Original Article

Knowledge and practice of diabetic foot care in Sudan: A cross sectional survey

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ABSTRACT

Background: Diabetes in Sudan is real health challenge for health authorities especially optimum glycemic control and complications in particular diabetic septic foot. This is study aimed to assess knowledge of individuals with diabetes about self-foot care.

Methods: This is descriptive cross sectional, health facility-based study conducted in diabetes center in Khartoum, Sudan. The study recruited 150 individuals with diabetes. Data was collected using a standardized pretested questionnaire.

Results: Among the participants 64.7% were females and 35.3% were males, 36% of the participants were between the age of 51–60 years old. Good glycemic control (HbA1c) were achieved by 41.3% only. The participants who had good knowledge about diabetic foot self-care were 46.7%, poor knowledge 29.3% and moderate knowledge 24%. Good self-practice toward diabetic foot self-care was reported by 42.6%, moderate by 36.7% and poor practice by 20.7%. The awareness and practices significantly correlated with an increase in ages (≥51 years), higher level of education, medium income, unemployment, longer duration of diabetes > 10years, family history, controlled diabetes mellitus and education about diabetes complications and diabetic foot care (P value < 0.05).

Conclusions: Only (46.7%) of participants address good awareness and practices about self-foot care. Accordingly, there is a great need to provide continuous health education to the patients about diabetic foot self-care and this knowledge-application gap must be narrowed down.

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1. Background

The prevalence of diabetes in Sudan have increased significantly in urban areas. For example in 2016, Elamdhoun et al. have shown that the prevalence of diabetes in urban areas in North Sudan was 19% , while the prevalence remains stable in rural areas at 2.5% [1]. This high prevalence of diabetes in Sudan was associated with high prevalence of uncontrolled diabetes (85% of type 2 diabetes with high HbA1c) and complications like fatty liver (50.3%), retinopathy and diabetic foot ulcer (DFU) [2].Importantly, the estimated global prevalence of diabetic foot ulcer was thought to be 6.3%. There was large variations of prevalence of diabetic foot in different continents (North America 13%, Europe 3% and in Africa about 7.2% [4]. Different factors are thought to be associated with DFU like male gender, type 2 diabetics, older individuals, low body mass index (LBMI), longer diabetic duration, hypertension, diabetic retinopathy (DR), and smoking history [3]. Unfortunately, the prevalence of DFU is thought to increase in Africa, due to high prevalence of diabetes complications like neuropathy and peripheral vascular disease in association with lack of adequate diabetes financial support [4].It worth mentioning, the current global diabetic population will double by the year 2030 to around 370 million [5,6].DFU can cause significant distress to individuals and difficult to treat as its combination of different pathological processes (vascular, neuropathy

and hyperglycemia) [7,8]. These contributory factors co-exist in more than 10% of patients at the time of diagnosis of T2DM [9].In Sudan the prevalence of diabetic foot ulcer was 18.1%, and the risk of development of diabetic foot ulcer was related to longer duration of diabetes > 10 years [10]. In low resource setting country like Sudan, using foot self-care behaviors, like daily inspection of feet, professional treatment, hygiene, and proper shoes material minimize the risk of foot complications [11]. This may explain why diabetes requires a multidisciplinary approach in order to achieve good glycaemic control and decrease complications [12]. Therefore investment in education and patient awareness about DSU and good foot practice may decrease the incidence of foot disease [13,14]. Importantly, several studies showed poor foot care knowledge among individuals with diabetes. For example, in Malaysia 58%, had poor foot care knowledge while 61.8% had poor diabetic foot care practice [15]. In India, 12.5% had received previous foot care advice from healthcare professionals, and awareness of foot care among people with diabetes is low among those attending all levels of healthcare(mean foot care score in all three groups was 5 of a maximum of 14, which was poor) [16]. In China, 82.7% had good foot care knowledge, 22.4% had good foot self-care practice, and 71% had satisfactory practice score [17]. In Saudi Arabia, In addition to lack of knowledge concerning diabetic foot disease which is likely to dominant among male, family history and smoking, are major risk factors for diabetic foot complications [18,19]. Interestingly, in Germany it was shown that individuals with type 2 diabetes who had participated in more than education program performed significantly better self-care than patients who had no or only one training program. Patients with a foot at risk for the development of diabetic foot ulcer perform more adequate self-care regarding professional assistance in foot care, but are not more active in the self-control of the feet, shoes and socks [20]. Therefore, the aim of this research was to assess knowledge of Sudanese individuals with diabetes about self-foot care.

