SHORT ARTICLE

Exploring the Insights: Unraveling the Knowledge, Attitude, and Practice of Diabetics Regarding Diabetes and Diabetic Retinopathy in Hail, Saudi Arabia

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ABSTRACT

Background: Diabetes Mellitus is a metabolic disorder causing high blood glucose levels and is a major health concern in Saudi Arabia (SA). **Aims & objectives:** This study aimed to assess the knowledge, attitude, and practices of diabetic patients towards diabetes and diabetic retinopathy (DR) in Hail, SA. **Methods:** A descriptive cross-sectional survey using an anonymous, structured, validated, and pilot-tested questionnaire was conducted between February and June 2023 from adult diabetic patients in Hail and analyzed using RStudio. Associations between variables were evaluated, with statistical significance set at $p < 0.05$. **Results:** 280 participants took part in the survey, with 57.0% females and 51.4% aged between 18 to 34 years. Poor knowledge was significantly higher among participants aged 35 to 50 years (92.8%). Negative attitudes were more prevalent in males (37.8% vs 24.7%, $p = 0.019$) and those with lower income levels (16.7%, 29.5%, and 62.5% among high-, middle-, and low-income groups, respectively, $p = 0.008$). **Conclusions:** The study revealed a lack of knowledge and negative attitudes towards diabetes, particularly among lower-income patients. There is a significant relationship between education and good disease control, highlighting the need for improved education and awareness of DM and DR in Hail.

INTRODUCTION

Diabetes Mellitus (DM) is a metabolic disorder that causes abnormally high blood glucose levels. The incidence of DM has more than doubled over the past two decades, making it an epidemic (1). Unfortunately, even children,

adolescents, and adults are now developing type 2 DM (1). A comparative study in 2012 predicted that the global diabetic population would reach 552 million by 2030 (2). In Saudi Arabia, diabetes is a significant health problem (3). According to a report by the Saudi Arabian Ministry of Health, the number of people diagnosed with DM increased from 1 million in 1992 to 2.5 million in 2010, representing rapid growth rates within less than two decades (4). The primary causes of DM are obesity and an aging population (5), which can lead to serious health problems such as kidney failure, leg amputation, vision loss, and nerve damage. Diabetic retinopathy, the major retinal vascular complication of DM, is becoming one of the leading causes of vision impairment and blindness in people aged 50 and above globally in 2020 (0.86 million cases) (6). In Saudi Arabia, Diabetic retinopathy (DR) is a serious complication that has risen substantially in recent decades as a direct effect of the dramatic increase in the prevalence of DM (7). Diabetes mellitus can cause DR when high blood sugar damages the small blood vessels that supply the retina. This can affect the blood supply in three stages. The initial stage is known as background retinopathy, which may present as a bulge and slight bleeding without affecting vision. Over time, the pre-proliferative stage may develop, characterized by significant bleeding and more damage. If the hyperglycemic state persists, it can progress to the proliferative stage, where scar tissue forms alongside new blood vessel formation that tends to bleed. At this stage, loss of vision is highly likely. However, these complications can be prevented by regular eye screenings, controlling glucose levels, and making lifestyle changes (8). Therefore, this study is designed to determine the knowledge, attitude, and practices (KAP) of diabetic patients towards DM and DR in Hail, Saudi Arabia.

MATERIAL & METHODS

Ethical approval: The present study is a cross-sectional analytics community-based study. The study was conducted in Hail Province, Saudi Arabia, among diabetic patients from February to June 2023. The study was performed after the ethical approval from the University of Hail (H-2022-272).

Participants: We included participants who were adults, had diabetic mellitus, and were residents of both urban and rural areas in Hail. Any participant under 18 years old, didn't have DM or was not a resident of Hail was excluded. Participation in the survey study was considered to be consent from the participants. Participants who didn't show a willingness to participate were excluded.

To determine the appropriate sample size for the study, we utilized the Raosoft sample size calculator (9). Our calculations were based on the total population of the Hail region (n = ≈ 731,147), with a 95% confidence level and a conservative margin of error of 5%. At the end of the study, 300 responses were collected (response rate 77.72%) using a convenience sampling technique. The researchers used a self-administered electronic questionnaire formulated by Srinivasan et al. (10) that served as the basis and transformed it into a 44-score online Google form. Some questions were excluded, and modifications were made in specific sections. The questionnaire was translated into Arabic to assess the KAP behavior of people with diabetes towards DM and DR.

