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Knowledge and practice of diabetic foot care and the prevalence of diabetic foot ulcers among diabetic patients of selected hospitals in the Volta Region, Ghana

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Abstract

Diabetic foot ulcers (DFUs) are a common but serious complication of diabetes mellitus (DM). The factors distressing the worth of diabetic foot care (DFC) are knowledge and practice. Foot ulcers are the main cause of amputation and death in people suffering from DM. This study assessed the knowledge and practice of DFC and the prevalence of DFUs and its associated factors among diabetic patients of selected hospitals in the Volta Region, Ghana. A multihospital-based cross-sectional study was conducted among 473 patients with DM who were recruited using the systematic sampling method. Data were collected using a validated, pretested, and structured questionnaire, while medical variables were obtained from patient folders and analysed using SPSS version 23. All statistically significant parameters in bivariate analysis were incorporated in the multivariate logistic regression analysis. The results showed that 63% of diabetic patients had good knowledge of DFC, while 49% competently practiced it. A negative correlation was found between knowledge and practice levels of DFC ($r = -0.15$, $P = <.01$). The prevalence of DFUs was 8.7% among the studied diabetic patients. Male diabetic patients were 3.4 times more likely to develop DFUs than female diabetic patients (crude odd ratio [cOR] = 3.35; 95% confidence interval [CI] = 1.75-6.43; $P = <.001$). Type 1 diabetic patients were five times more likely to develop DFUs than those who had type 2 diabetes (cOR = 5.00; 95% CI = 2.50-10.00; $P = <.001$). Diabetic patients who had a family history of diabetes were 4.7 times more likely to develop DFUs than those without family history (adjusted odd ratio [aOR] = 4.66; 95% CI = 1.55-13.89; $P = .006$). Those who had diabetes for 5 to 10 years were 3.3 times more likely to develop DFUs than those who had diabetes for less than 5 years (aOR = 3.28; 95% CI = 1.40-7.67; $P = .006$). Diabetic patients who had comorbidity were 3.4 times more

likely to develop DFUs than those without comorbidity (cOR = 3.35; 95% CI = 1.74-6.45; $P = <.001$). The study found that there was good knowledge but poor practices of DFC among patients. Health care providers are expected to better educate patients and emphasise self-care practices to patients. Health care providers should also give more attention to patients with associated risk factors to avoid further complications and reduce the occurrence of DFUs.

KEYWORDS

diabetes mellitus, diabetic foot care, diabetic foot ulcers, knowledge, practices

Key Messages

- this study established good knowledge but poor practices of diabetic foot care (DFC). A negative correlation was observed between knowledge and practice levels of DFC
- gender, type of diabetes, family history of diabetes, diabetes duration, and comorbidity were risk factors strongly linked to diabetic foot ulcers (DFUs)
- health care professionals should give proper attention to patients with associated risks factors, especially patients who had diabetes for a longer time, to avoid further complications and to lower the prevalence of DFUs

1 | INTRODUCTION

Diabetes mellitus (DM) is a metabolic disorder characterised by prolonged hyperglycaemia.[1,2] Either there is insufficient insulin being manufactured or there is tissue insensitivity to insulin.[3] Globally, about 422 million individuals have diabetes.[4] The majority of them are from developing countries.[4] It is estimated that the figure will increase 1.4 times by 2045 due to a sedentary lifestyle and changing dietary patterns.[5,6] Prolonged hyperglycaemia results in several DM complications, such as peripheral neuropathy, peripheral vascular disease, foot ulcers, high risk of sepsis, poor wound healing, and limb amputations.[3,7] Diabetic neuropathy often leads to the development of diabetic foot ulcers (DFUs),[8,9] where a thickened wound at the balls of the feet forms regardless of the duration.[10] Foot ulcer is the most common, but serious and costly complication of DM,[11-13] accounting for 7% to 11% of all hospital admissions in diabetic patients.[3,7,14] This affects societies and leaves a huge financial impact on low-income families and the health care system in developing nations.[7,15]

The consequence of DFUs is amputation.[3] An estimated 52% to 68% of diabetic patients with amputation experienced stable frailty, loss of movement, and significant reduction in the lifespan.[3,11,16] Inferior extremity amputations are greater in DM patients than in non-DM patients.[17] A study by Ignatyeva et al showed the higher cost of medical care for DM patients with DFUs than those with no DFUs. The study also observed increased severity in DFUs than those with foot ulcers not caused by DM.[11] The global prevalence of DFUs ranged from 1.6% to 8.0%.[18] This is expected to reach 19% by 2045.[11] In Ghana, DFU prevalence was at 3.8[19] to 11%.[10] Singh et al reported that 11% to 14% of diabetic patients will develop foot ulcers, and about 6% to 23% of the foot ulcers may worsen and eventually lead to amputation.[20]

