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Exploring caregivers' knowledge and attitudes towards diabetic foot care in the Eastern Region of Saudi Arabia

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ABSTRACT

Background: Diabetes-related foot disease (DFD) is one of the most severe complications of diabetes, leading to ulcers, infections, amputations, and numerous other complications. Little is known about the level of knowledge concerning foot care among caregivers in Saudi Arabia, though it is essential. *Methods:* A cross-sectional survey study was conducted in the Eastern Region of Saudi Arabia with 219 caregivers of diabetic patients. Knowledge, attitude, and practice assessment were done using a closed-ended questionnaire for foot care. SPSS software version 27 was used to perform statistical tests to identify trends and correlations. *Results:* The study found that most caregivers were female (n = 120, 73.5%), young (n = 69, 42.5%) and had achieved university education (n = 104, 63.5%). Although 73.1% of respondents expressed a desire to learn more, only 15.5% felt they had sufficient knowledge of diabetic foot care. Significant correlates of knowledge levels included education (p = 0.049) and the relationship with the caregiver (p = 0.046). Although 22.4% of caregivers did not check the patient's feet, 44.3% sought medical help only when problems occurred. *Conclusion:* Awareness and practice of diabetic foot care are inadequate among caregivers. Encouraging support and education are crucial to preventing serious complications and achieving better outcomes.

Keywords: Diabetic Foot Disease (DFD), Diabetic Foot Ulcer (DFU), Caregiver Knowledge, Foot Care Practices, Diabetes Mellitus (DM), Diabetic Foot Care Awareness, Preventive Foot Care, Saudi Arabia, Cross-Sectional Study, Health Education, Chronic Disease Management, Caregiver Attitudes, Self-Care Practices, Diabetes Complications.

1. INTRODUCTION

Diabetes has several serious complications, and diabetic foot disease (DFD) is one of the most serious complications (AlZubaidi et al., 2023; Alharbi and Sulaiman, 2022). Diabetic foot disease is a portion of a serious long-term complication closely associated with a high morbidity and mortality index. Diabetic foot disease (DFD) is the leading cause of hospitalization for diabetic patients, with 25% of all diabetes-related hospital admissions stemming from DFD (Alharbi and Sulaiman, 2022). DFD is a multifactorial disease that develops through a series of complex pathogenesis events, resulting in foot-related issues such as diabetic foot ulcers (DFUs) that can ultimately become infected and require amputation (AlZubaidi et al., 2023; Alsaigh et al., 2022).

Diabetes is becoming increasingly common worldwide, and the prevalence of diabetic foot ulcer (DFU), a common complication for diabetic patients, varies from 3% to 8%. According to a systematic review reported in Saudi Arabia covering five Arab countries, Saudi Arabia stood out in two to have the highest mean prevalence of DFUs (8.5%), and the incidence was estimated to be 1.8% (Mairghani et al., 2017). Lower limb amputation is the most severe complication of diabetic foot ulcer (DFU), and DFUs are among the main causes of lower limb amputations not associated with trauma. About every 30 seconds, a limb is lost because of a diabetic foot ulcer. According to a study conducted in Jeddah, Saudi Arabia, the percentage of DFUs among all lower limb amputation cases was found to be 52.7% (Wang et al., 2016).

As a result of the consequences of diabetic foot complications on patients' quality of life, the health of the population, and the major physical and psychological burden on patients and their family members Alshaikh et al., (2023), it has been demonstrated that these complications are the most preventable ones (Singh et al., 2020). Open patient-family communication and ongoing efforts to promote patient involvement in appropriate self-care behaviors in a supportive environment can limit risk by enhancing patient and caregiver awareness. Increasing the awareness and knowledge of caregivers to facilitate patients' ability to perform diabetic foot care at home is one way to support the maintenance of self-care practices (Suglo et al., 2022).