2. Methodology

2.1. Study setting

Descriptive cross sectional, health facility-based study. The study was conducted in Alamel Centre of diabetes and endocrinology in Khartoum, Sudan.

2.2. Inclusion criteria

Adult patients more than 18year of both genders with confirmed diabetes mellitus, agreed to participate attending the Alamal Center during the study period (from Ist May −30th of October 2018) were included. Patients refused participation and Patients unable to participate were excluded from the study.

2.3. Sample size

The sample was determined using the following formula:
SS = (z2 pq) d2) where SS is the estimated sample size; z the standard value for 5% level of significance (z = 1.96); d, the margin of desired error taken as 5%; p the prevalence rate of diabetes and q = 1 _ p. According to the prevalence of diabetes mellitus in Sudan in 2017, the sample size = 150 participants.

2.4. Tool and materials

The data was collected through direct interview by using pre-designed standardized questionnaire contain eight branches of questions. The branches of awareness of the participants about

diabetes foot cares and practices were determined according to modified score of 16 items, accordingly the knowledge and practice grade were categorized as follow:

2.4.1. Knowledge score

The questions that assessing the knowledge of the patients about diabetic foot self-care were 16, each question given the answers (yes or no), yes indicates the knowledge of the specified item of knowledge, accordingly the knowledge of the patient calculated as accumulation of the correct answers as follow:

- -The participant who mentioned 12−16 correct answers rated as good level of knowledge.
- -The participant who mentioned 8−11 correct answers rated as moderate level of knowledge.
- The participant who mentioned <8 correct answers rated as poor level of knowledge.

2.4.2. Practice grade

The questions that assessing the practice of the patients about diabetic foot self-care were 17, each question given the answers (done or not done), done response indicates practice of the specified item of practice, accordingly the practice of the patients calculated as accumulation of their answers as follow:

- The participant with answer of 12−16 items of practice rated as good level of practice.
- The participant with answer of 8−11 items of practice rated as moderate level of practice.
- The patient who mentioned <8 correct answers rated as poor level of practices.

2.5. Materials

- Using electronic sphygmomanometer, BP was measured three times and the average was taken.
- A combined Weighing and Height scale was used to calculate BMI.
- Glycemic control was determined based on HbA1c result.

2.6. Data analysis

Data was analyzed by using the computerized program; statistical package for social science (SPSS, version 23). Results were presented as tables and figures. Chi-square test was used for cross tabulation at 0.05 margins of error (P value).

2.7. Ethical consent

It was obtained from SUMASRI Institutional Review Board (SIRB) and permission from Alamal National Canter of diabetes and endocrinology was obtained. The information was communicated verbally. Refusal to participate in the study did not deny the patient the appropriate management. The participants did not bear any cost.

3. Results

3.1. Socio-demographic characteristics

This was shown in Table (1): The most common age group was 51−60 years in (36%) of the participants. Females were (64.7%) while males were (35.3%), 68.7% of the participants were from

Table 1
Distribution of the participants according to socio-demographic characteristics.

