Research Article

Knowledge and Awareness of Diabetic Retinopathy among Diabetic Sudanese Patients, Khartoum State, Sudan, 2018

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Abstract

Background: The level of awareness of diabetic retinopathy is considered an important factor for early diagnosis and management of diabetic retinopathy. This study aimed to assess the level of awareness of diabetic retinopathy among patients with diabetes mellitus in Khartoum, Sudan.

Methods: This cross-sectional study was conducted among diabetic patients attending Zeenam and Abdullah Khalil Diabetic Centers between June and September 2018. A convenience sample of diabetic patients was used. Information on the sociodemographic characteristics of the patients, patients' knowledge, compliance with available treatments, and routine eye examinations was collected using a semi-structured questionnaire. Patients were also asked about the barriers that may interfere with a regular eye examination.

Results: A total of 200 patients were enrolled and 94 (47%) of them were female; 13% of the respondents were diagnosed with diabetic retinopathy, 31.5% were hypertensive, and 13.5% had hyperlipidemia. Additionally, 88.5% of the patients were aware that DM can affect their eyes and 87% had never been diagnosed with diabetic retinopathy. Although around 83% thought that diabetic retinopathy could lead to blindness, only 35.5% of them had undergone fundus examination by ophthalmologists. Moreover, 39% of the participants had irregular diabetes follow-up and 43% monthly follow-up. Only 31% went for regular eye check-up; however, their compliance with routine retinal assessment was poor, with a total of 72.5% of participants assuming that they have good vision and need not get their eyes checked up regularly. The chief factor that was related to increased awareness of diabetic retinopathy in the study was the level of education.

Conclusion: Although a large proportion of diabetic patients in Khartoum are aware that diabetes mellitus can affect their eyes, regular retinal assessment of patients was poor, thus hindering early diagnosis and management.

Keywords: awareness, diabetic retinopathy, diabetes mellitus

1. Introduction

According to the International Diabetes Federation (IFD) data, in 2019, one out of five people over the age of 65 years had diabetes mellitus (DM), and 79% of adults with DM were living in low- and middle-income countries. Moreover, DM was claimed to be the cause of 4.2 million deaths [1].

The mortality, morbidity, and cost-related complications of diabetes are on the rise globally and are a persisting global public health problem [2]. Diabetic retinopathy (DR) is considered to be the commonest cause of microvascular complications of diabetes and vision loss [3, 4], causing blindness in 1.8 million out of 37 million cases (4.5%) worldwide [5].

Many patients may not know about DM and its complications such as DR, and referral system from primary care may be inadequate [6].

Screening programs are fundamental especially in low-income countries where the patient–physician ratio is low and services such as dilated fundus examination can be accessed only at certain locations, which could require travelling long distances for many individuals[7]. In a study done in Saudi Arabia, the prevalence of DR was 15.2%. The duration of DM, uncontrolled diabetes, hypertension, dyslipidemia, nephropathy, insulin treatment, and age were identified as strong predictors of DR among diabetics [8].

There is a variation worldwide in knowledge and practice regarding DM. The awareness among some Middle East countries was as follows: in Oman, the knowledge about DM diagnosis and eye care was found to be 72.9% and 18%, respectively, and the grade for their attitude toward eye involvement and eye care were 18% and 29.9%, respectively [9]; 75.62% of Saudi diabetic patients were aware of the eye disorders DM can cause, 73.80% were aware of the need of a regular eye check-up, and 95% of all participants went for regular ocular examination [10]; in Jordan, 88.2% of the patients were aware that diabetes can affect their eyes and 81% reported that DR can lead to loss of vision, 29.5% of participants have had an ocular examination in the previous year [11].While awareness about the importance of routine check-ups for the screening of DR is poor even in the developed countries, the situation is much worse in developing countries.

A study in African countries revealed that: in South Africa, only 37% of patients had annual eye examinations, 97% reported that DM could affect vision, 82% underwent regular medical follow-up, and 63% had no regular ophthalmic examination [12]; in Kenya, 83% of the patients had heard about diabetic eye disease, 60% knew the relationship between diabetic eye disease and DM, and only 50% went for eye examination [13]; in Nigeria, 77.7% of diabetic patients were aware that diabetes can affect their eyes,

however, 58.8% did not know which part of the eye can be affected, only 13.5% were aware that the retina can be affected by diabetes and hypertension was found to be a comorbid factor 44.6% [14].

