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Awareness and Knowledge of Diabetic Retinopathy among Type-2 Diabetes Mellitus Patients in Hail Populations, Saudi Arabia

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Abstract **Background:** Diabetic Retinopathy (DR) is a leading cause of preventable blindness among patients with Type 2 Diabetes Mellitus (T2DM). Early detection through regular screening significantly reduces visual morbidity; however, awareness and adherence to screening remain suboptimal in many communities. **Objective:** To evaluate the level of awareness and knowledge of diabetic retinopathy among patients with type 2 diabetes mellitus in Hail city, Saudi Arabia. **Methods:** An analytic cross-sectional community-based study was conducted among adult residents aged 18-60 years in Hail. Data were collected using a structured, self-administered electronic questionnaire adapted from validated published tools. The questionnaire included demographic characteristics and 15 items assessing knowledge and awareness of DR. A pilot study was conducted to ensure clarity and feasibility. Data were analyzed using SPSS version 23. **Results:** A total of 245 participants were included in the study. The mean age was 40.64±16.49 years and 138 (56.3%) were females. Overall, 189 (77.1%) participants were aware that diabetes can affect the eyes and 176 (71.8%) knew that diabetic retinopathy may lead to blindness. However, only 104 (42.4%) were aware of the need for annual eye examination and just 98 (40.0%) reported undergoing regular retinal screening. Good knowledge level was observed in 112 (45.7%) participants, while 93 (38.0%) had moderate knowledge and 40 (16.3%) had poor knowledge. Higher educational status and longer duration of diabetes were significantly associated with better awareness ($p<0.05$). **Conclusion:** Awareness of diabetic retinopathy among patients with type 2 diabetes mellitus in Hail is moderate but insufficient in key preventive aspects. Strengthening patient education, enhancing primary healthcare counseling and improving accessibility to retinal screening programs are essential to promote early detection and reduce preventable vision loss.

Key Words Diabetic Retinopathy, Metabolic Disorders, Health Challenge

INTRODUCTION

Diabetes mellitus is one of the most prevalent chronic metabolic disorders worldwide and represents a growing public health challenge, particularly in low- and middle-income countries. Type 2 Diabetes Mellitus (T2DM) accounts for the majority of cases and is associated with long-term microvascular and macrovascular complications that significantly increase morbidity and reduce quality of life. Among these complications, Diabetic Retinopathy (DR) remains one of the most serious and vision-threatening consequences, emerging as a leading cause of preventable blindness among working-age adults globally [1]. Diabetic retinopathy develops as a result of chronic hyperglycemia-induced microvascular damage to the retinal vessels. Persistent elevated blood glucose levels lead to capillary basement membrane thickening, pericyte loss, microaneurysm formation and ultimately retinal ischemia and neovascularization. The progression from non-proliferative to proliferative diabetic retinopathy and diabetic macular edema can occur silently, often without

noticeable symptoms in the early stages [2]. By the time visual impairment becomes evident, retinal damage may already be advanced and partially irreversible. This makes early detection through regular screening critically important.

The risk of developing diabetic retinopathy increases with longer duration of diabetes, poor glycemic control, hypertension, dyslipidemia, nephropathy, pregnancy and smoking. Studies indicate that nearly one-third of individuals with diabetes may develop some degree of retinopathy during their lifetime. Without timely screening and intervention, vision loss can become permanent. Importantly, most early retinal changes are asymptomatic, which means patients cannot rely on symptoms alone to determine when to seek eye care [3]. This underscores the need for proactive patient education and routine ophthalmological assessment. Despite the availability of effective screening tools such as fundus examination and retinal photography and treatment modalities including laser photocoagulation, intravitreal anti-VEGF therapy and optimized systemic control, many patients still present with advanced stages of disease. One of the most significant barriers to early diagnosis is inadequate awareness and poor knowledge regarding diabetic retinopathy among individuals with diabetes. Patients who do not know that diabetes can damage the retina are unlikely to seek preventive eye examinations.

Awareness refers to basic recognition that diabetes can affect vision and cause blindness, whereas knowledge involves understanding specific risk factors, symptoms, screening intervals, preventive strategies and treatment options [5]. Several regional and international studies have demonstrated variable levels of awareness among diabetic populations. While some patients may have heard that diabetes affects the eyes, fewer understand the importance of annual retinal screening even in the absence of visual complaints [6-7]. This knowledge gap contributes to delayed presentation and increased rates of irreversible visual impairment. Socioeconomic factors, educational status, cultural beliefs, accessibility to healthcare services and physician counseling practices significantly influence awareness levels. In many outpatient settings, consultation time is limited and the focus often remains on glycemic control, with insufficient emphasis placed on long-term complications such as retinopathy. Furthermore, patients with low literacy levels may not fully comprehend medical advice regarding preventive ophthalmic care. In developing countries, including Pakistan, the burden of diabetes is rising at an alarming rate due to urbanization, sedentary lifestyle, dietary transitions and genetic predisposition. With the projected increase in T2DM prevalence, the incidence of diabetic retinopathy is expected to escalate proportionally. However, systematic evaluation of patients' awareness and knowledge regarding diabetic eye disease remains inadequate in many tertiary and secondary care settings [8].

