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IS KNOWLEDGE OF DIABETES AND ITS MANAGEMENT INFLUENCE ADHERENCE TO EXERCISE, HEALTHY DIET AND MEDICATIONS?: A SURVEY AMONG SUDANESE PATIENTS IN KHARTOUM STATE; SUDAN.

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ABSTRACT

Background: Non-adherence to self-care practices and medications represents a challenge to the control of diabetes. This study main aim was to measure patients' knowledge of diabetes and its management and to identify the influence of knowledge on the level of adherence to self-care practices and medications. **Methods:** A cross-sectional study was conducted during 15th February– 30th May 2013 in Khartoum State; Sudan. Adults (aged >18 years) diabetic patients on medical treatment were recruited. Convenience method of sampling was adopted. Data was collected through face-to face interview method by a structured questionnaire. Data was processed by the Statistical Package for Social Sciences (SPSS). **Results:** A total of 400 patients was recruited with a mean age of 54 years. Of them 230(57.5%) were males. Nearly two-third suffered from diabetes for < 5 years and 50% were living with another disease /s concomitantly with diabetes. Patients had satisfactory knowledge on diabetes were 132 (33.0%). The rate of adherence to diet, exercise, and medications was 24.5%, 33.3% and 9.5% respectively. Adherence to diet was significantly associated with the presence of other disease/s (P = 0.020). Patients who had diabetes for a duration < 5 years were more adherent to a healthy diet compared to those living with the disease for a duration > 5 years (P = 0.002). Predictors of adherence to medications were educational level and duration of

diabetes (P = 0.024) and (P = 0.005) respectively. **Conclusions:** The study revealed wide room for improvement in patients' knowledge of their disease and its management together with low adherence to self-care practices. Health education and patient motivation are badly needed to upgrade patients' knowledge and to improve adherence.

KEYWORDS: Diabetes, Knowledge, Adherence, Diet , Exercise, Medications.

INTRODUCTION

Diabetes mellitus, particularly type II, is a major public health concern worldwide. According to WHO, there will be an alarming increase in the population with type II diabetes mellitus, both in the developed and developing countries over the next two decades.[1] In Sudan, about two million patients are living with diabetes and the number is expected to rise further.[2]

Diabetes management is a complex disease and could not be controlled by medications alone.[3] Therapeutic plans for treating diabetics usually contain lifestyle changes that include e.g. diet control, physical activity, aerobic exercise and weight reduction.[4] Therefore, the attitude of the diabetics towards disease, medications and other daily activities plays a significant role in achieving the therapeutic goal.[5]

Poor knowledge on diabetes and its management was noted in many researches.[6, 7, 8] Similarly sub-optimal adherence to lifestyle changes and adherence to medications was quoted in the literature.[9, 10, 11] Non- adherence to diet, exercise and medications was identified as significant factors associated with poor glycemic control.[12] Multiple demographic, socioeconomic and social support factors are important in determining adherence to diabetes self-care activities.[4]

Despite the high prevalence of the disease in Sudan, no much research had been carried on diabetes among Sudanese patients. From these, only few assessed the knowledge, attitude and practice of diabetics in Sudan.[13] Therefore, this study main aim was to measure patients' knowledge of diabetes and its management and to identify the influence of knowledge on the level of adherence to self-care practices and compliance with medications.

The study findings were expected to offer guidance for health care providers and health authorities to design educational interventions to upgrade diabetic patients' knowledge and improve their adherence to self-care practices and medications. This will ultimately lead to

improvement in patients' clinical outcomes with the resultant decrease in morbidity and mortality.

METHODS

Study design: A cross-sectional study was conducted during the period of 15th February–30th May 2013.

Settings: Three potential diabetes centers in Khartoum State namely; Jaber Abo-Eliz Center in Khartoum City, Diabetes Center in Khartoum North and Norain Center in Omdurman City were selected for data collection.

Inclusion criteria: All adults (aged >18 years) diabetic patients on medical treatment (insulin or/and oral anti-diabetic) who came for follow-up in the above mentioned centers during the study period were recruited.

Exclusion criteria: Patients who did not consent to take part in the study or who had cognitive impairment were excluded.

Sample size and sampling technique: Convenience method of sampling was adopted. The sample size was calculated according to the Ministry of Health of Sudan report published in December 2012.[2] The number of diabetic patients about two million, of them 19% were in Khartoum State. Based on these statistics, the sample size for this study was calculated to be 400 patients.

