

## Knowledge of the Risk Factors for Diabetic Foot Syndrome and Self-Foot Care Practices among Diabetic Patients at Muhimbili National Hospital in Dar es Salaam, Tanzania: A Cross-Sectional Study

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### Abstract

**Background:** Evidence indicates diabetic patients have more than 15 times increased risk of non-traumatic foot disabilities. Patients' knowledge of the potential risk factors and self-care practices anticipate better self-management.

**Objective:** This study aimed to assess patients' knowledge of the risk factors for diabetic foot syndromes and reported self-foot care practices at Muhimbili National Hospital.

**Methods:** A hospital-based quantitative cross-sectional study design was conducted in June and December 2022. A random sampling technique was applied to recruit 140 diabetic patients at an outpatient clinic. The Guided Interview questionnaire was used to obtain data. Data were analyzed using SPSS version 25.

**Result:** The reported history of foot ulceration was 42(30%). Participants did not identify Smoking 106 (78.4%), foot sores/fungus 101(72.1%), and toenail ingrowth 96(68.3%) as potential contributors/risks for foot ulceration. Participants 93(66.4%) had an Inadequate knowledge score on the risk factors for Diabetic Foot Syndrome. The gender(male) (AOR: 3.71, 95%CI: 1.513-9.114,  $P=0.004169$ ), education (secondary level) (AOR: 0.179, 95%CI: 0.045-0.70,  $P=0.0139$ ), and history of foot ulceration (have not experienced foot ulcer) (AOR: 5.5, 95%CI: 2.14-14.165,  $P=0.000403$ ) were significant associated to Inadequate knowledge score. Washing the foot with warm water and drying between the toes [daily] 84(60.4%) received poor response. Of the participants, 97(69.3%) had Good self-foot care practices. The duration of Diabetic illness (more than five months and less than one year) (AOR: 19.025, 95%CI: 2.716-133.293,  $P=0.003$ ) and history of foot ulceration (have not experienced foot ulcer) (AOR: 3.377, 95%CI: 1.218-9.366,  $P=0.019$ ) were significantly associated to Poor self-foot care practices.

**Conclusion:** The finding reveals inadequate knowledge of risk factors for diabetic foot syndromes and poor self-care practices. It gives insight into the respective authorities to develop a comprehensive rehabilitative therapy, focusing on foot health education and addressing every aspect affecting their quality of life.

**Keywords:** Diabetes, Diabetic Foot, Risk factor, Self-Foot Care, Tanzania.

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## Introduction

Globally, up to 2021, 537 million people were reported to be living with Diabetes Mellitus (DM), making the prevalence of DM to become 10.5% of all adults aged 20-79 years (IDF et al., 2021). Diabetes foot (ulcer) remained an outstanding potential DM complication, which makes a global prevalence of 6.3%, which is predominantly burdened in Lower Middle-Income Countries (LMIC) (IDF et al., 2021; Pengzi Zhang et al., 2017). Evidence indicates that within 30 seconds, one leg is amputated elsewhere in the world due to a Diabetic Foot Ulcer (DFU) (IDF Diabetes Atlas. Evidence has depicted that 15% of DM patients develop foot ulcers during their diabetic lifetime, and have a 2.5 risk of dying within five years due to diabetic foot complications (Walsh et al., 2016). Africa has 24 million diabetic patients, with a 13% prevalence of diabetic foot ulcers, which is two times higher than the global prevalence (IDF Diabetes Atlas. In Africa, 15% of diabetic patients undergo foot amputation, and 14.2% die during the period of hospitalization (Mauro Rigato et al., 2018). In Tanzania, A study done at Muhimbili National Hospital (MNH) and three Municipal Hospitals (Mwananyamala, Temeke, and Amana) in Dar es Salaam region indicates the prevalence of diabetic foot was 15% among diabetic patients (Chiwanga & Njelekela, 2015).

