

# Knowledge and Practice on Diabetic Foot Self-Care and Associated Factors Among Diabetic Patients at Dessie Referral Hospital, Northeast Ethiopia: Mixed Method

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**Introduction:** Diabetic foot ulcer is a serious and disabling complication of diabetes mellitus that consists of lesions in the deep tissues resulting in lower extremity amputations. The incidence of diabetic foot ulcers has increased due to an increased prevalence of diabetes mellitus. This study assessed the knowledge and practice of diabetic foot self-care among diabetic patients attending Dessie referral hospital.

**Methods:** A facility-based explanatory sequential mixed method was used from April 03/2019 to May 09/2019. The quantitative method employed an institutional-based cross-sectional study design using a structured questionnaire. A simple random sampling technique was employed to select the study participants. Descriptive and inferential statistics were made using the statistical package for social sciences version 20. Then, a phenomenological study was employed among key informants and content analysis was performed.

**Results:** Sixty-eight (19.8%) of patients with diabetes developed complication, among them 97 (28%) had foot ulcer. Nearly two-third (217 (61.3%); 95% CI (57.6–68.3%)) and 134 (39%; 95% CI:34.3–45.1%) of patients with diabetes had good knowledge and practice on diabetic foot self-care, respectively. Diabetic nephropathy ((AOR): 0.03, 95% CI (0.00–0.27)) was associated with knowledge on foot self-care. Practice of foot self-care was associated with female ((AOR): 2.07, 95% CI (1.04–4.12)), age 21–30 ((AOR): 6.42, 95% CI (1.54–26.8)), 31–40 years ((AOR): 7.4, 95% CI (1.42–39.05)), 41–50 years ((AOR): 8.4, 95% CI (1.4–50.6)), single ((AOR): 0.35, 95% CI (0.150–0.81)), living in rural ((AOR): 0.31, 95% CI (0.18–0.545)) and no comorbidity ((AOR): 0.406, 95% CI (0.18–0.88)). Key informants were not compliant, confused and negligent to foot self-care.

**Conclusion:** Nearly two-third and more than one-third of patients with diabetes had good knowledge and practice on diabetic foot self-care, respectively. Patients lack proper knowledge regarding self-care and how it is practiced. Patient education and proper management of diabetic foot ulcers are recommended to reduce, delay, or prevent complications.

**Keywords:** diabetic foot self-care, knowledge, practice

## Introduction

Diabetes mellitus (DM) is a group of chronic metabolic disorders characterized by elevated levels of blood glucose that is associated with significant morbidity, mortality, and increasing health care cost.<sup>1</sup> Accordingly, there are two major types and treatment varieties according to the cause.<sup>2</sup> The world prevalence of diabetes is 8.5% among adults aged over 18 years, affecting 422 million adults, in

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2014 increased to 9.3% million people in 2019.<sup>3,4</sup> The prevalence of DM has been steadily increasing for the past three decades and is growing most rapidly in low- and middle-income countries. According to the International Diabetes Federation Atlas guideline report, the prevalence of diabetes in Africa among adults aged 20–79 years was 4.2% in 2017.<sup>4,5</sup> In Ethiopia, DM is emerging as one of the major chronic health problems, and the prevalence adjusted to the national population was 4.4% in 2013.<sup>6,7</sup>

Diabetes mellitus can result in blindness, renal failure, lower limb amputation, coronary artery disease, peripheral vascular disease, stroke, and other long-term consequences that impact significantly on the quality of life.<sup>1,3</sup> Of these complications, diabetes-related foot problem affects the majority of patients with DM.<sup>8</sup> A diabetic foot ulcer is the most frequently recognized complication of diabetes mellitus that consists of lesions in the deep tissues associated with neurological disorders and peripheral vascular disease in the lower limbs.<sup>9</sup> It is a full-thickness wound penetrating through the dermis (the deep vascular and collagenous inner layer of the skin) located below the ankle in a DM patient.<sup>10</sup> Wagner classified diabetic foot ulcers mainly based on wound depth. Accordingly, there are six wound grades. These include Grade 0 no ulcer, but the foot is at risk for ulceration, Grade 1 superficial ulceration, Grade 2 ulcer with deep infection, but without the involvement of the bone, Grade 3 ulcer with osteomyelitis, Grade 4 localized gangrene, and Grade 5 gangrene of the whole foot.<sup>11</sup>