Patients with DFUs have a prospect of a longer period of convalescence, poor glycaemic control, and comorbidities (e.g., neuropathy, peripheral vascular disease, foot deformity, infections, and inappropriate foot care by oneself[3,21-23]). Walking barefoot is common in many nations,[14] especially in Ghana. For patients with DM, especially those who already have DFUs, this poses a problem because walking barefoot worsens the foot ulcers.[24,25] The therapy that is found effective about the care of DFUs and its complications is prevention.[26,27] This involves identifying high-risk patients and educating them by health care providers through a multidisciplinary team whose members are experts in DFUs and foot care.[7,26-28] One of the primary problems affecting the quality of diabetic foot care (DFC) is the lack of sufficient and relevant knowledge and best practices.[20,29] Research studies have reported that the lack of sufficient knowledge and best practices[14,24,26,30,31] increased the patients' chances of suffering from diabetic foot complications.[26,32] To minimise complications, especially those that may lead to an amputation, diabetic patients should learn proper foot care.[30,33,34] Studies have shown that the

development of DFUs is influenced by several factors such as age, educational background, weight, DM type, foot care hygiene or practices, and the existence of complex nerves disorders.[15,35,36] However, even with measures taken to prevent complications, which were also found to be cost-effective, DFUs persist, becoming a challenge for the patient and the health care system.[37] Foot care education has not been given the importance it deserves. Many patients only realised the need for it after they had developed a foot ulcer or they already had an amputation, both of which could have been prevented through proper and timely intervention. The noticeable rise in the cases of diabetic patients developing foot ulcers requires concrete action that is founded on epidemiological knowledge, evidence-based care, and efficient protective approaches that are specific to each patient.[38-40] No scientific paper has yet been published regarding knowledge and practices of DFC and the prevalence of DFUs among diabetic patients receiving treatment in selected hospitals in the Volta Region, Ghana. This is despite the rise in the cases of DFUs in the region. Therefore, this study assessed the knowledge and practices of DFC and the prevalence of DFUs and its associated factors among diabetes patients receiving treatment in selected hospitals in the Volta Region, Ghana.

2 | MATERIALS AND METHODS

2.1 | Study setting

The study was conducted at four selected hospitals in the Volta Region, Ghana. These are Ho Teaching Hospital, Ho Municipal Hospital, Hohoe Municipal Hospital, and Margret Marquart Catholic Hospital. The Volta Region is one of Ghana's 16 regions, with Ho being its administrative capital.[41] It is located to the west of the Republic of Togo and east of Lake Volta.[41] It has 18 districts composed of a mix of sociocultural and multilingual groups, such as the Ewes, the Guans, and the Akans.[41]

2.2 | Study design

A multihospital-based descriptive cross-sectional study was carried out from September 2019 to December 2019 in three secondary hospitals and one tertiary hospital in the Volta Region. The study design described a phenomenon that exists naturally and helped in thoroughly and accurately gathering facts and information about the current study and drawing possible conclusions. This design was appropriate because the study aimed to assess the quality of the existing knowledge and practices about DFC and the prevalence of DFUs and related factors among diabetic patients.

2.3 | Study population

The study population included diabetic patients who served as the respondents and were given schedules for their visits to the diabetic clinic at the outpatient department (OPD) of the selected hospitals.

2.4 | Eligibility criteria

The respondents were DM patients who were asked for their consent to participate in the study. The following patients were excluded from the study: diabetic patients who were extremely sick, gestational diabetes patients, diabetic patients who had painful ulcers and were unable to communicate, and those who dissented from participating in the study.

2.5 | Sample size determination

The average monthly attendance of diabetic patients at the diabetic clinics in the selected hospitals was used in determining the sample size. On average, the following are the number of diabetic patients who were attended to in the selected hospitals: 135 (Ho Teaching Hospital), 103 (Ho Municipal Hospital), 210 (Hohoe Municipal Hospital), and 180 (Margret Marquart Catholic Hospital). For 2 months, the expected total attendance was 1256. The sample size was determined using Yamane's formula: $n = N/1 + N(e^2)$,[42] where n = sample size, N = population size, e = margin of error (5%), plus 10% non-response and a recommended smallest sample of 334 was calculated.

2.6 | Sampling technique and procedure

A systematic sampling technique was employed to collect the data. An accurate representation of the average monthly attendance was obtained, which lessened the effects of bias during data collection at the selected health facilities. This was done by dividing the total study population by the required sample size to get the fraction (d), $d = N/n = 1256/334 = 3.76$. We used the concept of systematic sampling. Every fourth patient on the register was contacted and asked to participate in the study from patient one to patient four. The interview began with the fourth patient at the clinic. This continued by enrolling every fourth patient based on the schedule after the departure of the last one attended to. A total of 513 questionnaires were sent out, with 473 (92.2%) completely filled out and used for the analysis.

