Practice and Associated Factors Regarding Foot Care among Diabetes Mellitus Patients Attending a Rural Primary Health Center in South India

Abstract

Background: Diabetes mellitus patients are more likely to undergo nontraumatic foot or leg amputations because they have decreased circulation to the feet or reduced sensation. This condition may cause ulcerations, infections, and delayed wound healing, leading to amputations. Adequate knowledge and practices regarding foot care will be vital in the prevention of diabetic foot complications. Hence, this study aimed to determine the level of knowledge and practices of foot care among diabetes mellitus patients attending a rural primary health center in Belagavi-South India. **Materials and Methods:** A cross-sectional study was conducted in the rural field practice area of J.N. Medical College, Belagavi, for 7 months (November 2019 to May 2020). A pretested questionnaire was administered to 461 diabetes patients attending the health center. A written informed consent was obtained from each participant. They were interviewed with a questionnaire consisting of 15 "yes" or "no" questions, each on foot care knowledge and practice. **Results:** The mean age of the study participants was 50.28 ± 9.48 years. The mean duration of diabetes was 10.69 ± 7.09 years. Majority, i.e., 296 (64.2%) participants showed satisfactory knowledge and 293 (63.6%) showed satisfactory practice. Only 97 (21%) had poor knowledge, 90 (19.5%) had poor practice, 68 (14.8%) patients had good knowledge, and 78 (16.9%) had good practice about diabetic foot care. **Conclusions:** The low level of knowledge and practice in patients with diabetes regarding foot care necessitates an educational program to increase awareness related to foot complications of diabetes, thereby motivating diabetic patients to incorporate foot care practices in their day-to-day routine.

Keywords: *Complications, diabetes mellitus, diabetic foot, epidemiology, foot care, India, knowledge, practice, prevention and control, primary health center*

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Introduction

Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action, or both. The number of people with diabetes in India was 65 million in 2016.[1] By 2035, it is estimated to rise to 109 million diabetic patients in the country.[2] The incidence of diabetic foot will surge due to a rise in global prevalence of diabetes mellitus along with an increased life expectancy among patients with diabetes, which is comparable to the life expectancy in the general population.[3,4] Diabetic foot affects approximately 15% and 25% of all diabetic patients globally and in India, respectively.[5,6]

A systematic review from India showed that 50% of diabetic foot ulcers get infected necessitating hospitalization and 20% require lower-extremity amputation. Diabetic foot ulcers contribute to approximately 80% of all nontraumatic amputations.[5] Patients with diabetic foot complications spend significantly more than diabetic patients with no complications.[7] In addition, diabetic foot ulcers have a negative impact on patients' health-related as well as overall quality of life.[8-10] The practice of foot care measures such as daily foot washing and drying, daily foot examination, proper nail care, and footwear are important with regard to prevention and early detection of the expected complications. Knowledge about the above-mentioned foot care practices varies among studies. A previous study by Ralineba *et al*.,[11] in South Africa, has shown that majority of people have insufficient knowledge, while a study by Pavithra *et al*[12] in Karnataka, India, showed that seven and four out of ten study participants had good awareness and practice scores about foot care, respectively.

The number of studies on knowledge and practices about foot care among patients

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with diabetes in India especially in rural areas is very few. Besides, majority of patients in the rural areas are unaware about the importance of foot care and its consequences because of an education gap and also, information regarding foot care is not provided by the concerned authorities in the rural settings. With this background, the present study was carried out to assess the level of knowledge and practices of foot care among diabetes mellitus patients attending a rural primary health center in Belagavi-South India.

Materials and Methods

This was a cross-sectional study conducted among 461 diabetic patients who attended the outpatient department of primary health center at Kinaye which is a rural field practice area affiliated with Jawaharlal Nehru Medical College, KAHER University, Belagavi, Karnataka, between November 2019 and May 2020.

Universal sampling method was used to select patients attending the clinic for routine diabetic health checkup. Patients who were willing to participate and provided informed consent were recruited for the study.