Diabetic foot syndrome is a “constellation of neuropathy, ischemia and several foot infections”, It’s associated with lesions in deep tissue and neuropathy (Tuttolomondo et al., 2015). It led to non-traumatic disability, morbidity, and loss of quality of life among diabetic patients (Jeyaraman et al., 2019; Rubio, Jim, & Luis, 2020). Meanwhile, it’s a preventable diabetic foot complication, which can be addressed through different perspectives, from patients (self-motivation) to clinical bases (attributes of care) (Amin & Doupis, 2016). The International Working Group on the Diabetic Foot (IWGDF) provides evidence in dealing with diabetic foot care in different approaches

and categories (Monteiro-Soares. Crucial evidence demands healthcare providers periodic foot assessments according to the risk of stratification category, deliver foot health education and insist on other accompanying self-management support to diabetic patients depending on their needs (Monteiro-Soares et al., 2020; Morey-Vargas.

Diabetic foot syndrome is attributed to two major risk factors, namely loss of protective foot sensation peripheral neuropathy and peripheral artery disease (PAD) (Monteiro-Soares et al., 2020). However, other factors like walking barefoot, Charcot joint, dry foot skin, toenail ingrowth, onychomycosis, smoking, tight footwear, and poor foot hygiene are equally significant in causing foot ulcers (Monteiro-Soares. The study done in Tanzania reported that dry skin and toenail ingrowth are four times more likely to increase future foot ulceration (Naemi et al., 2020). Meanwhile, these are modifiable risk factors through early recognition and intervention to prevent the likelihood of foot ulceration through integrated clinical and self-management efforts (Hjelm & Beebwa, 2013; IDF et al., 2021; Monteiro-Soares).

Although health education on self-management and support has been put into clinical evidence of diabetic patients, knowledge and the self-foot care practices for patients have previously been reported poor (Chiwanga & Njelekela, 2015; Muhammad-Lutfi et al., 2014; Solan, Kheir, Salih, & Al-fairy. Previous evidence supports that poor practices and low foot care knowledge among diabetic patients are anticipated by limited health information and teaching about diabetic foot care (Chiwanga & Njelekela, 2015; Rubio et al., 2020; Seid & Tsige, 2015). A study at MNH report that only 48% of the diabetic patients received information for diabetic foot care, although teaching program daily conducted at a clinic (Chiwanga & Njelekela, 2015). Assessment of knowledge on the risk factors for diabetic foot and the foot care practices to patients is a pivotal cornerstone toward

planning and implementation of their integrated care and prevention of foot complication (Morey-vargas & Smith, 2015; Tuha *et al.*, 2021).

Hence there's limited quantitative evidence concerning diabetic foot syndrome knowledge on the risk factors and the self-foot

## **Materials and methods**

### **Study design and setting.**

A hospital based descriptive cross-sectional study design was employed in this study to assess the knowledge on the potential risk factors for foot ulceration and the self-foot care practices among diabetic patients attending the Diabetic clinic at MNH. The hospital is in Dar es Salaam, Tanzania. The hospital serves as a national referral hospital while simultaneously functioning as a teaching hospital for the Muhimbili University of Health and Allied Sciences. The hospital has a bed capacity of 1,500 and attends about 2,000 outpatients per day. The diabetic clinic is one of the clinics in the MNH and delivers services to both insured and non-insured diabetes patients. The clinic receives both adult and pediatric diabetes patients from within and outside of Dar es Salaam. The clinic provides routine diabetic services such as monitoring of body mass index, glucose monitoring, medication prescriptions, nutritional review, and consultation sessions.

### **Study population and eligibility criteria.**

This study involved a population of diabetic patients attending the Diabetic clinic at Muhimbili National Hospital. All adult diabetic patients attending the Diabetic clinic at MNH were included in this study. Patients who had cognitive impairment were excluded from this study because they could introduce recall bias due to distorted memory and concentration. Also, all patients who had communication problems like hearing and speaking problems were excluded from the current study.

care practices among DM patients. The study aimed to assess the knowledge on the potential risk factors for foot ulceration and the self-foot care practices among diabetic patients at the Muhimbili National Hospital in Tanzania.