2.7 | Data collection tool

A validated, pretested, and structured questionnaire was designed based on earlier studies and divided into four parts: socio-demographic data, clinical variables, knowledge, and practices of DFC.[10,15,30,36] The socio-demographic data obtained included the age, gender, marital status, educational level, occupation, and average monthly income of the respondents. Clinical factors comprised type of diabetes, family history of diabetes, duration of sickness, presence of foot ulcer, comorbidities, and diabetes treatment. These were validated using patient records. The questions on knowledge and practices of DFC were adapted and standardised according to the American Diabetes Association, which is used in nationwide diabetes training course,[43] the Nottingham Assessment of Functional Foot Care,[44] the American College of Foot and Ankle Surgeons,[45] and international consensus recommendation guidelines for DFC[46,47] and used in earlier research studies.[2,14,37,48,49] The questionnaire was translated into the local dialects of the respondents. This was done by proficient decoders and the main investigators.

2.8 | Assessment of knowledge and practices of DFC

The third part is comprised of 10 items on knowledge of DFC, such as complications, risk factors, prevention, and management. The dichotomous question type required a "true" or "false" response. The fourth part consisted of 10 statements on the practices of DFC, such as cleaning and drying the feet, taking care of the nails and skin, wearing appropriate footwear, and inspecting the feet regularly. The questions were answerable by "yes" or "no." In the study, each correct response was given 1 point, while the wrong response was given 0 point. The level of DFC knowledge and practices, either good or poor, was based on a total tally of 10 for each knowledge and practice questions. A cumulative cut-off score (0-6), ≤60% of the correct answers was considered "poor," while (7-10) ≥70% was considered "good".[14,26,38]

2.9 | Data quality assurance

Face and content validation of the questionnaire was done by six experts on the subject. The questionnaire was pretested on 10 diabetic patients at Ho Polyclinic to test the comprehension of the questions. The responses obtained from the pretesting were used to improve the questionnaire by making the questions more straightforward, relevant, and clear. The approved and certified questionnaire was administered through face-to-face interviewers and conducted by five researchers. The collected data were analysed for accuracy and kept in locked files, with the copies also secured on the computer by the main researchers.

2.10 | Statistical analysis

Questionnaires were checked manually for completeness before the data were entered into Microsoft Excel 2016 spreadsheet. IBM SPSS (ver 23.0) was used for statistical analysis. Descriptive statistics composed of frequencies and percentages were computed. DFU variations were carried out through the Chi-square (χ^2) test, or the Fisher's exact test where appropriate. All statistically significant parameters in bivariate analyses were appended into multivariate logistic regression analyses. A level of $P < .05$ was deemed significant. Pearson correlation coefficient (r) was calculated to determine the association between DFC and the study parameters.

2.11 | Ethical considerations

Ethical clearance was obtained from the Research Ethics Committee (REC) of the University of Health and Allied Sciences (UHAS), Ho (UHAS-REC No: A.1[16]19-20), as well as written approval from the management of the selected health facilities. Permission was also obtained from each study respondent. The objectives of the research were explained using the language of the respondents. Informed consent was given by the respondent through a signature or thumbprint. To ensure confidentiality, no spaces were provided for names and other personal identification. All questionnaires were filled out one by one to ensure privacy.

3 | RESULTS

3.1 | Socio-demographic and clinical characteristics

A total of 473 diabetic patients were listed as respondents of the study. The majority (n = 349; 73.8%) of diabetic patients were females. About 249 (52.6%) of diabetic patients aged above 49 years old and 423 (89.4%) were married. Regarding educational attainment, 185 patients (39.1%) had secondary education. Over half (n = 252; 53.3%) of the diabetic patients were self-employed. Most (n = 207; 43.8%) of the diabetic patients

TABLE 1 Socio-demographic and clinical data of diabetes patients (n = 473)

Parameter	Frequency	Percentage
Total	473	100
Gender		
Male	124	26.2
Female	349	73.8
Age group		
<30 y	52	11.0
30-39 y	33	7.0
40-49 y	139	29.4
>49 y	249	52.6
Marital status		
Single	34	7.2
Married	423	89.4
Other[a]	16	3.4
Educational status		
None	106	22.4
Basic	127	26.8
Secondary	185	39.1
Tertiary	55	11.6
Employment status		
None	99	20.9
Formal	122	25.8
Informal	252	53.3
Average monthly income		
<500 Cedis	103	21.8
500-1000 Cedis	207	43.8
>1000 Cedis	163	34.5
Type of diabetes		
Type 1	71	15.0
Type 2	402	85.0
Family history of diabetes		
Yes	89	18.8
No	384	81.2
Duration of diabetes		
<5 y	170	35.9
5-10 y	247	52.2
>10 y	56	11.8
Presence of foot ulcer		
Yes	41	8.7
No	432	91.3
Comorbidity		
Yes	152	32.1
No	321	67.9
Diabetes treatment		
Diet	81	17.1
Insulin	34	7.2
Oral hypoglycaemic agents (OHAs)	196	41.4
OHAs and insulin	162	34.2

[a]Divorced/Widowed.

earned an average monthly income between GHc500 and GHc1000. Concerning their type of diabetes, 402 (85.0%) had type 2 diabetes. Only 89 (18.8%) diabetic patients had a family history of diabetes. Over half (n = 247; 52.2%) were diabetic patients for 5 to 10 years. Foot ulcers were observed in 41(8.7%) diabetic patients. More than one-third (n = 152; 32.1%) had comorbidities, including other diseases. Most (n = 196; 41.4%) of the diabetic patients were on OHAs diabetes treatment (see Table 1).

