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Article

Knowledge and practice of diabetic foot prevention among diabetic patients attending Edward Francis Small Teaching Hospital, Banjul, The Gambia: an institutional-based cross-sectional study

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Abstract: Background: The increasing prevalence of Diabetes Mellitus (DM) is closely tied to complications, particularly diabetic foot ulcers, which significantly raise the risk of lower extremity amputations due to infected, non-healing ulcers. This study aimed to assess diabetic foot prevention knowledge, practices and associated factors among patients at the Edward Francis Small Teaching Hospital (EFSTH), Banjul. **Methods:** In this cross-sectional study, we employed a convenience sampling technique to enroll 357 diabetic patients, both inpatients and outpatients, who were under the care of EFSTH. Data on diabetic foot prevention were collected through semi-structured interviews conducted by trained interviewers. Statistical analyses were carried out using SPSS, encompassing descriptive analysis, chi-square, Fisher exact tests, and logistic regression. Statistical significance was set at $p<0.05$, with a 95% confidence interval. **Results:** The mean age of the respondents was 47.3 years (±10.5), with women comprising 55.2% of the study population and 94.4% were married. About 73% demonstrated good knowledge of diabetic foot care and prevention, while 25.8% exhibited fair knowledge. A significant association was observed in bivariate analysis with patients' educational level (P = 0.032). Specifically, patients with Madarasa (Arabic) education had a 68% lower likelihood [aOR: 0.320, 95% CI: (0.103, 0.992), p = 0.048] of practicing diabetic foot care and prevention compared to those with tertiary education. **Conclusion**: The study revealed that participants' knowledge of preventing diabetic foot was high. However, the practice was poor. Therefore, there is a need for more health education on the practices that would emphasize diabetes management among diabetes patients.

Keywords: Knowledge, Practice, Diabetes, Diabetic foot, Prevention of diabetic foot

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1. Background

Diabetes mellitus (DM) is a significant clinical and public health issue that only worsens. The World Health Organization (WHO) predicted that 190 million people across the world had diabetes in 2007, and that number is expected to rise to approximately 330 million by 2025 [1]. Nearly 80 percent of all non-traumatic lower limb amputations are caused by complications. Nearly a third of all diabetic patients are admitted to specialized hospitals in order to access good medical care [2]. Those with Diabetic foot ulcers (DFU) hada mortality risk of 12.1 per 100 person-years of follow-up, whereas those without foot ulcers hada death risk of 5.1 [3]. DFU is the most frequently reported and under-recognized complication of diabetes [3], which significantly declines health-related

quality of life and loss of life expectancy. Approximately 12-15 percent of the total costs associated with diabetes and up to 40 percent in developing countries are accounted for by its complications [2].

In the Gambia, the prevalence of diabetes was 22,000 in 2000 and is estimated to reach 61,000 in 2030 [4, 5]. In 2003, the prevalence was 3.7% and about 90% of all diabetes cases were type II [5]. Chronic hyperglycemia is a hallmark of the metabolic disorder known as diabetes mellitus (DM), a common but potentially crippling condition [6]. DF disease, which includes diabetic foot ulcers, is a major complication of diabetes [2, 3]. Our society's dietary habits can be improved if more people are educated about nutrition. Diet, on the other hand, has the power to alter the poor eating habits of diabetics. Diabetes patients with a positive outlook on dietary management may see improvements in their blood sugar levels. Further complications of diabetes can be avoided by following a diet prescribed by a qualified dietician [7]. Diabetic education leads to better control of the disease and is widely accepted as an essential component of comprehensive diabetes care. Despite the high prevalence of diabetes mellitus in Ethiopians, patients frequently lack the knowledge and skills to take charge of their own health care and wellbeing [8].

There is a 10-15 percent chance of developing a diabetic foot ulcer. Within six to eighteen months, the majority of foot ulcers (60–80 percent) will heal; however, 10–15 percent will be active for some time, and 5–24% will require limb amputation. Diabetes results in the loss of a lower limb somewhere in the world every 30 seconds. Non-injured lower extremities amputation (LEA) is the leading cause of amputation in the United States. About majority of the individuals require another amputation within three to five years after their first LEA [9]. Diabetic complications, like DFU and amputation, do have adverse effects on the quality of life of those with diabetes. Patients with diabetes are more likely to have lower limb amputations if they have a foot ulcer, which can be caused by barefoot walking, improper footwear, poor foot hygiene, and a delay in getting medical care [6].

