



Characteristics of Diabetes Type II Foot Complications at Kisii Teaching and Referral Hospital, Kenya

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Authors' contributions

This work was carried out in collaboration between both authors. Both authors read and approved the final manuscript.

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ABSTRACT

Diabetes is a global non-communicable disease with a prevalence of 3.3% in Kenya and 11% in Kisii County. It is estimated that somewhere in the world, every 30 seconds a person suffering from advanced diabetes loses a limb to amputation due to foot complications, which in turn have negative impact on patients' lives and puts them at risk of losing their independence, with social, psychological, and economic effects. The study aimed to determine the prevalence of foot complications, foot care knowledge, and self-care practices among patients with Type 2 Diabetes. The study involved 175 patients seeking care at the outpatient clinic at Kisii Teaching and Referral Hospital. Fisher exact test and chi-square test were used to evaluate association and assess the strength of interaction between variables. The most prevalent foot complication was corns, with male gender being associated with 85.7%. The study found that participants had poor foot care knowledge, average self-care practices, and did not know the signs of diabetic foot at risk. The study also found a significant association between foot care knowledge and diabetes duration and

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education background. Addressing this knowledge gap could involve incorporating health education on diabetes complications into community programs. Regular assessments from healthcare workers are recommended to identify foot at risk and prevent serious complications.

Keywords: Non-communicable disease; type II foot complications; diabetes management; ulcers.

1. INTRODUCTION

Diabetes is a metabolic disorder characterized by hyperglycemia without treatment, resulting in defects in insulin secretion, action, or both, and disturbances in fat, carbohydrate, and protein metabolism. There are three types: Type 1, which mostly affects children [1], Type 2 Diabetes Mellitus (T2DM), and gestational diabetes, which occurs during pregnancy. Uncontrolled diabetes can damage the nervous and cardiovascular system, reducing blood flow to different body parts, increasing the risk of developing foot complications and limb amputation. In Africa, diabetes foot prevalence is 7.2%, higher than Asia's 5.5%. Undiagnosed Type 2 Diabetes Mellitus (T2DM) is high in Africa [2], with 69% undiagnosed. In Kenya, Non Communicable Diseases, diabetes included accounts for 39% of all deaths where the National Prevalence of diabetes in 2019 was estimated at 3.3% and is projected to rise to 4.5% in 2035. Undiagnosed individuals with diabetes are more likely to experience complications before diagnosis [3] is, leading to irreversible complications and increased costs in management. Good foot care practices, foot self-care, and regular inspections with health education are essential to reduce the risk of foot complications. In Kenya, diabetes management focuses on bringing blood glucose levels to normal, using hypoglycemic drugs, diet, and exercise, and patient education on medications, injection sites, foods, blood glucose monitoring, activity home management, and lifestyle improvement. A study at Kenyatta National Hospital indicate the overall prevalence of diabetic foot at risk was 76.1%, while the prevalence of diabetic foot ulcer at the same facility was 4.6%, risk factors attributed to poor glycemic control, comorbidities and poor self-care which is the leading cause of amputation is Type 2 Diabetes Mellitus (T2DM), causing mortality, prolonged in-hospital stay, life-long dependence on others, inability to work and misery [4]. Kisii County has 11% higher diabetes prevalence than the national prevalence, but no data on diabetic foot related complications is available in the county's largest government-owned facility.

Diabetes foot complications are a significant public health issue, causing increased morbidity and mortality. They are the leading cause of hospitalization for patients, affecting their physical, psychosocial, economic, and overall quality of life. In Africa, diabetic complications are high due to 69% undiagnosed Type 2 Diabetes Mellitus. In Kenya, diabetes prevalence ranges between 2.2% [5] and 3.3 percent [6] and predicted to rise to 4.5% by 2025. Undiagnosed patients make it difficult to eradicate the problem. In Kisii County, diabetic foot complications are not reported, emphasizing the need for proper care to reduce the progression of diabetes to ulcers or amputations.

1.1 Objective of the Study

The study aimed at Identifying socio-demographic characteristics, foot complications prevalence, foot care knowledge, and self-care practice among Type 2 Diabetes patients at Kisii Teaching and Referral Hospital between May and December 2021.