Another study conducted in India aimed to determine the level of knowledge, attitude, and practice found that 42% of their patients had good information about diabetes, 4.5% had good knowledge about DR, and 61.1% did not have an annual eye examination. The most common barrier identified in this study was lack of awareness [15].

Very limited literature exists on the knowledge and awareness of DR amongst people with diabetes in Sudan. Thus, in our research, we tried to assess the awareness of diabetic patients about DR in Sudan. The aim of this study was to determine the awareness of DR among diabetic patients in Sudan.

2. Materials and Methods

2.1. Study design and setting

This cross-sectional study targeted patients diagnosed with DM and attending Zeeman and Abdullah Khalil Diabetic Centers (specialized centers offering diagnosis and management for diabetic patients, located in Khartoum state, Omdurman locality). All patients were referred from primary healthcare centers.

2.2. Sampling

Data were collected using a convenience sampling technique.

The sample size was calculated using the sample size of the unknown population (Cochran's formula):

$n = z2p (1–p)/d2,$

where; n: desired sample size; z: standard error of the mean which corresponds to 95% confidence level (1.96); and p = prevalence (unknown, so it was considered as 0.5).

$(1.96)2 \times 0.5(1–0.5) \div (0.05)2 = 384.$

The study was done over a period of three months (June–September 2018). All patients who attended Zeeman and Abdullah Khalil Diabetic Centers during the period were enrolled in this study, 200 diabetic patients who met the eligibility criteria of selection were enrolled in the study and informed consent was obtained from all participants.

2.3. Data collection tools

Following a thorough literature review, a semi-structured questionnaire was formulated by the investigators. The questionnaire was prepared in English and translated to Arabic. The content of the questionnaire was validated by submitting the tool to the experts in the field of ophthalmology for content validation and a pilot study was conducted on a representative population that was not included in the study. The response was then analyzed as to whether the questions were understood or not.

Four medical personnel were trained in administering the questionnaire. The participants were given the questionnaire and were required to fill it in the presence of the medical personnel after obtaining informed consent.

The questionnaire consisted of four parts: (i) patients' profile which included their names, gender, occupation, marital status, educational status, and their consent for the study; (ii) details of comorbid diseases, if any; (iii) DM-related information such as its duration, control, the modality of diabetes, DM treatment place, and follow-up of DM; and (iv) questions about DR awareness.

2.4. Statistical analysis

All collected data were entered, stored, and analyzed using the Statistical Package for Social Science (SPSS v.20 [SPSS Inc.; Chicago, IL, USA]). The association of awareness of DR was evaluated between the groups using unilabiate analysis (Chi-square test). P-value < 0.05 was considered statistically significant.

3. Results

3.1. Patient characteristics

The demographic characteristics of diabetic patients recruited in this study are given in Table 1. Out of the 200 patients who were interviewed, 110 were male (55%) and 90 were female (45%). A total of 171 (85.5%) participants were >40 years of age, 14% were aged between 20 and 40, and only 0.5% were <20 years old, with a mean age of 58.54 +11.4 years.

In terms of the level of education, 22.5% of the participants were illiterate, 37.5% were educated up to the primary school level, 23.5% up to the secondary school level, and 16.5% up to the university level (see Table 1).

TABLE 1: Demographic characteristics of the study population, *n* = 200.

	Percentage (%)	Frequency
Age group (yr)		
<20	1	0.5
20–40	28	14
>40	171	85.5
Gender group		
Male	110	55
Female	90	45
Education level		
University	33	16.5
Secondary	47	23.5
Primary	75	37.5
Illiterate	45	22.5
Duration of DM (yr)		
<10	107	53.5
>10	93	46.5
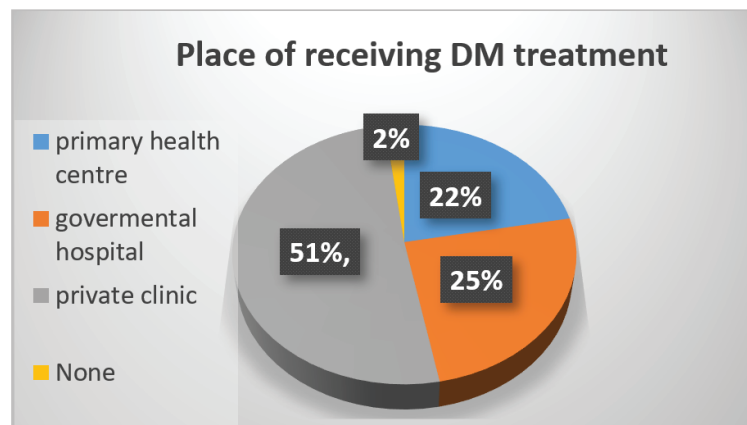
Figure 1: Distribution of patients according to follow-up centers for DM.

