Awareness and Attitudes Towards Cataract, Glaucoma, and Diabetic Retinopathy among Adult Patients with Diabetes Mellitus in Saudi Arabia

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ABSTRACT

This study was conducted to evaluate the awareness of Cataract, Glaucoma, Diabetic Retinopathy, and their related factors among adult patients with Diabetes in Riyadh, Saudi Arabia. This study was conducted through an electronic self-administered questionnaire which was distributed randomly among adult patients with Diabetes Mellitus who visited Imam Mohammad Ibn Saud Islamic University Medical Centre in Riyadh, Saudi Arabia, during the 2023-2024 academic year. Awareness of cataracts among patients was low, with only 27.3% correct about the definition of cataract. The most commonly identified risk factors were DM and hypertension (72.8%). Only 25.8% knew that surgery is the best treatment method for cataracts, while 62% knew that vision could return to normal after cataract treatment. Regarding glaucoma, only 13% were aware of the correct definition, with diabetes (56%) and increased intra-ocular pressure (55.3%) as common risk factors. Poor knowledge was seen on the treatment method for glaucoma (39.5%) and whether the visual field can return to normal after glaucoma treatment (12%). For diabetic retinopathy, nearly half (47.8%) were aware of the correct definition, while about three-fourths (75%) knew that DM and HTN were risk factors. Only 38.3% believed vision could return to normal after treatment, and those undergoing regular eye exams for DM were even less (24%). Binary logistic regression analysis revealed that females were 2.16 times more likely to be knowledgeable about cataract, glaucoma, and diabetic retinopathy compared to males (CI: 1.42-3.29, p<0.001). Conversely, older patients (aged >45 years), non-Saudis, individuals with a middle income level (10,001 – 15,000 SAR), and those diagnosed with type 2 diabetes mellitus showed reduced knowledge of these conditions (p<0.05). This study demonstrated that patients with diabetes mellitus have low level of knowledge concerning cataract, glaucoma, and diabetic retinopathy.

Keywords: Cataract; Glaucoma; Diabetic Retinopathy; Diabetes Mellitus; Saudi Arabia

INTRODUCTION

Uncontrolled type 1 or type 2 Diabetes Mellitus, as well as its complications, may lead to evident effects on vision. Patients with uncontrolled type 1 or type 2 diabetes who do not follow the considered recommendations for eye examination are at a high risk for developing retinopathy as well as other diabetic ocular complications such as Cataract and Glaucoma[1]. Diabetic retinopathy is a distinguishable vascular complication of both type I and type II diabetes mellitus, and the prevalence of retinopathy is highly associated with the duration of diabetes; by 20 years after the onset of diabetes, almost all individuals with type I diabetes and more than 60% of individuals with type II diabetes may have some degree of retinopathy[2]. Longer duration of diabetes can also execute a prolonged damage to the glial and neuronal functions, leading to higher glaucoma risk[3]. Furthermore, the risk of having Cataract in individuals with diabetes was higher than the risk of having cataract in medically free individuals as the onset of cataract in individuals suffering from diabetes appeared to be 20 years earlier than in those who do not suffer from such illness and the risk can be further increased in individuals with longer duration of diabetes[4-7].

Such findings further implement the need for patients with longer duration of diabetes to adhere to optimal screening examinations and management. Regardless, it has been revealed in a previous study that merely close to half of patients with diabetes seem to fulfil their recommended annual eye examination[8]. Another previous study in Saudi Arabia has also revealed a low percentage of patients with diabetes who underwent an annual DR screening[9]. It is suggested that the knowledge of common eye diseases can result in an increase in understanding and management of eye health, and thereby, it may reduce visual impairment[10]. Public awareness regarding common eye diseases in Saudi Arabia was revealed to be very poor, and such study suggested an urgent need to establish methods to increase the public awareness of ocular eye diseases[11].

