

**ASSESSMENT ON KNOWLEDGE AND PRACTICE OF FOOT CARE
AMONG DIABETES PATIENTS ATTENDING MEDICAL OPD IN
HIWOT FANA UNIVERSITY SPECIALIZED HOSPITAL, HARAR****Hawa Redwan¹, *Vijai basker G^{1*}**¹Haramaya University, School of Pharmacy, College of Health & Medical sciences, Ethiopia.Article Received on
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Author****Mr. Vijai basker G**Haramaya University,
School of Pharmacy,
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Medical sciences, Ethiopia.**ABSTRACT**

Diabetes Mellitus (DM) foot complications are a leading cause of mortality in developing countries. The aim of this study was to determine the knowledge and practice of foot care among diabetes patients attending medical OPD in Hiwot fana University specialized hospital in Harar. This study was carried out from March to May 2014. The respondents were interviewed on a pre-tested structured questionnaire after their verbal consent. The data was collected by direct face to face interview from diabetic patients attending medical OPD. The outcome variables were knowledge and practice regarding foot care. The knowledge and practice scores were classified as adequate if score $\geq 80\%$, moderately adequate if score was 51-70% and

Inadequate if score was $< 50\%$. Of 235 diabetes patients, 9% had adequate knowledge and 5% had adequate practice of DM foot care. Majority 58% of patients with poor practice had poor knowledge of foot care. With regard to knowledge, 69% of diabetes patient should not look after their feet because wounds and infection may not heal quickly and 61% were unaware of smoking cause poor circulation affecting their feet. Poor foot practices include 76% were not keeping dry well between their toes and 72% were not checking their feet daily for any injury. Educational status and marital status were significantly associated with knowledge and practice of foot care. This study has highlighted the gaps in the knowledge and practice of foot care in DM patients and underscores the need for an educational programme to reduce of diabetic foot complication.

KEYWORDS: DM, Diabetic foot ulcers, Diabetes.

INTRODUCTION

Diabetes Mellitus

Diabetes mellitus, or simply diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the pancreas does not produce enough insulin, or because cells do not respond to the insulin that is produced. ^[1] All forms of diabetes have been treatable since insulin became available in 1921, and type 2 diabetes may be controlled with medications. Insulin and some oral medications can cause hypoglycemia (low blood sugars), which can be dangerous if severe. Both types 1 and 2 are chronic conditions that cannot be cured. ^[2] DM is a major disease that is becoming more prevalent, affecting 171 million people worldwide. The number of people affected by DM is expected to rise to 366 million by 2030. ^[3] The IDF Atlas 5th edition 2012 report (ARF) revealed that in 2011, 14.7 million adults in the Africa Region are estimated to have diabetes, with a regional prevalence of 3.8%. The top six countries with the highest number of people with diabetes make up just over half of the total number in the region. This would rise to 28 million by 2030 with prevalence of 4.3%, an increase of 80%, as such exceeding the predicted worldwide increase of 55%. Type 2 diabetes is responsible for 85-95% of all diabetes in high-income countries but Type 2 diabetes accounts for well over 90% of diabetes in Sub-Saharan Africa. Based on the IDF Atlas 5th edition, 2012 report, numbers of cases of diabetes in Ethiopia to be estimated about 1.4 million in 2011. ^[4, 5]

Diabetic Foot Ulcer

It is a major complication of diabetes mellitus, and probably the major component of the diabetic foot. It occurs in 15% of all patients with diabetes and precedes 84% of all lower leg amputations. ^[6] The diabetic foot was recognized in the 19th century, but it was only in the second half of the 20th century that scientists and clinicians paid due attention to the magnitude of the problem. ^[7, 8]

Definition

Various foot abnormalities result from peripheral neuropathy, macro-angiopathy, and other consequences of metabolic disturbances in patients with diabetes. Important clinical manifestations are foot ulcers, Charcot foot deformity, and amputation of parts of the foot or of the lower leg. ^[9] Structured healthcare is one of the promising ways to reduce major amputation in diabetic subjects ^[10, 11, 12] There has been a clearer understanding of the causal factors leading to limb loss and increasing consensus on the management of various aspects

of diabetic foot care. ^[13, 14, 15] Overall rates of limb loss among people with diabetes appear to be decreasing in the US. ^[16, 17, 18] and elsewhere ^[19, 20, 21, 22] At least part of this decrease may be due to improved coordination of care and more frequent interdisciplinary collaboration between specialty providers. ^[23, 24, 25, 26, 27, 28, 29, 30] Overall, one out of four patients with diabetes runs the risk of sustaining a foot lesion throughout his/her lifetime. ^[31] Worldwide, the prevalence of the diabetic foot ranges between 1.4% and 5.9%. ^[32]

Pathogenesis

In the pathogenesis of diabetic foot ulcers (DFUs), neuropathy, angiopathy (ischaemia), foot deformity and limited joint mobility are central risk factors, as shown in Figure 1 below.