3.2. DM-related characteristics

On being asked about the duration of diabetes, 53.5% replied that they have been diabetic for <10 years, while 46.5% have had it for >10 years (see Table 1).

As regard to the follow-up centers, 51% of the respondents went to private clinics, 25% to governmental hospitals, 22% to primary healthcare centers, while 2% had no specific follow-up centers (see Figure 1).

Regarding DM follow-up, 43% had a monthly follow-up, while 17%, 39%, and 1% had 3–6 month, irregular, and no follow-up, respectively (Table 2).

Table 2: Characterization of the sample according to the frequency of DM follow-up.

	Frequency of follow-up visits for DM	
	Frequency	Percentage (%)
Monthly	86	43
3–6 months	34	17
<6 months	0	0
Irregular	78	39
No follow-up	2	1
Total Sample	**200**	**100**

Table 3: Distribution of patients according to doctor's advice about DR.

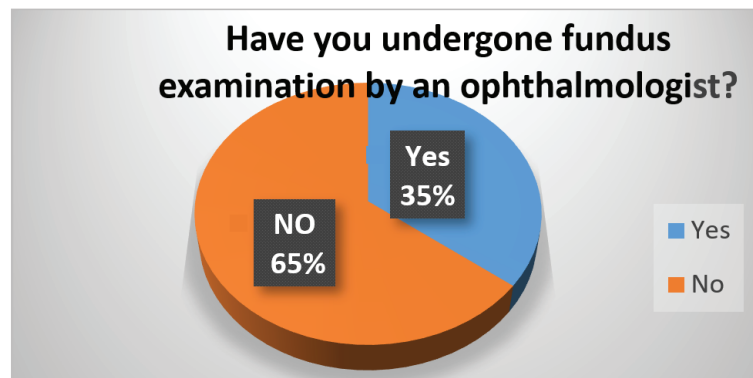| Percentage (%)	Frequency	Had your doctor informed you about DR?
77.5	155	Yes
22.5	45	No
100.0	**200**	**Total sample**

Figure 2: Distribution of patients according to ophthalmic examination.

The main source of information about DR, as shown in Table 3, was counselling by their doctors for majority of the respondents (155 [77.5%]).

Table 4 shows that 88 (44%) patients used Glucometer at home to monitor diabetes.

Moreover, with respect to ophthalmic examination, only 71 (35.5%) patients had been examined by an ophthalmologist (Figure 2).

Furthermore, 26 patients were diagnosed with DR (13%), while 174 (87%) were not (Figure 3).

Table 4: Distribution of patients according to glucometer use at home.

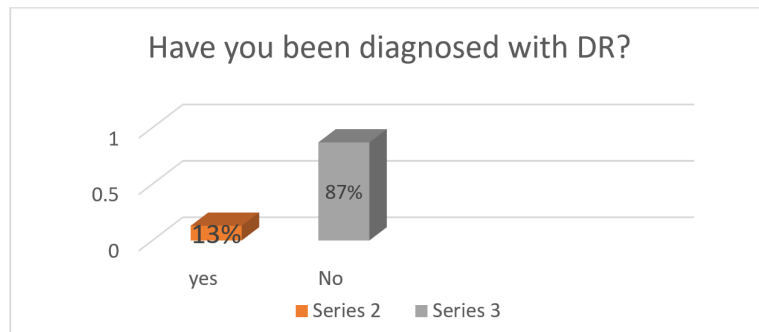| Percentage (%)	Frequency	Glucometer use at home
44	112	Yes
56	88	No

Figure 3: Sample according to the diabetic patients diagnosed with DR.

TABLE 5: Distribution of patients according to Comorbid diseases.