Thus, the awareness of patients with diabetes regarding eye related health conditions such as Diabetic Retinopathy, Cataract, and Glaucoma must be sought out for early detection and management. There are very few studies about the public awareness of ocular eye diseases in Saudi Arabia[12], and almost none among Patients with Diabetes which further added value to this current study. Hence why this study was conducted to evaluate the awareness of Cataract, Glaucoma, Diabetic Retinopathy, and their related factors among adult patients with Diabetes in Riyadh, Saudi Arabia.

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METHODOLOGY

Study design and subjects: An online cross-sectional survey study was conducted from July 2023 to August 2024 in Riyadh, Saudi Arabia among Adult patients with Diabetes Mellitus.

Sample size: A minimum sample of 385 participants, with 95% confidence level, and 5% margin error, and power of calculation of 80%.

Inclusion and Exclusion Criteria: All participants who met the following criteria: adults from 18 years and above who are a diagnosed with Diabetes mellitus and live in Saudi Arabia and are agreeing to participate, were invited to complete the self-administered questionnaire. Those who did not agree to participate in this study or who did not meet the inclusion criteria were excluded.

Sampling technique, data collection method, and the instrument used: This study was conducted through an electronic self-administered questionnaire which was distributed randomly among adult patients with Diabetes Mellitus who visited Imam Mohammad Ibn Saud Islamic University Medical Centre in Riyadh, Saudi Arabia, during the 2023-2024 academic year. Out of the eligible participants, a total of 400 Adult patients with Diabetes Mellitus completed the survey and were included in the statistical analysis. The authors used a scale that is adapted from a previous study for the questionnaire [11], which was further modified and validated by an ophthalmologist and double checked by a family medicine consultant. The validity and reliability of this questionnaire was assessed by a pilot study. The self-administered questionnaire contained 4 sections; demographic, a scale for Awareness regarding Cataract, a scale for Awareness regarding Glaucoma, and a scale for Awareness regarding Diabetic retinopathy.

Questionnaire criteria: Awareness regarding cataracts, glaucoma, and diabetic retinopathy was assessed using a 25-item questionnaire, with the correct answer being identified and coded with 1, while the incorrect answer was coded with 0. The total awareness score has been calculated by adding all 25 items. Score ranging from 0 to 25 points has been achieved. The higher the score, the higher the awareness of cataracts, glaucoma, and diabetic retinopathy. By using 50% and 75% as cutoff points to determine the level of knowledge, patients were considered poor awareness if the score was below 50%, 50% to 75% were moderate, and above 75% were considered good awareness levels.

Statistical Analysis: Categorical variables were shown as numbers and percentages, while continuous variables were calculated and presented as mean and standard deviation. The normality test was performed using skewness and kurtosis measure, and histogram. The awareness score followed the normal distribution and therefore, was presented using the mean and standard deviation. The differences in the mean awareness score in relation to patients' socio-demographic characteristics were conducted using the student t-test. Binary logistic regression analysis was used to identify predictors of higher awareness score. The cut-off point used to identify the dependent variable in the logistic regression model was the mean awareness score of the study participants, which was 10.2 (SD: 6.1). The significance level was identified as p-value less than 0.05. Statistical data were analyzed using Statistical Packages for Social Sciences (SPSS) version 29 Armonk, NY: IBM Corporation.

RESULTS

Socio-demographic characteristics of the diabetic patients:

This study enrolled four hundred diabetic patients. Table 1 presents the socio-demographic characteristics of the patients. Around 40.3% were between 18 and 24 years old, with females being dominant (65.3%). The vast majority of the patients were Saudis (90.0%). Patients who were bachelor degree or higher holders constitute 60.8%. With respect to monthly income, 43% were earning less than 5,000 SAR per month. Patients with type 1 diabetes constitute 53.3%. In addition, 47.3% had a diabetes duration of less than 5 years.