REVIEW OF LITERATURE

Several studies conducted in Saudi Arabia have assessed awareness and knowledge of Diabetic Retinopathy (DR) among patients with diabetes mellitus, demonstrating regional variations in findings. In Qassim, 63.5% of diabetic patients were reported to have good knowledge regarding DR. A high proportion recognized the association between diabetes and retinopathy (86%) and understood that good glycemic control can prevent DR (89.9%). However, only 32.9% were aware of the need for annual eye examinations. Knowledge levels were significantly higher among younger and more educated individuals, while no strong association was observed with gender, duration of diabetes or comorbid conditions [9-10]. Similarly, in Madinah, most patients (90.8%) knew that diabetes can affect the retina and 72.1% were aware that DR may lead to blindness. Despite this, only 25% recognized the importance of annual screening. Overall, 42.1% demonstrated good knowledge, whereas 10.8% had poor knowledge. Longer duration of diabetes (>10 years) was associated with better treatment adherence [11-12]. In Al Qunfudah, a cross-sectional study involving 251 adult diabetic patients showed that 68.5% were aware that diabetes could cause eye problems and 72.5% knew that regular eye examinations were recommended. However, only 36.3% reported attending annual eye check-ups. Awareness was significantly higher among individuals aged 25-49 years, those with university education, longer disease duration, good medication adherence and those who received information from physicians [13]. A study conducted in AlJouf and Hail among 439 diabetic patients revealed that 75% were aware that diabetes can cause eye disorders, 73% acknowledged the need for regular eye examinations and 65% reported visiting an ophthalmologist. Additionally, 302 participants recognized that treatment can prevent diabetic eye complications. The authors emphasized that all diabetic patients should undergo regular eye examinations for early detection and prevention of DR [14]. In Arar, among 535 diabetic patients, 54% demonstrated elevated knowledge and 57% showed positive attitudes and practices regarding DR. A significant association was observed between personal history of DR and better knowledge and practices. The internet was the most common source of information, followed by physicians and ophthalmologists [15]. In Riyadh, a study involving 280 diabetic patients attending primary healthcare centers found generally positive awareness; however, fewer than half had undergone an eye examination within the past year. Higher education levels were significantly associated with better knowledge [16].

Objectives

General Objective: To evaluate the awareness and knowledge of diabetic retinopathy among patients with type 2 diabetes mellitus in Hail city.

Specific Objectives

- To assess patients' understanding of the relationship between diabetes mellitus and diabetic retinopathy
- To evaluate knowledge regarding the need for regular eye examinations and screening intervals
- To determine factors associated with higher awareness levels, including age, education and duration of diabetes
- To provide evidence that may assist health authorities and primary healthcare providers in developing targeted educational programs aimed at improving early detection and prevention of vision loss

METHODOLOGY

This analytic cross sectional community-based study was conducted at Hail from June 2025 to February 2026 The study was conducted among adults aged 18-60 years residing in Hail, Saudi Arabia. Both males and females who met the eligibility criteria were included. The sample size was calculated using the OpenEpi calculator with a 95% confidence interval and a 5% margin of error. The estimated sample size was 224 participants. To account for incomplete or missing responses, 10% was added, increasing the final sample size to 245 participants.

A convenience sampling technique was used. Eligible participants were recruited electronically through social media platforms (Figure 1).

Data Collection

Data were collected using a structured, self-administered electronic questionnaire designed through Google Forms. The questionnaire was adapted and modified from previously published studies assessing awareness of diabetic retinopathy, particularly the study conducted by Alhamoud *et al.* [10].

The questionnaire consisted of 15 items divided into two sections:

- Demographic characteristics
- Knowledge and awareness of diabetic retinopathy

A pilot study was conducted on 20 participants to assess clarity, applicability and feasibility of the questionnaire. It also helped determine the average time required to complete the survey and identify potential ambiguities. Data obtained from the pilot study were excluded from the final analysis. All collected data were stored securely and were accessible only to the research team. Participant anonymity and confidentiality were strictly maintained throughout the study.