Data collection: Data was collected through face-to face interview method by the principal author using a pre-tested questionnaire. The questionnaire was developed after thoroughly searching the relevant literature. It was composed of three parts. The first part was designed to collect data on the socio-demographic characteristics of the patients (e.g. gender, age, residence and educational level. In addition, questions about the duration of being diabetic and presence of concomitant disease/s were also included in this part. Part two composed of twelve questions design to assess patients' knowledge of diabetes and its treatment. Patients' knowledge on the disease and its treatment was scored by assigning one point for each correct response. Finally, patients who answered correctly seven out of the twelve questions were classified as having satisfactory knowledge on the disease and its management. Scores less than seven was considered as non-satisfactory. The last part of the questionnaire composed of questions to assess patients' practices on compliance with their drugs and

lifestyle changes including diet and exercise. Medication non-adherence was measured using the self-reported 4- item Morisky scale[14] which assess patients, forgetfulness about taking medications, carelessness about taking medications, stopping medications when feeling better and stopping medications when feeling worse. Questions were answered as "yes" and "no" and scored as one point for "yes" and zero for a "no" response. Scores were summed to give total score, ranging from 0 to 4. Non- adherence was defined as a score greater than zero. Patients' adherence to diet was assessed by direct questions and answered as yes, sometimes and no responses. Consequently patients were classified as non-adherent to a diabetic diet if they their responses were recorded as "sometimes" or" no". Assessment of adherence to exercise was measured by direct questioning the patients and responses were recorded as "yes" or "no". The questionnaire was tested with a group of ten patients to ensure applicability. Minor changes were recommended and finally adopted in the final questionnaire.

Data analysis

Data was processed by the Statistical Package for Social Sciences (SPSS), (Version20). Frequencies and proportions/percentages were used to describe all variables. Logistic regression analysis was performed. Patients' background characteristics which showed significant association on univariate analysis with level of knowledge and adherence to diet, exercise and medications were fitted into multiple logistic regression models to determine the independent predictors of all domains. The 5% level of significance was used as the cutoff for statistical significance.

RESULTS

Patients' demographics: A total of 400 eligible patients was recruited with a mean age of 54 years, of them 230 (57.5%) were males. Town dwellers constituted > 75% and who attained secondary and above educational level had nearly the same proportion. The percentage (89.5%) of patients who were living in the town and attained higher educational level was significantly higher compared to residents of rural areas (29.8%), (P<0.001). Nearly two third suffered from diabetes for < 5 years and 50% were living with another disease /s concomitantly with diabetes. Of them 96 (48.5%) were diabetic hypertensive, 44 (22.2%) had hypercholesterolemia, 24 (12.1%) suffered from cardiac diseases and 14 (7.1 %) had renal problems. Table (1) showed patients' demographic characteristics.

Sources of information on diabetes and its management: Physicians represented the main source of information about diabetes for 53.7% compared to 12% of patients relied on pharmacists and 19% receive information from relatives and friends. However, about 3.2% and 2.9% of the patients depend on the media and medical fliers respectively.

Patients' knowledge on diabetes and its management: Table (2) showed patients' responses to each question designed to test knowledge. Overall 132 (33.0%) patients were classified as having satisfactory knowledge. Univariable analysis showed significant difference in knowledge between patients living in town and those residing in rural areas [35.9% vs. 23.4% respectively; [Crude OR 0.5 (0.3-0.9), (P= 0.025)]. Table (3) showed predictors of knowledge.

Patients' adherence to exercise and diet: Out of all patients 162(40.2%), 140(35.0%) and 98 (24.5%) admitted complete non-adherence, partial adherence and full adherence to a healthy diet respectively. Regression analysis revealed a significant association between adherence to a healthy diet and coexistence of other disease/s. Patients had other disease/s with diabetes adhered more than those suffering from diabetes only [adjusted OR 0.4(0.3-0.7), (P =0.020)]. Another identified predictor was the duration since the patient diagnosed with diabetes. Patients who had diabetes for a duration < 5 years were comparatively more adherent than those patients living with the disease for a duration >5 years [adjusted OR 0.4(0.3-0.7), (P =0.002)]. Table (4) showed predictors of adherence to a healthy diet.

Exactly one- third of the patients admitted adherence to regular exercise Adherence to exercise was not significantly associated with all patients' background characteristics.

Adherence to medications

Participants' rate of adherence to medication was 9.5%. Predictors of adherence identified on multivariate analysis were educational level and duration of diabetes [adjusted OR 3.4(1.2-10.0), (P=0.024)] and [adjusted OR 3.6(1.3-8.1), (P=0.005)] respectively. Table (5) showed predictors of adherence to medications.

Influence of knowledge on adherence to diet, exercise and medications: Adherence to a healthy diet among patients who had non-satisfactory knowledge on diabetes and its management 75(28.0%) was higher, compared to those with satisfactory knowledge

23(17.4%) [Crude OR 0.5(0.3-0.9), (*P*= 0.013)]. However, no significant difference in rate of adherence to exercise and medications between both groups.