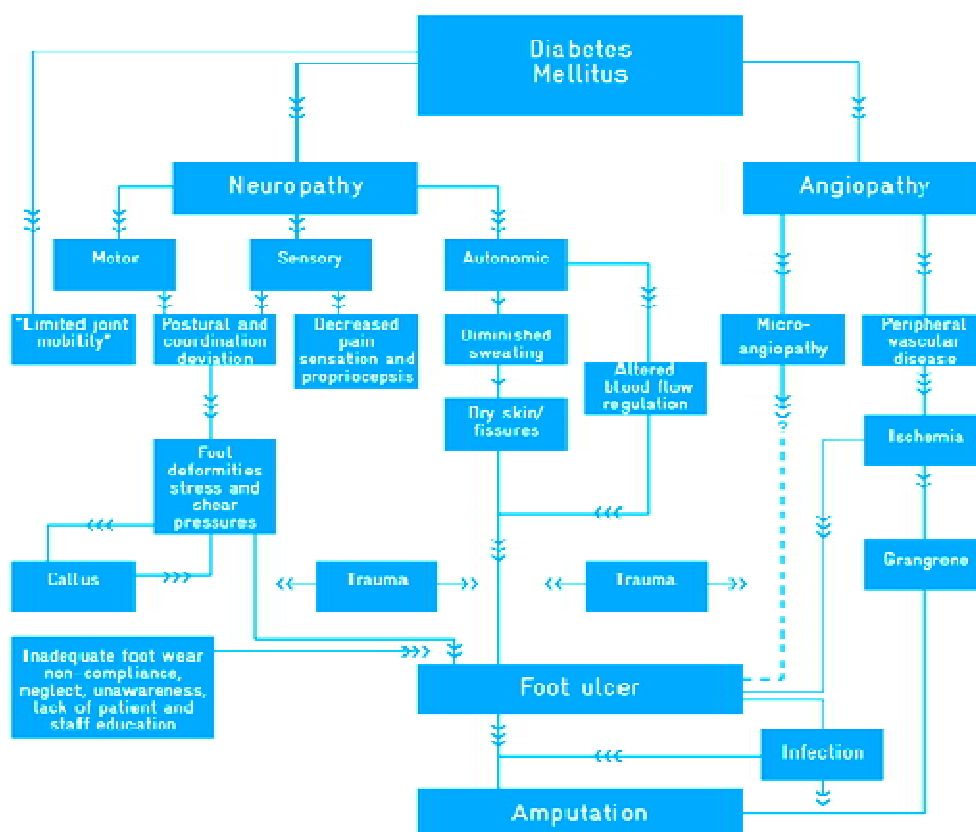


Fig. 1 Pathogenesis of Diabetic Foot Ulcer ^[33]

With regard to the etiology of foot ulceration, 45–60% of ulceration is thought to be purely neuropathic, 10% purely ischemic and 25–40% mixed neuroischaemic. People in developed countries tend to be more often neuroischaemic. ^[34] Because of the presence of diabetic neuropathy, many patients do not observe classic signs and symptoms such as pain. It has been observed that the local temperature of the foot increases prior to ulceration, as a result of inflammation thought to be most likely related to repetitive trauma. ^[35]

The centers for disease control and prevention has determined that "regular foot care can reduce serious foot disease by 50 to 60% affecting the quality of life of our aging population".

^[36] Poor foot care knowledge and practices are important risk factors for foot problems among people with diabetes. Also there are no sufficient studies on knowledge and practice assessment related to diabetic foot self care among the diabetic patients in Ethiopia. Hence the major aim of this study is to assess the knowledge and practice of foot care among diabetes patients in Ethiopia. The information gained on the knowledge and practices regarding foot care can aid health care providers and policy makers to develop targeted self-management education programs for people with diabetes.

MATERIALS AND METHODS

The study site was Hiwot Fana University Specialized Hospital which is a 210 bedded hospital, and serves inpatient, outpatient and emergency patients. The study was designed as a descriptive cross sectional design. This approach helped to collect the detailed descriptions of existing variables and to use the data to satisfy and assess the knowledge and practice of foot care among diabetic patients attending medical OPD at Hiwot Fana University Specialized Hospital, Harar. The sample size ($n=384$) determination was done by using single proportion population formula by taking $p_1=0.5$ and $q_1=0.5$ proportion with margin of error 5% and also 95% confidence interval. The exact numbers of diabetic patient in Hiwot Fana University Specialized hospital are 538. Since the population is less than 10,000, the investigators used the correction formula to get the final sample size. Hence the final sample size were $n=224$. By adding 5% non-respondent to the final sample found to be 235.

