Knowledge and self-care activities among Sudanese individuals with diabetes: a cross sectional survey

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Background: Increasing knowledge and self-care practices may lead to adequate glycemic control and decrease diabetes complications. Therefore, the aim of the current study was to determine the knowledge and self-care activities among Sudanese individuals with diabetes.

Method: A cross-sectional study was conducted in four centers of diabetes in Khartoum state (286 participants). The respondents were interviewed using a set of validated questionnaires. The data collected were analyzed using the statistical package for the social sciences (SPSS) version 20.

Results: Among 286 of individuals with diabetes, 43.4% were males and 56.6% females. Regarding knowledge, 19 ± 5.145 was obtained as the median of total score of knowledge and 51.4% consider had sufficient knowledge about diabetes, and its complication, while 48.6% had insufficient knowledge. The respondent's practice towards self-care activity in regards to foot examination, inspection of shoes and diet was acceptable (56.0%, 59.0%, 66.0%) respectively. But their practice towards exercise and eye examination was insufficient (47.0%, 45.1%) respectively. There was a significant association between knowledge and hypertension (HTN), patient that received education before staring treatment for diabetes and the patient that tells the health care provider about diabetes before taking any other medication. There was a significant association between the mean score of knowledge and the name of centers, education level and duration of diabetes. Importantly, no association was found between knowledge with the Frequency of meeting health care provider.

Conclusions: The overall knowledge of Sudanese individuals with diabetes towards diabetes was sufficient and their practice towards self-care activity was acceptable. Clinical and community pharmacists may have role in increasing knowledge and practice of diabetes.

Keywords: Diabetes; self-care; Sudan

Introduction

Diabetes mellitus (DM) is one of the most common endocrine disorders. It is a chronic condition, characterized by hyperglycemia and due to impaired insulin secretion with or without insulin resistance (1). Achieving glycemic control is struggle across the globe. For instance, the prevalence of uncontrolled diabetes among Sudanese individuals with type 2 diabetes was found to be 85.0% (2). Poor knowledge and practices among individuals are some of the important variables influencing the progression of diabetes and its complications, which are highly preventable. Compared with the general population incidence of coronary heart diseases and stroke are more common among in individuals with diabetes. Unfortunately, high prevalence of diabetes complications, namely, diabetic peripheral neuropathy (68.2%), diabetic retinopathy (72.6%) and hile the prevalence of diabetic foot was found to be only 12.7% (3). Such high prevalence of diabetes complications were attributed to urbanized life-style and have longer duration of diabetes with poor control (3). A community based, cross-sectional study among individuals with type 2 DM in Sullia Taluk, Karnataka, showed only 24.25% of diabetic patients had good knowledge toward diabetes, adherence to some of the self-care practices was also poor (4). Another cross-sectional study which was done in Hidalgo Mexico, 2015, showed that less than 20% of the patients have an adequate understanding of the disease (5). A study in Mangalore was conducted to assess the knowledge of diabetic complications and its prevention among type 2 diabetic patients, and their results found that majority of the study population (49.0%) considered heart disease as the most serious complication of diabetes (6). Almobarak *et al.* showed that in Sudanese adults with type 1 diabetes 83.0% have poor glycemic control and 76.2% have high cholesterol (7). Management of DM requires setting a proper treatment plan including medications, healthy diet, weight loss, and regular physical activity. Patient adherence, education, and integration into the health-care team are essential for the successful management of diabetes. In Sudan, only 15.0% were highly adherent to diabetes medications, 44.6% were medium adherent, and 40.4% showed low adherence (8). Our study aimed to assess the knowledge and self-care activities among Sudanese individuals with diabetes in three diabetic centers in Khartoum state.

Methods

Study design

Hospital based descriptive cross-sectional survey, the study was conducted in four centers of diabetes (Omer Ibn Al-Khattab Health Center in Ibrahim Malik Hospital, Omdurman Hospital Abdalla Khalil Diabetes Center, Al-Khatmia Health Center and Shambat Health Center), the study was conducted from March to May 2018.

Study participant and data collection

The total number of patients attending the four centers was (1,010 per month) the distribution of patients was 60, 500, 200, and 250 among Omer Ibn Al-Khattab Health Center, Abdalla Khalil Diabetes Center, Al-Khatmia Health Center and Shambat Health Center respectively. The equation of known population was used to calculate the sample size as follow:

$$n = \frac{N}{1 + N(e)^2}$$

$$n = \frac{1010}{1 + 1010(0.05)^2} \qquad [1]$$

$$n = 286.5$$

N = target population; n = sample size; e = margin of error (0.05).