	Frequency	Percentage (%)
Hypertension		
Yes	63	31.5
No	137	68.5
Hyperlipidemia		
Yes	27	13.5
No	173	86.5

3.3. Comorbid disease

Sixty-three respondents (31.5%) were diagnosed with hypertension while only 27 (13.5%) were diagnosed with hyperlipidemia (see Table 5).

3.4. Knowledge and awareness of DR

Table 6 details the knowledge and awareness of participants regarding DR. Overall, 77 (38.5%) respondents knew that diabetes can affect vision, while 123 (61.5%) did not.

TABLE 6: Knowledge and attitude regarding diabetic retinopathy.

Knowledge and awareness	Yes	No
Do you know that diabetes can affect vision?	77 (38.5)	123 (61.5%)
Do you know that diabetes can affect your retina?	177 (88.5%)	23 (11.5%)
Do you know diabetic retinopathy can lead to blindness?	166 (83%)	34 (17%)
Did you go for regular eye check-ups?	62 (31%)	138 (69%)
Why don't you go for regular eye follow-up?	**N**	
I think I have good vision	100 (72.5%)	
High cost	30 (21.7%)	
Ophthalmologist not available in diabetic center	8 (5.8%)	

TABLE 7: Association between awareness of DR and selected variables.

Variable		Awareness		P-value
		Yes	No	
Age group (yr)				
<20	1	1 (100%)	0	0.137
20–40	28	24 (85.8%)	4 (14.2%)	
>40	171	155 (90.6%)	16 (9.4%)	
Gender group				
Male	110	100 (90.9%)	10 (9.1%)	0.377
Female	90	74 (82.2%)	16 (17.8)	
Educational level				
University	33	29 (87.8%)	4 (12.2%)	*0.001
Secondary	47	41 (87.2%)	6 (13.8%)	
Primary	75	67 (89.4%)	8 (10.6%)	
Illiterate	45	32 (71.1%)	13 (28.9%)	
Duration of diabetes (yr)				
<10	107	90 (84.1%)	17 (15.9%)	*0.003
>10	93	84 (90.3%)	9 (9.7%)	

Moreover, while 177 (88.5%) patients knew that diabetes could affect the retina and cause retinopathy, 23 (11.5%) did not. In addition, 83% of the respondents answered that DR can lead to blindness, while 17% did not know.

Only 31% of the respondents went for regular eye check-ups, while 69% did not, 72% of whom thought that they had good vision (Table 6).

3.5. Association between awareness of DR and selected variables (gender, age, duration of DM, and educational level)

Table 7 shows that the awareness of DR was not significantly associated with patients' age ($p = 0.137$) and gender ($p = 0.377$), but with patients' duration of DM ($p = 0.003$) and their level of education ($p = 0.001$).

Table 8 indicates that glucometer use at home is significantly associated with the level of education ($p = 0.003$).

As seen in Table 9, most patients who went to a private clinic (87%) were advised by their doctors for ocular examination by ophthalmologist followed by those who went to a government hospital (73%), and a low percentage for who went to primary healthcare centers. A significant association was observed between the place of follow-up and doctors' advice (p-value = 0.001).

TABLE 8: Glucometer use at home (*educational level cross-tabulation).

			Educational level			
			Illiterate	Primary	Secondary	University
Glucometer use at home	Yes	Frequency	9	36	25	18
		Percentage	10.20%	40.90%	28.40%	20.50%
	No	Frequency	36	39	22	15
		Percentage	32.10%	34.80%	19.60%	13.40%
Total		Frequency	45	75	47	33
		Percentage	22.50%	37.50%	23.50%	16.50%
P-value			0.003			

TABLE 9: DM treatment place (*Did your doctor advise you about DR cross-tabulation?).

Place of treatment		Did your doctor advise you about DR?	
		YES	NO
Government hospital	Frequency	37	14
	Percentage	73.6.0%	27.4.0%
None	Frequency	1	3
	Percentage	25.00%	75.00%
Primary healthcare	Frequency	28	16
	Percentage	63.60%	36.40%
Private clinic	Frequency	87	15
	Percentage	85.30%	14.70%
Total	Frequency	155	45
	Percentage	77.50%	22.50%
P-value		0.0001	

4. Discussion

In this cross-sectional study, the majority of the participants were 40 years old and above (85%) which shows an increased incidence of DM with age, a similar finding was reported with a previous study done in South Africa [12].

For the prevention of DM complications, especially microvascular complications such as retinopathy, awareness and knowledge, and time management are essential steps [3].