Several studies Shaqran et al., (2023), Abdulghani et al., (2018) have correlated improving awareness and understanding of diabetic foot care among caregivers with a decline in diabetic foot complications. In Egypt, previous studies evaluating caregivers' knowledge of appropriate diabetic foot ulcer (DFU) management have revealed disparate levels of caregiver knowledge. More than half (56.2%) of the participants had poor knowledge, and nearly half (46.9%) of them had poor knowledge (Abdallah et al., 2022). In Egypt, a study was conducted to assess the change in foot care practice following a program aimed at increasing foot care knowledge.

The results showed that caregivers' initial knowledge was very low, but scores improved significantly after the program (El-Rahman and Shousha, 2015). Learn knowledge and awareness of diabetic foot care among caregivers in the Eastern Region of Saudi Arabia: A cross-sectional study. The way to accomplish this is by assessing knowledge and awareness regarding diabetic foot care among Saudi Arabian caregivers. As diabetic foot disease is important to explore the knowledge of diabetic foot care and practices among caregivers.

2. STUDY METHODOLOGY

Cross-sectional study using a self-administered survey in the Eastern Province of Saudi Arabia to assess the knowledge and attitudes of caregivers towards diabetic foot care in diabetes patients. Study data were obtained from 219 study participants recruited using non-probability convenience sampling based on the specified inclusion criteria. Participants provided consent to participate in the study. We included individuals aged 18 years or older who provide care for diabetic patients and reside in the Eastern Province. Conversely, exclusion criteria were applied to those who did not fulfill these conditions. An updated second questionnaire, based on earlier research, supported voluntary participation and included a brief summary of the research purposes. In the first segment, demographic characteristics of participants were collected, including region, age, education, employment status, monthly income, and marital status section.

Besides assessing the current health status of the patient, the second part explored the participants' relations with the patients. The questionnaire also included questions related to the participants' knowledge of diabetic foot care. The third section assessed caregivers' attitudes regarding foot care provision. These included questions on promoting patient visits to clinics for foot examinations and whether participants check, clean, dry, apply cream, and trim the patients' feet. The final section assessed the patients' footwear.

Participants will be contacted via electronic links to the survey, informed of its purpose and target population, and invited to participate voluntarily. An electronic copy will be sent by email or social media apps to all participants who meet the inclusion criteria.

Data Analysis

All data analysis was performed using SPSS version 27 (IBM Corp., Armonk, NY, USA). The bio-demographic characteristics of caregivers of diabetic patients in the Eastern Province of Saudi Arabia were summarized using descriptive statistics, including frequencies and percentages. Descriptive frequency tables and graphs displayed caregivers' knowledge, attitudes, and practice issues. Cross-tabulations were used to examine caregivers' knowledge, awareness, and practices of diabetic foot care. Data were analyzed up to October 2023. The correlation between different levels of knowledge and variables, including age, sex, education, working status, income, marital status, relationship to the diabetic patient, and diabetes status, was analyzed using the chi-square test. Statistical significance was defined at a p-value of <0.05.

3. RESULTS

Table 1 presents the bio-demographic features of 219 caregivers of diabetes patients in the Eastern Region, Saudi Arabia. The 18–30-year age group (n=93, 42.5%) had the highest population of caregivers, followed by the 41–50 age range (n=39, 17.8%). Female caregivers accounted for the majority (n=161, 73.5%) of the study population. Table 1: The majority of caregivers held a university degree (n=139, 63.5%), compared to a smaller proportion with a general education (n=69, 31.5%). Most participants were employed (n=81, 37.0%), followed by those who were not working (n=72, 32.9%), and students (n=58, 26.5%).

Almost half of the caregivers (n = 109, 49.8%) reported a monthly income of less than 5,000 SR. Most caregivers are married (n = 125, 57.1%), and the most common relationship with the diabetic patient was described as "other" (n = 62, 28.3%), followed by relative (n = 54, 24.7%) and parent (n = 42, 19.2%). A minority of caregivers (n=23, 10.5%) reported that the diabetic patient was a smoker. Finally, 19.2% of caregivers reported having diabetes (n=42).