The study population were Diabetic patients attending medical OPD at Hiwot Fana University Specialized Hospital. Patients were eligible for the study if they were 15 years of age or older, had diabetes and those who were volunteer to participate in the study. Those patients critically ill were excluded from the study. The sampling technique used was Non probability Convenience Sampling Technique.

The respondents were interviewed on a pre-tested structured questionnaire after their verbal consent. The data were collected by direct face to face interview from diabetic patients attending medical OPD. Data collection was carried out from 5th March to 16th May 2014. Data were entered; cleaned and analyzed using the Statistical Package for Social Sciences, SPSS version 20.0. Descriptive analyses such as frequency, percentage distribution and graphic representation were done to assess the knowledge and practice of foot care among

diabetic patients attending medical OPD. Interferential statistics such as Chi-square test were used to find out the association between selected socio-demographic variables and knowledge and practice of foot care.

Articles, books, journals, published research studied, and web-site links were reviewed and used to build up a good tool for the study. The Performa developed by the investigators to collect the sample characterists which contains 10 questions regarding socio demographic variables such as age, sex, religion, marital status, educational status, occupation, family income, food habit, type of family and family history of diabetes. Knowledge questionnaire consists of 10 knowledge related questions regarding foot care. Each “right answer” scores one mark and “wrong answer” scores zero mark. Practice questionnaire contains 10 practice related questions regarding foot care. Each “right answer” scores one mark and “wrong answer” scores zero mark. The score interpretation were Adequate 80-100% (8-10), moderately adequate 51-70% (5-7) and Inadequate $\leq 50\%$ (<5). All processes were started after secure the ethical clearance from Ethical committee. A signed written consent obtained from the heads of institutions/facilities following an explanation, the purpose, risk and benefit of the study. Confidentiality of the data kept throughout the data collection and the entire study period. The study may not representative to all diabetic patients since the sampling technique used was non probability convenience sampling and limited to only one hospital.

RESULTS

The demographic characteristics of participants are presented in Table 1. A total of 235 diabetic patients, 93 (40%) were in the age category of 41 years old and above followed by age category of 15 to 20 years old, 21 to 25 years, 26 to 30 years, 31 to 35 years and 36 to 40 years old were 50 (21%), 24 (10%), 3 (1%), 26 (11%) and 39 (17%) respectively.

Table.1. Frequency and Percentage distribution of socio demographic variables of respondents

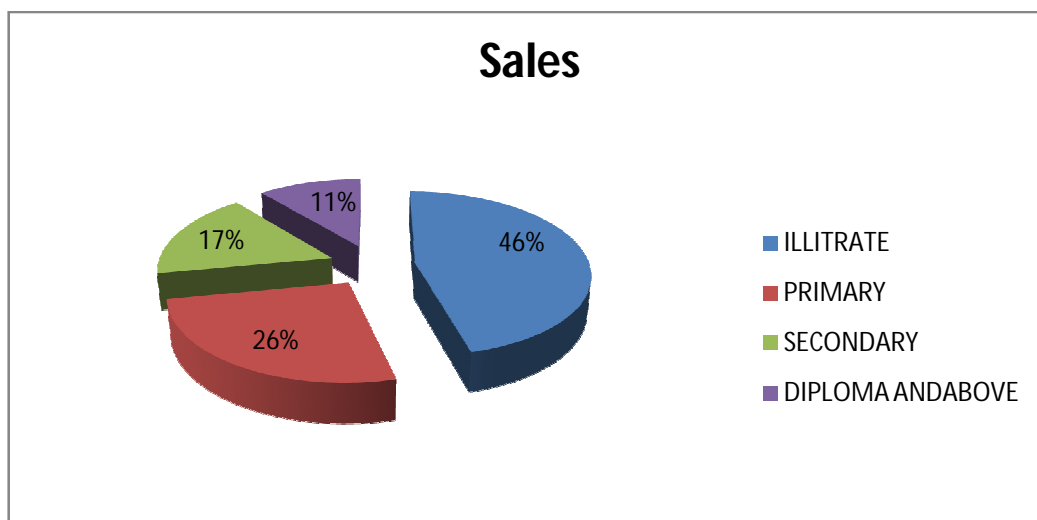
S. No.	Socio Demographic Variables		Frequency	Percentage(%)
1.	Age in years	a) 15 – 20 years	50	21
		b) 21 – 25 years	24	10
		c) 26 – 30 years	3	1
		d) 31 – 35 years	26	11
		e) 36 – 40 years	39	17
		f) 41 years and above	93	40
2.	Sex	a) Male	145	62
		b) Female	90	38