The incidence of diabetic foot ulcers has increased due to the worldwide prevalence of DM and the prolonged life expectancy of patients with diabetes, poor knowledge and practice of diabetic foot self-care.<sup>9,12–14</sup> The worldwide prevalence of diabetic foot ulceration is 6.3%. The lifetime risk of a person with diabetes developing a foot ulcer could be as high as 25%.<sup>9,15</sup> Rates of foot ulceration in Africa vary between regions and have been estimated to be between 4% and 19%.<sup>16</sup> In Ethiopia, the incidence and prevalence of diabetic foot ulcers are still unknown in the general population.<sup>7</sup> The study conducted in North-West Ethiopia and South Ethiopia showed that the prevalence of diabetic foot ulcers among patients with diabetes was 13.6% and 14.8%, respectively.<sup>17,18</sup>

Diabetic foot complications are the most common cause of hospitalization in the patients with diabetes,<sup>19</sup> and the risk of foot ulceration and limb amputation increases with older age, long duration of diabetes, poor

glycemic control, peripheral neuropathy, cigarette smoking, foot deformities, peripheral arterial disease, history of foot ulcer, amputation, visual impairment and diabetic kidney disease (especially patients on dialysis).<sup>20,21</sup> Factors that affect DM patients' foot self-care include sex, educational status, residence, and non-attendance to diabetic educational program.<sup>11,12,22–25</sup>

Yet, early recognition and treatment of patients with diabetes and feet at risk for ulcers and amputations can delay or prevent adverse outcomes.<sup>26</sup> Diabetic foot ulcer tends to affect not just physical but also psychosocial, economic, and overall quality of life of patients with DM.<sup>27,28</sup> This study was conducted to assess knowledge and practice on diabetic foot self-care and associated factors among patients with diabetes at Dessie referral hospital, Northeast Ethiopia. This study is used to develop the strategies for counseling of vulnerable group on seriousness of the problem and help to develop effective prevention therapy.

## Methods

### Study Area and Period

This study was done in a hospital at Dessie town, Northeast Ethiopia, from 03/08/2019 to 09/09/2019. The city is located 401 kilometers north of Addis Ababa, Ethiopia, Amhara Region. The hospital is being provided with specialized health services to the town and the surrounding population. In the hospital, there are different wards and clinics within hospital at Dessie town, from which the diabetic ambulatory clinic is one of the services provided.

### Study Design

An explanatory sequential mixed method was used. A facility-based cross-sectional study and phenomenological study were employed to assess knowledge and practice of diabetic foot self-care and associated factors among patients with DM at hospital in Dessie.

### Population

All patients with DM attending hospital at Dessie during the study period were the source of the population while patients with diabetes attending hospital at Dessie diabetic ambulatory clinic during the study period and who fulfilled the inclusion criteria were the study population.

## Inclusion and Exclusion Criteria

Patients with diabetes who had periodic regular follow-ups during the study period and willing to participate in the study were included. All DM patient who was unable to hear or communicate and with mental disabilities newly diagnosed patients with DM ( $\leq 1$ -month duration) and patients in serious clinical states who will not consent or communicate were excluded from the study.

## Sample Size Determination and Sampling Technique

The sample size for the quantitative study was estimated by using a single population proportion formula using 54.6% prevalence,<sup>14</sup> 95% confidence level, and 5% tolerable sampling error. Since the source population was less than 10,000 (2000), the sample size was adjusted with a total of 352 participants. A simple random sampling technique was employed to select the study participants. The sample size for the phenomenological study was determined by the saturation of information concerning emerging themes. Thus, 12 key informants were included. Key informants were selected purposively by the DM clinic nurse.

## Study Variables

The dependent variables were knowledge, and practice of patients with diabetes on diabetic foot self-care and independent variables were socio-demographic characteristics of DM patient, duration of DM, type of DM, previous history of foot ulcer, and presence of other complications (peripheral neuropathy, visual disturbance, and nephropathy).

## Data Collection Procedure and Quality Assurance

Data collection instrument was adapted from similar study conducted before.<sup>24</sup> The data collection instrument was pretested in five percent of the sample size at the Dessie health center. The pilot test was done prior to the actual study. After collecting the pilot data, the data were cleaned using principal component analysis. Knowledge and practice on patients with DM on diabetic foot self-care were assessed using a total of 16 questions (8 for each). The reliability of the questionnaire was also checked using Cronbach's alpha test and a value of 79.8% was obtained. The data were collected using a structured interviewer-administered questionnaire by three nurses who had no

working relation to the hospital after recruiting and training with the supervision of the principal investigators. Data completeness, accuracy, and consistency was checked after collection and appropriately arranged and kept in a secured place for compilation and analysis.