The sample size was 287 DM patients, the response rate was 99.6%. We selected these centers because they have the highest capacity for reviewing individuals with diabetes in Khartoum state. We used a stratified sampling method and considered each center from the four centers as stratum according to their proportion, the participants were selected in each center by convenience sampling method.

We determined the targeted number of patient in each center, that we should take from each center as follow: Omer Ibn Al-Khattab Health Center's total patients capacity in a month represented 6.0% of the total sample, accordingly the sample that we should take was 17 participants, Abdalla Khalil Diabetes Center represented 49.0% of the total sample, accordingly 142 participants were taken as sample, Al-Khatmia Health Center represented 20.0% of the sample, accordingly 58 participants were taken and Shambat Health Center represented 25.0% of the total sample, accordingly the sample was 72 participants.

A structured questionnaire was filled by the researchers which consisted of three parts: 12 items related to socio-demographic and diabetes specific information, second part consisted of 26 questions related to knowledge regarding diabetes among patients and its complications and 22 questions related to self-care activities followed by the patients, patients were classified into those who had achieved glycemic control and those who did not, based on the fasting blood sugar levels (≤126) mg/dL based on standard range used in the centers, a pilot study was carried out with 7 patients who met the inclusion criteria (not included within the data) for a final adjustment of the questionnaire, then the questionnaire was released after consider the arrangement of each part and the questions consisting it.

In our study, reliability test was performed and Cronbach's alpha was (0.869). Data entering and analysis were done by using the statistical package for the social sciences (SPSS) version 20 and Excel version 2016. The data was represented in the form of figures and frequency table, statistical tests like mean and standard deviation, chi-square test, correlation and logistic regression used to analyze our data. Score of knowledge was developed for each component, each 'right' answer was given a score of 1 and each 'wrong' or 'I do not know' answer was given 0 score. This give a total score of [0–26] marks, we used a median score as a cut-off point [19] to assess the knowledge question (9). Level of (≥19) was considered as sufficient knowledge while (<19) was considered as insufficient knowledge.

Inclusion criteria and exclusion criteria

We include all patients with type I or type II DM who above 18 years. We excluded patients who could not complete the questionnaire for medical reasons or not willing to participate in the study. We also excluded patients that are newly diagnosed (duration of diabetes less than 1 month).

Ethical consideration

The purpose of the study was explained and informed consent was obtained from the respondents. Privacy and confidentiality were ensured during the process. The ethical approval was obtained from the ministry of health—Khartoum State (KMOH-REC-1-2019). The data were collected from the patients by face to face interview, and the questions were explained by using a native language.

Results

Baseline characteristics of the respondents

More than half of participants were females (56.6%), and the mean age of participants was 54.18 years old. Majority of the participants completed Higher Secondary School. Hypertension (HTN) was the most common comorbid disease. Individuals with type 2 diabetes were the most prevalent (93.0%), and (63.0%) of participants have had diabetes for duration ranged between 1–10 years. One hundred and twenty-four participants (43.4%) had history of hospital admission due to diabetes, and 78 (27.3%) had the experience of attending diabetes education courses. Physicians were the main source of information, and most of respondents were meeting the health care providers regularly (*Table 1*).

Assessing participant's knowledge

The participants in this study were asked questions in general about diabetes, its risk factors, signs and symptoms, and complications to estimate the knowledge about their disease as shown *Table 2*. Nineteen was obtained as the median of total score of knowledge and 51.4% (above the median 19) were considered had sufficient knowledge about diabetes and its complication, while 48.6% were considered had insufficient knowledge. In our study, reliability test was performed and Cronbach's alpha was (0.869).

Practice towards self-care activities

Regarding exercise the study also showed that exercise was achieved by 46.9% of participants; among them 28.3% were doing exercise daily and majority of the participants (80.8%) had never smoked. Regarding eyes examination, less than half of respondents, 129 (45.1%) was checking their eyes in hospital. Among them 74 (57.4%) were checking yearly, while 41 (31.8%) were checking every 3 months.

