class attendance and knowledge and practice levels.

Table 7: Univariable Analysis — Foot Care Class Attendance and Knowledge/Practice Levels

Parameter	Attended Class (n=98) n (%)	Did Not Attend (n=102) n (%)	χ^2 (df)	p-value
Knowledge			7.55 (2)	0.023
Good	30 (30.6)	20 (19.6)		
Satisfactory	39 (39.8)	33 (32.4)		
Poor	29 (29.6)	49 (48.0)		
Practice			5.19 (2)	0.075
Good	20 (20.4)	10 (9.8)		
Satisfactory	46 (46.9)	48 (47.1)		
Poor	32 (32.7)	44 (43.1)		

Table 8 presents the complete multivariable logistic regression results for predictors of good knowledge and good practice.

Table 8: Multivariable Logistic Regression — Predictors of Good Knowledge and Good Practice

Predictor	Good Knowledge aOR (95% CI)	p	Good Practice aOR (95% CI)	p
Foot care class attendance (Yes vs No)	2.15 (1.12–4.12)	0.021	1.95 (1.02–3.74)	0.043
Age (per 10-year increase)	0.89 (0.72–1.10)	0.289	0.91 (0.73–1.14)	0.421
Literacy: Primary vs unable to read/write	1.78 (0.94–3.38)	0.078	1.58 (0.79–3.16)	0.194
Literacy: Secondary+ vs unable to read/write	2.64 (1.18–5.91)	0.018	2.12 (0.89–5.04)	0.090

Diabetes duration: 5–10 vs <5 years	1.12 (0.61–2.06)	0.714	0.98 (0.51–1.89)	0.960
Diabetes duration: >10 vs <5 years	1.38 (0.68–2.80)	0.374	1.14 (0.53–2.46)	0.740
Diabetes type (Type 2 vs Type 1)	0.82 (0.42–1.60)	0.559	0.76 (0.37–1.57)	0.458
History of foot ulceration (Yes vs No)	1.24 (0.65–2.36)	0.512	1.32 (0.68–2.56)	0.411

Reference categories: Foot care class: did not attend; Literacy: unable to read/write; Diabetes duration: <5 years; Diabetes type: Type 1. Outcomes defined as Good knowledge or Good practice versus the combined Satisfactory and Poor categories. Hosmer-Lemeshow goodness-of-fit: knowledge model $p=0.724$, practice model $p=0.681$.

The results of multivariable logistic regression, after adjustment for age, literacy level, diabetes duration, diabetes type, and history of foot ulceration, showed that attendance at a foot care education class was independently associated with good knowledge (aOR = 2.15, 95% CI: 1.12–4.12, $p = 0.021$) and with good practice (aOR = 1.95, 95% CI: 1.02–3.74, $p = 0.043$). Higher literacy level was also significantly associated with good knowledge (secondary or above vs unable to read/write: aOR = 2.64, $p = 0.018$). No other predictor reached statistical significance in either model.

DISCUSSION

The current study evaluated knowledge and self-reported foot care practices of patients with diabetes mellitus, as well as the association of previous foot care education with these two factors. Only a quarter of participants demonstrated good knowledge about foot care, while good foot care practices were reported by only 15%. Poor knowledge and poor foot care practices were observed in 39% and 38% of participants, respectively. These findings reveal substantial gaps in foot care knowledge and practices among diabetic patients in this setting, consistent with results from other studies conducted in Pakistan and other regions [12–14].

Several basic foot hygiene practices were prevalent among participants. Almost all patients (96%) reported washing their feet daily, and 77% reported checking their feet regularly. However, certain preventive foot care practices that are particularly important for people with diabetes were less commonly adopted. Only 39% reported drying their feet properly between the toes, and 39% wore appropriate footwear. Barefoot walking was reported by 34% of participants, 53% wore shoes without socks, and 31% soaked their feet.

Testing water temperature before immersion was performed by fewer than half of participants. These findings suggest that while basic hygiene behaviours are relatively common, protective practices specific to diabetic foot care remain insufficiently adopted. Barefoot walking appeared to be less common than in a study from southern India [15], whereas shoe inspection before wearing was reported at lower rates than in a study from Lahore [16].

Regarding foot care education, 49% of participants reported having previously attended a foot care education class. Fewer had received written materials on foot care (34%) or appropriate footwear (29%). Notably, 83% expressed a willingness to receive health education, indicating substantial receptiveness among the study population.

In univariable analysis, previous attendance at a foot care class was significantly associated with knowledge level ($\chi^2=7.55$, $df=2$, $p=0.023$). This association remained significant in multivariable analysis after adjustment for literacy, age, diabetes duration, and history of ulceration (aOR = 2.15, $p = 0.021$). The association between class attendance and good practice was not statistically significant in univariable analysis ($p=0.075$) but became significant after multivariable adjustment (aOR = 1.95, $p = 0.043$). This pattern suggests that confounders such as literacy and diabetes duration partially obscured the practice-education relationship in the unadjusted analysis.

The gap between knowledge and practice scores indicates that improved knowledge is not automatically associated with appropriate foot care behaviour. Self-care practices are shaped by multiple practical, social, and economic factors including footwear affordability and availability, literacy, visual impairment, habitual behaviours, and cost. A single educational exposure may therefore be insufficient to sustain long-term behavioural changes. Evidence from other studies suggests that repeated education, reinforcement, and follow-up may be needed to translate knowledge into appropriate foot care behaviours [18,19].

Healthcare professionals, including physicians, nurses, and diabetes educators, should incorporate structured foot care education into routine diabetes management. Education should emphasise practical behaviours including daily foot inspection, adequate drying between the toes, appropriate footwear and socks, avoidance of barefoot walking, and early reporting of foot abnormalities. Repeated education and follow-up may be particularly important for reinforcing these behaviours over time.

Limitations

Several limitations should be acknowledged. First, the cross-sectional design does not permit causal inference regarding the relationship between education and behavioural change. Second, the enrolled sample of 200 participants was below the calculated minimum sample size of 246, which may have reduced statistical power, particularly for detecting smaller associations in subgroup analyses. Third, practice data

were based on self-report and may be subject to recall and social desirability bias; objective confirmation of practices would strengthen future studies. Fourth, the study was conducted at a single tertiary trauma centre serving mainly patients with advanced complications, which limits generalisability to the broader diabetic population in primary care settings. Finally, data on the duration, frequency, and content quality of previous educational exposures were not collected.

CONCLUSION

Previous attendance at a foot care education class was independently associated with better knowledge and practice of diabetic foot care among the study participants, after controlling for major clinical and demographic confounders. These findings support the need for regular, structured foot care education as part of routine diabetes management to improve patients' knowledge and promote appropriate preventive foot care behaviours.

FUNDING

This study received no external financial support.

CONFLICT OF INTEREST

The authors declare no conflict of interest related to the conduct or publication of this study.

ETHICAL APPROVAL

The study was approved by the relevant Institutional Ethical Review Committee (Reference No: XXXXX) prior to commencement. Written informed consent was obtained from all participants, and the study was conducted in accordance with applicable ethical standards and guidelines.

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