3.	Religion	a) Muslim	112	48
		b) Orthodox	98	42
		c) Others: Protestant	25	10
4.	Marital status	a) Married	70	30
		b) Unmarried	99	42
		c) Widowed	37	16
		d) Divorced/Separated	29	12
5.	Educational status	a) No formal education/Illiterate	108	46
		b) Primary	62	26
		c) Secondary	39	17
		d) Diploma and above	26	11
6.	Occupation	a) Farmer	68	29
		b) Day labourer	60	26
		c) Business	21	9
		d) Government employee	23	10
		e) Nongovernment employee	48	20
		f) Others	15	6
7.	Level of Income per month	a) Less than 1000 ETB/month	70	30
		b) 1001 - 5000 ETB/month	123	52
		c) More than 5000 ETB/month	42	18
8.	Food habit	a) Vegetarian	78	33
		b) Mixed	157	67
9.	Type of family	a) Nuclear	90	38
		b) Joint	145	62
10.	Family history of Diabetes	a) Yes	122	52
		b) No	113	48

Table 1 shows that among 235 respondents, 145 (62%) were males and 90 (38%) were females. It was found that 112 (48%) of the respondents were belonging to Muslim religion, 98 (42%) were belonging to Orthodox and the remaining 25 (10%) were belonging to protestant. Table shows that 70 (30%) were married, 99 (42%) were unmarried, 37 (16%) were widowed and 29 (12%) were divorced/separated. Taking occupation, 68 (29%) were farmers, 60 (26%) were day laborers, 21 (9%) were doing business, 23 (10%) were government employees, 48 (20%) were nongovernment employees and remaining 15 (6%) belongs to other occupation. Among the respondents, 70 (30%) were having family income less than 1000 ETB / month, 123 (52%) were having family income between 1001 – 5000 ETB / month and the remaining 42 (18%) were having family income more than 5000 ETB / month. Depending on the food habit, 78 (33%) were vegetarian and 157 (67%) were taking

mixed food. It was found that 90 (38%) of the respondents were from nuclear family and 145 (62%) were from joint family. Taking family history of diabetes, 122 (52%) of the respondents were having family history and 113 (48%) were not having family history of diabetes.

Fig 2. Distribution of Level of Educational Status Among Diabetes Patients Attending Medical OPD In Hiwot Fana University Specialized Hospital, Harar.



Regarding their educational status, nearly about half of the respondents 108 (46.0%) were illiterate, 62 (26.4%) were attend primary school and 39 (16.6%) were attended secondary school and 26 (11%) were completed diploma and above.

Table -2- Distribution of The Responses To Questions Related To The Knowledge Of Foot Care.

S/n	Questions related to knowledge of foot care	True	False
1	Diabetes patients should take medication regularly because they are liable to get DM complication.	94 %	6 %
2	Diabetes patient should look after their feet because they may not feel a minor injury to their feet.	47 %	53 %
3	Diabetes patient should look after their feet because wounds & infection may not heal quickly.	31 %	69 %
4	Diabetes patient should look after their feet because they may get a foot ulcer.	34 %	66 %
5	Diabetes patient should not smoke because smoking causes poor circulation affecting their feet.	39 %	61 %
6	Diabetes patient should inspect the inside of their foot wear for objects or torn lining.	40 %	60 %
7	Diabetes patient should wash their feet regularly.	67 %	33 %
8	Diabetes patient should wash their feet with hot water.	69 %	31 %
9	Diabetes patient should avoid carbohydrates rich food.	75 %	25 %
10	Diabetes patient should wear shoes with high heal.	28 %	72 %

One hundred and seventy (72 %) of the DM patients were unaware of wearing flat shoes, 162 (69 %) were unaware of looking after the feet because wounds and infection may not heal quickly and likewise 155 (66%) they may get a foot ulcer, 144 (61 %) were unaware of that smoking cause poor circulation affecting their feet. Majority of the respondent (60%) were unaware of the importance of inspecting the inside of the footwear for objects or torn lining. The distributions, of the response to questions related to the knowledge of foot care are shown in Table 2.

Table 3: Distribution of level of knowledge score on foot care among diabetes patients attending medical OPD in Hiwot Fana University Specialized Hospital, Harar.

N = 235

S1.NO	Level of Knowledge	Score	
		Frequency	Percentage
1.	Adequate (8 – 10)	21	9%
2.	Moderately adequate (5 – 7)	125	53%
3.	Inadequate (0 - 4)	89	38%

Maximum score = 10

Table 3 shows that out of 235 respondents only 21 (9%) had adequate knowledge, 125 (53%) had moderately adequate knowledge and 89 (38%) had inadequate knowledge regarding foot care.

Fig 3. Distribution of level of knowledge score on foot care among diabetes patients attending medical OPD in Hiwot Fana University Specialized Hospital, Harar.