Regarding diet, two-thirds (66.1%) of participants have had a proper meal plan recommended by doctors, and 72.4% followed low carbohydrate diet, 28.0% used artificial sweeteners, 87.7% eat very few sweets and 77.3% eat a lot of fruits and vegetable (*Table 3*).

Discussion

Most of the study participants were in the 51–60 years' age group and there is significant difference between knowledge

Table 1 The distribution of socio-demographic characteristics among studied participants

Variables	Features of variables	%
Sex	Male	43.0
	Female	57.0
Age	–	Mean: 54.18
Education level	Illiterate	24.5
	Primary	25.9
	High school	29.0
	University	18.2
	Post graduate	2.4
Comorbid disease	HTN	36.0
	Other CVD	3.1
	Kidney disease	2.8
	Dyslipidemia	10.5
	Others	13.3
Types of diabetes	Type 1	7.0
	Type 2	93.0
Duration	1	9.0
	2–5	38.0
	6–10	25.0
	11–15	15.0
	15	13.0
Did you have admitted to hospital as result of diabetes	Yes	43.4
	No	56.6
Have you received diabetes education before	Yes	27.3
	No	72.7
Source of information	Physician	97.9
	Pharmacist	0.3
	Other	1.7
Frequency to meet the health care provider	Daily	0.7
	Weekly	9.8
	Monthly	85.0
	One in year	4.2
	None	0.3
Fasting blood sugar (n=147)	Controlled	38.8
	Uncontrolled	61.2

HTN, hypertension; CVD, cardiovascular disease.

and age (P=0.009), also this study revealed that knowledge level is declining with older age, this might be explained by the observation that the majority of old age patients were illiterate which might affect their knowledge. However, a study in Hidalgo, Mexico showed decline in knowledge about diabetes with an increase in age (5). While studies in north Malaysia and southern India demonstrate that there is no association between age and knowledge about diabetes (10,11).

Our study showed an association between educational level and diabetes knowledge (P=0.000). Importantly, when compared to those who achieved secondary high school education the illiterate group demonstrated poor knowledge about diabetes, and this consistent with other similar previous studies (12,13). It worth mentioning that self-care knowledge was associated with level of education (P=0.000) (14). Furthermore, our study showed that there was no association between score of knowledge and types of diabetes (P=0.372), but it seems to be have high contribution in knowledge (odd ratio =2.156) which mean that type 1 diabetic patients are most likely to have sufficient knowledge by two times than those with type 2 diabetes.

Regarding to knowledge and duration of disease, there was highly significant difference between knowledge and duration of diabetes (P=0.000) the longer duration of the disease, the higher the knowledge of patients. Similar findings have been reported in study done by Murata *et al.*, which stated that a longer duration of the disease was associated with better knowledge (15). However, West and Goldberg, found no significant increase in knowledge scores with the number of years post-diagnosis in the Veterans' Clinic in the USA (16). Dinesh *et al.* showed that the lesser the duration of the disease, the higher the knowledge in individuals with diabetes in India (4). This contrast might be explained by the lack of established education programs on diabetes which would have empowered the patient's knowledge about diabetes.

This study reveals that general knowledge of Sudanese individuals with diabetes was sufficient. Similar result was also noted in individuals with diabetes in Iraq (17). Importantly, many cross-sectional studies were shown that general knowledge of their subjects about diabetes was poor (13,18-21).

Despite the fact that several studies showed that men were more knowledgeable about diabetes than women, one study in Nigeria showed no gender difference (8,19-22). Our study showed no insignificance difference in knowledge among men and women (P=0.991). Integrating frequency

Table 2 The distribution of knowledge about diabetes (signs, symptoms, complications and risk factor) among studied participants (n=286)