### **Sample size and sampling procedure.**

We used the single population proportion formula to estimate the minimum required sample size given as  $[N=(Z)^2 \times p(1-p)/e^2]$ , where  $N$  is the minimum required sample size, and  $p$  is the estimated prevalence of diabetic foot ulcers (9.04%) based on a previous study conducted in Kenya (Maingi, Kikuvi, & Matheri, 2020). Furthermore,  $e$  is the margin of error or precision (5%), and  $Z$  is the standard normal value (1.96) corresponding to a 95% CI. After adding a 10% proportion of non-response, the estimated sample size was 140 diabetic patients.

A simple random sampling technique was applied to select participants from patients whose visited at a clinic and registered for consultation.

### **Data collection tool**

An interviewer-administered questionnaire was used as a data collection tool in this study. The tool was adopted from previous related studies (Monteiro-soares *et al.*, 2020; Morey-vargas & Smith, 2015; Naemi *et al.*, 2020) and modified to suit the specific objectives of this study. The questionnaire was prepared in English language and then translated into the Swahili language, the Tanzania national language to enhance better understanding by the study participants. The translation of the questionnaire was done by the principal investigators of this study (EJ and EZC) who are fluent in both languages (English and Swahili language). The questionnaire was divided into three parts, first part comprised of questions on socio-demographic characteristics, the second part comprised of questions

concerning knowledge on the risk factors for diabetic foot syndrome and third part contained questions on participants' self-foot care practices.

#### **Validity and reliability of the questionnaire**

As part of quality control, a pilot study was done on 10% of the sample size (14 diabetic patients) who were finally excluded from the actual study sample. A reliability test was performed by calculating the reliability coefficient (Cronbach's alpha), and its values for knowledge on risk factors for diabetic foot syndromes and self-foot care practices parts were 0.717 and 0.792 respectively. These findings indicate a good reliability level for the tool with the studied sample.

#### **Data collection procedure**

Data collection was conducted in June 2022 and December 2022 by the principal investigators (EJ and EZC) of this study with the assistance of 1 trained research assistant who had completed 2 days of intensive training at the data collection site. Patients waiting for their consultation at the waiting area were approached by the principal investigators and research assistant and invited to participate in the study. All participants provided written informed consent and completed a background information sheet to obtain the demographic information. Data collection was conducted in Swahili (the national language) to enhance a better understanding to participants of this study. Each participant spent an average of 15 to 20 minutes responding to items of an interviewer-administered questionnaire employed as a data collection tool in the current study.

#### **Data management and analysis**

After data collection, the response was coded and entered the computer using Epi-info software version 7.2, and the data were analyzed using IBM SPSS version 25.0. Descriptive analyses were performed to present the demographic characteristics of the

participants. Descriptive statistics using frequencies, percentages, means, and standard deviations were computed, and data were then presented in tables. The knowledge on the risk factors for diabetic foot syndrome was measured based on 9 parameters. Of which it contained 9 principal questions, patients were supposed to respond by choosing "Yes/No or I don't know", where "correct answer" as "Yes" was principal accounted as 1 to all question except 2 of which "Yes" was counted as 0 or null and "No" was counted as 1 (**getting asleep and experiencing body weakness**). The knowledge was categorized as Inadequate Knowledge if participants scored 0-5 (55% and below) out of 9 identified questions, and Adequate Knowledge if participants scored above 6-9 (more than 55%).

The self-foot care practices were measured based on the six parameter questions. The participants were supposed to respond "Yes/No or I don't know", where "Yes" was a correct answer, it was counted as 1 and "No or I don't know" counted as 0. Therefore, the foot practices were categorized based on half of the maximum parameters as Poor self-foot care practices scoring 0-3 (50% or below), Good self-foot care practices scoring 4-6 (more than 50%). A bivariate analysis was performed to determine the associated factors and variables that showed association,  $p < 0.2$  were candidates for multivariate logistic regression. In a multivariate logistic regression model by adjusting for potential confounding variables, the test of significance was performed using a 95% confidence interval, and the level of significance was set at a  $p$ -value  $< 0.05$ .