Selection criteria

Patients were included if they (a) were diabetic patients more than 18 years of age and (b) had duration of diabetes mellitus for more than 6 months.

A pretested structured questionnaire developed by Hasnain *et al.* was used to interview the participants which consisted of 15 "yes" or "no" questions each on foot care knowledge and current self-care practices.[13] Each correct response was assigned 1 mark. Scores for knowledge and practice were determined to be good, satisfactory, or poor based on the median and interquartile range (IQR) values.

Compliance was measured using the Medication Adherence Questionnaire (MAQ) by Lavasa *et al.*[14] The MAQ contains the same four questions as the 4-item Morisky Medication Adherence Scale. The closed question format with "yes-saying" bias allows disclosure of nonadherence. A patient scores 1 point for each "Yes" answer. Scores of 0, 1, or 2 have been termed as good compliance and scores of 3 or 4 have been termed as poor compliance. Morisky Scale questionnaire is the quickest to administer and is also able to identify barriers to adherence due to its length. Because it has been validated in the broadest range of diseases and in patients with low literacy, it has been used in this study and is also the most widely used scale for research.

The median values obtained were 8 (IQR: 7–10) and 8 (IQR: 6–9) for level of knowledge and practices regarding foot care, respectively. Those who scored more than the third quartile were considered to have good knowledge (>10) and practice (>9), and below the first quartile were poor for knowledge (<7) and practice (<6).

Scores between first and third quartiles signified satisfactory knowledge (7–10) and practice (6–9).

Primary outcome variables were level of knowledge and practices of foot care. Sociodemographic and clinical parameters were the primary explanatory variables.

Statistical analysis

Descriptive analysis was carried out using mean and standard deviation for quantitative variables and frequency and proportion for categorical variables. All quantitative variables were checked for normal distribution within each category of the explanatory variable by using visual inspection of histograms and normality Q-Q plots. Shapiro–Wilk test was also conducted to assess normal distribution. $P > 0.05$ was considered as normal distribution.

For normally distributed quantitative parameters, mean values were compared between the study groups using ANOVA. If statistically significant differences were found using ANOVA, appropriate *post hoc* tests (least significant difference/Bonferroni) were used to assess statistical significance of pair-wise comparisons.

Categorical outcomes were compared between the study groups using Chi-square test/Fisher's exact test, wherever appropriate. Association between quantitative explanatory and outcome variables was assessed by calculating Spearman's rank correlation coefficient, and scatter plot was used to represent the data. Regression analysis was performed to identify the risk factors related to the main outcomes. $P < 0.05$ was considered statistically significant. Data obtained were analyzed using IBM SPSS Statistics for Windows, Version 22.0 (IBM Corp., Armonk, NY, USA).[15]

Ethical approval

The JNMC Institutional Ethics Committee on Human Subjects Research (Ref: MDC/DOME/435) approved the study.

Results

Sociodemographic characteristics of the study participants

We recruited a total of 461 participants for the study. The mean age was 50.28 ± 9.48 years, and 230 (49.89%) were female [Table 1]. A total of 421 (91.32%) participants had a minimum primary school education, 195 (42.30%) were of agriculture background and 70 (15.18%) were doing business. A total of 301 (65.29%) participants belonged to either socioeconomic class IV or V,[16] and 203 (44.03%) participants had a family history of diabetes mellitus and 390 (84.60%) had good compliance of taking medication for diabetes.

Practices and knowledge regarding foot care

A total of 392 (85%) participants were taking antidiabetic treatment regularly [Table 2]. The responses were good

for daily washing of feet and drying after washing. A total of 110 (23.86%) patients walked barefoot, 223 (48.4%) did not know the proper technique to trim toenails, and 288 (62.5%) knew that keeping the skin of the feet soft was important to prevent dryness, but majority (84.2%) had no knowledge of the importance of using talcum powder to keep interdigital spaces dry. There was a striking difference for responses on daily change of socks, lotion application in the interdigital spaces, using of warm water, or checking the temperature of water before use.