Knowledge questions	Responses (%)		
	Yes	No	I don't know
Is diabetes mellitus hereditary?	61.9	23.4	14.7
Is diabetes mellitus curable?	22.7	53.1	24.1
What are the signs of hypoglycemia?			
Excessive sweating	61.1	15.1	23.9
Blurred vision	60.1	18.2	21.7
Fatigue	69.9	12.9	17.1
Headache	38.1	26.2	35.7
What are the signs of hyperglycemia?			
Increased thirst	78.7	8.4	12.9
Increased urination	86.4	5.2	8.4
Frequent skin and urinary infections	83.2	4.2	12.6
The complications of diabetes mellitus:			
Ophthalmic problems	88.1	2.8	9.1
Foot infections	83.2	4.2	12.6
Cardiac ischemia	59.1	12.9	28.0
Renal problems	78.0	5.6	16.4
Neuropathy	72.4	7.7	19.9
Once diabetes is controlled, can the drugs be stopped?	29.4	56.3	14.3
Does excess sugar intake increase blood glucose, even if your diabetes is controlled?	86.0	5.2	8.7
Can dietary modification control diabetes?	87.1	3.8	9.1
Is exercise beneficial in control of diabetes?	89.5	4.2	6.3
Diabetic patients take extra care when cutting their toenails?	80.8	13.3	5.9
Diabetic Medications are more effective than diet or exercise?	47.6	38.5	14.0
Diabetics patients are more exposed to oral diseases (e.g., dental caries)?	69.2	8.7	22.0
Smoking is more injurious to the gum of diabetic's patients more than non-diabetics?	65.0	2.8	32.2
Do you know when and how to take your medication?	89.9	8.0	2.1
Risk factors for diabetes mellitus:			
Age	47.6	38.8	13.6
Low physical activity	75.9	9.4	14.7
High cholesterol	68.5	11.9	19.6

of self-monitoring blood glucose (SMBG) results into diabetes management can be a useful tool for guiding medical nutrition therapy and physical activity, preventing hypoglycemia, and adjusting medications (particularly prandial insulin doses) as recommended by American Diabetes Association (ADA) in 2018. Moreover, among patients with type 1 diabetes, there is a correlation between greater SMBG frequency and lower HbA1C (23).

Table 3 the distribution of self-care activity among studied participants

Selfcare activities	Responses	%
Do you have a glucometer in your home? (n=286)	Yes	39.5
	No	60.5
If yes, do you check your blood sugar with glucometer by yourself? (n=113)	Yes	66.4
	No	33.6
Where do you measure your blood sugar (n=286)	In the lab	73.8
	In home by glucometer	20.6
	Both	5.6
The frequency of testing your blood sugar levels (n=286)	Every day	10.1
	Twice a week	4.2
	Once a week	19.9
	Once a month	65.7
Do you exercise (n=286)	Yes	46.9
	No	53.1
Frequency of doing physical exercise in week (n=134)		
Do you smoke (n=286)	Daily	3.5
	Occasionally	0.7
	Never	80.8
	Stopped	15.0
Do you examine your feet (n=286)	Yes	55.9
	No	44.1
If yes, how many (n=160)	Every day	81.9
	Once a week	8.8
	Twice a week	3.1
	Once a month	4.4
	Once a year	1.9
If your skin is dry, do you apply moisturizing lotion on your feet (n=286)	Yes	67.8
	No	32.2
Inspection of the shoes before putting on (n=286)	Yes	59.4
	No	40.6
Do you check your eyes in hospital (n=286)	Yes	45.1
	No	54.9

Table 3 (*continued*)

Table 3 (*continued*)

Selfcare activities	Responses	%
If yes, how many (n=129)	Once a month	10.9
	Every 3 months	31.8
	Once a year	57.4
Do you tell the health care provider about your diabetes before taking any other medicine's (n=286)	Yes	81.1
	No	18.9
Do you have a proper meal plan recommended by your doctor (n=286)	Yes	66.1
	No	33.9
Do you follow? (n=286)		
Low carbohydrate diet	Yes	72.4
	No	27.6
Do you use artificial sweeteners?	Yes	28.0
	No	72.0
Eat very few sweets	Yes	78.7
	No	21.3
A lot of fruits and vegetables	Yes	77.3
	No	22.7
Control of diabetes (n=286)		
Insulin	Yes	33.2
	No	66.8
Diet	Yes	66.8
	No	33.2
Tablets	Yes	74.5
	No	25.5
Physical activity	Yes	45.1
	No	54.9

With concern of the frequency of glucose testing ADA in 2018 stated that individuals with type 2 diabetes on less intensive insulin therapy, more frequent SMBG (e.g., fasting, before/after meals) may be helpful, as increased frequency is associated with meeting HbA1c targets, in our study we found that about 65.7% of participants tested their blood sugar at least once a month, which nearly match the guidelines (23). A chi-square test was performed and highly association between knowledge and SMBG frequencies was

noticed.