#### **Ethical considerations**

This study received ethical approval from the Institutional Review Board in the Directorate of Research and Publications of the Muhimbili University of Health and Allied Sciences (Ref. DA. 25/111/01B/117). Permission to conduct the study was obtained from MNH administration

with (Ref. No: MNH/TRCU/Perm/2022/033). Written informed consent was sought and obtained from all participants before data collection. Anonymity and confidentiality of the participants' information were strictly maintained by removing any personal

identifiers from the data. Moreover, participation was fully voluntary, and the participants were informed of their full right to skip or ignore any question or withdraw from their participation at any stage without undesirable consequences.

## Results

### The Social-Demographic characteristics of the Participants.

One hundred forty adult participants aged (20-100 years) were enrolled in the study, it was equal to 40% of 350 encountered during the data collection period. The mean age ( $\pm$ SD) ( $57.8 \pm 14.7$ ). Majority of participants were

female 87(62.1%), aged between 41-65, 98(70%) and below/primary education 69(49.3%). 42(30%) of the participants reported to have history of foot ulceration, statistically indicates that in every 3 Diabetic patients 1 have history of foot ulceration among encountered study participants (Table 1).

**Table 1: The social-demographic characteristics of the participants (N=140)**

Variable		Frequency(N)	Percent's (N) %
<b>Gender</b>	Male	53	37.9
	Female	87	62.1
<b>Age</b>	20-40	11	7.9
	41-65	98	70.0
	66-100	31	22.1
<b>Marital status</b>	Married	119	85.0
	Divorced	10	7.1
	Not married	11	7.9
<b>Education level</b>	Below/primary	69	49.3
	Secondary	38	27.1
	Collage/University	33	23.6
<b>Occupation</b>	Employed	25	17.9
	Self-employed	56	40.0
	Retired	32	22.9
	No job	27	19.3
<b>Residences</b>	Out of Dar es salaam	35	25.0
	Dar es salaam	105	75.0
<b>Duration of DM</b>	>5 months ago	9	6.4
	1-5year	46	32.9
	>5-10 year	32	22.9
	>10 year	53	37.9

History of diabetic foot ulcer.	No	98	70.0
	Yes	42	30.0

Source: Research data base of diabetes 2022

### Knowledge on the risk factors for diabetic foot syndromes.

As in (Table 2), Majority of participants were unaware on the Smoking 109(78.4%) and Toenail ingrowth 96(68.3%) as potential risk to diabetic foot ulceration. Furthermore, sore/foot fungus is also a potential risk factors for diabetic foot, but minority of participants 39(27.9%) shows attention in observing it as the potential risk factors. However, other factors

were not as real potential risk factors but were incorporated as destructors like sleeping and body weakness. The knowledge on the risk factors was computed out of 9 maximum score, majority of the participants 93(66.4%) have overall Inadequate knowledge on the risk factors for diabetic foot syndromes. The mean score of knowledge on the Risk Factors for Diabetic Foot Syndromes was 5.1±1.52, out of maximum score of 9 (Table 4).

**Table 2: Participants responses on the risk factors for diabetic foot syndromes, [multiple choice] (N=140).**

Knowledge assessments Items	Correct response N(%)	Incorrect response N(%)
Losing protective foot sensation is a risk for your feet to develop ulcers.	92(65.7%)	48(34.3%)
Emerging foot fungus (between the toe) is a risk factor for your feet to develop ulcers.	39(27.9%)	101(72.1%)
Walking barefoot indoor and outdoor, you are at risk of getting foot ulcer.	102(73.4%)	37(26.6%)
Having Charcot joint/limited ankle mobility, you are at risk of getting foot ulcer	75(55.0%)	62(45.0%)
Wearing tight shoes is putting yourself at higher risk of developing foo ulcer.	116(83.5%)	23(16.5%)
Smoking reduces blood flow to the feet, which is a risk for foot ulcer.	30(21.6%)	109(78.4%)
If you are diabetic getting normal asleep is a risk cause of foot ulcer.	19(13.7%)	120(86.3%)
If you are diabetic experiencing body weakness is a risk for foot ulcer.	42(30.4%)	96(69.6%)
If you're diabetic, foot toenail ingrowth is a potential risk for developing foot ulcer.	44(31.7%)	96(68.3%)