3.2 | Knowledge of DFC

Approximately three-quarters (n = 352; 74.4%) were aware that diabetic patients are at high risk for developing foot ulcers. The majority (n = 310; 65.5%) knew that diabetic patients should see a specialist when they develop sores on their feet. About 338 (71.5%) were aware that diabetic patients should keep their feet moisturised by applying cream. The majority (n = 363; 76.7%) were aware that diabetics develop a loss of sensations in their feet. About 347 (73.4%) were aware that diabetic patients should take their drugs frequently to avoid complications. Over half (n = 311; 65.8%) were aware that diabetic patients should examine their feet every day. Most (n = 274; 57.9%) of the diabetic patients knew that diabetes causes reduced blood flow to the legs. Above half (n = 301; 63.6%) of the diabetic patients were aware that uncontrolled diabetes can lead to poor vision. Also, 393 (83.1%) of diabetic patients knew that poor care of diabetic foot can lead to ulcer and amputation. More than half (n = 310; 65.5%) were aware that diet can be used in the management of diabetes (see Table 2).

3.3 | Practices of DFC

According to the data obtained from the questionnaires, the majority (n = 338; 71.5%) of diabetic patients washed their feet regularly. More than half (n = 293 61.9%) checked their feet every day for injury. However,

TABLE 2 Knowledge of diabetic foot care

Statement	Responses n (%)	
	True	False
DM patients at risk of foot ulcers	352 (74.4)	121 (25.6)
DM patients should see a specialist when developing sore on feet	310 (65.5)	163 (34.5)
Diabetics must keep their feet flexible with a cream	338 (71.5)	135 (28.5)
Diabetics develop an absence of sensations in their feet	363 (76.7)	110 (23.3)
DM patients must take drugs frequently to avoid complications	347 (73.4)	126 (26.6)
Diabetics should examine their feet every day	311 (65.8)	162 (34.2)
Diabetes causes reduced blood flow to the legs	274 (57.9)	199 (42.1)
Uncontrolled diabetes can lead to poor vision	301 (63.6)	172 (36.4)
Poor care of diabetic foot can lead to ulcer and amputation	393 (83.1)	80 (16.9)
Diet can be used in the management of diabetes	310 (65.5)	163 (34.5)

Abbreviation: DM, diabetes mellitus.

TABLE 3 Practices of diabetic foot care

Question	Answers n (%)	
	Yes	No
Wash feet regularly	338 (71.5)	135 (28.5)
Check feet every day for injury	293 (61.9)	180 (38.1)
Wash feet with a hot water	318 (67.2)	155 (32.8)
Walk bare-footed at least once every day	340 (71.9)	133 (28.1)
Trim nails with a sharp device	322 (68.1)	151 (31.9)
Inspect shoes before wearing them	289 (61.1)	184 (38.9)
Wear shoes without socks	238 (50.3)	235 (49.7)
Dry foot after washing it	280 (59.2)	193 (40.8)
Wear closed-tight shoes or high heels	369 (78.0)	104 (22.0)
Feel tight in shoes	293 (61.9)	180 (38.1)

318 (67.2%) washed their feet with warm water. The majority (n = 340; 71.9%) of diabetic patients walked barefoot at least once every day. Over half (n = 322; 68.1%) trimmed their nails with a sharp device; 289 (61.1%) inspected their shoes before wearing them; 238 (50.3%) wore shoes without socks; and 280 (59.2%) dried their foot after washing it. Also, 369 (78.0%) wore closed-tight shoes or high heels. The majority (n = 293; 61.9%) felt tight in their shoes (see Table 3).

3.4 | Levels of knowledge and practices of DFC

Based on the data gathered, the majority (n = 298; 63.0%) had good knowledge of DFC, while 241 (51.0%) had poor DFC practices (see Figure 1A). The Pearson coefficient correlation indicated a negative correlation between the knowledge score and the practices score ($r = -0.15$, $P = <.01$) (see Table 4). This correlation is similar for the 134 out of 473 diabetic patients taking part in this study whose scores for the knowledge and practices of DFC were different (see Figure 1B).