Table 1. Socio-demographic characteristics of the diabetic patients

Study Data	N (%)
Age group	
• 18 – 24 years	161 (40.3%)
• 25 – 34 years	51 (12.7%)
• 35 – 44 years	52 (13.0%)
• ≥45 years	136 (34.0%)
Gender	
• Male	139 (34.7%)
• Female	261 (65.3%)
Nationality	
• Saudi	360 (90.0%)
• Non-Saudi	40 (10.0%)
Educational level	
• Lower than primary level	17 (04.3%)
• Primary	09 (02.3%)
• Intermediate	15 (03.8%)
• Secondary	116 (29.0%)
• Bachelor degree or higher	243 (60.8%)
Monthly Income (SAR)	
• <5,000	172 (43.0%)
• 5,000 – 10,000	92 (23.0%)
• 10,001 – 15,000	72 (18.0%)
• 15,001 – 20,000	39 (09.8%)
• >20,000	25 (06.2%)
Diabetes type	
• Type 1	213 (53.3%)
• Type 2	187 (46.7%)
Diabetes duration	
• <5 years	189 (47.3%)
• 5 – 9 years	81 (20.2%)
• 10 – 15 years	68 (17.0%)
• >15 years	62 (15.5%)

Patients' awareness profile:

Regarding the awareness assessment of cataracts, only 27.3% were correct about the definition of cataract. Besides, according to the patient's knowledge, the most commonly identified risk factors for cataracts were DM and hypertension (72.8%), followed by age (60%) and systemic diseases (40.3%). Only 25.8% knew that surgery is the best treatment method for cataracts, while 29.8% knew that not all cataracts require surgery. Additionally, 62% knew that vision could return to normal after cataract treatment. Regarding the awareness of glaucoma, only 13% were aware of the correct definition of glaucoma. The most common risk factors of glaucoma, based on the patient's knowledge, were diabetes (56%) and increased intra-ocular pressure (55.3%). Besides, poor knowledge was seen on the treatment method for glaucoma (39.5%) and whether the visual field can return to normal after glaucoma treatment (12%). Regarding the awareness of diabetic retinopathy, nearly half (47.8%) were aware of the correct definition of diabetic retinopathy, while about three-fourths (75%) knew that DM and HTN were the risk factors of diabetic retinopathy. Patients who believed that vision could return to normal after diabetic retinopathy

treatment were less (38.3%), while those who underwent regular eye examination for DM were even less (24%). The total mean awareness score was 10.2 (SD 6.1), with poor, moderate, and good awareness constituting 61%, 28.5%, and 10.5%, respectively (Table 2).

Figure 1 shows that the most common source of cataract information was social media (29.8%), followed by a family member/friend who has the disease (19%) and a healthcare provider (17%), while family member/friend who is free of the disease showed the least (5.3%).

Table 2. Participants' answers for awareness of cataract, glaucoma, and diabetic retinopathy items

	Awareness regarding cataract	**N (%)**
1.	What is a cataract? [A clouding of the normally clear lens of the eye]	109 (27.3%)
Risk factor of cataract		
2.	DM and HTN [yes]	291 (72.8%)
3.	Age [yes]	240 (60.0%)
4.	Systemic diseases [yes]	161 (40.3%)
5.	Drugs [yes]	145 (36.3%)
6.	Dietary habits [yes]	136 (34.0%)
7.	Smoking [yes]	135 (33.8%)
8.	Treatment method of cataract [surgery]	103 (25.8%)
9.	Do all types of cataracts require surgery? [no]	119 (29.8%)
10.	Vision can return to normal after treating cataract [yes]	248 (62.0%)
Awareness regarding glaucoma		
11.	What is glaucoma [Optic nerve damage]	52 (13.0%)
Risk factors of glaucoma		
12.	Diabetes [yes]	224 (56.0%)
13.	Increased intra-ocular pressure [yes]	221 (55.3%)
14.	Age [yes]	205 (51.2%)
15.	Family history of glaucoma [yes]	189 (47.3%)
16.	History of cataract [yes]	156 (39.0%)
17.	Drugs [yes]	117 (29.3%)
18.	Treatment method of glaucoma [medications and surgery]	158 (39.5%)
19.	Visual field can return to normal after treating glaucoma [no]	48 (12.0%)
Awareness regarding diabetic retinopathy (DR)		
20.	What is diabetic retinopathy? [Retinal Vascular lesion and it's a complication of DM]	191 (47.8%)
Risk factors of diabetic retinopathy		
21.	DM/HTN [yes]	300 (75.0%)
22.	Dietary habits [yes]	137 (34.3%)
23.	Smoking [yes]	134 (33.5%)
24.	Vision can return to normal after treating diabetic retinopathy [yes]	153 (38.3%)
25.	Frequency of eye examination for DM [annually]	96 (24.0%)
Total awareness score (mean ± SD)		**10.2 ± 6.1**
Level of awareness		
•	Poor	244 (61.0%)
•	Moderate	114 (28.5%)
•	Good	42 (10.5%)