Table 1 Bio-demographic characteristics of caregivers for diabetic patients in the Eastern Region of Saudi Arabia (N=219)

Bio-demographic data	**No**	**%**
Age in years		
18-30	93	42.5%
31-40	34	15.5%
41-50	39	17.8%
51-60	34	15.5%
> 60	19	8.7%
Gender		
Male	58	26.5%
Female	161	73.5%
Educational level		
General education	69	31.5%
University education	139	63.5%
Graduate degree	11	5.0%
Work status		
Not working	72	32.9%
Student	58	26.5%
Employee	81	37.0%
Free work	8	3.7%
Monthly income		

< 5000 SR	109	49.8%
5000-10000 SR	53	24.2%
10000-20000 SR	48	21.9%
> 20000 SR	9	4.1%
Marital status		
Single	80	36.5%
Married	125	57.1%
Divorced / widow	14	6.4%
Relationship with the person with diabetes		
Relative	54	24.7%
Parents	42	19.2%
Siblings	29	13.2%
Friend	22	10.0%
Brother/sister	10	4.6%
Others	62	28.3%
Is the patient a smoker?		
Yes	23	10.5%
No	184	84.0%
Ex-smoker	12	5.5%
Do you have diabetes?		
Yes	42	19.2%
No	177	80.8%

Knowledge and awareness regarding diabetic foot among 219 caregivers of diabetic patients is shown in (Table 2). In terms of perceived level of information, only 15.5% (n = 34) of caregivers reported having adequate knowledge regarding diabetic foot. 60.6% (n=131) felt they had somewhat enough information (completely agree (n=45) or agree (n=86)), and 26.0% (n=57) reported that they had not enough information. A large proportion of caregivers (73.1%, n = 160) reported a need for more information about diabetic foot care. More than half of the caregivers reported that a doctor had explained the importance of foot care for the patient or accompanying person at the time of diagnosis or during a doctor's appointment (53.4%, n = 117). In comparison, 32.9% (n = 72) reported that they did not know if this occurred, and 13.7% (n = 30) reported that it did not occur. Finally, almost half of caregivers (49.8%, n = 109) agreed that the patient's interest in foot care improved after their diagnosis of diabetes.

Table 2 Knowledge and awareness of diabetic foot care among caregivers of diabetic patients in the Eastern Region of Saudi Arabia (N=219)

Knowledge items	**Yes**		**Somewhat**		**No**		**I don't know**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Do you think you have sufficient information on diabetic foot?	34	15.5%	128	58.4%	57	26.0%	0	0.0%
Do you need more information about diabetic feet and ways to care for them?	160	73.1%	42	19.2%	17	7.8%	0	0.0%
When diagnosing the patient or during one of his visits to the doctor, did the	117	53.4%	0	0.0%	30	13.7%	72	32.9%

doctor explain to the patient or the companion the importance of taking care of the foot?								
Did the patient's interest in foot care grow after being diagnosed with diabetes?	109	49.8%	53	24.2%	21	9.6%	36	16.4%

Attitudes and perceptions towards diabetic foot among 219 caregivers of diabetic patients in the Eastern Region, Saudi Arabia (Figure 1). The caregivers agreed on various warning signs for diabetic patients. The clear majority (96.8%, n = 212) indicated that foot ulcers are a danger sign, and an equally high proportion of individuals with foot color change indicated that the change is a danger sign (96.3%, n = 211). Of concern are wounds that take two weeks or longer to heal (87.7%, n = 192), blood pouring out of the sock (90.4%, n = 198), and pain and numbness in the foot (88.6%, n = 194); caregivers also agreed that these are dangerous signs. In contrast, the disagreement with these statements remained relatively low, with values ranging from 3.2% to 12.3%. These are dangerous signs.