Socio-demographic characteristics (n = 150)	N	%
Age group		
<30 years	7	4.7
30–40 years	19	12.7
41–50 years	22	14.7
51–60 years	54	36.0
>60 years	48	32.0
Gender		
Male	53	35.3
Female	97	64.7
Residence		
Rural	47	31.3
Urban	103	68.7
Level of education		
Illiterate	28	18.7
Primary	57	38.0
Secondary	41	27.3
University	21	14.0
Postgraduate	3	2.0
Marital status		
Single	8	5.3
Married	124	82.7
Divorced	2	1.3
Widowed	16	10.7
Socioeconomic status		
Low	53	35.3
Medium	90	60.0
High	7	4.7
Occupation		
Working	55	36.7
Not working	95	63.3

urban areas. Regarding education level highest percentage of the participants (38%) had primary level of education, the most of them (82.7%) were married, moreover the highest percentage (60%) had medium income, and the majority of the participants (63.3%) were not working.

3.2. Type of diabetes and duration

The participants had diabetes for ≤ 10 years were (65.3%), more than 10 years (30.7%), while newly discovered were (4%). The majority (89.3%) had type 2 diabetes mellitus while only (10.7%) had type 1. 31% of the participants had hypertension, hyperlipidemia reported only in (9%) and other diseases were (4.7%).(67.3%) of the participants had family history of diabetes mellitus (Table 2). The participants who found it is difficult to take medication on daily basis were (25.5%).The most common diabetes complications complained by the participants were retinopathy (46.7%), numbness and tingling (39.3%), sexual and dental problems(22%), while only 6% complained of nephropathy.

According to HbA1c, the controlled participants were (41.3%) and the uncontrolled were (58.7%)

Education about diabetes complications was provided for (50%) of the patients, education on self-foot care reported by (45.3%),

Table 2
Distribution of the participants according to diabetes type and duration.

DM information	N	%
Duration of DM (n = 150)		
Newly discovered (<1 year)	6	4.0
< = 10 years	98	66.3
>10 years	46	30.7
Type of DM (n = 150)		
Type 1	16	10.7
Type 2	134	89.3

education about annual foot examination was done only for (29.3%) and (57.3%) received education from doctors. Only 28.6% of the participants said that they use warm water for feet washing. 46% of the participants Referred to foot care specialist while only 28.7% of them their Foot examined by specialists.

3.3. Knowledge and practice about diabetic foot care

The participants who had good knowledge on diabetes foot self-care were (46.7%), poor knowledge (29.3%) and moderate knowledge (24%). Good self-practice toward diabetes foot self-care was reported by 42.6%, moderate by 36.7% and poor practice by 20.7% (Tables 3 and 4). Statistically Significant results were found between ages ≥ 51 years, higher level of education, medium income and none working patients in one hand and good knowledge on the other hand.

The association between gender and residence with knowledge revealed statistically insignificant results (p values = 0.077, 0.079 respectively). Significant results found between longer duration of diabetes more than 10 years, family history of diabetes, HbA1c level, provision of education of DM complications, self-foot care and annual foot examination in one hand and good knowledge. When Crosstabulation and chi-square test were performed to determine if there is an association between the practice and sociodemographic characteristics the results were statistically significant with age group, level of education, marital status, and socioeconomic status of the participants (p values = 0.002,0.001, 0.016, 0.034 respectively).Statistically Significant results found between diabetes duration more than 10-year, family history of diabetes, control of diabetes based on HbA1c and provision of education to diabetic patients with good practice of diabetes food self-care (p = 0.032, 0.04,0.044,0.001 respectively) (Tables 5,6).

4. Discussion

36% of the respondents belonged to the age group of 51–60 years; females were (64.7%) while males were (35.3%). This is comparable with a study from Saudi Arabia, in which the mean age

Table 3
Distribution of the participants according to their knowledge towards the consequences of injury (n = 150).

Variables	%	
	Yes	No
Diabetic patient if injured in his feet what happen?		
Infection	38.7	61.3
ulcer	18	82
difficult healing	50	50
amputation	77.3	22.7
gangrene	26	74

Table 4
Distribution of the participants according to level of knowledge and practice about diabetes foot self-care n = 150.