For the phenomenological study, the semi-structured interview guide was prepared in English initially and then translated to Amharic for interview, and finally back-translated into the English language for thematic analysis to maintain consistency and standardization of the instruments. The translation from Amharic to English was done through Google translator and edited with context. The principal investigators made the in-depth interview, which lasted 10–20 minutes. The interview was done in Amharic to fully explore in-depth about the knowledge and lived experience of patients with diabetes and all interviews were audio-recorded and transcribed verbatim.

To enhance the validity of an in-depth interview, the interview guide was tested for validity of contents by one expert from social and administrative pharmacy groups. Language translation was done to check message consistency. To assure the quality of the qualitative data, a standard questionnaire was used and four investigators were involved. Methodological triangulation (the data collected through field note, observations and individual in-depth interview) and investigator triangulation (four research team members participated in data coding and analysis) were also enhancing the validity. Multiple methods were used and the Amharic version of the transcript was also brought back to key informants and was signed. In this study, key informants were chosen carefully to be individuals who had all experience of DM. The researchers also separated themselves from the text by their understanding in a reflective way.

## Issues of Reflexivity: The Principal Investigator Status as an Insider

The principal investigators being senior pharmacy professionals offer certain strengths and limitations for this study. They operated with an awareness of insider bias. They practiced non-judgment and with the awareness of professional relativity.

## Data Processing and Analysis

Data entry and analysis were done using the Statistical Package for Social Sciences version 20. Variables with a p-value less than 0.25 were entered in the multivariate

logistic regression after bivariate logistic regression analyses, and those with a p-value less than 0.05 were taken as statistically significant. Knowledge was measured using eight questions. Each “yes” answer carried one point and zero points for a “no and don’t know”. The points were then added up to provide a total knowledge score. The level of knowledge, whether good or poor, was determined based on the mean score. The practice was also determined in the same manner of knowledge.

All written transcripts were read several times to obtain their overall feelings and all sections of original transcripts were translated into English to facilitate coding line by line. The analysis was done manually using the principles of content analysis. A narrative strategy was employed for the presentation of qualitative findings. Key informants’ level of education, sex, and age were used to elucidate their verbatim portray.

## Definition of Terms

**Good knowledge:** Patients with DM who score greater than or equal to mean score.

**Poor knowledge:** Patients with DM who score less than the mean score.

**Good practice:** Patients with DM who score greater than or equal to mean score.

**Poor practice:** Patients with DM who score less than the mean score.

**Diabetes foot self-care:** This is the care taken by patients with DM towards their foot health and wellbeing.

**Sugar:** A local nomenclature for DM.

## Results

The response rate of the study was 344 (97.7%). Of the respondents, 78 (22.7%) were in the aged group of 41–50 years, 177 (51.5%) were female, and 243 (70.6%) were married. Moreover, 130 (37.8%) patients with DM were at the primary school level and 197 (57.3%) patients with DM were lived in the urban area. Most patients with DM 88 (25.6%) were housewives (Table 1).

More than one-third 244 (70.9%) of respondents were typed two DM patients, 65 (18.9%) had comorbidity. Sixty-eight (19.8%) of patients with DM developed a complication, among them 97 (28%) were developed foot ulcers (Table 2). The majority<sup>9</sup> of key informants revealed that they had not developed diabetes foot ulcers. The key informant portrayed: “I have never admitted in health institutions and been treated. But I have kidney stones and liver fat. I still don’t have leg ulcers” (54,

**Table 1** Socio-Demographic Characteristics of Diabetic Patient at Dessie Referral Hospital, 2019 (N=344)

Variables		Frequency	Percent
Age	11–20	24	7.0
	21–30	42	12.2
	31–40	63	18.3
	41–50	78	22.7
	51–60	70	20.3
	>60	67	19.5
Sex	Male	167	48.5
	Female	177	51.5
Marital status	Married	243	70.6
	Single	56	16.3
	Divorced	45	13.1
Education	Illiterate	31	9
	Primary	130	37.8
	Secondary	110	32
	College and above	73	21.2
Occupation	No job	20	5.8
	Governmental	57	16.6
	Non-governmental	35	10.2
	House wife	88	25.6
	Student	18	5.2
	Other	126	36.6
Residence	Urban	197	57.3
	Rural	147	42.7