3.5 | Factors associated with DFUs

Age, marital status, educational attainment, employment status, average monthly income, diabetes treatment, and knowledge and practices of DFC were not remarkably linked to the development of DFUs. The predictors of DFUs were gender, type of diabetes, family history of diabetes, duration of diabetes, and the presence of comorbidities (see Table 5). Male diabetic patients were 3.35 times more likely to develop DFUs compared with female diabetic patients (crude odd ratio [cOR] = 3.35; 95% confidence interval [CI] = 1.75-6.43; $P = <.001$). The odds of developing DFUs increased five times for diabetic patients with type 1 diabetes likened to type 2 (cOR = 5.00; 95% CI = 2.50-10.00; $P = <.001$). The diabetic patients who had a family history of diabetes were 4.66 times more likely to develop DFUs than those without a family history (adjusted odd ratio [aOR] = 4.66; 95% CI = 1.55-13.89; $P = .006$). Patients who had diabetes for 5 to 10 years were 3.28 times more likely to develop DFUs than those who had diabetes for less than 5 years (aOR = 3.28; 95% CI = 1.40-7.67; $P = .006$). Diabetic patients who had comorbidities were 3.35 times more likely to develop DFUs than those without comorbidities (cOR = 3.35; 95% CI = 1.74-6.45; $P = <.001$) (see Table 6).

4 | DISCUSSION

This present study assessed the knowledge and practices of DFC and the prevalence of DFUs and its associated factors among diabetes patients receiving treatment in selected hospitals in the Volta Region, Ghana. DFC aids in the prevention of nerve disorders and vascular deficiency that are complications of DM.[29] Our study showed that 63.0% of respondents had good knowledge of DFC. One possible reason may be their level of formal education, as over three-quarters of the respondents had formal

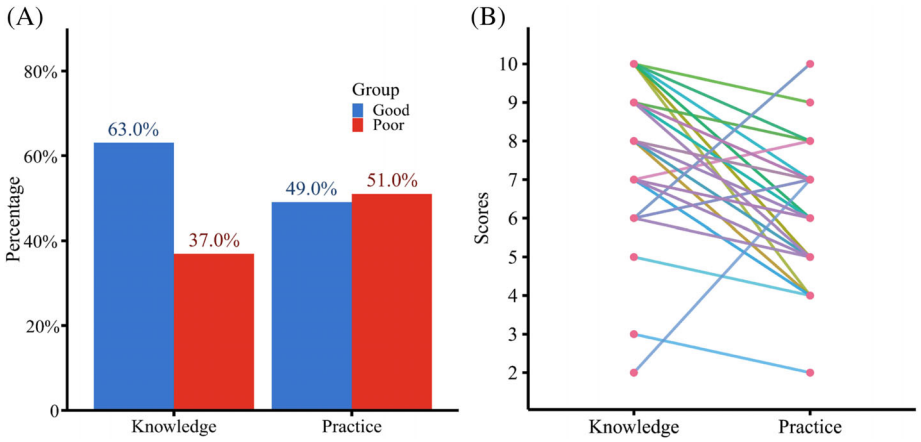

FIGURE 1 Levels of knowledge and practices of diabetic foot care

education, attended enrichment activities, and showed seriousness in acquiring knowledge regarding their condition. Similar findings were seen in Malaysia, Bangladesh, and Pakistan.[14,50,51] In other countries, the opposite is true. Studies reported poor knowledge in Saudi Arabia, Malaysia, Nigeria, Tanzania, and Iraq.[14,24,26,30,31] The factors identified as the cause for this difference in the levels of knowledge of DFC across the studies could be the type of education, the frequency of education provided by health care professionals in diverse study settings, patients' understanding, importance and relevance of the information to the patients, the methodology, and the educational attainment of the patients.

This study found that most of the respondents were aware that diabetic patients develop a loss of sensation in their feet, which concurs with a study conducted in Saudi Arabia.[52] This would help to prevent further complications among diabetic patients because a tingling sensation is one of the signs of diabetic foot complications, and its spread is caused by uncontrolled blood sugar levels. The present study revealed that a vast majority of diabetic patients were aware that they should see a specialist when sores develop on their feet, which corresponds to a study carried out in Saudi Arabia.[52] This would inform the physicians about the seriousness of the patients' condition concerning DFUs and the risk of limb amputation and they are more than likely to prescribe drugs to inhibit the progress of the condition.

The present study showed that a little over half (51%) of the diabetic patients had poor DFC practices, which is similar to the situation[26,29,30] in Nigeria, Iran, and Iraq. The likely reason for this may be non-compliance due to a busy lifestyle or everyday worries that take precedence over the patients' concern for their health. Another possible reason could be that health care professionals tasked with disseminating the information at the various secondary and tertiary care levels did not emphasise enough the serious risk to their health when they do not follow the prescribed care practices. Another reason could be that patients need more encouragement and motivation in practicing proper self-care, including lifestyle modification. Also, the respondents in this study were self-employed; therefore, their working hours may conflict with the times they were supposed to practice what they have been taught regarding DFC. In the studies conducted in Jordan and Pakistan,[48,49] proper DFC is practiced. One possible reason is that both are predominantly Muslim countries, and part of their religion's practice is to regularly wash their feet. This practice creates the opportunity for diabetic patients to inspect their feet daily, letting them detect any foot injuries. The poor practices of DFC observed in this study include washing the feet with warm water, walking barefoot every day, trimming nails using sharp tools, wearing shoes without socks, wearing closed, tight, or high-heeled shoes. These practices increased the risk of diabetic foot complications that could lead to the development of foot ulcers. Other studies attributed the poor DFC practice to inadequate knowledge of DFC among the respondents. However, in this study, the poor practices observed were due to non-compliance. Because our study showed that the majority of the diabetic patients had good knowledge. This implies additional importance should be given to these aspects while teaching diabetic patients.