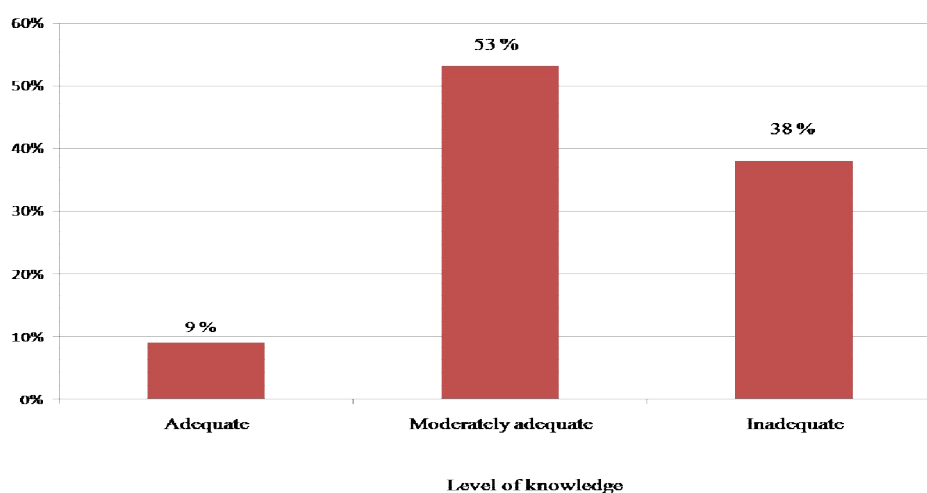


Fig 4. Distribution of level of practice score on foot care among diabetic patients attending medical OPD in Hiwot Fana University Specialized Hospital, Harar.

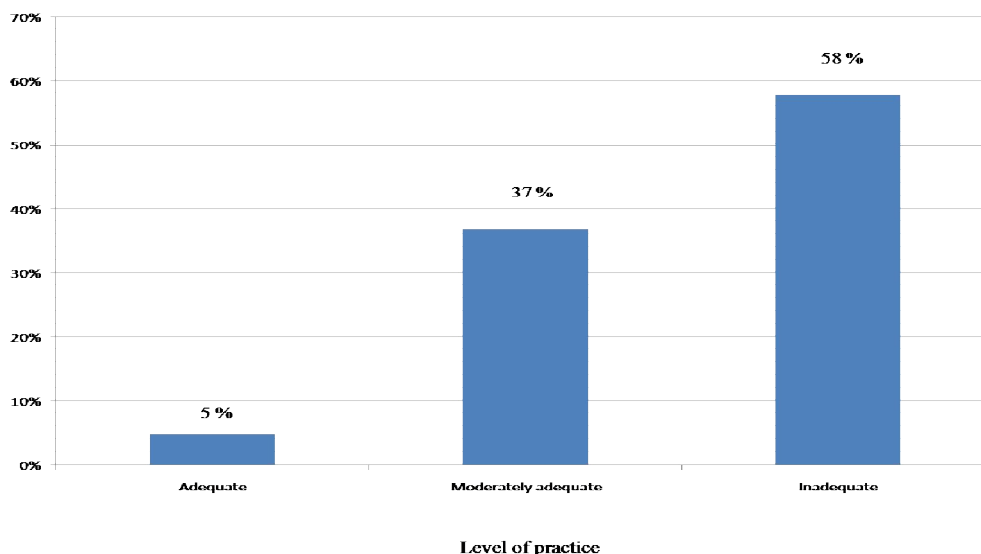


Table 4: Distribution of the responses to questions related to the practice of foot care

S.No	Questions related to practice of foot care	Yes	No
1.	Do you check your feet daily for an injury	28 %	72 %
2.	Do you wash your feet daily	45 %	55 %
3.	Do you wash your feet with hot water	60 %	40 %
4.	Do you dry well between the toes	24 %	76 %
5.	Did you ever moisturize dry areas of your feet daily	54 %	46 %
6.	Do you clean nails with sharp instrument	71 %	29 %
7.	Did you ever walk around in your bare foot	65 %	35 %
8.	Do you use a hot water bottle or heating pad on your feet	12 %	88 %
9.	Did you ever inspect inside your foot wear for foreign objects or torn linings before you wear	11 %	89 %
10.	Did you ever used foot wears with high heels	11 %	89 %

Table 4 shows less than half of the respondents (27.7%) daily check their feet for any injury, (44.7%) daily wash their feet, (24.3%) dry well between the toes and (10.6%) inspect the inside of their footwear.

Table 5: Distribution of level of practice score on foot care among diabetes patients attending medical OPD in Hiwot Fana University Specialized Hospital, Harar.

N = 235

S1.NO	Level of Practice	Score	
		Frequency	Percentage
1.	Adequate (8 – 10)	12	5%
2.	Moderately adequate (5 – 7)	88	37%
3.	Inadequate (0 - 4)	135	58%

Maximum score = 10

Table 5 shows that out of 235 respondents only 12 (5%) had adequate practice, 88 (37%) had moderately adequate practice and 135 (58%) had inadequate practice regarding foot care.