**Note:** Other: farmer, merchant, butcher, daily worker.

Male, Primary education). This finding was further substantiated by 50 years old female DM patient: “I have high blood pressure. I am still taking pressure pills. It hurts my heart too. I am also taking diuretics. I was examined and ordered to wear glasses. Occasionally it itches away at my feet. My leg was swollen and I was given medicine. All of this has to do with sugar” (50, Female, Secondary education). However, three of the key informants developed diabetes foot ulcer and one key informant described the scenario:

My leg was amputated because of the sugar. Iron pierced my feet. Although I went for treatment, I developed gangrene and had my leg amputated. A small wound causes a large wound. (70, Male, Illiterate)

## Knowledge of Patients with DM on Diabetic Foot Self-Care

Three hundred fourteen (91.3%) patients with DM knew the impact of regular taking of medication on the reduction

**Table 2** Clinical Characteristics of DM Patient at Dessie Referral Hospital, 2019 (N=344)

Variable		Frequency	Percent
Type of DM	Type 1 Type 2	100 244	29.1 70.9
Duration of DM	<5 6–10 11–15 >16	203 83 49 9	59.0 24.1 14.2 2.6
Comorbidity	Yes No	65 279	18.9 81.1
Type of comorbidity	Hypertension Human Immunodeficiency Virus, Acquired Immunodeficiency Syndrome	54 11	83.1 16.9
Diabetic complications	Yes No	68 276	19.8 80.2
Type of complication	Neuropathy Nephropathy Retinopathy Hypertension Foot ulcer	19 7 20 3 19	27.9 10.3 29.4 4.4 28
History of foot problems	Yes No	97 247	28.2 71.8

of DM complications. Despite all key informants knew the role of appropriate usage of DM medication on the disease, the majority<sup>9</sup> key informants were not using medications appropriately. One of the key informants explained the scenario:

I will take the pill. I have never quit. I was told to take it morning and night, so I took it as soon as I found it. I don't wait time. I take it in the morning or I take it late. (64, Male, Illiterate)

It is substantiated by one of the key informants:

Because my home and place of work are far away; it is too late to take the medicine and I will take the next one. When I left the place where I was working, I fell asleep at night. (60, Male, Diploma)

Controlling blood sugar can reduce complications and nearly all<sup>10</sup> key informants did not have a glucometer at their home. This was supported by one of the key informants:

I know my blood sugar level when going to a health facility. I do not have a home sugar meter. I only know when I come to my appointment. But when I feel ill, I go

to a private clinic and get tested. (39, Female, Primary education)

Inspection of feet for foot ulcer knew by 250 (72.7%) patients with DM while 235 (68.3%) patients with DM knew wounds and infection may not heal quickly. This was further substantiated by one of the key informants: "I always see my feet. My legs are fine. I follow my feet and know that my feet will not be infected" (48, Male, Primary education).

Nearly half of 182 (52.9%) patients with DM knew the effect of smoking on the progression of DM. All of the key informants explained the health danger of smoking. One of the key informants portrayed that: "Drinking alcohol and smoking should not be used because it does not go well with sugar. These can cause further damage. They also aggravate the sugar". (60, Male, Diploma)

The frequency of washing feet and wearing shoes and socks knew by 248 (72.1%) and 190 (55.2%) respectively. The temperature of water for washing feet was correctly answered by 57 (16.6%) patients with DM (Table 3). Nearly two-third (217 (61.3%): 95% confidence interval (CI) (57.6–68.3%)) of patients with DM had good knowledge of diabetic foot self-care. One key

**Table 3** Knowledge of Diabetic Foot Self-Care Among DM Patient at Dessie Referral Hospital, 2019 (N=344)

Variables		Frequency	Percent
DM patients should take medication regularly	Yes	314	91.3
	No	2	0.6
	I don't know	28	8.1
Controlling blood sugar can reduce complications	Yes	198	57.6
	No	4	1.2
	I don't know	142	41.3
DM patients should look after their feet because wounds and infection may not heal quickly	Yes	235	68.3
	No	2	0.6
	I don't know	107	31.1
DM patients should look after their feet because they may get a foot ulcer	Yes	250	72.7
	I do not know	94	27.3
Effect of smoking of DM progression	Yes	182	52.9
	No	4	1.2
	I don't know	158	45.9
Frequency of feet washing	Every day	248	72.1
	Rarely	84	24.4
	I do not know	12	3.5
Temperature of water for washing feet	Warm water	57	16.6
	Cool water	124	36
	I don't know	163	47.4
Frequency of wearing shoes and socks	All times	190	55.2
	Rarely	47	13.7
	I don't know	107	31.1