1.2 Study Significance

This study highlights inadequate self-care practices and foot care knowledge deficits in patients with type 2 diabetes. It helps healthcare providers plan interventions based on patients' needs, minimizing foot complications and amputations. Good foot care practices and health education are essential for reducing foot complications. The study also reveals 11% higher diabetes prevalence in Kisii County compared to the national prevalence of 3.3%.

1.3 Socio-Demographic Characteristics

Socio-demographic characteristics among Type 2 diabetic patients include age, education level, and comorbid conditions. Older age and presence of type 2 Diabetes Mellitus increase the severity of ulcers. Social demographic variables play a significant role in managing diabetic foot ulceration and whether the patient has family or caregiver support. Female patients are more active in prevention and self-care, while men seek help for acute problems and have a more pessimistic view of the future. Socio-economic

status is also a factor in the increased incidence of lower limb amputations.

Globally, 15% of 150 million diabetic patients [7] are likely to suffer from diabetic foot complications, contributing to high hospital admissions. Foot ulcers are a major concern among patients living with diabetes, with 85% of lower limb amputations preceded by a foot ulcer. Factors predicting abnormalities include comorbidities, ageing, longer duration of diabetes, insulin use, male gender, and low social class.

In Africa, diabetes has increased, with a prevalence of 3.1% in 2014. Factors associated with foot ulcers include rural residence, diabetes duration, co-morbidity, mean arterial blood pressure, and occupation. Insufficient self-care activities and proper footwear may lower the incidence of diabetic foot ulcers. Diabetes-related hyperglycemia affects the immune and nervous system, causing higher rates of fungal infections and peripheral neuropathy in diabetic patients compared to non-diabetics.

A retrospective study at Tenwek Mission Hospital in Bomet County found that diabetic vasculopathy [8] is the leading cause of amputations in elderly males in Kenya. Controlling blood sugar within normal ranges and improving foot care knowledge among diabetic patients are recommended. Lower limb amputation has a negative impact on these patients' lives, putting them at risk of losing independence and experiencing social, psychological, and economic effects.

1.4 Foot Care Knowledge

Foot care knowledge is crucial in combating diabetes and its complications. Studies have

shown that poor knowledge and practices regarding foot care are associated with various factors, such as male gender, low education level, and lesser duration of diabetes. In Africa, a study found that 63% of patients had good knowledge, but poor practices of diabetic foot care, longer duration of diabetes, comorbidities, and family history of diabetes were likely to develop diabetic foot ulcers. In Ethiopia, 93% of patients had general knowledge on self-care, but 39% [9] only put that into practice. In India, 64% of patients who followed recommended self-care methods achieved good glycemic control. In Africa, walking barefoot has been identified as common practice among rural populations. In Nigeria, 10.2% [10] had good self-practice on foot, but majority of patients had poor foot care practices.

1.5 Operational Conceptual Framework

The operational conceptual framework suggests that diabetic foot complications are influenced by foot care knowledge and self-care practices. Factors such as clinical characteristics, socio-demographic characteristics, and foot care knowledge can influence self-care practices and potentially cause foot complications.

2. MATERIALS AND METHODS

2.1 Study Site

The study was conducted at Kisii Teaching and Referral Hospital (KTRH), the largest government-owned health facility in Kisii County, Kenya. The hospital, has a high prevalence of diabetes due to starch-rich staple foods. The clinic, run by a consultant doctor, doctors, clinical officers, nurses, and a nutritionist, treats 400 adult patients with Type 2 Diabetes Mellitus.

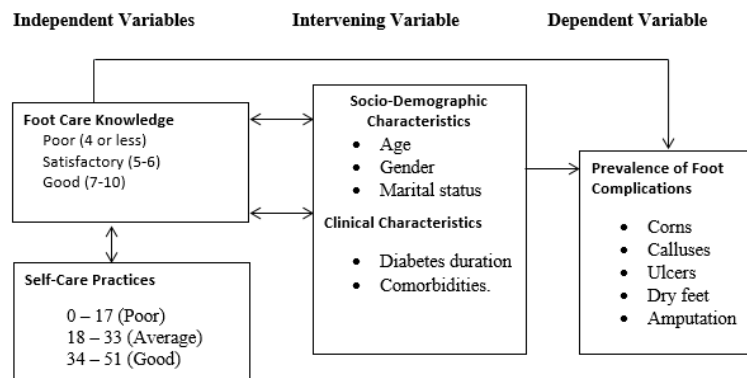


Fig. 1. Conceptual framework
Adapted from American Diabetes Association 2018

Services offered include vital signs check-ups, physical exams, history-taking, patient education; wound cleaning, dressing, and dispensing hypoglycemic drugs.