Increased awareness of the disease and its complications can have a significant impact on patient compliance with treatment and the risk of developing complications [8, 10]. It has been reported that foot ulcers are prolonged complications of diabetes, which occur after an average of 13 years from the time of diagnosis in Nigerians. The rising prevalence of diabetes in the adult populations of Nigeria and Ghana in the tropics means that DFU may become more common in clinical practice [11]. Diabetics' amputation rates are 15 times higher than non-diabetics, due to foot ulcers. Disabling diabetic complications like DFU and amputation reduces patients' quality of life. Foot ulcers caused by barefoot walking, improper footwear, poor foot hygiene, and delayed medical care are more common in diabetics than non-diabetics [12].

However, little is known about what diabetic patients in The Gambia know and do to prevent the development of diabetic foot. As a result, this study will examine how well diabetic patients in Gambia understand and practice preventing diabetic foot. The findings could help policymakers improve diabetic foot management in hospitals. Thus, the paper sought to assess diabetic foot prevention knowledge and practice among EFSTH Banjul patients.

2. Methods

2.1. Study design

A cross-sectional study design was used to determine the knowledge and practice of diabetic patients regarding the prevention of diabetic foot. This study design was used because it is quick, easy to conduct, and less expensive. Additional details could be sourced from the main thesis project [13].

2.2. Study area

The Edward Francis Small Teaching Hospital (EFSTH) was built in 1853 by the British Government, formerly known as the Royal Victoria Teaching Hospital (RVTH). It is a 650 bedded tertiary hospital based in the capital, Banjul. It is the leading referral hospital in The Gambia and has become a Teaching Hospital to train Gambian doctors in country. Daily, it treats an average of nearly 650 patients. In terms of service provision, the following departments and units are within the hospital: internal medicine, pediatrics, surgery, and obstetrics/gynecology, as well as related units such as orthopedics; radiology; pathology; laparoscopic gynecology, ear, nose, and throat (ENT)| and a department of clinical, and laboratory research departments respectively.

2.3. Population

The population under study was the diabetes patients receiving diabetes care in EFSTH both on outpatient basis and on admission.

2.4. Sample size determination

Sample size estimation for this study was calculated using the Leslie Kish formula for descriptive cross-sectional study.

Minimum sample size:

$$n = \frac{Z\alpha^2 pq}{d^2}$$

Where:
n = minimum sample size
$Z\alpha$ = standard normal deviate at 95% confidence (1.96)
p = Proportion of adults with good diabetic foot care in a Chinese General Hospital and Medical Center (Magbanua&Lim_Alba, 2017)
= 22.4% = 0.224
q = 1 – p = 1-0.224 = 0.776
d = level of precision which is at 5% (0.05)

$$n = \frac{1.96^2 \times 0.224 \times 0.776}{0.05^2} = 268$$

Adjustment for a non-response rate of 5% and the final recruited sample became 282 respondents.

2.5. Sampling technique

All eligible patients who were readily available during the study period and willing to participate during the data collection at EFSTH were selected. In order to participate in this study, adult patients who were 18years and above and outpatient and inpatient diabetics at EFSTH. Those excluded were those with coagulation disorders or having community-acquired pneumonia.

2.6. Data collection tool

A semi-structured interview questionnaire was developed using both open-ended and close-ended questions. The questionnaire was adapted from a similar study in the Gambia on Knowledge and Practice of diabetic patients attending Pakala clinic regarding preventing diabetic foot from August to September 2017. An observational checklist was used for a general foot inspection. Patients' feet were inspected for pain, cuts, blister, amputation, and infection between the toes.

2.7. Validity and reliability

The instruments were developed in English and later interpreted into Mandinka, Fula and Wolof, the major languages spoken in the study area. The questionnaire was first reviewed by the thesis supervisor for structure and content validity and then given to experts who have research experience and in diabetic diseases. To assess reliability, we employed Cronbach's alpha test with a value of 0.87, which suggests that the tools used in this study were reliable. It was then pretested at another hospital that has similar characteristics to the study site to see how the respondent has answered the questions and also to determine the appropriateness of the questions.

2.8. Ethical consideration

Ethical clearance was obtained from the University of the Gambia Research and Publication Committee (RePubliC) and the Gambia Government/MRC Joint Ethics Committee, with approval from EFSTH management board. Informed consent was obtained from all participants after explaining the study's purpose, ensuring confidentiality, and emphasizing their right to withdraw at any time.