Table (1): Patients' background characteristics

Background characteristic	Frequency	Percentage
Gender Male Female	230 170	57.5 42.5
Age group in year < 54 >54 Missing	228 166 6	57.0 41.5 1.5
Residence Town Outside town	306 94	76.5 23.5
Educational level Secondary & above Below secondary	302 98	75.5 24.5
Co –morbidity Yes No	198 202	49.5 50.5
Time since diagnosis with diabetes <5year >5 years	256 144	64.0 36.0
Total	400	100

Table (2): Patients' responses to individual questions designed to test knowledge

Question	Frequency of correct answer (n =400)	% of correct answer
The cause of diabetes is that the body cannot produce enough insulin or use it	66	16.0%
Do you think diabetes caused by genetic disorder?	265	66.3
Is diabetes Infectious?	248	62.0%
The best method for glucose testing	116	29.0%
Effect of exercise on plasma glucose level	175	43.0%
Effect of infection on plasma glucose level	148	37.0%
Neuropathy is a sign of diabetes	236	59.0%
Diabetes is treatable	220	55.0%
Diabetes complications are preventable	198	48.5%
Importance of visiting the ophthalmologist	142	35.5%
Diabetic patients are at high risk of developing foot injuries	278	69.5%
How do you overcome hypoglycemia?	284	71.0%

Table (3): Predictors of Knowledge on diabetes and its management

Covariates	% with satisfactory knowledge	n	Univariable analysis crude OR(95% CL)	P value
Gender Female Male	 28.2 36.5	 230 170	 1 0.7(0.4-1.0)	 0.082
Age group in year >54 < 54 Missing	 28.3 37.3	 228 166 006	 1 0.7(0.4-1.0)	 0.063
Residence Rural Urban	 23.4 35.9	 094 306	 1 0.5(0.3-0.9)	 0.025
Educational level Below secondary Secondary & above	 25.5 35.4	 098 302	 1 0.6(0.4-1.0)	 0.071
Co –morbidity No Yes	 33.2 32.8	 202 198	 1 1.0(0.7-1.5)	 0.942
Time since diagnosis with diabetes >5 years <5year	 30.6% 34.4%	 144 256	 1 0.8(0.5-1.3)	 0.436
Total		400		

Table (4) Predictors of adherence to healthy diet

Covariates	% with adherence to diet	n	Univariable analysis crude OR(95% CL)	P value	Multivariable analysis adjusted OR(95% CL)	P value
Gender Male Female	 24.3 24.7	 170 230	 1 1.0(0.6-1.6)	 0.934		
Age group in year >54 < 54 Missing	 23.7 25.3	 228 166 006	 1 1.1(0.7-1.7)	 0.712		
Residence Urban Rural	 24.2 25.5	 306 094	 1 1.1(0.6-1.8)	 0.79		

Educational level Below secondary Secondary & above	 18.4 26.5	 098 302	 1 0.6(0.4-1.1)	 0.106		
Co –morbidity No Yes	 20.8 28.3	 202 198	 1 0.7(0.4-1.0)	 0.083	 1 0.6(0.3-0.9)	 0.020
Time since diagnosis with diabetes >5 years <5year	 16.7 28.9	 144 256	 1 0.5(0.3-0.8)	 0.007	 1 0.4(0.3-0.7)	 0.002
Total		400				

Table (5): Predictors of patients' adherence to medications

Covariates	**% with adherence to treatment**	**n**	**Univariable analysis crude OR(95% CL)**	P value	**Multivariable analysis adjusted OR(95% CL)**	**P value**
Gender Female Male	 8.2 10.4	 170 230	 1 1.3(0.7-2.6)	 0.459		
Age group in year < 54 >54 Missing	 9.6 9.6	 228 166	 1 1(0.5-2.0)	 0.997		
Residence Rural Urban	 6.5 10.5	 94 306	 1 1.7(0.7-4.2)	 0.243		
Educational level Below secondary Secondary & above	 4.1 11.3	 98 302	 1 3.0(1.0-8.6)	 0.044	 1 3.4(1.2-10.0)	 0.024
Co –morbidity Yes No	 9.1 9.9	 198 202	 1 0.9(0.5-1.8)	 0.782		
Time since diagnosis with diabetes >5 years <5year	 4.2 12.5	 144 256	 1 3.3(1.3-8.1)	 0.009	 1 3.6(1.3-8.1)	 0.005
Total		400				