Source: research data base of diabetes 2022

### Self-Foot care practices

In (Table 3), Majority of participants 84(60.4%) reported poorest foot wash with warm water and dry with a clean dry towel. However, taking

medication for glycemic control was among of the practices that was best done by the patients 118(84.9%), it seems that emphasis has been on proper taking hypoglycemic drugs or

insulin than other potential factors to diabetic patients.

The self-foot care practices were computed out of 6 maximum score factors, majority of

the participants 97(69.3%) has good self-foot care practices (Table 4). The mean practices score of self-foot care practices was 4.02±1.9 out of 6 maximum score.

**Table 3: The distribution of self-foot care practices responses among the patients.**

Self-foot care practices assessments Items	Correct response N(%)	Incorrect response N(%)
Inspecting foot [every day]	97(69.8%)	42(30.2%)
Washing foot with warm water dry between the toe by clean towel	55(39.6%)	84(60.4%)
Lifestyle changing [exercising, stop smoking, alcohol and dieting]	97(69.8%)	42(30.2%)
Taking medication for glucose control [every day]	118(84.9%)	21(15.1%)
Following order and guideline for foot care given in each clinic visit	94(67.6%)	45(32.4%)
Wearing soft and non-tight shoes [every day]	102(73.4%)	38(26.6%)

Source: Research data of diabetes 2022

**Table 4: Classification of knowledge on the risk factor for diabetic foot syndrome and the self-foot care practices.**

	Knowledge on risk factor for DFS.		Self-Foot Care Practices.	
	Inadequate	Adequate	Poor	Good
Scores	93(66.4%)	47(33.6%)	43(30.7%)	97(69.3%)

Source: Research data on diabetes 2022

**Association between the knowledge on the risk factors and the self-foot care practices.**

After all possible confounders were controlled using multivariate logistic regression analysis. Gender(male) were three more likely associated with Inadequate knowledge on the risk factor for DFS (AOR: 3.71, 95%CI, 1.513-9.114, P=0.004169). Participants with history of foot ulceration (didn't experienced foot ulcer) was five-time more likely associated with Inadequate knowledge score for diabetic foot syndrome (AOR: 5.5, 95%CI: 2.14-14.165,

P=0.000403) and duration of DM (>5months and less than 1year) was six times more likely to have Inadequate knowledge score (AOR:6.933, 95%CI: 0.69-68.97, P=0.098). on other hand the secondary education level was 0.179 times less associated with Inadequate knowledge score on the risk factors (AOR: 0.179, 95%CI: 0.045-0.70, P=0.0139). However, other independent and covariate variable was not significant correlated (**Error! Reference source not found.**).

Concerning the self-foot care practices, participants with >5months and less than 1 year from DM diagnosis were nineteen more likely associated with Poor self-foot care practice (AOR: 19.025, 95%CI: 2.716-133.293,  $P=0.003$ ). History of foot ulceration (haven't experienced foot ulcer) were five times more likely associated with Poor self-foot care practices (AOR: 3.377, 95%CI: 1.218-9.366,  $P=0.019$ ). furthermore, participants with primary education level were three times more likely to have Poor self-foot care practices (AOR: 3.33, 95%CI: 0.881-12.63,  $p= 0.0759$ ). Other participants characteristics was not significant associated (**Error! Reference source not found.**).