2.9. Data analysis

The data was analyzed using Microsoft excel 2019 and IBM SPSS version 26, Univariate analysis was used to analyze data in this study. Data was presented by the use of graphs, tables, charts, and tallies. Bivariate analysis was conducted using Chi-square and Fisher exact test with the level of significance set at 5%. Binary Logistic regression was done to examine the influence of education level on practice on diabetes foot care and prevention. Statistical significance was set at $p<0.05$, with a 95% confidence interval.

3. Results

A total of 357 patients participated in the study with a response rate of 100%. The results in this section are presented as follows:

3.1. Socio-demographic characteristics

The mean age of the participants was 47.3 years of age with a standard deviation of ±10.5, as shown in Table 1. Participants within the age group 31-60 years old accounted for the highest age group in the distribution. Women accounted for 55.2% of the study, while 94.4% were reported to be married. Concerning educational background, about one-third of the participants had never been to school, followed by those with a secondary level of education at 22.1%.

Table 1. Participants socio-demographic characteristics

Variable	Frequency (n)	Percent (%)
Age of participants		
30 & below	14	3.9
31 – 60	301	84.3
above 60	42	11.8
Mean (±SD): 47.30(±10.5)		
Marital status		
Married	337	94.4
Single	20	5.6
Gender		
Female	197	55.2
Male	160	44.8
Educational level		
Never been to school	127	35.6

Madrasa	70	19.6
Primary	62	17.4
Secondary	79	22.1
Tertiary	19	5.3

3.2. Participants knowledge on prevention of diabetic foot

As shown in Table 2 below, 92.4% of the participants have never heard of foot ulcer before, and 93.6% reported having sore on their foot or leg for more than two weeks. The greater proportion of the participants (79.0%) reported that their cuts on feet or legs could not be healed within two weeks. Two in five participants had more than two cuts on their feet at the study time. Regarding having a blister on their feet, only 3.1% reported having sustained a blister, with only 2.0% reporting having blood or discharge from the sore. The majority of the participants reported numbness, tingling, pins, and needles or itching sensation (76.5%) at the time of the study. Only 0.8% of the participants reported having ever attended a class on how to care for their feet, while 38.4% reported health education in groups is the most popular way of increasing their knowledge and practice on foot care.

Table 2. Patient knowledge on diabetic foot prevention

Variable	Frequency (n)	Percent (%)
Ever heard of foot ulcer		
No	330	92.4
Yes	27	7.6
Sore on your foot or leg more than 2 weeks		
No	334	93.6
Yes	23	6.4
Cut on foot or leg more than 2 weeks to heal		
No	282	79.0
Yes	75	21.0
Number of times for cuts on foot		
2 and below	45	60.0
More than 2	30	40.0
Had foot ulcer or blister on your feet		
No	346	96.9
Yes	11	3.1
Blood or Discharge on your sore		
No	350	98.0
Yes	7	2.0
Numbness, tingling, pins and needles or itching sensation		
No	84	23.5
Yes	273	76.5
Ever attended a class on how to care of your feet		
No	354	99.2
Yes	3	0.8
Ways to increase your knowledge and practice of foot care		
Health education in group	137	38.4
Individual Health education	91	25.5
Media such as TV, radio, etc.	81	22.7
Receiving handout/brochure	47	13.2
Others	1	0.3

3.3. Knowledge of diabetic foot care

As shown in Table 3, almost all the patients took diabetes treatment to prevent complication while only 13.4% did not wash their feet on daily basis. The application of lotion in their inter-digital space was very low at 6.4% while almost 97.0% kept their feet' skin soft to prevent dryness. The majority of patients (95.8%) used talcum powder to keep their inter-digital spaces dry and about 99.0% checked the water temperature before use. About 84.3% of the respondents change their socks daily, and 98.9% trim their nails with care. Almost all the respondents inspect their feet once a day, wearing comfortable coat shoes and checking of shoes from inside before wearing. A greater proportion of the respondents (98.9%) did not walk barefooted and knew the warning signs required for consultation at 99.4%. In total, 97.8% of the participants use warm water for washing/bathing.

Table 3. Patient knowledge on diabetic food care.