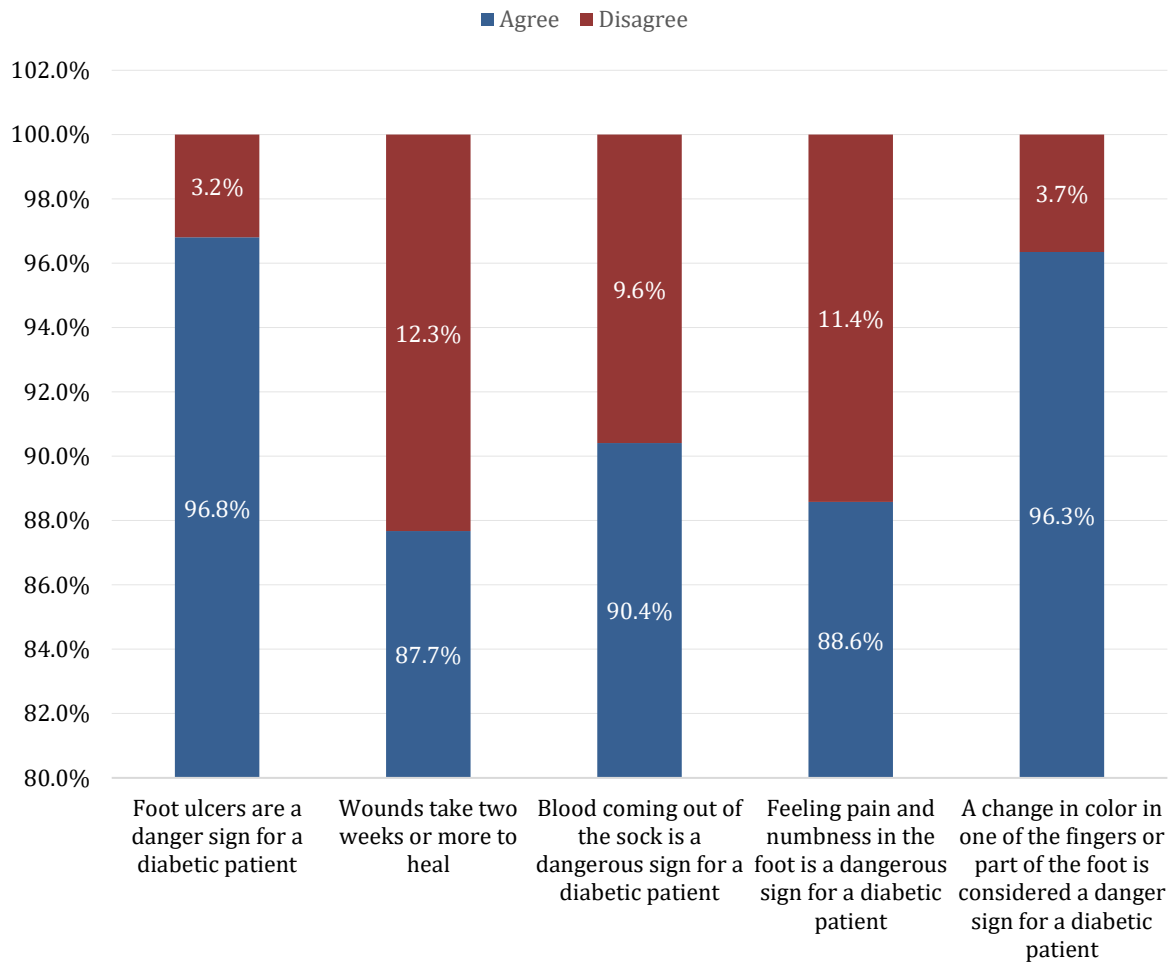

Figure 1 Attitudes and perceptions of diabetic foot health among caregivers of diabetic patients in the Eastern Region of Saudi Arabia (N=219)

Table 3 exhibits the diabetic foot care practices of 219 caregivers of diabetic patients. Foot checking: 30.1% (n=66) of patients visit a doctor specifically for foot checking. A greater percentage (44.3%, n=97) indicated that the patient comes only if they have a problem.

The frequency of foot checks varied, with 47.0% (n=103) of caregivers performing foot checks only when there was a problem and 22.4% (n=49) never checking the patient's feet. The most prevalent practice among those who routinely assessed the feet was weekly (13.2%, n = 29). More than half of the caregivers (52.1%, n = 114) stated that the patient washed their feet frequently, while 3.7% (n = 8) reported washing their feet occasionally. Washing and drying between the toes was performed by patients (42.0%, n = 92) and caregivers (6.4%, n = 14).