Tab 6. Association of knowledge of foot care with selected socio-demographic variables of respondents

N = 235

S1. NO	Socio – demographic variables		Knowledge score on foot care			Chi square value X^2	p-value
			Adequate	Moderately adequate	Inadequate		
1.	Sex	a. Male	10(6.90)	80(55.17)	55(37.39)	2.04	0.360
		b. Female	11(12.22)	45(50.00)	34(37.78)		
2.	Education al status	a. Illiterate	0(0.00)	52(48.15)	56(51.85)	66.02	0.000**
		b. Primary	2(3.23)	41(66.13)	19(30.65)		
		c. Secondary	8(20.51)	19(48.72)	12(30.77)		
		d. Degree and above	11(42.31)	13(50.00)	2(7.69)		
3.	Marital status	a. Married	10(14.29)	38(54.29)	22(31.43)	28.61	0.000**
		b. Unmarried	6(6.06)	40(40.40)	53(53.54)		
		c. Widowed	0(0.00)	27(72.97)	10(27.03)		
		d. Divorced	5(17.24)	20(68.97)	4(13.79)		
4.	Level of Income per month	a. Less than 1000 TB/month	6(8.57)	36(51.43)	28(40.00)	6.43	0.169
		b. 1001- 5000 ETB/month	15(12.20)	66(53.66)	42(34.24)		
		c. More than 5000 TB/month	0(0.00)	23(54.76)	19(45.24)		

** Significant

Table 6 shows that there is significant association found between level of knowledge of the diabetic patients towards foot care with socio – demographic variables such as educational status ($\chi^2 = 66.02$, $p = 0.000$) and marital status ($\chi^2 = 28.61$, $p = 0.000$).

Table 7. Association of practice of foot care with selected socio-demographic variables of respondents.

N = 235

S.NO	Socio – demographic variables		Practice score on foot care			Chisquare value X^2	p - value
			Adequate	Moderately adequate	Inadequate		
1.	Sex	a. Male	10(6.90)	62(42.76)	73 (50.34)	8.55	0.014
		b. Female	2(2.22)	26(28.89)	62(68.89)		
2.	Education al status	a. Illiterate	4(3.70)	50(46.30)	54 (50.00)		
		b. Primary	6(9.68)	20(32.26)	36 (58.06)		

		c. Secondary	0(0)	14(35.90)	25 (64.10)	14.46	0.025
		d. Degree and above	2(7.69)	4(15.38)	20 (76.92)		
3.	Marital status	a. Married	6(8.57)	31(44.29)	33 (47.14)	21.71	0.001**
		b. Unmarried	6(6.06)	43(43.43)	50 (50.51)		
		c. Widowed	0(0.00)	11(29.73)	26(70.27)		
		d. Divorced	0(0.00)	3(10.34)	26 (89.66)		
4.	Level of Income per month	a. Less than 1000 ETB/month	0(0.00)	34(48.57)	36(51.43)	17.47	0.002**
		b. 1001- 5000 ETB/month	129.76()	35(28.46)	76(61.79)		
		c. More than 5000 ETB/month	0(0.00)	19(45.24)	23 (54.76)		

** Significant

Table 7 shows that there is significant association found between level of practice of the diabetic patients towards foot care with socio – demographic variables such as marital status ($\chi^2 = 21.71$, $p = 0.001$) and level of Income per month ($\chi^2 = 17.47$, $p = 0.002$).

DISCUSSION

Out of 235 respondents only 21 (9%) had adequate knowledge, 125 (53%) had moderately adequate knowledge and 89 (38%) had inadequate knowledge regarding foot care. Out of 235 respondents only 12 (5%) had adequate practice, 88 (37%) had moderately adequate practice and 135 (58%) had inadequate practice regarding foot care.

Socio – demographic variables such as educational status ($\chi^2 = 66.02$, $p = 0.000$) and marital status ($\chi^2 = 28.61$, $p = 0.000$) were significantly associated with poor knowledge on foot care. There is significant association found between level of practice of the diabetic foot care with socio-demographic variables such as marital status ($\chi^2 = 21.71$, $p = 0.001$) and level of Income per month ($\chi^2 = 17.47$, $p = 0.002$).

The results of the present study was supported by a study done in Chennai at India, only 33% of the patients obtained good scores (>50%) on knowledge regarding foot care. [37] Studies from other countries like Nigeria and Iran also showed poor awareness regarding foot care. [38, 39] On analysis of foot care practices, this current study showed a very small proportion i.e., only 5 % had adequate foot care practice score. This is closely similar to a study conducted in Nigeria, the study also revealed that a very small proportion of the diabetic patients (10.2 %) had good practice of diabetic foot care. [38] This level of foot care is very frightening considering the complication and socioeconomic consequences of diabetic foot ulceration. Furthermore, the education of physician is highly imperative to complement and

reinforce the behaviors of patient with regards to foot care; they need to learn and imbibe the skills of counseling and risk assessment.