Our study showed a negative correlation between knowledge and practices of DFC. This contrasts with earlier studies conducted in Nigeria, Pakistan, India, and Sri Lanka,[30,49,53,54] which found a positive correlation between knowledge and practices of DFC. The probable reason is the disparity between the knowledge and practices scores found in the present study compared with the previous ones. In the previous studies, the majority of the respondents had poor knowledge and poor practices. However, in the current study, the majority had good knowledge compared with the majority who had poor

TABLE 4 Pearson coefficient correlation showing the relationship between diabetes foot care and study variables

Variables	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1		0.15**	−0.04	−0.07	0.07	0.02	0.71**	−0.67**	−0.03	−0.18**	−0.47**	0.05	−0.02	−0.02
2	0.15**		0.04	−0.02	0.03	0.04	0.10*	−0.19**	−0.06	−0.04	−0.04	0.72**	−0.01	−0.06
3	−0.04	0.04		0.03	0.11*	0.14**	−0.09	−0.01	−0.02	−0.08	0.08	0.05	−0.04	0.05
4	−0.07	−0.02	0.03		0.00	0.05	0.01	−0.01	−0.12**	−0.03	0.04	−0.06	−0.02	0.09
5	0.07	0.03	0.11*	0.00		0.74**	0.03	−0.10*	0.18**	−0.07	−0.01	−0.03	0.03	0.08
6	0.02	0.04	0.14**	0.05	0.74**		−0.03	−0.08	0.07	−0.05	0.00	−0.02	−0.06	0.00
7	0.71**	0.10*	−0.09	0.01	0.03	−0.03		−0.63**	0.01	−0.23**	−0.61**	0.03	0.00	0.00
8	−0.67**	−0.19**	−0.01	−0.01	−0.10*	−0.08	−0.63**		0.04	0.26**	0.42**	−0.12**	−0.01	0.05
9	−0.03	−0.06	−0.02	−0.12**	0.18**	0.07	0.01	0.04		0.06	0.06	−0.03	0.01	−0.01
10	−0.18**	−0.04	−0.08	−0.03	−0.07	−0.05	−0.23**	0.26**	0.06		0.17**	−0.07	0.05	0.01
11	−0.47**	−0.04	0.08	0.04	−0.01	0.00	−0.61**	0.42**	0.06	0.17**		0.01	0.01	0.00
12	0.05	0.72**	0.05	−0.06	−0.03	−0.02	0.03	−0.12**	−0.03	−0.07	0.01		−0.08	−0.07
13	−0.02	−0.01	−0.04	−0.02	0.03	−0.06	0.00	−0.01	0.01	0.05	0.01	−0.08		−0.15**
14	−0.02	−0.06	0.05	0.09	0.08	0.00	0.00	0.05	−0.01	0.01	0.00	−0.07	−0.15**	

Note: 1 = Gender, 2 = age group, 3 = marital status, 4 = educational status, 5 = employment status, 6 = average monthly income, 7 = type of diabetes, 8 = family history of diabetes, 9 = duration of diabetes (years), 10 = presence of foot ulcer, 11 = comorbidity, 12 = diabetes treatment, 13 = KDFC, 14 = PDFC.

Abbreviations: KDFC, knowledge of diabetic foot care; PDFC, practices of diabetic foot care.

*$P < .05$.

**$P < .01$.

TABLE 5 Univariate analysis of study variables associated with diabetic foot ulcers

Variable	Diabetic foot ulcer		χ^2	*P* value
	Yes n (%)	No n (%)		
Gender			14.51	<.001**
Male	21 (51.2)	103 (23.8)		
Female	20 (48.8)	329 (76.2)		
Age group			4.10	.251
<30 y	8 (19.5)	44 (10.2)		
30-39 y	2 (4.9)	31 (7.2)		
40-49 y	9 (22.0)	130 (30.1)		
>49 y	22 (53.7)	227 (52.5)		
Marital status			3.10	.213
Single	5 (12.2)	29 (6.7)		
Married	36 (87.8)	387 (89.6)		
Divorced	0 (0.0)	16 (3.7)		
Educational status			2.35	.502
None	9 (22.0)	97 (22.5)		
Basic	15 (36.6)	112 (25.9)		
Secondary	13 (31.7)	172 (39.8)		
Tertiary	4 (9.8)	51 (11.8)		
Employment status			5.24	.073
None	14 (34.1)	85 (19.7)		
Formal	7 (17.1)	115 (26.6)		
Informal	20 (48.8)	232 (53.7)		
Average monthly income			2.66	.264
<500 Cedis	13 (31.7)	90 (20.8)		
500-1000 Cedis	15 (36.6)	192 (44.4)		
>1000 Cedis	13 (31.7)	150 (34.7)		
Type of diabetes			24.62	<.001**
Type 1	17 (41.5)	54 (12.5)		
Type 2	24 (58.5)	378 (87.5)		
Family history of diabetes			30.86	<.001**
Yes	21 (51.2)	68 (15.7)		
No	20 (48.8)	364 (84.3)		
Duration of diabetes (years)			7.92	.019*
<5 y	8 (19.5)	162 (37.5)		
5-10 y	30 (73.2)	217 (50.2)		
>10 y	3 (7.3)	53 (12.3)		
Comorbidity			14.35	<.001**
Yes	24 (58.5)	128 (29.6)		
No	17 (41.5)	304 (70.4)		
Diabetes treatment			4.86	.182
Diet	12 (29.3)	69 (16.0)		
Insulin	2 (4.9)	32 (7.4)		