The use of moisturizing foot cream was reported as 'yes' by 35.6% (n=78), 'sometimes' by 25.6% (n=56), and 'no' by 16.9% (n=37). Nail trimming was widely performed (n=156, 71.2%), but 13.2% (n=29) stated that their nails were not trimmed. Walking barefoot was answered positively by 49.8% (n=121) and negatively by 50.2% (n=110) caregivers. 58.4% (n = 128) of the caregivers reported "yes" regarding the patient wearing shoes when walking. Patients reported wearing medical shoes, the most common type of shoe (47.5%, n = 104). Shoes were typically worn with socks (63.9%, n = 140), and cotton socks were the most common type of garment worn over the feet (69.2%, n = 137).

Table 3 Diabetic Foot Care Practices Among Caregivers of Diabetic Patients in the Eastern Region of Saudi Arabia (N=219)

Practice		**No**	**%**
Does the patient visit a doctor to check foot health?	Yes	66	30.1%
	If had a problem	97	44.3%
	No	28	12.8%
	I don't know	28	12.8%
How often do you examine the patient's feet?	Daily	18	8.2%
	Weekly	29	13.2%
	Monthly	20	9.1%
	If had a problem	103	47.0%
	Never	49	22.4%
Are the patient's feet washed frequently?	Yes, by the patient	114	52.1%
	Yes, I do	8	3.7%
	No	20	9.1%
	I don't know	77	35.2%
Is the area between the fingers dried after washing?	Yes, by the patient	92	42.0%
	Yes, I do	14	6.4%
	No	34	15.5%
	I don't know	79	36.1%
Does the patient use moisturizing foot cream?	Yes	78	35.6%
	Sometimes	56	25.6%
	No	37	16.9%
	I don't know	48	21.9%
Do you trim the patient's nails?	Yes	156	71.2%
	Sometimes	34	15.5%
	No	29	13.2%
Does the patient walk barefoot?	Yes	25	11.4%
	Sometimes	57	26.0%
	No	110	50.2%
	I don't remember	27	12.3%
Do you make sure that the patient wears shoes when he walks?	Yes	128	58.4%
	Sometimes	61	27.9%
	No	30	13.7%

What type of shoes does the patient wear?*	Medical shoes	104	47.5%
	Sports shoes	53	24.2%
	Formal shoes	26	11.9%
	Sandal	24	11.0%
	Slippers	84	38.4%
	I don't know	29	13.2%
Does the patient wear socks with shoes?	Yes	140	63.9%
	Sometimes	36	16.4%
	No	21	9.6%
	I don't know	22	10.0%
If yes, types of socks*	Cotton	137	69.2%
	Wool	28	14.1%
	Silk	8	4.0%
	I don't know	50	25.3%

* Percentages exceed 100% due to multiple responses.

Table 4 Clinical Features and Complications in Diabetes Patients. The majority of caregivers (n = 164, 74.9%) also perceived patients as having well-controlled diabetes, indicating blood sugar levels within the range of acceptable values and medication adherence. In contrast, 9.6% (n = 21) stated that patients had diabetes complications, and 15.5% (n = 34) declared themselves uncertain about the patient's condition. A large number of study subjects had a previous history of foot ulcers (21.9%, n=48), while 56.6% (n=124) and 21.5% (n=47) indicated 'no' or 'unsure,' respectively, in response to the question about previous foot ulcers. Additionally, a smaller proportion (5.9%, n = 13) had a prior amputation.

Table 4 Patient Health Status and Complications Among Diabetic Patients in Eastern Region, Saudi Arabia (N=219)

Items	**No**	**%**
What is the condition of the patient with diabetes?		
Good in the sense that his blood sugar level is balanced and he is adhering to his medications	164	74.9%
Evil in the sense of suffering from diabetes complications	21	9.6%
I don't know	34	15.5%
Has the patient ever had foot ulcers?		
Yes	48	21.9%
No	124	56.6%
I don't know	47	21.5%
Does the patient have an amputated part?		
Yes	13	5.9%
No	206	94.1%

Table 5 associated factors of caregivers' knowledge and awareness of diabetic foot care. A statistically significant association (p=0.046) was found between caregivers' relationship to the person with diabetes and the perceived knowledge level (Table 5). The best-informed caregivers were friends of the diabetic (27.3%), while the least informed were siblings of the patient (6.9%). Perceived knowledge (p=0.049) was also statistically significantly associated with educational level. Caregivers with postgraduate education (27.3%) were more aware than caregivers with general education (14.5%) or university education (15.1%). Demographic characteristics, including age, sex, work status, monthly income, marital status, and whether the caregiver has diabetes, were not associated with perceived knowledge about diabetic foot care.