2.2 Study population

The study involved adult patients with Diabetes Mellitus Type 2 seeking care at outpatient clinic. A sample size of 200 participants was calculated, but 175 were recruited. High response rates provide unbiased estimates, but low response rates have greater sampling error and less ability to detect statistically significant differences.

2.3 Inclusion Criteria

Adults aged 18+ diagnosed with T2DM, receiving treatment at KTRH outpatient clinic, and having at least one foot complication were included in the study.

2.4 Exclusion Criteria

Study excludes Type 2 diabetes patients with disability affecting self-care.

2.5 Study Design

The study used a cross-sectional descriptive research design to collect data from 175 adult patients with Type 2 Diabetes at Kisii Teaching and Referral Hospital. A response rate of 87.5% was considered adequate, but a high rate of non-response may increase bias.

2.6 Sample Size Determination

$$n = \frac{N}{[(1 + N(e)^2)]} \quad (\text{Yamane, 1967})$$

Where:

n = sample size.

N = population size.

e = accepted level of error taking alpha as 0.05

$$= \frac{400}{[1 + 400 (0.05)^2]} = 200$$

Thus, the study sample was 200 participants

2.7 Sample Size Determination

Health education and sensitization were conducted on Fridays before clinic program, using purposive sampling. Participants met

inclusion criteria, signed informed consent, and completed questionnaires weekly for four months.

2.8 Data Collection and Procedures

A pre-tested questionnaire was used to collect data from a large population, covering socio-demographic, foot-care knowledge, self-care practice, and foot complications. The questionnaire was written in English and translated into Swahili. Two knowledgeable research assistants recruited and administered questionnaires to study participants. They were trained in participant recruitment and administration, adhering to confidentiality and privacy. Mass sensitization was conducted at the waiting bay before diabetic clinic services began, and participants were interviewed to obtain responses instantly.

2.9 Validity and Reliability

The study aimed to assess foot care knowledge and practice among diabetic patients with type 2 diabetes. Knowledge was measured by the presence of corns, calluses, ulcers, limb amputation, or dry feet as dependent variables. Independent variables were knowledge and practice, with scores ranging from 1 to 5. The Nottingham Assessment of Functional Foot-care Questionnaire (NAFF) was used to assess self-care practices, with scores categorized into poor, average, and good practices. Socio-demographic characteristics, clinical characteristics, and comorbidities were also considered.

2.10 Ethical Approval and Considerations

The study was approved by Maseno University School of Graduate Studies, Maseno University Ethics Review Committee, and KTRH hospital administration. Participants voluntarily participated without coercion and had the right to ask questions. The study followed four elements of informed consent: disclosure of essential information, voluntary participation, understanding the information, and the right to withdraw without prejudice. The researcher used a written consent form. The beneficence principle ensured participants were free from harm, and the study procedure was explained before the interview. The principle of justice ensured fair treatment, and privacy was achieved through anonymity. Participants' information was limited to the researchers and computerized data was protected using passwords. The study findings

was made available to interested individuals and groups with authority from Maseno University and KTRH, and will be published in peer-reviewed journals.

2.11 Data Analysis

The study utilized the statistical program for social sciences version 24 to analyze socio-demographic factors, foot complications, self-care practices, and knowledge. Descriptive statistics were used to analyze age, gender, marital status, education, and income, occupation, understanding of foot care, self-care use, and foot complications frequency. Fischer exact and Chi-square tests were applied to determine associations.

3. RESULTS

3.1 Socio-Demographic Characteristics of the Study Participants

Demographic characteristics of study participants, including age, marital status, education, religion, and income. The average age was 51.3 years, with 96 (54.9%) aged 50+, 150 (85.7%) male, 129 married, 43.4% having completed secondary education, and 60 (34.3%) small-scale farmers.

3.2 Prevalence of Foot Complications among the Study Participants

Corns were the most common foot issue, occurring in 64 cases (36.8%), followed by ulcers in 56 cases (32%) and calluses in 45 cases (25.7%). Only five (2.9%) of the participants

reported having dry feet or having had their feet amputated in the past, as is displayed below.