Variable	%
Level of practice	
Good	42.6
Moderate	36.7
Poor	20.7
Level of knowledge:	
Good	46.7
Moderate	24
Poor	29.3

Table 5
Crosstabulation and Chi-Square test to determine the associations between knowledge of diabetes foot care and socio-demographic data of the participants n = 150.

Socio-demographics	Knowledge (N)				
	Poor	Moderate	Good	χ^2	P
Age group					
<30 years	2	1	4	10.60	0.008*
30−40 years	4	1	14		
41−50 years	7	7	8		
51−60 years	15	12	27		
>60 years	16	15	17		
Level of education					
Illiterate	10	7	11	8.37	0.004*
Primary	19	17	21		
Secondary	11	7	23		
University	3	5	13		
Postgraduate	1	0	2		
Marital status					
Single	2	1	5	6.86	0.015*
Married	34	32	58		
Divorced	0	0	2		
Widowed	8	3	5		
Socioeconomic status					
Low	17	10	26	8.27	0.026*
Medium	26	23	41		
High	1	3	3		
Occupation					
Working	15	10	30	2.51	0.044*
Not working	29	26	40		

* Significant (P value < 0.05.

Table 6
Crosstabulation and Chi-Square test to determine the associations between knowledge of diabetes foot care and duration of diabetes, presence of family history, diabetes control and participant education towards diabetes (n = 150).

	Knowledge (N)				
	Poor	Moderate	Good	χ^2	P
Duration of DM					
Newly discovered < 1 year	1	3	2	4.07	0.028*
<= 10 years	31	23	44		
>10 years	12	10	24		
Family history of DM					
Yes	33	24	44	1.84	0.034*
No	11	12	26		
DM control (HbA1c)					
Controlled	17	11	34	3.67	0.037*
Uncontrolled	27	25	36		
Education about DM complications					
Yes	12	19	44	13.88	0.001*
No	32	17	26		
Education about Self-foot care					
Yes	8	21	39	18.59	0.001*
No	36	15	31		
Education about Annual foot examination					
Yes	5	11	28	10.72	0.001*
No	39	25	42		

* Significant (P value < 0.05).

of majority of individuals with diabetes was 50.87 ± 15.9 years with a range of 20−90 years [18]. Importantly, 39.3% of participants were complained of numbness and tingling (neuropathy) while only 5.3% were suffered of previous DFU, while numbness was found in 47.7% of Egyptian population [21]. It's important to screen for other diabetes complications especially retinopathy. Diabetic retinopathy was regarded as one of the most common diabetes complications in Saudi Arabia and in our study retinopathy was reported in 46.7% of the participants [23]. Good glycemic control was reported in 41.3%, in comparison with previous study in Sudan which showed only 15% with good glycemic control [2]. This can be attributed to the

fact that our study was conducted in specialized center with regular follow up for patients. This still less than good glycemic control achieved in Lebanon (64%) [22].

One of the key strategies in addressing problem of DSU is patient's education. In this study half of individuals with diabetes received education about diabetes complications and only (45.3%) of participants educated about diabetic foot self-care by doctors, health educators and/or diabetic foot specialist. Health education sessions on importance of how to conduct foot care have been held only for less than half of patients, this can be attributed to busy clinic and shortage of the staff. Similar problem was also reported in India, as only 12.5% had received previous foot care advice from healthcare professional [16]. Furthermore, in this study we showed that the near half of the study's participants had good knowledge on diabetes foot self-care, (29.3%) had poor knowledge about diabetic foot care while the remaining had moderate knowledge, in spite of that, most of them were aware of the consequences of diabetic foot injury, (77.3%) addressed their awareness about amputation and (38.7%) about foot infection.Significant correlation found between ages, higher level of education, medium income, unemployment, longer duration of diabetes, family history diabetes, controlled diabetes mellitus and reception of education on diabetes complication and diabetic foot self-care (P value < 0.05). Similar result is also observed in Bangladesh, where over (50%) of the study population was not aware of the risks of diabetic foot. Furthermore, this study in Bangladesh also showed that poor knowledge of the complications of diabetes was associated with age, a low educational level and low socioeconomic status, Their results revealed low levels of patients awareness concerning the potential severity of diabetic foot lesion and the means of preventing foot problems [24].