informant explained the frequency of washing feet as: "According to my religion, I wash my feet morning and night. I generally wash up to five times a day" (18, Female, Secondary education). Concerning the temperature of water for washing feet, five key informants used cold water. One key informant mentioned His experience: "I always wash my feet with cold water". (55, Male, Illiterate) While four key informants reject this idea and one key informant mentioned: "I wash my feet

with lukewarm water, not too cold or too hot. Because very cold water is not good, I wash my feet with lukewarm water". (50, Male, Degree)

Multivariate logistic regression analysis revealed that knowledge regarding diabetic foot self-care was significantly associated with the type of complication. Patients with diabetic nephropathy had 97% less (Adjusted odds ratio (AOR): 0.03, 95% CI (0.00–0.27)) knowledge than patients with diabetic foot ulcers (Table 4).

**Table 4** Factors Associated with Knowledge of DM Patients on Diabetic Foot Self-Care at Dessie Referral Hospital, 2019 (N=344)

Variable		Knowledge		COR(95% CI)	AOR(95% CI)
		Poor (%)	Good (%)		
Type of complication	Neuropathy	1 (5.26)	18 (94.78)	0.07 (0.00–0.91)	0.07 (0.00–0.91)
	Nephropathy*	3 (42.86)	4 (57.14)	0.03 (0.00–0.27)	0.03 (0.00–0.27)
	Hypertension	0 (0)	2 (100)	0.12 (0.13–1.12)	0.12 (0.13–1.12)
	Foot ulcer	6 (31.58)	13 (68.42)	1	1

Note: \*p value <0.05.

Abbreviation: COR, crude odds ratio.

## The Practice of Patients with DM on Diabetic Foot Self-Care

Thirty (8.7%) of the patients with DM inspect their foot. Washing of feet more than once a day was done by 159 (46.2%) of patients with DM while 90 (26.2%) of patients with DM dry their feet after washing. Seven of the key informants mentioned regular inspection of their feet. One key informant described that: “I keep an eye on my feet. I see it day by day. After I wash my feet, I dry them. I thought it was sugar; it looks white”. (50, Male, Degree) Another key informant also mentioned the situation:

When I wash my feet and change my shoes, I see it. If I see anything from the change; I do not give time. I will consult a doctor. As a healthy person; I do not give time. The foot should dry out and the middle of your toe should be wiped. It should also be wiped with a towel. (55, Male, Illiterate)

While five key informants mentioned irregular inspection and a statement made by one key informant described: “Saying that my feet are fine; I did not always see my

feet. I put on my shoes to keep me cool in the morning. I take off at night. I wash and sleep”. (38, Male, Diploma)

The use of moisturizing cream on their feet was practiced by 269 (78.2%) patients with DM while 167 (48.5%) patients with DM were put moisturizing cream between their toes. Half of the key informants use moisturizing cream. One key informant stated:

... when my feet are white and I feel dry; I always use moisturizing cream. I often use it when my feet were rigid. I did not paint the middle of the fingers. I only paint the upper part of my foot. (54, Male, Primary education)

In this study wearing sandals/slippers and shoes without socks/stockings/tights was practiced by 121 (35.2%) 152 (44.2%) patients with DM, respectively (Table 5). One hundred thirty-four (39%; 95% CI: 34.3–45.1%) of patients with DM had a good practice on diabetic foot self-care. Nearly half of the key informants wear sandals/slippers in their house. The key informant stated:

When I leave home, I wear comfortable shoes. If I am at home, I use soft or non-slip sandals. I would not wear shoes without socks. I am careful not to wear tight shoes.