Statistical Analysis

Data were analyzed using IBM Statistical Package for Social Sciences (SPSS) version 23. Quantitative variables were presented as Mean±Standard deviation, while categorical variables were expressed as frequencies and percentages. Comparisons between groups were performed using Student's t-test or One-way ANOVA for quantitative variables and Chi-square (χ^2) test for categorical variables. A p-value of ≤0.05 was considered statistically significant.

Ethical Consideration

This study is approved by the ethical committee of Hail University Written informed consent was obtained from all patients.

Sample Size for Frequency in a Population

Population size(for finite population correction factor or fpc)(*N*):	535
Hypothesized % frequency of outcome factor in the population (*p*):	50%+/-5
Confidence limits as % of 100(absolute +/- %)(*d*):	5%
Design effect (for cluster surveys-*DEFF*):	1

Sample Size(*n*) for Various Confidence Levels

ConfidenceLevel(%)	Sample Size
95%	224
80%	126
90%	180
97%	251
99%	297
99.9%	359
99.99%	396

Equation

Sample size $n = [DEFF*Np(1-p)]/ [(d^2/Z^2_{1-\alpha/2}*(N-1)+p*(1-p)]$

Results from OpenEpi, Version 3, open source calculator--SSPropor
Print from the browser with ctrl-P
or select text to copy and paste to other programs.

Figure 1: Sample Size for Frequency in a Population

RESULTS

A total of 245 participants were included in the study. The mean age was 40.64±16.49 years, with ages ranging from 18 to 60 years. Females constituted 161 (65.7%) of the sample, while males accounted for 84 (34.3%). The mean duration of diabetes was 9.14±8.98 years. Most participants had Type 2 diabetes mellitus (169; 69.0%), while 76 (31.0%) had Type 1 diabetes. Regarding treatment modality, 143 (58.4%) were using oral hypoglycemic agents and 102 (41.6%) were on insulin therapy. The majority were married (151; 61.6%), followed by single individuals (91; 37.1%). In terms of awareness, 218 (89.0%) participants believed there is a relationship between diabetes and diabetic retinopathy (DR) and 175 (71.4%) knew that diabetes can lead to blindness. Furthermore, 219 (89.4%) agreed that controlling diabetes can prevent DR and 203 (82.9%) acknowledged that diabetic patients can develop eye problems. However, only 162 (66.1%) reported having undergone an eye examination in the past year. Regarding misconceptions, 64 (26.1%) believed that retinal examination is not necessary if both eyes are fine and 97 (39.6%) thought that DR is curable. Additionally, 39 (15.9%) considered visiting an optician or optical shop sufficient for diabetic eye care, whereas 206 (84.1%) correctly disagreed (Table 1-5, Figure 2).

Table 1: Baseline Demographic and Clinical Characteristics of Participants (N = 245)

Variable	Category	n (%)/Mean±SD
Age (years)	-	40.64±16.49
Duration of Diabetes (years)	-	9.14±8.98
Gender	Male	84 (34.3%)
	Female	161 (65.7%)
Type of Diabetes	Type 1 DM	76 (31.0%)
Treatment Modality	Oral hypoglycemic agents	143 (58.4%)
	Insulin therapy	102 (41.6%)
Marital Status	Married	151 (61.6%)
	Single	91 (37.1%)
	Other	3 (1.2%)

Table 2. Awareness of Diabetic Retinopathy Among Participants (N = 245)

Variable	Response	n (%)
Relationship between diabetes and DR	Yes	218 (89.0%)
	No	27 (11.0%)
Diabetes can cause blindness	Yes	175 (71.4%)
	No	70 (28.6%)
Controlling diabetes prevents DR	Yes	219 (89.4%)
	No	26 (10.6%)
Diabetic patients can develop eye problems	Yes	203 (82.9%)
	No	42 (17.1%)
Eye examination in past year	Yes	162 (66.1%)
	No	83 (33.9%)

Table 3: Misconceptions and Practices Related to Diabetic Retinopathy (N = 245)

Variable	Response	n (%)
Retinal exam not needed if vision is normal	Yes	64 (26.1%)
	No	181 (73.9%)
DR is curable	Yes	97 (39.6%)
	No	148 (60.4%)
Visiting optician is sufficient for DR care	Yes	39 (15.9%)
	No	206 (84.1%)

Table 4: Overall Knowledge Level of Diabetic Retinopathy (N = 245)

Knowledge Level	Score Range	n (%)
Good Knowledge	≥75% correct responses	112 (45.7%)
Moderate Knowledge	50-74% correct responses	86 (35.1%)
Poor Knowledge	<50% correct responses	47 (19.2%)