Sudan is a country where there is a lack of awareness of DM and of the facilities and resources concerning diabetes with no suitable screening program for the disease.

Our study revealed that DR was 13% in our studied population, a similar result was obtained by a study in Saudi Arabia [8]. According to the present study, only 38.5% of the respondents knew that diabetes could affect their eyes, which may be attributed to a lack of awareness among participants.

The study showed high awareness of DR occurring as a complication of DM among Sudanese diabetics, a similar conclusion was suggested by studies done in some Middle East countries: Oman [9], Saudi Arabia [10], and Jordon [11], and in some African countries: South Africa [12], Kenya [13], and Nigeria [14].

Regarding hypertension which is considered as the most common comorbid disease, the same finding was reported in Nigeria [14], and was also reported as a risk factor for developing DR in a study done in Saudi Arabia [8].

Although the results showed a high level of awareness about DR in the current study, on the contrary, there was low compliance for ophthalmic examinations to reduce the diabetes eye complications such as DR. There is a noticeable discrepancy between the levels of awareness and compliance in terms of a routine eye examination. Only 31% of our participants went for regular eye check-ups that may be due to a lack of awareness and difficulty in the accessibility of services, a slightly comparable value to our finding was found in a Kenyan study where only 50% went for eye check-ups [13] and India [15].

The percentage of regular ocular examination identified in our study is stated as being less than that in Saudi Arabia (95%) and South Africa (82%), in which a high percentage of diabetic patients went for regular ocular examinations [10, 12].

When we asked the participants about the reasons that prevented them to get an early DR screening, we found that the main reason was that they need to get it only when their vision is affected. Other reasons mentioned were the high cost and the availability of ophthalmologists at the diabetic center. A lack of accurate information about DR is the basic reason for low compliance in attending eye examinations.

Also, our study showed that 51% of the diabetic patients went to a private clinic, 25% went to government hospitals, and only 22% to primary healthcare centers for treatment which may be due to a lack of referral guidelines regarding DM and DR management for primary care or referral system from primary care being inadequate [6].

Regardless of eye examinations, our results revealed that only 35.5% of the patients interviewed were referred to an ophthalmologist by their doctor. There is an urgent need for revision of the general strategy of referrals system to ophthalmologists to be adopted by all general practitioners in Sudan.

Another important finding in this study, that is, the doctor is an important source of information on DR was reported by 77.5% of the participants, a similar result was reported among Jordanians [11].

Most patients who went to private clinics were advised about DR by the doctors (87%) and this study revealed a significant association between the place of follow-up and physician's advice about retinopathy, this indicates the role of appropriate health

education in the prevention of diabetic complications so health education should be a crucial part of the management of a patient with diabetes.

The study found that there was a significant association between awareness and education which agreed with the finding of a study done in Jordon [11].

In addition, there was an association between the use of Glucometer at home and the level of education, these findings highlighted that the level of education is momentous for the prevention of diabetic complications such as DR.

There is need for clear guideline protocol for diabetic patients and referral protocol. Educational programs should be adopted to increase the awareness of diabetes complications and how to avoid them. Diabetic patients must also be advised about regular visits to the diabetic and ophthalmic clinics, an educational brochure should be made available to each patient at diabetic centers.

5. Limitations

The limitations of this study are the small sample size as present study was conducted at two specialized centers for the treatment of diabetes. There is a need for future research for the examination of the prevalence of retinopathy over a larger variety of areas to find out actual awareness of DR among diabetic patients.

6. Conclusion

A majority of patients in this study reported a high level of awareness. However, the practice of checking blood sugar and eye check-ups regularly was found to be low among the patients. Lack of knowledge concerning the need for a regular eye examination for DR was found to be a major barrier to compliance with a regular eye examination. There is a need to raise awareness for a regular eye examination. The doctors can be the best source for providing this awareness since a high proportion of patients reported that they received their first piece of information from their doctors.Acknowledgements

Ethical Considerations

This study was approved by the institutional review board of the Faculty of Medicine, Omdurman Islamic University. Moreover, data were collected after taking the necessary agreement from the Khartoum State Ministry of Health.

Competing InterestsThere are no conflicts of interest.

Availability of data and material

All relevant data and methodological details pertaining to this study are available to any interested researchers upon reasonable request to corresponding author.

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