The median total scores of knowledge were 8 with an IQR of 7–10. The results showed that 68 (14.8%) participants had good knowledge, 295 (64.2%) had satisfactory knowledge, and 97 (21%) had poor knowledge regarding foot care. The median total scores of practice were 8 with an IQR of 6–9. For practices regarding foot care, 294 (63.6%) had satisfactory and 90 (19.5%) had poor foot care. Seventy-nine (16.9%) participants had good practice.

Table 1: Distribution of study participants according to sociodemographic characteristics (*n*=461)

Characteristics	*n* (%)
Age (years), mean±SD (range)	50.28±9.48 (31-80)
Gender	
Male	231 (50.11)
Female	230 (49.89)
Education	
Illiterate	40 (8.68)
Primary school	133 (28.85)
High school	158 (34.27)
Graduate	130 (28.20)
Occupation	
Government job	32 (6.94)
Homemaker/not working/retired	103 (22.34)
Private job	61 (13.23)
Business	70 (15.18)
Agriculture/farming	195 (42.30)
Socioeconomic status (According to Modified B.G. Prasad classification 2019)	
Class 1	18 (3.90)
Class 2	52 (11.28)
Class 3	90 (19.52)
Class 4	192 (41.65)
Class 5	109 (23.64)
Duration of diabetes (years)	
1-5	109 (23.6)
6-10	189 (40.9)
>10	163 (35.4)
Family history of diabetes	
Yes	203 (44.03)
No	258 (55.97)
Compliance to diabetes medication	
Poor compliance	71 (15.40)
Good compliance	390 (84.60)

SD: Standard deviation

Predictors of knowledge regarding foot care

The mean difference for age across level of knowledge was statistically significant ($P < 0.001$) [Table 3 and Figure 1]. Out of the 461 participants, 10.6% of the female participants had good knowledge compared to 4.1% of male participants. Among 231 male participants, 112 (48.5%) had poor knowledge regarding foot care ($P < 0.001$) [Figure 2]. Among 172 (37.3%) participants who had scored poor in knowledge, 19 (47.5%) were illiterate, 91 (68.4%) had completed primary schooling, 85 (43.6%) were farmers, and 42 (60%) were in business. In addition, the duration of diabetes was longer for 33 out of 68 participants with good knowledge compared to that of the other groups ($P = 0.004$).
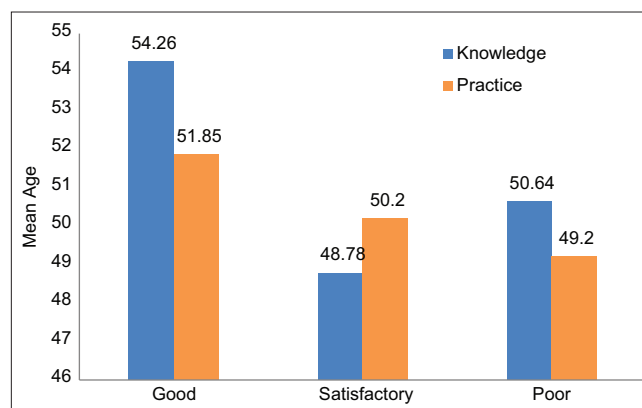

Figure 1: Bar diagram showing comparison of mean age across level of knowledge and practice regarding foot care (*n* = 461)

Table 2: Distribution of level of knowledge and practice about foot care in the study population (*n*=461)