Variable	Frequency (n)	Percent (%)
Taking a diabetes treatment to prevent complications		
No	2	0.6
Yes	355	99.4
Daily Washing the feet		
No	48	13.4
Yes	309	86.6
Lotion not to be applied in the inter-digital spaces		
No	23	6.4
Yes	334	93.6
Keeping skin of the feet soft to prevent dryness		
No	11	3.1
Yes	346	96.9
Talcum powder usage for keeping interdigital spaces dry		
No	15	4.2
Yes	342	95.8
Drying the feet after washing		
No	7	2.0
Yes	350	98.0
Checking temperature of water before using		
No	4	1.1
Yes	353	98.9
Daily Change of socks		
No	56	15.7
Yes	301	84.3
Trimming nails of feet straight with care		
No	4	1.1
Yes	353	98.9
Inspection of feet once a day by respondents		
No	1	0.3
Yes	356	99.7
Wearing comfortable coat shoes		
No	5	1.4
Yes	352	98.6
Checking the shoes from inside before wearing		
No	2	0.6
Yes	355	99.4
Not Walking bare foot		

No	4	1.1
Yes	353	98.9
Warning signs for which consultation is required		
No	2	0.6
Yes	355	99.4
Using warm water for washing/bathing		
No	8	2.2
Yes	349	97.8

3.4. Participants practice diabetic foot care and prevention

The study revealed that 70.0% of the participants examined their feet while 87.1% of them could reach and see the bottom of their feet. Almost half of the patients reported examining their feet every day and 10.4% for between 2 – 6 times a week, as shown in Table 3. Nine in every 10 participants wash their feet every day, and about 77.6% did dry between their toes well. Slightly more than half of the respondents used moisturizing cream on their feet, and about 73.9% cut their own toenails. Of these, 69.8% wore broad, round-toe shoes, followed by shoes made of leather or canvas at 48.0%. In terms of wearing socks, only 46.2% reported wearing socks with cotton and wool at 58.8% and 23.0%, respectively. Only 21.0% of the patients soak their feet.

Table 4. Patient Practices on diabetic foot prevention

Variable	Frequency (n)	Percent (%)
Able to reach and see the bottoms of your feet		
No	46	12.9
Yes	311	87.1
Examine your feet		
No	107	30.0
Yes	250	70.0
Frequency of examining your feet		
2-6 times a week	37	10.4
Every Day	171	47.9
Once	30	8.4
Week or less	11	3.1
When I have a problem	1	0.3
Wash your feet every day		
No	30	8.4
Yes	327	91.6
Dry well between the toes		
No	80	22.4
Yes	277	77.6
Used a moisturizing cream on your feet		
No	145	40.6
Yes	212	59.4
Cut own toenails		
No	93	26.1
Yes	264	73.9
Kind of shoes you wear (n=264)*		
Athletic/sneakers/runners,	51	14.4
Flip flop thong	129	36.4
Broad, round toes	247	69.8
Sandal	110	31.1

Shoe	27	7.6
Shoe made of leather or canvas	170	48.0
Wear socks		
No	192	53.8
Yes	165	46.2
If yes, types (n=165)		
Acrylic/synthetic	2	1.2
Cotton	97	58.8
Knee Highs	13	7.9
Not know	15	9.1
Wool	38	23.0
Ever soaked your feet		
No	282	79.0
Yes	75	21.0

**Multiple responses*

3.5. Diabetes foot screening

During foot screening for diabetes patients, the pain was recorded the highest at 64.7%, followed by nail disorder at 44.3%, while the lowest parameter observed was amputation at only 0.6%, as shown in Figure 1.