Table 5: Association Between Knowledge Level and Selected Variables (N = 245)

Variable	Category	Good Knowledge n (%)	Moderate/Poor n (%)	p-value*
Gender	Male (n = 84)	42 (50.0%)	42 (50.0%)	0.214
	Female (n = 161)	70 (43.5%)	91 (56.5%)	
Type of Diabetes	Type 1 (n = 76)	38 (50.0%)	38 (50.0%)	0.178
Duration of DM	≤5 years (n = 103)	38 (36.9%)	65 (63.1%)	0.032
	>5 years (n = 142)	74 (52.1%)	68 (47.9%)	
Eye Examination in Last Year	Yes (n = 162)	88 (54.3%)	74 (45.7%)	0.004
	No (n = 83)	24 (28.9%)	59 (71.1%)	

*Chi-square test applied. Statistical significance set at p≤0.05

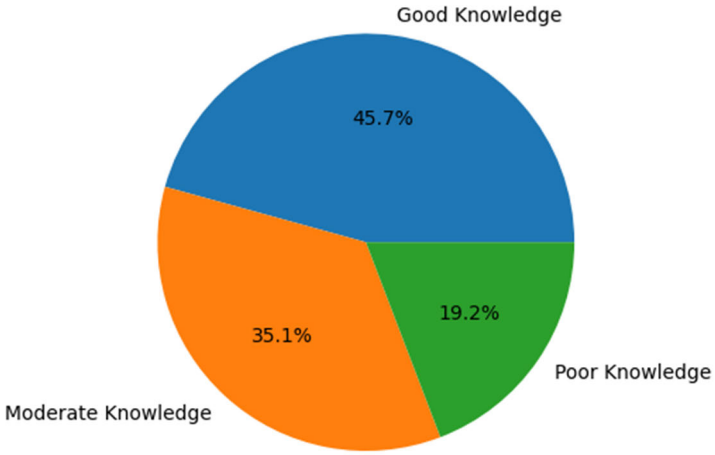

Figure 2: Overall Knowledge Level of Diabetic Retinopathy (N = 245)

DISCUSSION

The present study evaluated the awareness and knowledge of Diabetic Retinopathy (DR) among patients with type 2 diabetes mellitus in Hail city and identified important gaps despite generally moderate awareness levels. Although a large proportion of participants were aware that diabetes can affect the eyes and potentially lead to blindness, detailed knowledge regarding the timing and frequency of screening, as well as the asymptomatic nature of early DR, remained suboptimal [18]. This finding is consistent with several regional studies conducted in Saudi Arabia, where general awareness of DR was relatively high but adherence to annual eye examinations and understanding of screening recommendations were considerably lower [19-20]. In our study, higher educational level was significantly associated with better knowledge scores, which aligns with previous research showing that education plays a critical role in health literacy and disease awareness. Participants with university-level education demonstrated a clearer understanding of the need for regular ophthalmic evaluation, even in the absence of symptoms [21]. This is important because early-stage DR is often asymptomatic and delayed presentation contributes significantly to preventable visual impairment. Furthermore, duration of diabetes appeared to influence awareness levels. Patients with longer disease duration were more likely to report knowledge about DR and the importance of eye examinations. This may reflect increased exposure to healthcare providers over time or previous experiences with complications [22]. However, this also suggests that newly diagnosed patients represent a key target group for early educational interventions.

Despite reasonable awareness, actual screening behavior did not always match knowledge levels. A considerable proportion of participants had not undergone an eye examination within the past year. Reported barriers included lack of symptoms, difficulty accessing appointments and limited understanding of the screening process. These findings mirror other Saudi studies where absence of symptoms was the most common reason for not attending screening, highlighting a persistent misconception that eye evaluation is only necessary when visual changes occur. The results emphasize the need for structured educational programs integrated within primary healthcare services. Physicians, especially in diabetic clinics, play a central role in counseling patients about complications and reinforcing the importance of annual retinal screening. Public health campaigns, social media platforms and community-based awareness initiatives may further enhance knowledge and improve adherence to screening recommendations [23-24].

CONCLUSIONS

It is concluded that awareness of diabetic retinopathy among patients with type 2 diabetes mellitus in Hail city is moderate but remains insufficient in critical areas such as knowledge of recommended annual screening and the asymptomatic nature of early disease. While a substantial proportion of patients understand that diabetes can affect vision, adherence to regular ophthalmologic examination is inadequate. Higher educational level and longer duration of diabetes are associated with better awareness. These findings underscore the need for targeted educational interventions, strengthened counseling at primary care level and improved access to structured screening programs to reduce preventable vision loss.

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