DISCUSSION

The demographic characteristics of the patients included in this study more or less resemble the features of diabetes patients noted in many other studies. More than 75% of the patients were living in urban areas. Rapid urbanization, nutrition transition, and increasingly

sedentary lifestyles are all considered as contributory factors to the increased prevalence of the disease.[15] Researchers identified a high prevalence of diabetes, obesity, hypertension and hypercholesterolemia among Omani population, particularly among urban-dwellers and older people.[16] The serious coexistence of both hypertension and diabetes is another important feature noted among the recruited patients. Hypertension is approximately twice as frequent in patients with diabetes compared with patients without the disease.[17] The overlap between both diseases substantially increases the risk of ischemic cerebrovascular disease, retinopathy, and sexual dysfunction.[18]

In this study we attempted to identify the difference in level of adherence to self-care practices and medications among diabetic patients who were considered knowledgeable on the disease and its management and those with poor knowledge.

Concerning the level of knowledge of the studied sample, one- third of all patients was classified as having satisfactory knowledge. Individual responses to knowledge questions really showed poor knowledge on fundamental information a diabetic patient should know. These alarming results draw the attention of the seriousness of knowledge deficit among these patients.

Many reasons may justify such findings among Sudanese diabetic patients, but the most important would be the absence of educational programs. In Sudan, according to Ahmed [13], adequate diabetes care is extremely lacking. Personnel with even minimal specific training in diabetes care are severely deficient. There are few public diabetes care centers, but these are poorly equipped and critically under-staffed. There are few diabetologists; most of their time is devoted to general medicine or teaching in academic institutions. A few private clinics exist but their usefulness to the diabetes population is limited.

Another contributory factor to poor knowledge noted in this study was the dependence on unreliable sources of information about the disease particularly from non-medical personnel (relatives and friends). Relying on such sources results on misconceptions and/or misunderstanding of the disease especially when accompanied with lower influence of the healthcare professionals and very limited contact time they spend with patients.

A difference in level of knowledge between patients living in urban areas compared to rural residents was documented in this study. This may be attributed to the noted difference in

level of education between the two groups. In the above mentioned study; education, family income, glucose monitoring and presence of complication were identified as independent predictors of knowledge.[6]

Regarding lifestyles recommendations, exactly one- third of the participants claimed that they did exercise on a regular basis and nearly one- quarter reported that they fully adhered to a healthy diet regularly. Adherence to healthy diet was found to be significantly associated with coexistence of other co-morbidity with diabetes and duration since diagnosis with the disease. Non- adherence to diet may be attributed to social, economic and lack of knowledge on the role of commitment to a healthy diet in the short or long-term clinical outcomes. From a social viewpoint in Sudan; family members and friends traditionally eat in groups for such patients it may be difficult for them to follow their special dietary regimen. In addition, the components of a healthy diet are expensive. The low economic status of many of the Sudanese patients may be a barrier to full adherence. Researchers identified many factors that have a positive impact on compliance to diet like such as good family support, less busy work life, higher health conscious, and advice given by dietitian.[18]

Unexpectedly non-adherence to dietary regimen was higher among patients with low satisfactory knowledge of the disease. There were no obvious reasons to explain this finding and in-depth investigations is needed to explore this contradiction. However, the contribution of the above mentioned reasons should not be ignored.

Regimen adherence problems are common in individuals with diabetes, making glycemic control difficult to attain. Because the risk of complications of diabetes can be reduced by proper adherence, patient non-adherence to treatment recommendations is often frustrating for diabetes health care professionals.[19] Only 9.5% of participants were found to be adherent to treatment and the influence of educational level was significant. A substantial literature has documented a number of factors related to diabetes regimen adherence problems. It is helpful to consider demographic, psychological, and social factors, as well as health care providers, medical system, the disease and treatment-related factors.[20]

An important finding noted in this study and needs a further investigation was the significant association between the duration of having the disease and the level of adherence to both diet and medications. As observed with longer duration of having the disease the patients became less adherent. It seems there are multiple factors contribute to these findings. Future

researches on adherence should focus on this subset of patients to explore barriers to non-adherence.

This study had some limitations. First; the sample selected from three diabetes centers in the state, due to logistical reasons, this may limit the generalizability of the results to all diabetic patients. The level of adherence to self-care activities and medications was not linked to clinical parameters to identify the influence of non-adherence on achieving therapeutic outcomes.

CONCLUSIONS

The study revealed wide room for improvement in patients' knowledge of their disease and its management together with low adherence to self-care practices. It is therefore essential to direct more resources to improve the knowledge of diabetic patients and to develop innovative tools and educational models that improve patient's compliance and practices. Such efforts would need further in-depth research on diabetic patients' knowledge, attitudes and practice levels and how they interrelated. For the success of any future educational program, inclusiveness of information provided and patients' engagement are important.

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