Foot care measures	Knowledge, *n* (%)	Practice, *n* (%)
Importance of taking antidiabetic treatment to prevent complication	411 (89.2)	392 (85)
Daily washing of the feet	364 (79)	344 (74.6)
Using warm water for washing/bathing	143 (31)	102 (22.1)
Checking the temperature of the water before using	111 (24)	82 (17.8)
Drying the feet after washing	352 (76.4)	312 (67.7)
Talcum powder usage for keeping interdigital spaces dry	73 (15.8)	56 (12.1)
Keeping the skin of the feet soft to prevent dryness	288 (62.5)	260 (56.4)
Lotion not to be applied in the interdigital space	107 (23.2)	90 (19.5)
Daily change of socks	100 (21.7)	88 (19.1)
Trimming toenails straight with care	238 (51.6)	229 (49.7)
Inspection of feet daily by respondents	271 (58.8)	249 (54)
Wearing comfortable coat shoes	324 (70.3)	285 (61.8)
Checking the inside of the shoes before wearing	252 (54.7)	229 (49.7)
Not walking barefoot	390 (84.6)	351 (76.1)
Warning signs for which consultation is required	405 (87.9)	378 (72)

Table 3: Comparison of demographic variables across the level of knowledge regarding diabetic foot care (n=461)

Parameter	Knowledge regarding diabetic foot care			P
	Good, *n* (%)	Satisfactory, *n* (%)	Poor, *n* (%)	
Age (years), mean±SD	54.26±10.72	48.78±9.42	50.64±9.47	<0.001
Gender				
Male (*n*=231)	19 (8.2)	100 (43.3)	112 (48.5)	<0.001
Female (*n*=230)	49 (21.3)	121 (52.6)	60 (26.1)	
Education				
Illiterate (*n*=40)	0 (0)	21 (52.5)	19 (47.5)	*
Primary school (*n*=133)	4 (3)	38 (28.6)	91 (68.4)	
High school (*n*=158)	30 (19)	96 (60.8)	32 (20.3)	
Graduate (*n*=130)	34 (26.2)	66 (50.8)	30 (23.1)	
Occupation				
Private job (*n*=61)	21 (34.4)	31 (50.8)	9 (14.8)	*
Government job (*n*=32)	6 (18.8)	16 (50)	10 (31.3)	
Agriculture/farming (*n*=195)	0 (0)	110 (56.4)	85 (43.6)	
Business (*n*=70)	6 (8.6)	22 (31.4)	42 (60)	
Homemaker/not working/retired (*n*=103)	35 (34)	42 (40.8)	26 (25.2)	
Socioeconomic status				
Class 1 (*n*=18)	7 (38.9)	8 (44.4)	3 (16.7)	*
Class 2 (*n*=52)	8 (15.4)	41 (78.8)	3 (5.8)	
Class 3 (*n*=90)	20 (22.2)	58 (64.4)	12 (13.3)	
Class 4 (*n*=192)	33 (17.2)	93 (48.4)	66 (34.4)	
Class 5 (*n*=109)	0 (0)	21 (19.3)	88 (80.7)	
Duration of diabetes (years)				
1-5 (*n*=109)	14 (12.8)	65 (59.6)	30 (27.5)	0.004
6-10 (*n*=189)	21 (11.1)	93 (49.2)	75 (39.7)	
>10 (*n*=163)	33 (20.2)	63 (38.7)	67 (41.1)	
Family history of diabetes				
Yes (*n*=203)	28 (13.8)	99 (48.8)	76 (37.4)	0.870
No (*n*=258)	40 (15.5)	122 (47.3)	96 (37.2)	
Compliance to diabetes medication				
Good compliance (*n*=390)	55 (14.1)	194 (49.7)	141 (36.2)	0.187
Poor compliance (*n*=71)	13 (18.3)	27 (38)	31 (43.7)	

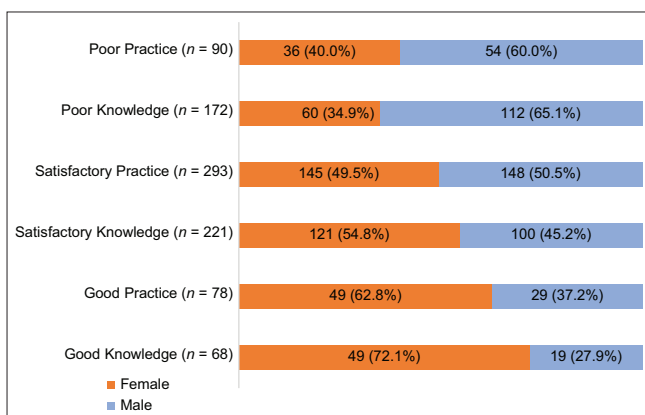*No statistical test was applied where the cells contain 0