**Table 5** Practice DM Patient on Diabetic Foot Self-Care at Dessie Referral Hospital, 2019 (N=344)

Variables		Frequency	Percent
Frequency of feet inspection	More than once a day	30	8.7
	Once a day	221	64.2
	Weekly	93	27
Frequency of feet washing	More than once a day	159	46.2
	Once a day	24	7
	Weekly	161	46.8
Frequency of checking feet drying after washing	Often	90	26.2
	Rarely	193	56.1
	Never	61	17.7
Use of moisturizing cream on feet	Yes	269	78.2
	No	75	21.8
Frequency of putting moisturizing cream between toes	Daily	167	48.5
	Weekly	111	32.3
	Month	11	3.2
	Never	55	16
Frequency of wearing sandals/slippers	Most of the time	121	35.2
	Rarely	212	61.6
	Never	11	3.2
Frequency of wearing shoes without socks/stockings/tights	Often	152	44.2
	Rarely	160	46.5
	Never	32	9.3

**Table 6** Factors Associated with Practice of Diabetic Foot Self-Care at Dessie Referral Hospital, 2019 (N=344)

Variables		Practice		COR(95% CI)	AOR(95% CI)
		Poor (%)	Good (%)		
Sex	Female*	53 (29.94)	124 (70.06)	2.04 (1.41–3.42)	2.07 (1.04–4.12)
	Male	81 (48.50)	86 (51.50)		
Age	11–20	11 (45.8)	13 (54.17)	3.10 (1.04–9.23)	5.82 (1.71–19.80)
	21–30*	9 (21.43)	33 (78.57)	3.10 (1.04–9.22)	6.42 (1.54–26.77)
	31–40*	16 (25.40)	47 (74.60)	2.48 (0.93–6.64)	7.43 (1.41–39.04)
	41–50*	27 (34.62)	51 (65.38)	1.59 (0.63–4.04)	8.39 (1.39–50.58)
	>60	34 (50.75)	33 (49.25)		
Marital status	Single*	15 (26.79)	41 (73.21)	0.36 (0.19–0.70)	0.35 (0.15–0.81)
	Married	91 (37.45)	152 (62.55)		
Residence	Rural*	83 (56.46)	64 (43.54)	0.26 (0.17–0.42)	0.31 (0.18–0.54)
	Urban	51 (25.89)	146 (74.11)		
Comorbidity	No*	116 (41.58)	163 (58.42)	0.54 (0.29–0.97)	0.40 (0.18–0.88)
	Yes	18 (27.69)	47 (72.31)		

Note: \*P <0.05.

I do not walk barefoot. Even at home, I move with socks.  
(50, Female, Primary education)

Another key informant also mentioned the scenario: “When the shoes are tight, I wear them without socks. And when it comes to wide shoes, I wear socks. I don’t always wear socks because I live in the countryside” (67, Male, Illiterate). However, five key informants mentioned walking barefoot without socks and sandals. One key informant described that:

When I walk home, I walk barefoot without socks. Because the carpet is in the house, I move barefoot. The women are angry since they are cleaning the house. I always take off my shoes when I go home. (70, Male, Primary education)

Multivariate logistic regression analysis revealed that the practice of patients with DM on diabetic foot self-care was significantly associated with sex, age, marital status, residence, and comorbidity. Females had 2.07 times ((AOR: 2.07, 95% CI (1.04–4.12)) good practice than males. Patients with age 21–30 years had 6.42 times ((AOR: 6.42, 95% CI (1.54–26.8)), patients with 31–40 years had 7.4 times ((AOR: 7.4, 95% CI (1.42–39.05)), and patients with 41–50 years had 8.4 times ((AOR: 8.4, 95% CI (1.4–50.6)) good practice than those greater than sixty years. Patient with single marital status were 65% less ((AOR: 0.35, 95% CI (0.150–0.81)) practice than married patients. Those patients living in the rural area were 69% less

((AOR: 0.319, 95% CI (0.18–0.545)) than those living in urban, and those patients with no comorbidity had 60% less ((AOR: 0.406, 95% CI (0.18–0.88)) practice than those with comorbidity (Table 6).

## Discussion

A diabetic foot ulcer is one of the chronic complications of diabetes patient which lead to disability and death if it is not effectively prevented and controlled. To prevent this, the patient should have good knowledge and practice on diabetic foot self-care. This study was conducted to assess knowledge and practice on diabetic foot self-care and associated factors among patients with DM at Dessie referral hospital.