Majority of respondents (89.5%) knew that it was important to exercise, similar results were obtained by Mukeshimana (24). There is a high association between knowledge and exercise (P=0.000), regarding patients who exercise we found that nearly two-thirds of them have sufficient knowledge (59.2%) and one third have insufficient knowledge (33.8%). This reflects that the more knowledgeable participants have, this may increase and empower them to perform exercise as per the recommendation of the ADA in 2003 (exercise at least three times a week and it is better to exercise every day and one session should last about 30 to 45 minutes) (25). Although more than half of the participants (53.0%) state they do not exercise and this was attributed to lack of time for exercises, not being ready to participate, perceives severity of the symptoms, co-morbidities, and perceived effectiveness of the intervention. In this cohort the majority of participants were not smokers, and there was no association between knowledge of patient's disease and smoking.

Regarding foot care, a comprehensive foot evaluation at least annually performed to identify risk factors for ulcers and amputations and all patients with diabetes should have their feet inspected at every visit as recommended by ADA in 2018 (23), in our study more than half (55.9%) of participants were examine their feet and most of them examine daily in contrast to the study done in Karnataka which found that only 0.5% were checked their feet daily (26).

ADA in 2003 state that it is necessary to inspect the shoes before putting them on to make sure that nothing has fallen into them that could hurt the feet (25). In our study we found that, more than half of participants (59.0%) were inspected the shoes before putting on, our results are in agreement with other study in Nigeria (27). As the diabetic retinopathy is one of the progressive microvascular complications of diabetes, hence, knowledge of diabetic patients toward the risk factors for such complication is crucial. High rates of diabetic retinopathy (82.0%) was noted among Sudanese individuals with diabetes and the duration of diabetes and HTN were the most risk factors associated with diabetic retinopathy (28). In our study, the level of knowledge about DM eye complications was 88.1% which is approximately similar to other studies in Oman (72.0%) and in Australia (96.0%) respectively (29,30).

Concerning eye examination, adults with type 1 diabetes should have an initial dilated and comprehensive eye examination by an ophthalmologist or optometrist within 5 years after the onset of diabetes while patients with type 2 diabetes should have it when diabetes diagnosed (ADA, 2018). This study reveals that eye examination was highly associated with diabetes knowledge (P=0.000), and (45.1%) of respondents were checking their eyes in hospital and most of them checking yearly, this similar to Myanmar study that reported around 57% of participants had visited ophthalmologists (31). The main reasons for ignoring eye examination maybe referred to the cost to visit ophthalmologist, and lack of patient's education about eye examination.

A majority of participants (87.1%) were knew that dietary modifications can control diabetes and (66.0%) had a proper meal plan recommended by doctors. study in Rwanda found that 58.0% of respondents knew the recommended diabetic meal plan which consistent with our study (24,32), although from result there is no association between knowledge and dietary control (P=0.090). Among the self-care practices, good dietary behavior was showed in (64.1%) of the participants in contrast with the study done in Karnataka (4). We asked the participants if they tell health care providers about their diabetes before taking any medication, and the results was highly associated with their knowledge (P=0.000). This study is not without limitation, as the cross-sectional design of the study may not allow generalization of the study findings to all population in Sudan. Further research may be needed in rural areas of Sudan to assess knowledge and self-care about diabetes. Despite these limitations, our study is novel and provide the first study to evaluate knowledge and self-care among individuals with diabetes in Sudan. Physicians, diabetologists, public health physician, and pharmacists are needed to work together to increase the level of knowledge and self-care about diabetes.

Conclusions

The overall level of knowledge of respondents was sufficient, and the participants had acceptable level of practice. To improve the knowledge among individuals with diabetes through community health centers, the patient's meeting time to health professional providers should be increased to give them the necessary information about their disease, it is complications, and ensure good communication between the health care provider and the patients. There is a wide range of educational strategies can be planned to correct some misconceptions about the self-care of the disease like treatment, giving priorities to the factors that are crucial and vital in controlling blood sugar, and educational materials or programs designed to assist patients in performing the

actions that reduce the burden of the condition in low resource setting country like Sudan. Similar studies should be conducted with wider scope and much larger sample size to provide more generalized results.

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Footnote

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/jhmhp.2020.12.02). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). Informed consent was obtained from the respondents. The ethical approval was obtained from the ministry of health—Khartoum State (KMOH-REC-1-2019).

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