CONCLUSION & RECOMMENDATION

In conclusion, the knowledge and practice of foot care among diabetes patients in this study were inadequate. These were associated with educational status, marital status and low income per month. Also the result of this study has highlighted the gaps in their knowledge and practice and pinpoints the necessity of inculcation of health education, making the patient aware regarding the disease and encouraging self-care management during the treatment will reduce health care burden and help achieve optimal control of the disease with minimal long term complications. The deficiency in the knowledge may be due to poor communication between the doctors and the patients and also lack of counseling by the doctors and nurses as result of busy clinic schedule. Thus, patient education on the prevention of foot ulceration is imperative and should be incorporated into the routine care of patients with diabetes both in the hospital and in the community. Time must be allotted to communication, information and education during clinic sessions. Also, the need of regular follow-up can never be underestimated in a chronic illness like diabetes and therefore be looked upon as an integral component of its long term management.

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REFERENCES

1. Shoback. Greenspan's basic & clinical endocrinology. Chapter 17, 9th ed.; edited by David G. Gardner, Dolores. New York: McGraw-Hill Medical, 2011.
2. "Diabetes - Overview". NHS. Retrieved, 2013; 07-14.
3. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes estimates for 2000 and projections for 2030. *Diabetes care*, 2004; 27(5): 1047-53.
4. Hall V, Thomsen RW, Henriksen O, Lohse N. Diabetes in Sub Saharan Africa 1999-2011: epidemiology and public health implications. A systematic review. *BMC Public Health*, 2011; 11:564.

5. Feleke Y, Enquselassie F. An assessment of the health care system for diabetes in Addis Ababa, Ethiopia. *Ethiop.J.Health Dev*, 2005; 19(3): 203-10.
6. Brem H, Tomic-Canic M. Cellular and molecular basis of wound healing in diabetes. *J Clin Inv*, 2007; 117(5): 1219–22.
7. Connor H. Some historical aspects of diabetic foot disease. *Diabetes Metab Res Rev*, 2008; 24(1): S7–S13.
8. Boulton AJM. The diabetic foot: grand overview, epidemiology and pathogenesis. *Diabetes Metab Res Rev*, 2008; 24(1): S3–S6.
9. International consensus on the diabetic foot 2007. Noordwijkerhout, International Diabetes Federation, 2007.
10. Weck M, Slesaczeck T, Paetzold H, Münch D, Nanning T, von Gagern G. Structured health care for subjects with diabetic foot ulcers results in a major reduction of amputation rates. *Cardiovasc Diabetol*, 2013; 12:45.
11. Prompers L, Schaper N, Apelqvist J, Edmonds M, Jude E, Mauricio D, et al. Prediction of outcome in individuals with diabetic foot ulcers: focus on the differences between individuals with and without peripheral arterial disease. The EURODIALE Study. *Diabetologia*, 2008; 51:747–55.
12. Gershater M, Londahl M, Nyberg P, Larsson J, Thörne J, Eneroth M, et al. Complexity of factors related to outcome of neuropathic and neuroischaemic/ischaemic diabetic foot ulcers: a cohort study. *Diabetologia*, 2009; 52: 398–407.
13. Frykberg RG, Armstrong DG, Giurini J, Edwards A, Kravette M, Kravitz S, et al. Diabetic foot disorders: a clinical practice guideline. American College of Foot and Ankle Surgeons. *J Foot Ankle Surg*, 2000; 39(5): S1–60.
14. Lipsky BA, Berendt AR, Cornia PB, Pile JC, Peters EJG, Armstrong DG, et al. Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. *Clin Infect Dis*, 2012; 54: e132–73.
15. Apelqvist J, Bakker K, van Houtum WH, Nabuurs-Franssen MH, Schaper NC. International consensus and practical guidelines on the management and the prevention of the diabetic foot. International Working Group on the Diabetic Foot. *Diabetes Metab Res Rev*, 2000; 16(1): S84–92.
16. Tseng CL, Rajan M, Miller DR, Lafrance JP, Pogach L. Trends in initial lower extremity amputation rates among Veterans Health Administration health care System users from 2000 to 2004. *Diabetes Care*, 2011; 34: 1157–63.