(Continues)

TABLE 5 (Continued)

Variable	Diabetic foot ulcer		χ^2	*P* value
	Yes n (%)	No n (%)		
OHAs	14 (34.1)	182 (42.1)		
OHAs and insulin	13 (31.7)	149 (34.5)		
KDFC			1.51	.283
Good	29 (70.7)	269 (62.3)		
Poor	12 (29.3)	163 (37.7)		
PDFC			0.09	.771
Good	21 (51.2)	211 (48.8)		
Poor	20 (48.8)	221 (51.2)		

Note: Significant at $^{*}p < .05$; $^{**}p < .001$.
Abbreviations: KDFC, knowledge of diabetic foot care; PDFC, practices of diabetic foot care.

TABLE 6 Bivariate and multivariate analysis of factors associated with diabetic foot ulcers among diabetic patients

Variables	Diabetic foot ulcer		Bivariate analysis		Multivariate analysis	
	Yes n (%)	No n (%)	cOR (95% CI)	*P* value	aOR (95% CI)	*P* value
Gender						
Male	21 (51.2)	103 (23.8)	3.35 (1.75, 6.43)	<.001***	12.04 (0.53, 7.83)	.297
Female	20 (48.8)	329 (76.2)	1		1	
Type of diabetes						
Type 1	17 (41.5)	54 (12.5)	5.00 (2.50, 10.00)	<.001***	0.37 (0.09, 1.47)	.158
Type 2	24 (58.5)	378 (87.5)	1		1	
Family history of diabetes						
Yes	21 (51.2)	68 (15.7)	5.62 (2.89, 10.93)	<.001***	4.66 (1.55, 13.89)	.006**
No	20 (48.8)	364 (84.3)	1		1	
Duration of diabetes (y)						
<5 y	8 (19.5)	162 (37.5)	1		1	
5-10 y	30 (73.2)	217 (50.2)	2.80 (1.25, 6.27)	.012*	3.28 (1.40, 7.67)	.006**
>10 y	3 (7.3)	53 (12.3)	1.15 (0.29, 4.48)	.844	0.93 (0.23, 3.82)	.922
Comorbidity						
Yes	24 (58.5)	128 (29.6)	3.35 (1.74, 6.45)	<.001***	1.49 (0.58, 3.82)	.408
No	17 (41.5)	304 (70.4)	1		1	

Note: Significant at $^{*}P < .05$; $^{**}P < .01$; $^{***}P < .001$.
Abbreviations: aOR, adjusted odd ratio and 1 is the reference; CI, confidence interval; cOR, crude odd ratio.

practices, which implied that the said good knowledge of the respondents did not translate into good practices.

This study's findings showed that there was 8.7% prevalence of DFUs among diabetic patients who attended diabetic clinics at the selected hospitals, which was lower compared with previous studies conducted in Ghana, Ethiopia, and India whose prevalence rate was 11.0%, 13.6%, and 14.0%, respectively.[10,15,55] The prevalence rate in the present research was, however, greater than that reported in Ghana, Jordan, and Saudi Arabia, whose prevalence rate was 3.8%, 2.1%, and 3.3%, respectively.[19,25,56] The disparity in the prevalence rates of foot ulcers may be the variation in the study variables and study populations. The prevalence of foot ulcers observed in the present research could be attributed to the research being conducted in hospitals that provided referral services for patients with serious health conditions across the Volta Region in Ghana.

In the univariate analysis, knowledge and practices of DFC were not significant predictors of DFUs, which contradicts[15] the study conducted in Ethiopia, which found the occurrence of DFUs to be linked to lack of proper foot care practices by the patients. The correlation between the two studies is almost non-existent even though both studies reported high scores on knowledge and on poor practices of DFC. The possible explanation may be the difference in the study population, setting, and cut-off used.