**Table 5: The factors associated with the knowledge on the risk factor for Diabetic Foot Syndromes (DFS)**

Variable	Level of Knowledge on DFS		COR(95%CI)	p-value	AOR(95%CI)	P-value
	Inadequate	Adequate				
<b>Gender</b>						
Male	26(49.1%)	27(50.9%)	3.391(1.48-7.783)	0.007	3.71(1.513-9.114)	0.004169
Female	59(67.8%)	22(32.2%)	1			
<b>Age</b>						
20-40	4(36.4%)	7(63.6%)	4.965(0.69-35.40)	0.109	0.201(0.028- 1.4)	0.1098
41-65	59(60.2%)	39(39.8%)	1.085(0.31- 3.73)	0.896		
66-100	22(71.0%)	9(29.0%)	1			
<b>Marital status</b>						
Married	71(59.7%)	48(40.3%)	1			
Divorced	6(60%)	4(40%)	0.830(0.13- 4.98)	0.839		
Not married	8(72.7%)	3(27.3%)	0.924(0.08-3.93)	0.890		
<b>Education level</b>						
Below/primary	42(60.9%)	27(39.1%)	3.293(0.82-13.08)	0.090	0.303(0.076- 1.2)	0.0903
Secondary	17(44.7%)	21(55.3%)	5.975(1.49-23.87)	0.011	0.179(0.045-0.70)	0.0139
Collage	26(78.8%)	7(21.2%)	1			
<b>Occupation</b>						
Employed	19(76.0%)	6(24.0%)	1			
Self-employed	30(53.6%)	26(46.4%)	0.663(0.11- 3.69)	0.639		
Retired	21(65.6%)	11(34.4%)	0.523(0.15-1.72)	0.286		

No job	15(55.6%)	12(44.4%)	0.795(0.16-3.75)	0.772		
Residence						
Dar es salaam	60(57.1%)	45(42.9%)	I			
Off Country	25(71.4%)	10(28.6%)	1.157(0.35-3.83)	0.810		
Duration of DM						
>5monthes	6(66.7%)	3(33.3%)	0.147(0.014-1.46)	0.102	6.93(0.69-68.97)	0.098
1-5year	30(65.2%)	16(34.8%)	0.631(0.22-1.77)	0.383		
>5year-10year	19(59.4%)	13(40.6%)	1.154(0.38-3.46)	0.797		
>10year.	30(56.6%)	23(43.4%)	I			
History of foot ulceration.						
Yes	24(57.1%)	18(42.9%)	I			
No	61(62.2%)	37(37.8%)	6.44(2.40-17.29)	0.0002	5.5(2.14-14.164)	0.000403

**COR: Crude odds ratio; CI: confidence interval; I, reference category, AOR: Advanced Odds Ratio.**

**Table 6: The association between the self-foot care practices and the social-demographic characteristics of the participants.**

		Self-foot care practices							
		Poor	Good	COR (95%CI)	P-value	AOR(95%CI)	P-value		
Sex	Male	16(30.2%)	37(69.8%)	1.051(0.42-2.58)	0.912				
	Female	27(31.0%)	60(69.0%)						
Age	20-40	3(27.3%)	8(72.7%)	1.984(0.27-14.5)	0.498				
	41-65	30(30.6%)	68(69.4%)	1.763(0.53-5.76)	0.347				
	66-100	10(32.3%)	21(67.7%)						
Marital Status	Married	40(33.6%)	79(66.4%)						
	Divorced	2(20.0%)	8(80.0%)	0.191(0.01-1.86)	0.154	1.719(0.086- 34.2)	0.722		
	Not Married	1(9.1%)	10(90.9%)	0.581(0.02-11.6)	0.722				
Education Level	Primary	27(39.1%)	42(60.9%)	0.295(0.07-1.12)	0.073			3.33(0.881-12.63)	0.0759
	Secondary	10(26.3%)	28(73.7%)	0.699(0.18-2.70)	0.604				
	Collage/University	6(18.2%)	27(81.8%)						
Occupation	Employed	9(36.0%)	16(64.0%)						
	Self-Employed	18(32.1%)	38(67.9%)	0.528(0.10-2.62)	0.435				
	Retired	6(18.8%)	26(81.3%)	0.917(0.27-3.01)	0.886				
	No Job	10(37.0%)	17(63.0%)	1.189(0.22-6.33)	0.838				
Residences	Off country	13(37.1%)	22(62.9%)	0.690(0.24-1.97)	0.489				
	Dar es salaam	30(28.6%)	75(71.4%)						
Duration of DM	>5 months ago	7(77.8%)	2(22.2%)	0.052(0.007-0.3)	0.0029	19.02(2.71-133.2)	0.003		
	1-5years	17(37.0%)	29(63.0%)	0.496(0.17-1.40)	0.186			2.013(0.712- 5.68)	0.186
	>5-10 years	8(25.0%)	24(75.0%)	0.863(0.28-2.64)	0.797				