There is considerable variation in the patient knowledge about diabetic foot care in the region. For instance, one study in Sudan showed low level of knowledge, while another study in Saudi Arabia showed good level of knowledge [25,26]. This variations can be attributed to locations of studies in urban or rural areas, specialist diabetes center or primary care center and also variation in knowledge of health professionals team. Good practice toward diabetes foot self-care was reported by (42.6%), moderate (36.7%) and poor practice (20.7%). The factors that significantly associated with good self-practice were the same factors that significantly associated with good knowledge addressed above (P value < 0.05). Similar factors were also reported in China to be associated with poor foot self-care practice like education, duration of diabetes mellitus, periodic inspection, and education about diabetes complications [27]. It worth mentioning that regular examination of feet by doctors can enhance the good patient foot care [28].

This study is not without limitations. The cross-sectional design of the study may not allow for the temporal relationship. The study cannot be generalized to the whole of Sudan as recruitment of participants took place only in Khartoum. Despite these limitations, we believe this study was novel and it clearly highlight the importance of increasing knowledge and self-care about diabetic foot.

5. Conclusion

Only (46.7%) of participants address good awareness and practices about self-food care. Accordingly, there is a great need to provide continuous health education to the patients about diabetic foot self-care and this knowledge-application gap must be narrowed down.

Conflict of interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.dsx.2019.06.016.

References

[1] Elmadhoun WM, Noor SK, Ibrahim AA, Bushara SO, Ahmed MH. Prevalence of diabetes mellitus and its risk factors in urban communities of north Sudan: population-based study. J Diabetes 2016 Nov;8(6):839–46.

[2] Almobarak AO, Barakat S, Suliman EA, Elmadhoun WM, Mohamed NA, Abobaker IO, et al. Prevalence of and predictive factors for nonalcoholic fatty liver disease in Sudanese individuals with type 2 diabetes: is metabolic syndrome the culprit? Arab J Gastroenterol 2015;16(2):54–8. Epub 2015/07/16.

[3] Zhang P, Lu J, Jing Y, Tang S, Zhu D, Bi Y. Global epidemiology of diabetic foot ulceration: a systematic review and meta-analysis (dagger). Ann Med 2017;49(2):106–16. Epub 2016/11/04.

[4] Bos MAC. Prevalence and complications of diabetes mellitus in Northern Africa, a systematic review. BMC Public Health 2013;13(1):387.

[5] Global Report on Diabetes. World Health Organization; 2016. Accessed on 15/5/2019 from the: https://apps.who.int/iris/bitstream/10665/204871/1/9789241565257_eng.pdf.

[6] Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. Diabetes Care 2004;27(5):1047–53. Epub 2004/04/28.

[7] Leung PC. Diabetic foot ulcers–a comprehensive review. Surgeon 2007;5(4):219–31. Epub 2007/09/14.

[8] WHO. Global report on diabetes. World Health Organization Library Cataloguing-in-Publication Data; 2016.

[9] The Merck manual. In: Beers MHPR, Jones TV, Kaplan JL, Berwits M, editors. Diabetes mellitus and disorders of carbohydrate metabolism. eighteenth ed. New Jersey, USA: Merck Research Laboratories; 2016.

[10] AOea Allmobarak. Prevalence of diabetes foot ulceration and associated risk factors an old and still major public health problem in Khartoum, Sudan? Ann Transl Med 2017;5(17):340.

[11] Matricciani L, Jones S. Who cares about foot care? Barriers and enablers of foot self-care practices among non-institutionalized older adults diagnosed with diabetes: an integrative review. Diabetes Educat 2015;41(1):106–17. Epub 2014/12/07.