Figure 2: Bar diagram showing comparison of gender across level of knowledge and practice regarding foot care (n = 461)

Predictors of practice regarding foot care

Out of the 78 participants with good foot care practice, 71 (91%) had either high school education or were graduates [Table 4]. We found that patients with good foot care practices were female (*P* = 0.012), worked in private sector, or were retired from work (*P* = 0.001). On the other hand, no significant differences were found between the groups in terms of age, family history of diabetes, and duration of diabetes.

Univariate logistic regression analysis showed statistically significant associations for knowledge as well as practice regarding diabetic foot care for explanatory variables such as male gender, illiteracy, primary school level of education, and agriculture or business as occupation [Table 5]. The strongest association was found with socioeconomic class 5 (*P* < 0.001) as compared to baseline (socioeconomic class 1). There were no statistically significant associations observed for duration or family history of diabetes.

There was a strong positive correlation between knowledge and practice regarding foot care (*R* = 0.91, *P* < 0.001) [Figure 3].

Discussion

We performed a study aimed to assess the level of knowledge and current practices of our diabetic patients
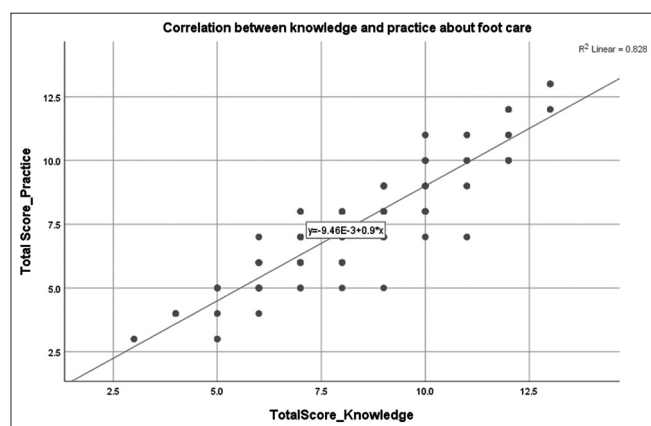

Figure 3: Correlation between knowledge and practice about foot care (*n* = 461)

regarding foot care. The average standard scores for foot care were lower for practice at 7.5 compared to knowledge which was 8.3. These findings are similar to a study done in Malaysia.[17]

The categories that scored poorly were checking the temperature and using warm water for washing/bathing, talcum powder usage, not applying lotion to keep interdigital spaces dry, and daily change of socks. Patients are generally advised to keep the skin of the feet soft by using moisturizing lotion or coconut oil. The low score obtained in keeping the interdigital spaces dry may be attributed to patients not knowing that lotion or oil should not be applied between the toes, and that talcum powder should be used instead. Not checking temperature or using hot or cold water for bathing in the place of warm water may be explained due to plausible factors such as habits, variations in weather, and personal preference. The low score in daily change of socks may be due to lack of proper information on hygiene. Patients must be informed about