	>10 years	11(20.8%)	42(79.2%)		I			
History of foot ulceration.	No	35(35.7%)	63(64.3%)	3.229(1.13-9.15)		0.0274	3.37(1.21-9.365)	0.0193
	Yes	8(19.0%)	34(81.0%)		I			

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**COR: Crude odds ratio; CI: confidence interval; I, reference category, AOR: Advanced Odds Ratio.**

## Discussion

This study assessed the knowledge on the risk factors for diabetic foot syndrome (ulcer) and the self-foot caring among diabetic patients attending the outpatient's clinic at The Muhimbili National Hospital in Dar es Salaam Tanzania. The current study has found 30% of participants had experienced foot ulcer during diabetic lifetime. A decade ago, a study done at Bugando Medical Center (BMC), an history of foot ulceration was 10.3% among diabetic, statistically its equal to threefold increase within a decade(Chalya et al., 2011). This finding resemble the previously reported history of foot ulceration in the different previous studies done in different setting in LMICs(Goweda et al., 2017; Seid & Tsige, 2015). The study conducted in Saudi Arabia indicated slightly higher (35%) reported history of foot ulceration among diabetic patients at Makkah Hospital(Goweda et al., 2017). The lower finding on history of foot ulcer was obtained from previous study done in South Africa, from which only 9.3% had previously history of foot ulceration (Goie, 2016). The finding reveals the growing burden of diabetic foot ulcer in the limited resource and low middle income countries. Its suitable call for the preparedness of the health facilities and respective authorities for resource and expertise in tackling outcome and demand of care.

The diabetic foot ulcer is anticipated by major two risk factors, the peripheral artery disease and loose of protective foot sensation(Monteiro-soares et al., 2020). Participants were knowledgeable on loose of protective foot sensation (65.7%) as the crucial risk factor for diabetic foot syndrome/ulcer. Studies done in South Africa and India reported only 38.2% and 39.0% respectively, were knowledgeable on loosing of protective foot sensation as a potential risk factor, contrasting to our current finding(Goie, 2016; John, John, Raj, & Fathima, 2019). However, participants lack knowledge on smoking (21.6%), developing foot fungus between the toe (27.7%) and toenail ingrowth (31.7%) to be potential risk

factors for DFS. According to WHO Regional Office for Africa 2015, smoking has tremendous increasing among different ethnic in LMIC Tanzania inclusively(WHO Africa, 2015). Smoking itself known to precipitate reduction on blood flowing to peripheral capillaries, posing risk for foot ulcer(WHO Africa, 2015). Previous studies done in India and Nigeria reported that 30% and 25% respectively, participants lack knowledge on smoking as a potential risk for DFS which was similar to our current finding(Desalu, Salawu, Jimoh, Adekoya, & Busari, 2011; John et al., 2019). Higher finding was reported from the study done in Kuwait which reported (75.6%) were aware with smoking as the potential risk factors for foot ulceration(Alsaleh, Albassam, Alsairafi, & Naser, 2021). Furthermore, the overall knowledge score on the risk factors for the diabetic foot syndrome was Inadequate (66.4%). This was slightly consistence with a study done at Rabat Hospital, Morocco, reported that over 50% of participants were overall unaware on the risk factors for diabetic foot(Lamchahab et al., 2011).