17. Jones WS, Patel MR, Dai D, Subherwal S, Stafford J, Calhoun S, et al. Temporal trends and geographic variation of lower-extremity amputation in patients with peripheral artery disease: results from U.S. Medicare 2000–2008. *J Am Coll Cardiol*, 2012; 60:2230–36.
18. Li Y, Burrows NR, Gregg EW, Albright A, Geiss LS. Declining rates of hospitalization for nontraumatic lower-extremity amputation in the diabetic population aged 40 years or older: U.S., 1988–2008. *Diabetes Care*, 2012; 35: 273–77.
19. Larsson J, Apelqvist J, Agardh CD, Stenström A. Decreasing incidence of major amputation in diabetic patients: a consequence of a multidisciplinary foot care team approach? *Diabet Med*, 1995; 12: 770 –76.
20. Krishnan S, Nash F, Baker N, Fowler D, Rayman G. Reduction in diabetic amputations over 11 years in a defined U.K. population: benefits of multidisciplinary team work and continuous prospective audit. *Diabetes Care*, 2008; 31: 99–101.
21. Vamos EP, Bottle A, Majeed A, Millett C. Trends in lower extremity amputations in people with and without diabetes in England, 1996–2005. *Diabetes Res Clin Pract*, 2010; 87: 275–82.
22. Lopez-de-Andres A, Martinez-Huedo MA, Carrasco-Garrido P, Hernandez-Barrera V, Gil-de-Miguel A, Jimenez-Garcia R. Trends in lower-extremity amputations in people with and without diabetes in Spain, 2001–2008. *Diabetes Care*, 2011; 34: 1570–76.
23. Larsson J, Apelqvist J, Agardh CD, Stenström A. Decreasing incidence of major amputation in diabetic patients: a consequence of a multidisciplinary foot care team approach? *Diabet Med*, 1995; 12: 770–6.
24. Krishnan S, Nash F, Baker N, Fowler D, Rayman G. Reduction in diabetic amputations over 11 years in a defined U.K. population: benefits of multidisciplinary team work and continuous prospective audit. *Diabetes Care*, 2008; 31: 99–101.
25. Hellingman AA, Smeets HJ. Efficacy and efficiency of a streamlined multidisciplinary foot ulcer service. *J Wound Care*, 2008; 17: 541–4.
26. Wrobel JS, Charns MP, Diehr P, Robbins JM, Reiber GE, Bonacker KM, et al. The relationship between provider coordination and diabetes-related foot outcomes. *Diabetes Care*, 2003; 26: 3042–7.
27. Pogach L, Charns MP, Wrobel JS, Robbins JM, Bonacker KM, Haas L, et al. Impact of policies and performance measurement on development of organizational coordinating strategies for chronic care delivery. *Am J Manag Care*, 2004; 10: 171–80.

28. Rogers LC, Andros G, Caporusso J, Harkless LB, Mills JL, Sr, Armstrong DG. Toe and flow: essential components and structure of the amputation prevention team. *J Vasc Surg*, 2010; 52(3): 23S–7S.
29. Carls GS, Gibson TB, Driver VR, Wrobel JS, Garoufalis MG, Defrancis RR, et al. The economic value of specialized lower-extremity medical care by podiatric physicians in the treatment of diabetic foot ulcers. *J Am Podiatr Med Assoc*, 2011; 101: 93–115.
30. Armstrong DG, Bharara M, White M, Lepow B, Bhatnagar S, Fisher T, et al. The impact and outcomes of establishing an integrated interdisciplinary surgical team to care for the diabetic foot. *Diabetes Metab Res Rev*, 2012; 28: 514–18.
31. Reiber GE, Ledoux WR. Epidemiology of diabetic foot ulcers and complications: evidence for prevention. In: Williams R, Herman H, Kinmoth AL, Wareham NJ, editors. *The evidence base for diabetes care*. Chichester: Wiley, 2002; 641–665.
32. Boulton AJM. The diabetic foot: grand overview, epidemiology and pathogenesis. *Diabetes Metab Res Rev*, 2008; 24(1): S3–S6.
33. International consensus on the diabetic foot 2007. Noordwijkerhout. International Diabetes Federation, 2007.
34. Oyibo SO, Jude EB, Voyatzoglou D, Boulton AJM. Clinical characteristic of patients with diabetic foot problems: changing patterns of foot ulcer presentation. *Practical Diabetes International*, 2002; 19: 10 – 12.
35. Armstrong DG, Holtz-Neiderer K, Wendel C, Mohler MJ, Kimbriel HR, Lavery LA. Skin temperature monitoring reduces the risk for diabetic foot ulceration in high-risk patients. *Am J Med*, 2007; 120(12): 1042–46.
36. Jill Heitzman. Foot care of patients with Diabetes [Serial on the internet] 2013. Available from: <http://www.nsgcentre.com/pdf>.
37. Viswanathan V, Shobhana R, Snehalatha C, Seena R, Ramachandran A. Need for education on footcare in diabetic patients in India. *J Assoc Physicians India*, 1999; 47: 1083–85.
38. Desalu OO, Salawu FK, Jimoh AK, Adekoya AO, Busari OA, Olokoba AB. Diabetic foot care: Self-reported knowledge and practice among patients attending three tertiary hospital in Nigeria. *Ghana Med J*, 2011; 45: 60–5.
39. Khamseh ME, Vatankhah N, Baradaran HR. Knowledge and practice of foot care in Iranian people with type 2 diabetes. *Int Wound J*, 2007; 4: 298–302.