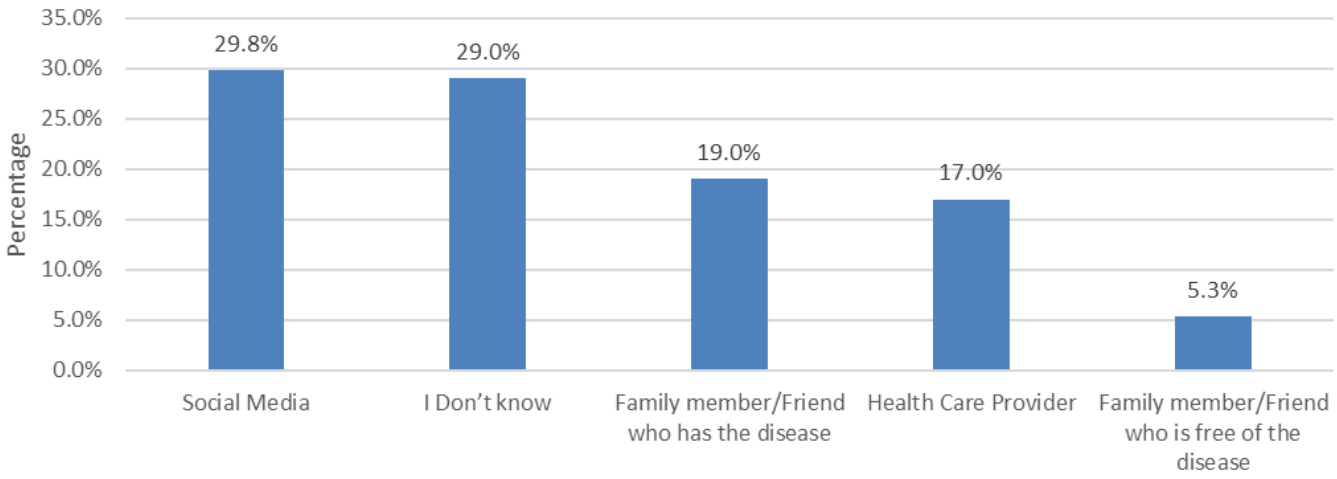

Figure 1. Source of information regarding cataract

Figure 2 depicts that the most common source of glaucoma information was social media (31%), followed by a healthcare provider (15.3%) and a family member/friend who has the disease (12.3%), whereas family member/friend who is free from the disease showed the least rating (6.0%).

Figure 3 illustrates that the most common source of diabetic retinopathy information was social media (28.2%), followed by a healthcare provider (27.5%) and a family member/friend who has the disease (12.8%), while family member/friend who is free from the disease has the lowest rating (5%).

Table 3 below presents the mean awareness score stratified by diabetic patients' socio-demographic characteristics. The mean awareness score showed statistically significant difference among diabetic patients based on their age, gender, nationality, and diabetes type ($p<0.01$). No significant differences were observed between the awareness score in relation to education, monthly income, and diabetes duration ($p>0.05$) (Table 3).

Predictors of higher awareness score:

Binary logistic regression analysis identified that females were two-fold more likely to be knowledgeable of cataract, glaucoma, and diabetic retinopathy (odds ratio: 2.16; confidence interval (CI): 1.42-3.29) compared to males; ($p<0.001$). On the other hand, older patients (aged above 45 years), non-Saudis, those with middle income level (10,001 – 15,000 SAR), patients diagnosed with type 2 diabetes mellitus were less likely to be knowledgeable of cataract, glaucoma, and diabetic retinopathy ($p<0.05$).