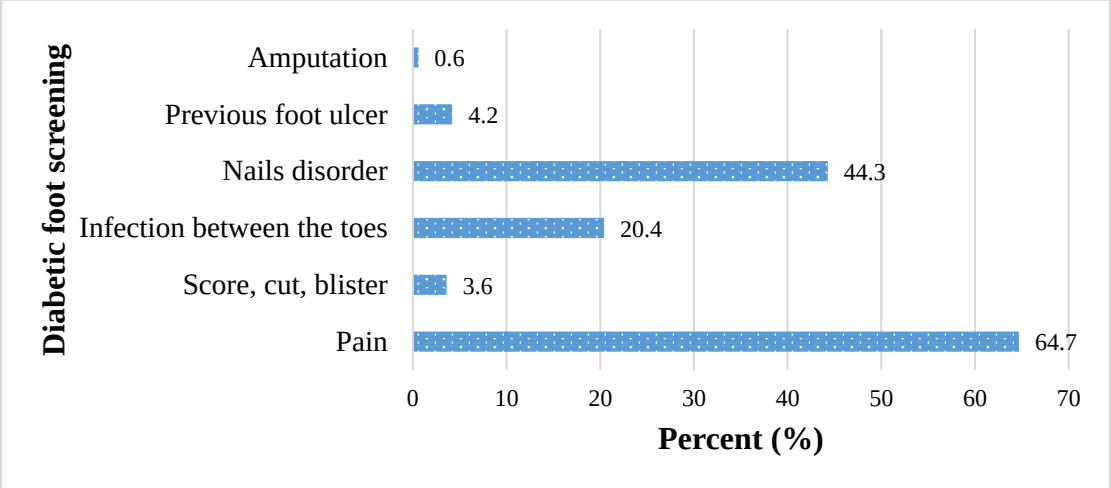

Figure 1. Diabetes foot screening among participants

3.6. Knowledge and practice on diabetic foot care and prevention

Table 5 shows that the overall good knowledge on diabetic foot care and prevention was 72.8%, followed by fair knowledge at 25.8%. However, poor practice on diabetic foot care and prevention was found to be 77.9%, with good practice at only 22.1%.

Table 5. Knowledge and practice on Diabetic foot prevention

Variable	Frequency (n)	Percent (%)
Knowledge on diabetic foot prevention		
Poor knowledge	5	1.4
Fair knowledge	92	25.8
Good knowledge	260	72.8

Practice towards diabetic foot prevention		
Poor practice	278	77.9
Good practice	79	22.1

3.7. Association between practice, knowledge, and selected socio-demographic characteristics

In exploring the association between practice on diabetic foot care and prevention with respect to knowledge on diabetic foot care and selected patients' socio-demographic profiles, there was no statistically significant association between knowledge, age of patients, gender, and marital status at p=0.862, 0.264, 0.702 and 0.168 respectively. However, there was a statistically significant association between practice and patients' educational level.

Table 6. Association between patients practice, knowledge on diabetic foot prevention, and selected socio-demographic variables

Variable	Practice		p-value
	Poor n (%)	Good n (%)	
Knowledge on diabetic foot prevention			0.862
Poor	4 (80.0)	1 (20.0)	
Fair	70 (76.1)	22 (23.9)	
Good	204 (78.5)	56 (21.5)	
Age of respondent			0.264
30 & below	13 (92.9)	1 (7.1)	
31 – 60	230 (76.4)	71 (23.6)	
Above 60	35 (83.3)	7 (16.7)	
Marital Status			0.168
Married	265 (78.6)	72 (21.4)	
Single	13 (65.0)	7 (35.0)	
Gender			0.702
Male	155 (78.7)	42 (21.3)	
Female	123 (76.9)	37 (23.1)	
Educational level			0.032*
None	103 (81.1)	24 (18.9)	
Madrasa	59 (84.3)	11 (15.7)	
Primary	51 (82.3)	11 (17.7)	
Secondary	53 (67.1)	26 (32.9)	
Tertiary	12 (63.2)	7 (36.8)	

** Statistical significance (p<0.05)*

The model (Table 7) predicted that patients with madrasa education are 68.0% less likely to have good practice on diabetes foot care and prevention as compared to those with tertiary level of education (aOR = 0.320; 95%CI=0.103, 0.992).

Table 7. Binary Logistic regression in examining the influence of education level on practice on diabetes foot care and prevention

Practice on diabetic foot care & prevention	B coefficient	aOR	95% C.I. for aOR		p value
			LB	UB	
Educational level (ref: Tertiary)					0.033
Madarasa	-1.141	0.320	0.103	0.992	0.048*
None	-0.918	0.399	0.142	1.122	0.082

Primary	-0.995	0.37	0.119	1.153	0.086
Secondary	-0.173	0.841	0.296	2.388	0.745
Constant	-0.539	0.583			0.257

Model adjusted for marital status

Ref = reference category

Significant at p<0.05

4. Discussion

The findings of this study highlight the predominant representation of individuals aged 31-60 years, with women constituting a significant proportion of the study population, and a high prevalence of married participants (94.4%). This demographic distribution aligns with similar research conducted by Cham et al. [14], where the majority of participants were males aged 51-60 years. These findings collectively underscore that diabetic foot issues are notably concentrated among the elderly population, potentially exacerbating the burden of diabetes-related morbidity [15]. It's worth noting that diabetic foot complications typically manifest in individuals with long-standing diabetes, a process that may span approximately a decade [14]. This aligns with our results, as the majority of participants were aged 31-60 years, suggesting a longer duration of diabetes in this age group. Additionally, our study's observation that women exhibited a higher level of diabetic foot care knowledge concurs with other studies [10, 16], who reported that women tend to have a significantly better understanding of diabetic foot care compared to men. These results collectively emphasize the importance of tailored diabetic foot care interventions, particularly among elderly individuals and men, to mitigate the risk of complications and enhance overall diabetes management.