Data collection method and tools: This study used a self-administered questionnaire using an online Google form. This survey was designed in English to measure the knowledge, attitude, and practice of people with diabetes towards DM and DR, then translated into Arabic by two expert translators. The survey questions were collected from previous study (10) as well as self-made questions were also included. The data collection tool underwent validation by a panel of two consultant endocrinologists and one consultant ophthalmologist to ensure its content validity and applicability. The reliability of the questionnaire was assessed by a pilot study involving 20 participants, resulting in a reliability coefficient (α-Cronbach's) of 0.76.

The questionnaire had four sections: demographic data, knowledge, attitude, and practice. Demographic data included questions related to age, gender, education level, residency, employment status, socioeconomic

status, and DR state. The knowledge section had ten questions, three of which were about diabetes in general, and seven were about DR. The attitude section had five questions, three of which assessed patients' attitudes regarding DM, and two assessed patients' attitudes regarding DR. The last section was the practice section, which involved 14 questions, five to assess patients' practice patterns towards diabetes, three to evaluate patients' practice patterns towards DR, and finally, six questions to assess the attitude toward retinopathy in patients diagnosed with DR.

Knowledge, attitude, and practice scoring: The study involved the evaluation of the participants' knowledge, attitudes, and practices. They were given a set of 10 knowledge items, out of which five had multiple selections. The knowledge score was computed by assigning a value of 1 for each correct response and 0 for incorrect responses. The maximum knowledge score was 30, and a score below 24 indicated poor knowledge. Similarly, a score of 1 was assigned for correct responses in the attitudes and practice domains. The attitude score ranged from 0 to 5, with a score of less than 3 indicating negative attitudes. The practice score for patients without DR ranged from 0 to 7, with a score of less than 5 indicating poor practice. For patients with DR, the practice score ranged from 0 to 2, and a score below 1 indicated poor practice.

Statistical Analysis: Categorical data were presented as frequencies and percentages, while numerical variables were presented as the median and interquartile range (IQR). The internal consistency of different domains (knowledge, attitudes, and practice) was assessed using Cronbach's alpha coefficient analysis; the reliability coefficient was 0.776 for knowledge, 0.669 for attitudes, and 0.732 and 0.783 for practice among patients without and with DR, respectively. Variables with multiple selections were analyzed using a multiple-response analysis. Factors associated with different levels of knowledge, attitudes, and practice were assessed using Pearson's Chi-squared test and Fisher's exact test. The statistical analysis was conducted using

RStudio (R version 4.1.1), and statistical significance was considered at $p < 0.05$.

RESULTS

Sociodemographic characteristics: The study collected responses from 300 participants, but 20 were excluded from participants under 18 years old, leaving 280 valid responses for analysis (Table 1). Of all the participants, slightly over half (57.0%) were women, and the majority (51.4%) were between the ages of 18 and 34. A significant proportion of the participants (70.4%) had completed college, resided in urban areas (87.9%), and were part of the middle socioeconomic bracket (83.6%). The study found that 43 participants (15.4%) had diabetic retinopathy, with 2 having proliferative DR (0.7%), 6 having non-proliferative DR (2.1%), and the rest unsure of the type.

Table 1 Sociodemographic characteristics of the study participants

Parameter	Category	N (%)
Age	18 to 34	144 (51.4%)
	35 to 50	83 (29.6%)
	>50	53 (18.9%)
Gender*	Male	119 (43.0%)
	Female	158 (57.0%)
Educational level	None	9 (3.2%)
	Primary	8 (2.9%)
	Middle	10 (3.6%)
	High school	56 (20.0%)
	College	197 (70.4%)
Residency	Urban	246 (87.9%)
	Rural	34 (12.1%)
Employment status	Not employed	59 (21.1%)
	Employed	119 (42.5%)
	Student	73 (26.1%)
	Retired	29 (10.4%)
Socioeconomic status	Low	16 (5.7%)
	Middle class	234 (83.6%)
	High	30 (10.7%)
Retinopathy state	No retinopathy	237 (84.6%)
	Have non-proliferative DR	6 (2.1%)
	Have proliferative DR	2 (0.7%)
	Have retinopathy but do not know the type	35 (12.5%)

* The variable has 3 missing values

Participants' knowledge and the factors associated with poor knowledge: In our study, the median (IQR) of the total score was 14.0 (9.8-19.0) out of a maximum total score of 30.