DISCUSSION

Previous studies have suggested that knowledge, attitude, and practice toward diabetes mellitus disease play a vital role in preventing diabetic retinopathy and influence their behavior related to eye care[13]. This study was aimed to assess awareness of diabetes mellitus patients concerning cataract, glaucoma, and diabetic retinopathy and to identify its associated predictors.

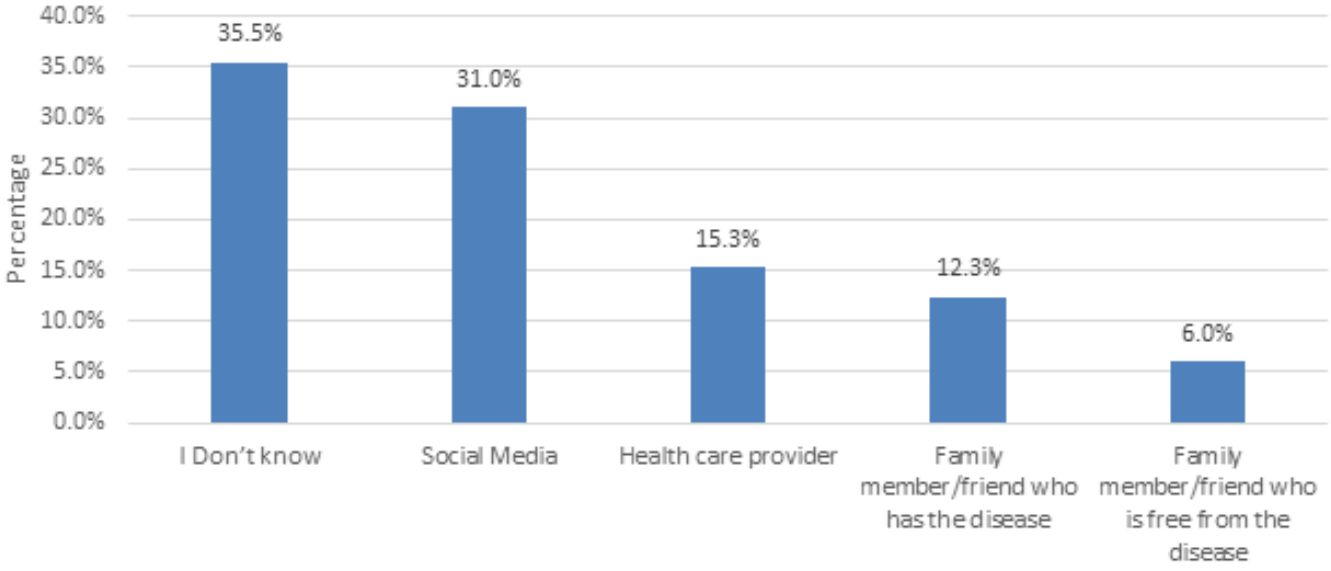

Figure 2. Source of information regarding glaucoma

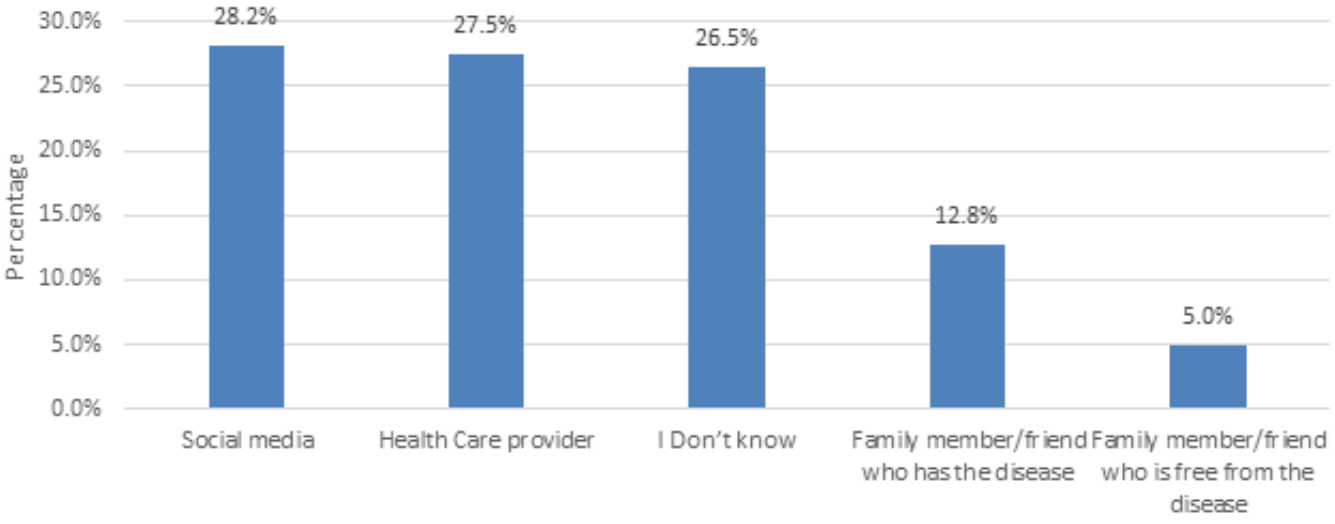

Figure 3. Source of information regarding diabetic retinopathy

Table 3. The mean awareness score stratified by diabetic patients' socio-demographic characteristics

Factor	Awareness Score (25) Mean ± SD	P-value
Age group		
• <35 yerars	11.0 ± 6.39	**0.003**
• ≥35 years	9.20 ± 5.53	
Gender		
• Male	8.24 ± 6.01	**<0.001**
• Female	11.2 ± 5.84	
Nationality		
• Saudi	10.5 ± 6.1	**0.005**
• Non-Saudi	7.6 ± 5.1	
Educational level		
• Secondary or below	9.53 ± 6.27	0.131
• Bachelor degree or higher	10.6 ± 5.89	
Monthly Income (SAR)		
• ≤10,000	10.6 ± 6.32	0.051
• >10,000	9.38 ± 5.46	
Diabetes type		
• Type 1	11.0 ± 6.09	**0.003**
• Type 2	9.21 ± 5.90	
Diabetes duration		