In this study, 217 (61.3%; 95% CI (57.6–68.3%)) of the patients with DM had good knowledge of diabetic foot self-care. This demonstrated a lower level of knowledge regarding diabetic foot self-care compared to the study done in China (70.38%).<sup>29</sup> The possible reason might be china was a developed country and there may be enough access to information through health education, print, and electronic media that helps to enhance the public awareness of diabetes and its complications.<sup>24</sup> The finding was higher than the studies done in Pakistan (29.3%),<sup>30</sup> Saudi Arabia (53.6%),<sup>12</sup> and Ethiopia (56.2%).<sup>24</sup> This might be due to high illiteracy and low role of the physician in providing face-to-face health education program on diabetic foot self-care during admission including advice for

diet, exercise and regular medication, and blood glucose checking.<sup>30,31</sup> The qualitative study also identified the knowledge gap among key informants. A similar finding was reported from a qualitative study done at Addis Abeba where the overall self-care practices were not adequate.<sup>32</sup>

One hundred thirty-four (39%; 95% CI: 34.3–45.1%) of patients with DM had a good practice on diabetic foot self-care. This prevalence of diabetic foot self-care practice was lower than the study done at Bahirdar (54.6%),<sup>24</sup> but this was higher than the study done in turkey.<sup>33</sup> This might be attributed to health education on diabetic foot self-care. However, it was higher than the studies done in India (19.4%)<sup>31</sup> and Pakistan (14%) due to the low educational status of the patient and low face-to-face health education by health care providers regarding diabetic foot self-care.<sup>29,31,34,35</sup> The proper diabetes foot self-care is not adequately practiced by key informants. In Addis Abeba, most patients lack proper diabetes foot self-care is not adequately practiced. Foot self-care was also the list of recognized self-care practices and most have not even heard of what foot self-care is.<sup>32</sup>

Knowledge regarding diabetic foot self-care was significantly associated with the type of complication. Patients with diabetic nephropathy had 97% less (AOR: 0.03, 95% CI (0.00–0.27)) knowledge than patients with diabetic foot ulcers. There is a strong association between stage of chronic kidney disease and for diabetic foot ulcer or low extremity amputation; even individuals with moderate chronic kidney disease have an increased risk for a diabetic foot ulcer and low extremity amputation.<sup>36</sup> Moreover, the risk of low extremity amputation is at least two to six times greater among those with both diabetes and chronic kidney disease than among those with diabetes alone.<sup>37</sup>

The finding of this study revealed that females had 2.07 times (AOR: 2.07, 95% CI (1.04–4.12)) good diabetic foot self-care practice than males. A similar finding was reported from Malaysia and Thailand.<sup>38,39</sup> This was due to women often feel like victims of something outside of themselves in a position of restrictions and limitations when they do not make self-care a priority. Men presented with a lower prevalence of feet scaling and use of inappropriate shoes when compared to women. Moreover, men presented less healthy habits.<sup>40</sup> Wearing open shoes increases the development of diabetic foot ulcer because it causes the foot sliding forward, foot exposed to external trauma and thus causing shear injury to the toes or plantar foot. It is important to encourage the use of suitable

footwear, and to educate the patient to promote healthy foot care and footwear habits. Closed shoes create moisture on feet and prevent from drying.<sup>41</sup>

In this study, patients with DM with age 21–30 years had 6.42 times ((AOR: 6.42, 95% CI (1.54–26.8)), patients with 31–40 years had 7.4 times (AOR: 7.4, 95% CI (1.42–39.05)), and patients with 41–50 years had 8.4 times (AOR: 8.4, 95% CI (1.4–50.6)) good diabetic foot self-care practice than those greater than sixty years. This was due to elder patients where belief in God and do not use their treatment appropriately which reduce their daily diabetic foot self-care practice. Diabetic foot ulcers and lower extremity amputation are severe complications of older diabetic patients.<sup>35</sup> The Elderly are not interested in increasing their longevity if the disease detracts their quality of life. Thus, family members and trusted caregivers should help them to identify, refine, and communicate their health goals.<sup>42</sup> Cultural beliefs were portrayed as a barrier relating to subjective norms by key informants.<sup>43</sup> Acknowledging and accepting the reality of diabetes is essential to living well with diabetes.<sup>44</sup>

Patients with single marital status had 65% less (AOR: 0.35, 95% CI (0.150–0.81)) diabetic foot self-care practice than married patients. The finding was similar to the study done in Malaysia where single marital status patients with DM were less (AOR: 0.75) diabetic foot self-care practice than married.<sup>38</sup> This might be attributed to married patients with DM had emotional and instrumental social support, including activities related to attention or listening, accompanying medical visits than single, which had a positive influence on diabetic foot self-care practice.<sup>45</sup> The qualitative study also identified that inadequate family support, and busy work schedules were the barriers related to diabetes foot self-care practice.<sup>43</sup> Receiving support from family and care teams is essential to living well with diabetes.<sup>44</sup>