This study showed that male diabetic patients were 3.4 times more likely to develop DFUs compared with females, which is homogeneous to previous research studies in Taiwan, Saudi Arabia, and Sri Lanka.[5,56,57] The possible explanation is the degree of social responsibility between males and females in the areas of study, where males were mostly farmers and manual labourers working outside the home, and standing on their feet for extended periods as well as wearing very tight or uncomfortable footwears that exert pressure on their feet compared with females who spend the majority of their time inside houses, offices, and shops, which put less pressure on their feet because they can sit and rest their feet longer. Studies in Taiwan and Iran[5,58] revealed that diabetic patients who were employed or performing working in whatever capacity were likely to develop DFUs than those who are unemployed. This differed from the current study, where employment status was not linked to the development of DFUs.

The type of DM a patient has is one of the strongest factors connected to the incidence of DFUs.[15] Patients with type 1 diabetes were five times more likely to develop DFUs than those who had type 2 diabetes. This finding contradicts earlier studies performed in Egypt and Ethiopia,[15,59] which found a correlation between type 2 diabetes and the development of DFUs. The probable reason is that type 1 diabetic patients had an insulin deficiency, which resulted in complications such as the hardening of arteries and peripheral vascular disease. These complications led to declined blood flow in the arteries and veins of the patient, further causing the stiffening of the capillary extracellular supporting layer, resistance privation, accumulation of triglycerides, and forming an obstruction that could lead to ischaemia.

The findings of this study showed that diabetic patients with a family history of diabetes were 4.7 times more likely to develop DFUs than those without, which concurs with the research performed in China.[60] Xiong et al found a strong link between a family history of diabetes and diabetic foot complications, specifically among diverse groups of families with diabetes. A family with at least one person who had diabetes were 1.4 times at risk of developing diabetic foot complications than those with no family history of diabetes.[60] This association is likely because a family history of diabetes means that there exist copies of both genetic material and ecological sequels from parents that were inherited by the children. Genomic and tribal elements contribute to the occurrence of DFUs in patients who have a family history of diabetes. Many studies have reported that the inherited traits from parents or relatives could be a possible cause for diabetic foot complications such as foot ulcers.[60-62]

Having diabetes for several years is another risk factor for developing DFUs.[25-27] The result of the current study showed that patients who had been diabetic for 5 to 10 years were 3.3 times more likely to develop DFUs than those who had it for less than 5 years. This finding corresponds to prior research studies conducted in Malawi, Ethiopia, India, and the United Arab Emirates.[3,36,63,64] This relationship could be highlighted by pointing out that patients who have been diabetic for a long time were at higher risk of developing DFU due to poor glycaemic control. This often progresses to chronic diabetic complications such as circulatory system disorders, damage in one or more nerves, and vision impairment, as well as diseases affecting the kidneys.

Having comorbidity is another factor strongly linked to the development of foot ulcers in diabetic patients.[3] Diabetic patients with comorbidity were 3.4 times more likely to develop DFUs than those without comorbidity. This association can be explicated by the pathophysiology of diabetes wherein diabetic patients with an uncontrolled sugar level were likely to develop microvascular complications and nerve damage. The manifestation of nerve damage may exacerbate foot ulcers due to increased pressure on the blood vessels. These long-term complications are a threat to diabetic patients due to the prolonged use of several medications, which delay treatment and cause the development of DFUs.[15]

One of the study's strengths is that it is the first study to assess the prevalence of DFUs, and the level of knowledge and practice of DFC in the Volta Region of Ghana. The findings provide empirical evidence for the improvement of public health and the health care system by addressing important issues and establishing relevant health programmes in the Volta Region. The current prevalence of DFUs created an avenue for policymakers to allocate sufficient funds for hospitals to facilitate proper management. The study also allowed health care providers to improve their knowledge and enforce proper self-care practice among diabetic patients. Despite this, the research has limitations. First, the research was based on a cross-sectional design, though the interview-administered questionnaire was validated and clinical data were obtained from patient records, the results should be analysed with discretion because of

recollection bias about the knowledge and practices. Second, hospital-based studies cannot guarantee an accurate result or give an overall picture of the prevalence of DFUs, knowledge and practice of DFC of the communities because some patients may not be able to attend their diabetic clinics during the study period.

5 | CONCLUSION

This study observed good knowledge but poor practice of DFC among diabetic patients. A negative correlation was also noted between knowledge and practice levels of DFC. The prevalence of DFUs was 8.7% among diabetic patients. Gender, type of diabetes, family history, length of time that a patient has diabetes, and comorbidity were factors strongly linked to DFUs. Health care workers are expected to better educate patients and emphasise the importance of following proper DFC practices. Health care professionals should give proper attention to patients with associated risk factors, especially patients who had diabetes for a longer time, to avoid further complications and to lower the prevalence of DFUs. Further studies are called for in other health facilities to support the study's findings.

CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

DATA AVAILABILITY STATEMENT

The datasets generated during and/or analyzed during the current study are not publicly available due to ethical consideration but are available from the corresponding author on reasonable request.

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