A large majority (247 participants, 88.2%) had poor knowledge (Figure 1A). The older participants, specifically those aged 35 to 50 years (92.8%) and over 50 years (96.2%), had significantly higher rates of poor knowledge compared to those aged 18 to 34 years (82.6%, p = 0.010). Similarly, unemployed, employed, and retired participants (93.2%, 91.6%, and 96.6%, respectively) had significantly higher rates of poor knowledge compared to students (75.3%, p = 0.002, Table 2).

Table 2 Factors associated with participants' knowledge and attitudes towards diabetic retinopathy.

Parameter	Category	Knowledge			Attitudes		
		Good, N = 33	Poor, N = 247	p-value	Positive, N = 196	Negative, N = 84	p-value
Age	18 to 34	25 (17.4%)	119 (82.6%)	0.010	105 (72.9%)	39 (27.1%)	0.127
	35 to 50	6 (7.2%)	77 (92.8%)		60 (72.3%)	23 (27.7%)	
	>50	2 (3.8%)	51 (96.2%)		31 (58.5%)	22 (41.5%)	
Gender*	Male	13 (10.9%)	106 (89.1%)	0.777	74 (62.2%)	45 (37.8%)	0.019
	Female	19 (12.0%)	139 (88.0%)		119 (75.3%)	39 (24.7%)	
Educational level	None	0 (0.0%)	9 (100.0%)	0.580	3 (33.3%)	6 (66.7%)	0.011
	Primary	1 (12.5%)	7 (87.5%)		3 (37.5%)	5 (62.5%)	
	Middle	0 (0.0%)	10 (100.0%)		6 (60.0%)	4 (40.0%)	
	High school	9 (16.1%)	47 (83.9%)		37 (66.1%)	19 (33.9%)	
	College	23 (11.7%)	174 (88.3%)		147 (74.6%)	50 (25.4%)	
Residency	Urban	31 (12.6%)	215 (87.4%)	0.394	177 (72.0%)	69 (28.0%)	0.055
	Rural	2 (5.9%)	32 (94.1%)		19 (55.9%)	15 (44.1%)	
Employment status	Not employed	4 (6.8%)	55 (93.2%)	0.002	38 (64.4%)	21 (35.6%)	0.045
	Employed	10 (8.4%)	109 (91.6%)		86 (72.3%)	33 (27.7%)	
	Student	18 (24.7%)	55 (75.3%)		57 (78.1%)	16 (21.9%)	
	Retired	1 (3.4%)	28 (96.6%)		15 (51.7%)	14 (48.3%)	
Socioeconomic status	Low	0 (0.0%)	16 (100.0%)	0.065	6 (37.5%)	10 (62.5%)	0.008
	Middle class	26 (11.1%)	208 (88.9%)		165 (70.5%)	69 (29.5%)	
	High	7 (23.3%)	23 (76.7%)		25 (83.3%)	5 (16.7%)	

Participants attitudes and the factors associated with negative attitudes: Most patients (70.0%) had positive attitudes toward DR management, while 30.0% had negative attitudes (Figure 1B). The median (IQR) of the total score was 4.0 (3.0-5.0) out of a maximum total score of 5. Male participants had a significantly higher proportion of negative attitudes compared to female participants (37.8% vs 24.7%, p = 0.019). Additionally, the proportions of participants with negative attitudes toward DR management increased consistently with lower income levels (16.7%, 29.5%, and 62.5% among the high-, middle- and low-income groups, respectively, p = 0.008) and with lower educational levels (25.4% for college levels, 33.9% for high school levels, 40.0% for middle school levels, 62.5% for primary school levels and 66.7% for participants no education, p = 0.011). Negative attitudes were also significantly higher among retired and unemployed participants (48.3% and 35.6%, respectively) than among employed participants (27.7%) and students (21.9%, p = 0.045, Table 2).