• <5 years	9.94 ± 6.85	0.515
• ≥5 years	10.4 ± 5.26	

Table 4. Predictors of higher awareness score

Study Data	Odds ratio of having higher awareness score	P-value
Age group		
• 18 – 24 years (Reference category)	1.00	
• 25 – 34 years	0.69 (0.36-1.29)	0.241
• 35 – 44 years	0.61 (0.33-1.15)	0.125
• ≥45 years	0.50 (0.31-0.79)	**0.003**
Gender		
• Male (Reference category)	1.00	
• Female	2.16 (1.42-3.29)	**<0.001**
Nationality		
• Saudi	1.00	
• Non-Saudi	0.40 (0.20-0.80)	**0.010**
Educational level		
• Lower than primary level (Reference category)	1.00	
• Primary	0.23 (0.02-2.30)	0.210
• Intermediate	3.67 (0.85-15.84)	0.082
• Secondary	1.83 (0.64-5.29)	0.262
• Bachelor degree or higher	1.91 (0.69-5.33)	0.216
Monthly Income (SAR)		
• <5,000 (Reference category)	1.00	
• 5,000 – 10,000	0.79 (0.48-1.32)	0.367
• 10,001 – 15,000	0.42 (0.24-0.75)	**0.003**
• 15,001 – 20,000	0.83 (0.42-1.67)	0.608
• >20,000	0.73 (0.32-1.69)	0.464
Diabetes type		
• Type 1 (Reference category)	1.00	
• Type 2	0.67 (0.45-1.00)	**0.050**
Diabetes duration		
• <5 years (Reference category)	1.00	
• 5 – 9 years	1.29 (0.77-2.17)	0.339
• 10 – 15 years	1.61 (0.92-2.82)	0.095
• >15 years	1.28 (0.72-2.27)	0.403