Table 5 Factors associated with caregivers' knowledge and awareness about diabetic foot care

Factors	Do you think you have enough information about diabetic foot?						p-value
	Yes		Somewhat		No		
	No	%	No	%	No	%	
Age in years							
18-30	14	15.1%	53	57.0%	26	28.0%	.772
31-40	7	20.6%	17	50.0%	10	29.4%	
41-50	5	12.8%	27	69.2%	7	17.9%	
51-60	4	11.8%	22	64.7%	8	23.5%	
> 60	4	21.1%	9	47.4%	6	31.6%	
Gender							
Male	10	17.2%	34	58.6%	14	24.1%	.879
Female	24	14.9%	94	58.4%	43	26.7%	
Educational level							
General education	10	14.5%	46	66.7%	13	18.8%	.049*^
University education	21	15.1%	77	55.4%	41	29.5%	
Graduate degree	3	27.3%	5	45.5%	3	27.3%	
Work status							
Not working	14	19.4%	41	56.9%	17	23.6%	.238
Student	8	13.8%	31	53.4%	19	32.8%	
Employee	12	14.8%	48	59.3%	21	25.9%	
Free work	0	0.0%	8	100.0%	0	0.0%	
Monthly income							
< 5000 SR	17	15.6%	64	58.7%	28	25.7%	.268^
5000-10000 SR	9	17.0%	34	64.2%	10	18.9%	
10000-20000 SR	5	10.4%	25	52.1%	18	37.5%	
> 20000 SR	3	33.3%	5	55.6%	1	11.1%	
Marital status							
Single	14	17.5%	40	50.0%	26	32.5%	.278
Married	17	13.6%	81	64.8%	27	21.6%	
Divorced/widow	3	21.4%	7	50.0%	4	28.6%	
Relationship with the person with diabetes							
Parents	5	11.9%	27	64.3%	10	23.8%	.046*^
Brother/sister	1	10.0%	4	40.0%	5	50.0%	
Siblings	2	6.9%	23	79.3%	4	13.8%	
Relative	8	14.8%	29	53.7%	17	31.5%	
Friend	6	27.3%	9	40.9%	7	31.8%	
Others	12	19.4%	36	58.1%	14	22.6%	
Do you have diabetes?							
Yes	7	16.7%	27	64.3%	8	19.0%	.517
No	27	15.3%	101	57.1%	49	27.7%	

P: Pearson X2 test *^: Exact probability test*

** P < 0.05 (significant)*

4. DISCUSSION

This study was conducted among 219 caregivers of diabetic patients in the Eastern Region of Saudi Arabia. The mean age of caregivers was 18 to 30 years, female, and they had a university-level education. Many of the caregivers were employed, but others were unemployed or students. The majority (49%) had a monthly income of less than 5,000 SR. Most caregivers were married. The type of connection between diabetic patients and their caregivers was varied, but the most common relationship type was "other," followed by relatives and parents. The percentage of those who smoked was low, and an equal proportion of caregivers also had better diabetes. Aiding patients and caregivers is key to all diabetes care.

A knowledge and awareness gap is found in our study of diabetic foot care among caregivers of patients with diabetes. Not all caregivers knew enough about diabetic foot care. However, most considered their expertise "somewhat adequate," and a quarter stated that they did not possess sufficient knowledge. These results underscore the need for strong training programs for caregivers who play such a crucial role in the health of people with diabetes. Other studies found similar results, including (Vandenbosch et al., 2018). Most of the caregivers do not have much information about diabetic foot care, which can affect the patients in a mal manner and lead to an increased number of patients with ulcers and/or amputations.