3.3 Foot Care Knowledge among the Study Participants and Self-Care Practice among the Study Participants

One hundred and forty six (83.4%) participants knew about foot care, with only 64% receiving information from healthcare workers and 36% from family, other patients, and television. Over half of participants did not know early signs of diabetic foot, and 102 (58.3%) did not know its causes. Most participants knew the importance of washing feet daily and drying them immediately. Most participants were unaware of cold feet, toenail trimming, and diabetic foot wounds.

The study found that only 14.9% and 6.3% of participants check their shoes sometimes or rarely before putting them on, while 73.10% never check their feet. 60.0% wear shoes without socks, as only 6.3% wear pointed shoes. Participants reported higher frequency of walking barefoot, walking out of the house, and near fires. Dry dressing was more frequently reported by 77.7% of participants.

There was no statistically significant correlation between overall foot care knowledge and self-care practice ($p = 0.202f$). Both the relationship between foot care knowledge and diabetes duration ($p = 0.05$) and the relationship between foot care knowledge and educational background ($p = 0.001$) were statistically significant.

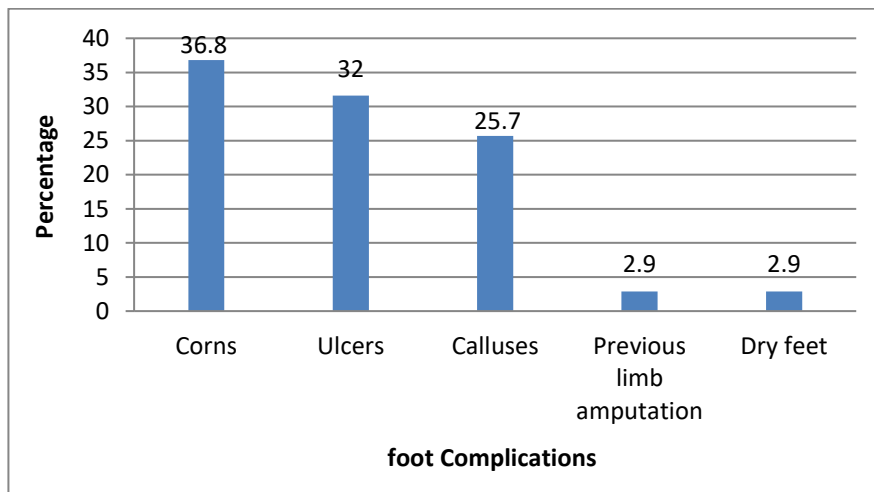


Fig. 2. Prevalence of foot complications among study participants with type 2 diabetes mellitus

Table 1. Foot care knowledge and self-care practice against demographic variables

Variable	Foot care knowledge			p-value	Self-Care Practice			p-Value
	Poor	Average	Good		Poor	Average	Good	
	66	52	57		13	152	10	
Age								
< 50	34(51.5%)	22(42.4%)	23(40.4%)	0.04	2(15.4%)	72(47.4%)	5(50%)	0.095
≥ 50	32(48.5%)	30(57.6%)	34(59.6%)		11(84.6%)	80(52.6%)	5(50%)	
Gender								
Male	61(92.4%)	50(96.1%)	39(68.4%)	0.078	5(38.5%)	139(91.4%)	6(60%)	0.325
Female	5(7.6%)	2(3.9%)	18(31.6%)		8(61.5%)	13(8.6%)	4(40%)	
Education background								
No education	10(15.2%)	6(11.5%)	2(3.5%)	0.001	7(53.8%)	9(5.9%)	2(20%)	0.095
Primary incomplete	17(25.8%)	2(3.8%)	1(1.8%)		2(15.4%)	17(11.2%)	1(10%)	
Primary complete	18(27.3%)	7(13.5%)	4(7.0%)		2(15.4%)	26(17.1%)	1(10%)	
Secondary incomplete	8(12.1%)	13(25.0%)	11(19.3%)		1(7.7%)	30(19.7%)	1(10%)	
Secondary Complete	6(9.1%)	2(3.8%)	22(38.6%)		1(7.7%)	29(19.1%)	0(0%)	
Post- Secondary	7(10.6%)	22(42.3%)	17(29.8%)		0(0%)	41(27%)	5(50%)	
Duration of diabetes								
<1 year	13(19.7%)	15(28.8%)	4(7.0%)	0.05	4(30.8%)	23(15.1%)	5(50%)	0.184
1- 5 years	24(36.4%)	21(40.4%)	21(36.8%)		6(46.2%)	57(37.5%)	3(30%)	
>5 years	29(43.9%)	32(61.5)	32(56.1)		3(23.1%)	72(47.4%)	2(20%)	