SAR: Saudi Arabia riyal

In our study, only 27.3% of our study participants defined cataract correctly. The most commonly identified risk factors for cataracts in our study were DM and hypertension (72.8%), followed by age (60%) and systemic diseases (40.3%). A cataract is defined as "a cloudy area in the lens of the eye (the clear part of the eye that helps to focus light)"[14]. Factors that increase the risk of cataracts include older age, being diagnosed with diabetes mellitus, high level of exposure to sunlight, smoking, high BMI, having family history of cataracts, having previous eye injury or inflammation or previous eye surgery history, and prolonged use of corticosteroids[15,16]. Specific risk factors associated with cataract among patients with diabetes mellitus include younger age, longer disease duration, use of insulin, and poor glycemic control[17].

In our study, only 25.8% knew that surgery is the best treatment method for cataracts. Additionally, 62% knew that vision could return to normal after cataract treatment. Several medical tests can be performed to diagnose cataract, these include vision test, eye structure exam, retinal exam, and fluid pressure test[15]. Surgery is the only intervention that can remove cataract and restore normal vision[16]. Cataract surgery is an outpatient procedure that involves replacement of patient's cloudy lens with clear artificial one[18]. Possible side effects of cataract surgery include blurry vision, eye redness, light sensitivity, and watery eyes[18]. It is worth mentioning that the success rate for cataract surgery can reach 98.0%. Usually, the recovery time for cataract surgery is short, which depends on patients' age, case severity, and overall health status[19].

Regarding the awareness of glaucoma, in our study, only 13% were aware of the correct definition of glaucoma. The most common risk factors of glaucoma in our study were diabetes (56%) and increased intra-ocular pressure (55.3%). Besides, poor knowledge was seen on the treatment method for glaucoma (39.5%) and whether the visual field can return to normal after glaucoma treatment (12%). Glaucoma is defined as "a disease that damages eye's optic nerve". Glaucoma occurs when fluid accumulate in the front part of the eye, which increases the pressure inside the eye, damaging the optic nerve[20]. Risk factors of glaucoma include older age (over 60 years), race (Hispanic, Asian, and African), having family history of glaucoma, use of corticosteroids, high intraocular pressure, having previous eye injury history, and thin central cornea[21,22]. Besides, patients diagnosed with diabetes mellitus are two-fold at higher risk of developing glaucoma compared to non-diabetic patients[23]. Glaucoma management approach include medication that lower intraocular pressure and prevent optic nerve damage, laser treatment that lower intraocular pressure, and surgery[22]. Despite that there is no complete cure for glaucoma, early diagnosis and management can help in protecting eye vision and preventing the damage of optic nerve[22].

Regarding the awareness of diabetic retinopathy, nearly half (47.8%) were aware of the correct definition of diabetic retinopathy, while about three-fourths (75%) knew that DM and HTN were the risk factors of diabetic retinopathy. Diabetic retinopathy is defined as "an eye condition that can cause vision loss and blindness in patients diagnosed with diabetes mellitus". Diabetic retinopathy can affect blood vessels in the retina[24]. Diabetic retinopathy affect around 30% of patients diagnosed with diabetes mellitus[25]. Diabetic retinopathy develop among diabetic patients with uncontrolled disease, as high blood glucose block tiny blood vessels which diminish nourishing the retina effectively[26]. The risk of developing diabetic retinopathy among patients with diabetes mellitus increases among patients with uncontrolled disease, prolonged duration of disease, uncontrolled blood pressure, patients with dyslipidemia, smokers, and among patients with specific ethnicity such as Africans, Hispanic, and native Americans[26].