Parameter	Practice regarding diabetic foot care			P
	Good, *n* (%)	Satisfactory, *n* (%)	Poor, *n* (%)	
Age (years), mean±SD	51.85±12.13	50.20±8.61	49.20±9.49	0.191
Gender				
Male (*n*=231)	29 (12.6)	148 (64.1)	54 (23.4)	0.012
Female (*n*=230)	49 (21.3)	145 (63)	36 (15.7)	
Education				
Illiterate (*n*=40)	0 (0)	22 (55)	18 (45)	*
Primary school (*n*=133)	7 (5.3)	70 (52.6)	56 (42.1)	
High school (*n*=158)	31 (19.6)	121 (76.6)	6 (3.8)	
Graduate (*n*=130)	40 (30.8)	80 (61.5)	10 (7.7)	
Occupation				
Private job (*n*=61)	27 (44.3)	31 (50.8)	3 (4.9)	0.001
Government job (*n*=32)	6 (18.8)	23 (71.9)	3 (9.4)	
Agriculture/farming (*n*=195)	4 (2.1)	159 (81.5)	32 (16.4)	
Business (*n*=70)	9 (12.9)	26 (37.1)	35 (50)	
Homemaker/not working/retired (*n*=103)	32 (31.1)	54 (52.4)	17 (16.5)	
Socioeconomic status				
Class 1 (*n*=18)	4 (22.2)	14 (77.8)	0 (0)	*
Class 2 (*n*=52)	11 (21.2)	41 (78.8)	0 (0)	
Class 3 (*n*=90)	26 (28.9)	61 (67.8)	3 (3.3)	
Class 4 (*n*=192)	37 (19.3)	136 (70.8)	19 (9.9)	
Class 5 (*n*=109)	0 (0)	41 (37.6)	68 (62.4)	
Duration of diabetes (years)				
1-5 (*n*=109)	24 (22)	62 (56.9)	23 (21.1)	0.322
6-10 (*n*=189)	25 (13.2)	127 (67.2)	37 (19.6)	
>10 (*n*=163)	29 (17.8)	104 (63.8)	30 (18.4)	
Family history of diabetes				
Yes (*n*=203)	31 (15.3)	130 (64)	42 (20.7)	0.649
No (*n*=258)	47 (18.2)	163 (63.2)	48 (18.6)	
Compliance to diabetes medication				
Good compliance (*n*=390)	62 (15.9)	251 (64.4)	77 (19.7)	0.410
Poor compliance (*n*=71)	16 (22.5)	42 (59.2)	13 (18.3)	

Table 4: Comparison of demographic variables across the level of practice regarding diabetic foot care (*n*=461)

*No statistical test was applied where the cells contain 0

Table 5: Univariate logistic regression analysis of factors associated with poor knowledge and poor practice of diabetic foot care in study population (*n*=461)

Parameter	Knowledge regarding diabetic foot care		Practice regarding diabetic foot care	
	Unadjusted odds ratio (95% CI)	*P*	Unadjusted odds ratio (95% CI)	*P*
Age	1.006 (0.986-1.027)	0.534	1.012 (0.992-1.032)	0.232
Male gender (baseline=female)	2.667 (1.803-3.944)	<0.001	2.147 (1.480-3.114)	<0.001
Education (baseline=graduate)				
Illiterate	3.016 (1.435-6.338)	0.004	6.083 (2.669-13.864)	<0.001
Primary school	7.222 (4.176-12.491)	<0.001	5.574 (3.265-9.516)	<0.001
High school	0.847 (0.482-1.487)	0.562	0.842 (0.516-1.373)	0.490
Occupation (Baseline=Private job)				
Agriculture/farming	4.465 (2.084-9.567)	<0.001	2.787 (1.502-5.171)	0.001
Business	8.667 (3.689-20.359)	<0.001	6.412 (2.994-13.735)	<0.001
Government job	2.626 (0.938-7.351)	0.066	1.635 (0.668-3.999)	0.282
Homemaker/not working/retired	1.951 (0.846-4.500)	0.117	1.712 (0.871-3.364)	0.119
Socioeconomic status (Baseline=Class 1)				
Class 2	0.306 (0.056-1.678)	0.173	1.842 (0.462-7.343)	0.387
Class 3	0.769 (0.193-3.059)	0.710	1.923 (0.512-7.218)	0.333
Class 4	2.619 (0.732-9.372)	0.139	4.231 (1.186-15.090)	0.026
Class 5	20.952 (5.553-79.051)	<0.001	55.556 (13.498-228.662)	<0.001
Duration of diabetes (baseline=1-5 years)				
6-10	1.732 (1.039-2.889)	0.035	1.018 (0.635-1.632)	0.941
>10	1.838 (1.089-3.102)	0.023	1.255 (0.772-2.040)	0.360
Family history of diabetes (baseline=No)				
Yes	1.010 (0.690-1.477)	0.960	1.140 (0.789-1.647)	0.485
Compliance to diabetes medication (baseline=Poor)				
Good	1.674 (0.703-1.892)	0.355	1.877 (0.592–1.443)	0.439