[12] Wu SCDV, Wrobel JS, Armstrong DG. Foot ulcers in the diabetic patient, prevention and treatment. Vasc Health Risk Manag 2007;3(6576):34–79.

[13] Ekore RAI, Arije A, Ekore J. Knowledge of and attitude to foot care amongst type 2 diabetes patients attending a university-based primary care clinic in Nigeria. Afr J Prim Health Care Fam Med 2010;2(10):1–3.

[14] Nyamu POC, Amayo E, Mcligeyo S. Risk factors and prevalence of diabetic foot ulcers at Kenyatta National Hospital, Nairobi. East Afr Med J 2003;80(1):36–43.

[15] Muhammad-Lutfi AR, Zaraihah MR, Anuar-Ramdhan IM. Knowledge and practice of diabetic foot care in an in- patient setting at a tertiary medical center. Malays Orthop J 2014;8(3):22–6. Epub 2015/09/25.

[16] Kishore S, Upadhyay AD, V PJ. Awareness of foot care among patients with diabetes attending a tertiary care hospital. Natl Med J India 2015;28(3):122–5. Epub 2016/01/03.

[17] Mabbanya EaL-a R. Knowledge and practice of diabetic foot care in patients with diabetes at Chinese general hospital and medical center. J ASEAN Fed Endocr Soc 2017;32(2):123–7.

[18] Al Odhayani AA, Al Sayed Tayel S, Al-Madi F. Foot care practices of diabetic patients in Saudi Arabia. Saudi J Biol Sci 2017;24(7):1667–71. Epub 2018/10/09.

[19] Salman ARA, Al-Ayed MY, Sweidan BA, Aljlouni MMA. Awareness of diabetic foot among type 2 diabetes in a tertiary care hospital, Saudi Arabia: a cross-sectional study. Endocrinol Metab Int J 2016;3(5):0063.

[20] Schmidt S, Mayer H, Panfil EM. Diabetes foot self-care practices in the German population. J Clin Nurs 2008;17(21):2920–6. Epub 2008/11/18.

[21] Alasmary AS, Mostafa OAYM. Diabetic patients' knowledge and practice regarding prevention of diabetic foot. Med J Cairo Univ 2013;81(2):197–205.

[22] Karam PSDB, Trupti NBM, Sameer V. Evaluation of knowledge and self care practices in diabetic patients and their role in disease management. Natl J Community Med 2012;3(1):12–7.

[23] Mea Alhabshan. Assessment of knowledge toward complications of diabetic septic foot among diabetics patients in Saudi Arabia. Egypt J Hosp Med 2017;69(6):2557–61.

[24] Lamchahab FZ, El Kihal N, Khoudri I, Chraibi A, Hassam B, Ait Ourhroui M. Factors influencing the awareness of diabetic foot risks. Ann Phys Rehabil Med 2011;54(6):359–65. Epub 2011/08/16.

[25] Mohamed M, SHM SMA. Diabetic foot lesions predicting factors, view from Jabir Abu-alaiz diabetic centre in Khartoum, Sudan. J Diabet Foot Complicat 2016;8(2):6–17.

[26] MAea Algshanen. Diabetic foot awareness among diabetic patients in Saudi Arabia. Egypt J Hosp Med 2017;68(2):1289–90.

[27] Rao LY, Xiao-Hui G, et al. The current status of foot self-care knowledge, behaviours, and analysis of influencing factors in patients with type 2 diabetes mellitus in China. Int J Nurs Sci 2014;14(1):266. e71.

[28] Goie TT, Naidoo M. Awareness of diabetic foot disease amongst patients with type 2 diabetes mellitus attending the chronic outpatients department at a regional hospital in Durban, South Africa. Afr J Prim Health Care Fam Med 2016;8(1):e1–8. Epub 2017/02/06.