This finding aligns with our study, which identified that several caregivers desired more information, highlighting a significant knowledge deficit in the domain of diabetic foot education. In the study, just over half the caregivers reported a doctor explained the importance of foot care after a diagnosis or a doctor's visit. A third, however, was unsure whether such an explanation had occurred, while others said it hadn't. As seen in other studies, this suggests that the caregiver and the health worker may not be communicating effectively. Hasnain and Sheikh, (2009) state that education provided to patients and their caregivers by healthcare professionals offers excellent knowledge of diabetic complications, particularly those affecting the feet.

Surprisingly, of diabetes diagnoses, more than half of the caregivers noted an increase in interest in foot care among patients. So, given the right information, support, and context, a diagnosis can truly act as a powerful catalyst for behavior change. Lincoln et al., (2008) found identical results, indicating that the greater interest of patients and caregivers in foot care stemmed from their diabetes diagnosis. However, sustained interest in an area necessitates education and reinforcement over time. The challenges in educating diabetic foot care are consistent with existing literature. A survey by Boulton et al., (2005) proposed that the global problem of inadequate knowledge of diabetic foot care can provoke preventable complications such as ulcers and amputations.

Our study extends this evidence by exploring how diabetic care often neglects the caregiver's perspective. Our study yielded an important finding, namely that caregivers were more interested in information about the disease, suggesting that education should be tailored to their specific needs. For Saudi Arabia, Goweda et al., (2017) according to a study by 49.1% of beneficiaries received counseling on foot care, while 34% were given foot care handouts, and 34% walked barefoot. Furthermore, in Solan et al., (2016) revealed that 53.6% of patients possessed good foot care knowledge. In contrast, Al-Jarallah et al., (2020) found that participants' knowledge of foot care to be poor.

Patients' friends reported the highest level of perceived understanding, which decreased in the following order: Patient friends > patient family > patient siblings. This may indicate disconnects between the information provided to caregivers and the information patients received, influencing the quality of the care patients ultimately received. The caregiver's level of education also played a significant role, as educated caregivers (postgraduates) felt significantly better informed than those who had completed only undergraduate or basic education.

This study highlighted four major gaps in diabetic foot care practices among caregivers in Saudi Arabia. Most people see doctors for foot issues, not for annual checkups. As studies from other countries have demonstrated, foot care is often not part of caregivers' routine, and many people only examine their feet when experiencing symptoms, while some never inspect them at all (Samia and Tork, 2020). Many patients practice foot hygiene—the washing and drying of feet—but these practices are notoriously difficult to adhere to, and the existing trends show that hygienic practices are correlated with an increased incidence of foot problems (Al-Rubeaan et al., 2015).

5. CONCLUSIONS AND RECOMMENDATIONS

The results showed that most participants were young, female, and well-educated. However, most felt they had been badly informed about how to care for their feet. They were, of course, not averse to considering a few key warning signs, but their foot care habits were

inconsistent, with far too many patients waiting until something had gone wrong before seeking help. Worryingly, a high proportion of them had foot ulcers, and some had undergone amputations. The caregivers' understanding was linked to their relationships with patients and educational qualifications, but not their age or sex. However, high-risk patients are also strongly advised to maintain hygiene, while wearing proper footwear is strongly recommended. In addition, further studies are needed to improve the information provided to caregivers and patient adherence, thereby decreasing diabetic foot complications.

Abbreviations and Acronyms

DFD – Diabetic Foot Disease
DFU – Diabetic Foot Ulcer
DM – Diabetes Mellitus
LLA – Lower Limb Amputation
QOL – Quality of Life

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Author Contributions

Details of the contribution of each author regarding manuscript work & production.

Ethical approval

The study was approved by the Medical Ethics Committee of King Faisal University, with the reference number is KFU-REC-2025-JAN-ETHICS2812.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

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Conflict of interest

The authors declare that there is no conflict of interests.

Data and materials availability

All data sets collected during this study are available upon reasonable request from the corresponding author.

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