Those patients living in a rural area had 69% less (AOR: 0.31, 95% CI (0.18–0.545)) diabetic foot self-care practice than those who live in urban. This was similar to the study done at Bahirdar patients where patients with DM living in rural were less (AOR: 0.14)<sup>24</sup> diabetic foot self-care practice than urban patients. This was because patients living in urban area had access to information through health education, print, and electronic media than these live in rural area.<sup>46</sup> Key informants mentioned that poor income levels, lack of glucometers, and long distance to the hospital. This was in line with the qualitative study done in Ghana.<sup>43</sup>

Those patients with no comorbidity had 60% less (AOR: 0.40, 95% CI (0.18–0.88)) diabetic foot self-care

practice than those with comorbidity. There was a significant relationship between self-care and the number of comorbidities.<sup>47</sup> Patients with comorbid chronic diseases experience a wide range of barriers to self-care, including physical limitations, lack of knowledge, financial constraints, a need for social and emotional support, and aggravation of one condition by symptoms of or treatment of another, and polypharmacy.<sup>48</sup> Since comorbidity influences the relationship between self-efficacy and self-care maintenance, self-management interventions need to address interactions between chronic conditions and individuals' diseases condition.<sup>47,48</sup>

Despite the incidence of diabetic foot ulcers have increased due to the increased worldwide prevalence of diabetes mellitus, proper preventative measures, patient education, appropriate foot self-care, and proper management of diabetic foot ulcers can greatly reduce, delay or prevent complications infection, gangrene, and amputation. Adequate foot self-care practice of patients with diabetes can prevent the occurrence of foot ulcer. To improve diabetes foot self-care, health professionals should understand and acknowledge the effect of diabetes on patients' health and communicate with patients openly with empathy and cultural consideration.<sup>44</sup> This study helps for the hospital to design the strategy to improve the knowledge and practice of self-care practice of patient with diabetes by considering the impact of foot ulcers and consequent amputation on physical and psychosocial life domains.

Recall bias and social desirability bias was the limitation as patients were requested to respond based on their life experience, and the cross-sectional nature of the study made unable to establish cause-and-effect relationships. The nature of qualitative study alters confidence in the generalizability of the findings. This study is used to force urgent need of counseling for most of vulnerable group and public awareness regarding seriousness of the problem and developing effective prevention therapy to reduce its impact on general health of population. Moreover, is used to develop the strategy and the policy on the prevention of foot ulcer secondary to the uncontrolled diabetes, implementing and improving the self-care practice.

## Conclusion

Nearly two-thirds of patients with DM had good knowledge of diabetes foot self-care and more than one-third of diabetic patients had good diabetic foot self-care practice. Diabetic nephropathy was associated with knowledge on

foot self-care. The practice of foot self-care was associated with females, age 21–30 years, 31–40 years, 41–50 years, single marital status, living in the rural area, and no comorbidity. Key informants stated that they were not compliant with DM medication, confused by health education, and negligent to foot self-care. Generally, patients lack proper knowledge regarding self-care and how it is practiced. Health professionals should approach patients openly with empathy and emphasize the impact of foot ulcers and consequent amputation on physical and psychosocial life domains. Public awareness should be created regarding seriousness of the problem. Appropriate counseling and proper management of diabetic foot ulcers should be offered to reduce, delay, or prevent complications to vulnerable group.

## Abbreviations

AOR, adjusted odds ratio; CI, confidence interval; DM, diabetes mellitus; COR, crude odds ratio.

## Data Sharing Statement

The datasets are available from the corresponding author upon reasonable request.

## Ethical Consideration

Ethical approval was obtained from the Ethics Review Committee of the Department of Pharmacy, College of Medicine and Health Sciences, Wollo University (WU Phar/078/11). Verbal informed consent was obtained from study participants while parental consent was obtained for adolescent patients after providing information regarding the purpose of the study, why and how they are selected to be involved in the study, and what will be expected of them. The participants' informed consent included publication of anonymized responses. Verbal informed consent was approved by the Ethical committee. Confidentiality of patient-specific data was maintained throughout the study. The study was done with the consideration and compliance with declaration of Helsinki.

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## Authors' Contribution

All authors made a significant contribution to the work reported, whether that is in the conception, study design,

execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

## Disclosure

The authors declare that they have no potential competing interests in this work.

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