The findings of this study revealed that the presence of multiple cuts on the feet in two out of five participants underscores the need for enhanced preventive strategies and education in this population. The low reported attendance (0.8%) in foot care classes and the preference for group health education (38.4%) highlight potential avenues for intervention and education. These findings align with the need for tailored and accessible diabetic foot care education programs, particularly focusing on early recognition of foot problems, effective wound management, and preventive strategies. It is essential to consider these results in the context of other studies, such as [15, 17–20], which similarly emphasized the importance of diabetes-related foot education and its potential impact on reducing complications.

This study has profound implications for the understanding of diabetic foot prevention practices among patients in this region. It is noteworthy that the association between diabetic foot care and prevention practices and patients' knowledge and socio-demographic factors was explored. A particularly significant finding was the statistically significant association between these practices and patients' educational levels. This contrasts with some previous studies, such as one that reported an association between knowledge and practice [21]. This divergence suggests that healthcare interventions tailored to educational backgrounds may be necessary, as a substantial proportion of patients in this study were not adhering to foot care principles [10]. Comparable findings have been documented in other parts of the world, including Sri Lanka [21], United States [22], Bangladesh [23] and Australia [24], indicating that these challenges in diabetic foot care and prevention are not unique to this region. Therefore, interventions addressing these issues should draw from the lessons learned in these global contexts to improve diabetic foot care practices among patients attending EFSTH.

The high prevalence of daily foot washing (90%) and adequate drying between toes (77.6%) indicates a commendable hygiene practice among the participants. However, only slightly more than half of the respondents reported using moisturizing creams, and a significant proportion of patients (26.1%) did not wear appropriate broad, round-toe shoes,

which is concerning given the importance of proper footwear in preventing diabetic foot complications. These findings are consistent with a previous study [11] which, like this study, highlighted the suboptimal practice of diabetic foot care among patients. In both studies, a notably low proportion of patients demonstrated good practice in diabetic foot care (10.2%), underscoring the need for comprehensive interventions to enhance patient education and self-care practices. The implications of these results are profound, considering the potential complications and socio-economic burdens associated with diabetic foot ulcers. Therefore, healthcare strategies in Banjul, The Gambia, should prioritize education and awareness campaigns to bridge this knowledge-practice gap in diabetic foot care.

5. Strength and limitations

We employed a representative sample size of patients at the diabetic clinic, ensuring that the study's results could be generalized to similar patients under a similar context in other hospitals in the Gambia. However, the studies used cross-sectional data, implying no causal relationships were determined.

6. Conclusion

The study revealed that participants' knowledge on the prevention of diabetic foot was moderate, which shows that majority of the patients had never heard of foot ulcers before, even though the majority reported having sores on their foot or leg for more than two weeks. The study also revealed that the association between practice on diabetic foot care and patients' educational level. Thus, the practice is low. There is a need for more health education programs targeting diabetes clinics focusing on awareness-raising and improving practices on its prevention and care. The government should design robust diabetes screening programs with high subsidization to ensure access by the population. There is a need for more research on the practice of diabetes management among diabetes patients.

7. List of abbreviations

PVD: Peripheral Vascular Disease; QOL: Quality of life; DFU: Diabetes Foot ulcer; ADA: American Diabetes Association; DM: Diabetes Mellitus; DR: Diabetes Retinopathy; ETDRS: Early Treatment Diabetes Retinopathy Study; PVD: Peripheral Vascular Disease; WHO: World Health Organization; FBS: Fasting Blood Sugar; LEA: Lower Extremity Amputation; EFSTH: Edward Francis Small Teaching Hospital; RVTH: Royal Victoria Teaching Hospital; SMBG: Self-Monitoring blood glucose.

8. Declarations

Acknowledgment

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Availability of data and materials

Data for this study is available and could be requested from the authors.

Authors' contributions

LT & AB conceptualized the study and prepared the study design, reviewed the literature, analyzed data and wrote the results. LT, AB, & AMA critically reviewed the manuscript for its intellectual content. AB had the final responsibility to submit for publication.

Competing interests

The authors declare that they have no competing interests.

Ethics approval and consent to participate

Ethics approval for this study was approved by University of The Gambia research and publication committee as well as the joined Gambia Government and MRC research ethics committee. All methods were performed in accordance with the relevant guidelines and regulations. Written informed consent was obtained from participants (signed or thumb-printed).

Consent for publication

No consent to publish was needed for this study as we did not use any details, images or videos related to individual participants.

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