We found gender (male) were three times more likely associated to have Inadequate knowledge for DFS, the finding was not in agreements with the study done Kenya(Maingi, Kikui, & Matheri, 2020). History of foot ulcer (haven't experienced foot ulcer) were five time associated with Inadequate knowledge on the risk factor for DFS. Education level (secondary) was significantly associated with inadequate knowledge on the risk factor for DFS. Considerable limited access to health information concerning of diabetic foot risk factors and influence of belief contributes to this association(Hjelm & Beebwa, 2013; Mwangome, Geubbels, Klatser, & Dieleman, 2017). However, The knowledge gap and lack of knowledge on smoking, toe nail ingrowth and foot fungus risk factors has paved the way for increased rate of foot ulceration and hamper the individual glycemic control and improving the quality of life, It led to increased rate of readmission, amputation

and demands of resource in provision of care to patients at family level and National at large (Hertz et al., 2019; Mwangome et al., 2017; Naemi et al., 2020). This finding call for health care provider and the respective authorities on establishing and developing of an urgency foot care programs which promote the compliance and delivering holistic individualized foot care health education (Chiwanga & Njelekela, 2015). Our findings reveal poorest practices of washing foot with warm water and drying between toes with a clean dry towel (39.6%). The finding was in consistence with the study done in Saudi Arabia by which only 39.1% practices drying well between the toes (Goweda et al., 2017), other studies also elucidated the similar finding (John et al., 2019; Muhammad-lutfi et al., 2014).

It can be considered that, the influence of the social economic factors, belief, insufficient information received from the health care personnel and ignorance distort the individual self-esteem and motivation toward self-directed managements of the problems (Hjelm & Beebwa, 2013; Mwangome et al., 2017). Meanwhile, daily taking medication to control hyperglycemia was highly practiced (84.9%) compared to others self-foot care parameter. It's clearly an indication that insistence has been on the controlling hyperglycemia (curative therapy) with minor consideration of other associative factor that must be practiced together to reduce the risk of foot ulceration. Furthermore, the self-foot care practices score was Good (69.3%), the good self-foot care practices could be anticipated by productive educational program carried at a diabetic clinic. The finding was in accordance with the study done in Ethiopia, northern west which indicates 54% had a good self-foot care practices (Seid & Tsige, 2015).

The finding was inconsistency to the study done in Malaysia which reported 61.8% had poor self-foot care practices (Muhammad-lutfi et al., 2014). The poor self-foot care practice was significantly associated to the

duration of DM (>5 months to less than 1 year) and the history of foot ulceration (haven't experienced the foot ulcer) which was in agreement with the study done in Ethiopia (Tuha abdu, Abebe Getie Faris, Ababil Andualem, AMohammed, 2021). Newly diagnosed patients considered to have lower self-esteem and not adherence on the treatments and self-care practices is a possible explanation of this association. Although, the self-foot care practice score was Good, ongoing health education intervention should focus on adherence/compliance of patients to foot care.

#### **Study limitation.**

This study considered to be limited on inadequate sample size and study done at only single tertiary relocated National Hospital. Therefore, this finding might not reflect the real knowledge and the self-foot care practices in the community and is very weak to generalize. The cross-sectional nature of a study design poses a difficulty in establishment of cause effect relationship, this challenge or biases a study.

#### **Conclusion and recommendations**

The finding reveals knowledge gap on risk factors for diabetic foot syndromes and Adequate (good) self-foot care practices. The finding gives an insight in relation to the health education provided, the need of developing comprehensive rehabilitative therapy that addresses all aspect, focusing on individual needs, diabetic lifetime (duration) and history of foot ulceration.

#### **Disclosure**

##### **Competing interests**

Authors declare to have no competing interests.

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### Authors contribution.

EJ conceived the study, designed, mobilized the resource, managed the project, collected data, cleansed and analyzed data, and prepared the final Draft. EZC conceived the study, designed, collected data, cleansed, and analyzed data and prepared the final manuscript. ME Participated in conception, methodology, participated in providing critical analysis and review of the manuscripts. All authors read and approved the final manuscript.

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### Abbreviations

DFU	Diabetic foot ulcer.
DM	Diabetes mellitus
DFS	Diabetic foot syndromes
IDF	International Diabetes Federation,
IWGDF	International Working Group on Diabetic Foot
LMIC	Low Middle-Income Country
WHO	World Health Organization

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