Chi Square test* $p \leq 0.05$

4. DISCUSSION

4.1 Socio-Demographic Characteristics among

The study found that 54.9% of participants were aged 50 or older, with a higher prevalence of foot complications among the older population. This is consistent with previous studies showing that diabetic foot disease occurs in the elderly with a peak age between 60 and 70 [11]. Older patients, those with limited formal education, low socio-demographic status, divorced or widowed, longer diabetes duration, high HbA1c, and on insulin treatment are at a greater risk of developing diabetic foot complications.

Furthermore, participants with diabetes for more than five years were associated with a higher prevalence of foot complications compared to those with diabetes for less than one year. This association may be due to a loss of pain sensation, pressure perception [12], and circulation impairment, which promotes the development of foot complications.

Men were more likely to develop foot complications than females, as demonstrated by a study in a Palestinian hospital [13]. Men were also more ignorant and combined smoking and poor foot hygiene, worsening their conditions and leading to hospitalizations which is also the case according to the study done by Nongmaithem, [14].

4.2 Prevalence of Foot Complications

The study found that 54.9% of participants were aged 50 or older, with a higher prevalence of foot complications among the older population. This is consistent with previous studies showing that diabetic foot disease occurs in the elderly [15] with a peak age between 60 and 70. Older patients, those with limited formal education, low socio-demographic status, divorced or widowed, longer diabetes duration, high HbA1c, and on insulin treatment are at a greater risk of developing diabetic foot complications [16].

Furthermore, participants with diabetes for more than five years were associated with a higher prevalence of foot complications compared to those with diabetes for less than one year. This association may be due to a loss of pain sensation, pressure perception, and circulation impairment, which promotes the development of foot complications.

Men were more likely to develop foot complications than females, as demonstrated by a study in a Palestinian hospital [13]. Men were also more ignorant and combined smoking and poor foot hygiene, worsening their conditions and leading to hospitalizations.

4.3 Foot Care Knowledge among Study Participants

A study established that 32.6% of participants had good foot care knowledge, lower than a 39% high level found in a study on determinants of foot self-care practices among patients with Type 2 Diabetes. Knowledge was associated with educational background [17] and duration of diabetes. A rural hospital study in Southern India found deficiencies in foot care knowledge, with 75% [18] having good knowledge. The study's findings could be attributed to community health programs, health education sessions, and quality care. However, the majority of participants (70.7%) did not know how to care for cold feet and 66.9% did not know early signs of diabetic foot at risk.

4.4 Self-Care Practice among Study Participants

The study found that only 5.7% of participants had good self-care practices, while 86.9% had average practices. This is lower than a similar study conducted in Ethiopia [19], which found good foot self-care practices among 102 participants (36.6%). Poor self-care practices could be due to knowledge deficits, such as not cutting toe nails and placing feet near fire, which puts diabetic patients at risk of developing foot complications. Over half of participants checked their feet dry after washing, and poor checking of shoe inside before putting on was found. This is consistent with a study in China [20], where foot wear checks were poor, which could lead to injury and amputation.

5. SUMMERY AND CONCLUSIONS

The study found that poor foot care knowledge and average self-care practices were prevalent among participants, with male gender being associated with the highest occurrence of foot complications. The most common foot complication was corns, followed by ulcers and calluses. Most patients (66.9%) did not know the signs of diabetic foot risk, and 67.4% of participants put their feet near fire. Regular assessments from healthcare workers are

needed to identify feet at risk and prevent serious complications. Health education programs should be tailored to meet patients' needs and incorporate diabetes-related complications into community programs.

Healthcare workers should identify patients at risk for foot problems and intervene to prevent complications. High-risk behaviors like diabetes and frequent clinic visits can lead to foot issues. Proper foot care practices can reduce ulcerations and amputations.

CONSENT AND ETHICAL APPROVAL

The study was approved by Maseno University School of Graduate Studies, Maseno University Ethics Review Committee, and KTRH hospital administration, with participants voluntarily participating without coercion and making informed decisions following full disclosure.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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