CI: Confidence interval

the ill effects of not checking the water so that scald burns can be averted especially in the lower extremities along with daily change of socks and keeping the interdigital spaces, often a neglected part of the feet, dry so that fungal infections can be prevented.[18]

Good practice for foot care was observed only in 79 (16.9%) participants, which is consistent with the results reported by Sutariya and Kharadi and Desalu *et al*.[19,20] These data also showed that foot care practice was higher among patients who had good foot care knowledge, which is similar to a study done in Riyadh, Saudi Arabia.[21] The majority was of satisfactory practice score, which is similar to findings shown by Al-Asmary *et al*. in Saudi Arabia and Saber and Daoud in Iraq.[22,23]

Almost one-fifth of the participants had poor foot care and their score of practice was almost always lower to the score of knowledge. This indicates reduced compliance and ignorance to the already-known benefits of foot care, which is consistent with findings from other studies.[13,17,20,24,25] Very few individuals had better foot care practice than knowledge, which may be attributed to support from family members' or patients' inclination to take control of their health.

The foot care scores increased from poor to good knowledge and practice with rise in the mean age, and our

results were consistent with a study conducted by Saber and Daoud.[22] This may be because patients were receiving information regarding diabetes and foot care with frequent visits to the health center. In our study, the foot care practices of women were high compared to those of men, which is similar to findings from studies done in Colombia, Thailand, and Brazil.[25,26] It may be because women may have better knowledge about the disease and, therefore, are more concerned about their health and well-being. Foot care score for practices were associated with occupation of the individuals, which coincides with the findings of other studies done in Iran.[27]

In our study, we noticed that as the duration of diabetes increased, the foot care knowledge increased, which was statistically significant. These findings are similar to a study documented by Li *et al*.[28] Although patients' knowledge increased with duration of disease, this knowledge was not converted into practice. These findings coincide with a study done by Gökdeniz *et al*.[29]

Our study revealed that patients with an educational level higher than primary schooling obtained noticeably higher foot care scores, the findings of which coincide with various studies.[13,25,30-33] People with low literacy will have lesser knowledge and poorer practices. Most patients may not be receiving foot care education as part of the management of diabetes.

Limitations of the study

This was a cross-sectional study design wherein a causal relationship cannot be established. The results cannot be generalized for the entire country with multiple ethnicities because this was done at a single rural health center. Further research through a qualitative assessment may be required to assess the barriers to foot care in our developing country which has a high incidence of diabetes.

Recommendations

General public

Patient education and motivation to practice is an effective way to reduce the incidence of complications of diabetes and its management.

Family members should also be involved in the care to improve overall assistance, support, and motivation to the diabetic patients. Spouse or, more importantly, their children can be advised to escort them during regular checkups so that they can be taught, which would enable more compliance.

Health workers

Foot care education in a primary care setting is vital to reduce the incidence of diabetic foot complications.

Health-care workers can distribute educational pamphlets with pictorial illustrations of foot care and conduct camps to promote patients' knowledge and awareness.

Community health workers such as accredited social health activists (ASHA) who know and understand people can be given training in teaching and in diabetes management and they can be empowered to become diabetes educators also.

Conclusions

We conclude that health-care professionals should teach about various complications which may come about without proper foot care. Patients with lower education need more information and knowledge about the diagnosis of diabetes and awareness regarding the complications. Patients will be motivated and empowered to include foot care into day-to-day routine when they understand the reasons behind its emphasis.

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Conflicts of interest

There are no conflicts of interest.

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