In our study, patients who believed that vision can return to normal after diabetic retinopathy treatment were less (38.3%). In our study, only 24.0% of the patients reported that they perform regular eye examination for DM. At early stages of developing diabetic retinopathy, controlling diabetes is the cornerstone for the management of diabetic retinopathy. However, in advanced stages, the main management approaches are laser treatment, eye injections, steroid eye implants, and eye surgery[27]. Diabetic eye examination on annual basis is important for early detection of eye diseases. The main challenge in managing diabetic retinopathy is that retinal damage starts long time before initial symptoms of retinopathy starts to appear[25]. Regular eye exam should be performed by healthcare professionals who manage patients with diabetes mellitus every 1-2 years[28].

In our study, the mean awareness score concerning cataract, glaucoma, and diabetic retinopathy was 10.2 (SD 6.1), with poor, moderate, and good awareness constituting 61%, 28.5%, and 10.5%, respectively. This is lower than the findings of a previous study that was conducted in India where 56.3% of the study participants demonstrated good level of knowledge[29]. Another study in Riyadh, Saudi Arabia reported that 79.6% of the study participants were knowledgeable of diabetic retinopathy[30]. Another study in Oman reported that the levels of knowledge about diabetes-related eye care and complications were satisfactory[31].

In our study, females were two-fold more likely to be knowledgeable of cataract, glaucoma, and diabetic retinopathy (odds ratio: 2.16; confidence interval (CI): 1.42-3.29) compared to males; ($p<0.001$). This confirmed the findings of a previous study in Jazan, Saudi Arabia [32]. However, this was different from the findings of a previous study that was conducted in Yemen where male patients had higher levels of knowledge[33]. Multiple evidences from previous literature support that females are more oriented towards healthcare and proactive health-seeking behaviors[34,35]. On the other hand, in our study, older patients (aged above 45 years), non-Saudis, those with middle income level (10,001 – 15,000 SAR), patients diagnosed with type 2 diabetes mellitus were less likely to be knowledgeable of cataract, glaucoma, and diabetic retinopathy ($p<0.05$). This was confirming the findings of a previous study in Yemen found that those over the age of 50 years, widowed, divorced, illiterate, and individuals with only a high school education or less demonstrated low awareness levels[33]. On the other hand, a previous study by Konstantinidisetal. B et al. which documented that there is no association between age, gender, type of diabetes, duration of disease, and education[36]. This could be justified due to low healthcare literacy levels among elderly population as elderly population usually prefer diseases treatment rather than prevention. Middle income level population could have limited access to healthcare services due to financial strains.

In order to enhance knowledge of diabetic patients towards their eye diseases including cataract, glaucoma, and diabetic retinopathy, decision makers in the healthcare sector and healthcare professionals who take care of patients with diabetes mellitus are advised to increase educational initiatives directed towards eye health. Enhance healthcare professional abilities to provide appropriate education and consultation related to eye health. Implement eye diseases screening practices for patients with high risk of developing diabetes mellitus complications. Finally, the use of technology such as email reminders and text messages to facilitate patients' education and check-up.

Limitations: This study has limitations. The cross-sectional study design restricts the ability to examine causality among independent variables and dependent outcome. The convenience sampling

technique used to recruit the study participants could have affected the generalizability of our study findings. Besides, this study could be prone to non-response bias. Therefore, our findings should be interpreted carefully.

Recommendations: This study revealed that there is a sub-optimal awareness and comprehension of glaucoma, cataract, and diabetic retinopathy among patients, notably in terms of terminology and treatment alternatives. Educational interventions should focus on males, non-Saudis, older persons, and middle-income groups—particularly those with type 2 diabetes—who exhibited diminished awareness. Community engagement and culturally customized eye health initiatives are crucial, focusing on routine screening, early detection, and treatment effectiveness.

CONCLUSION

This study demonstrated that patients with diabetes mellitus have low level of knowledge concerning cataract, glaucoma, and diabetic retinopathy. Health education initiatives should be directed towards enhancing patients' knowledge concerning their disease and its associated microvascular and macrovascular complications. These initiatives should be accompanied with comprehensive screening programs aiming for prevention.

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Potential Conflicts of Interest: None

Competing Interest: None

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