Participants practice and the associated factors: The study also analyzed the practice of patients with and without DR separately using different questions. The median (IQR) of the total score was 4.0 (2.0-6.0) out of a maximum total score of 7 in participants with no DR and 1.0 (9.8-2.0) out of a maximum total score of 2 in participants with DR. Among diabetic patients without DR (n=237), 70% of the participants (n = 166) had poor practice levels (Figure 1C). Poor practice levels were significantly higher among males (77.9% vs. 64.7% for females, p = 0.031) and among unemployed participants (89.1%) compared to their peers (73.7% among retired, 71.0% among students and 60.2% among employed participants, p = 0.005, Table 3). Regarding participants with DR (n=43), eight participants had missing responses in the practice domain.

Therefore, the association analysis was carried out for 35 patients, of whom 20 (57.1%, Figure 1D) had poor practice levels. The levels of practice among patients with DR did not differ significantly across different sociodemographic groups (Table 3).

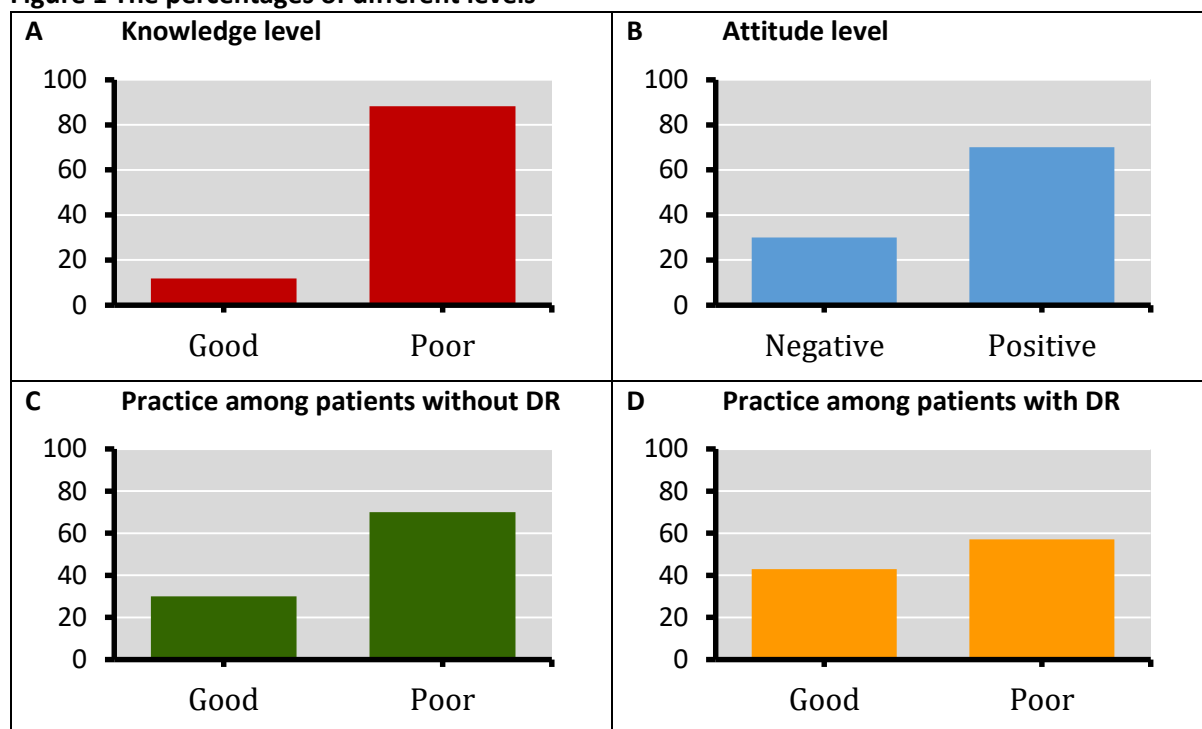**Figure 1 The percentages of different levels**

Table 3: Factors associated with the practice of patients with and without diabetic retinopathy.

Parameter	Category	Practice among patients without DR			Practice among patients with DR		
		Good Practice, N = 71	Poor Practice, N = 166	p-value	Good Practice, N = 15	Poor Practice, N = 20	p-value
Age	18 to 34	41 (31.3%)	90 (68.7%)	0.482	4 (50.0%)	4 (50.0%)	0.426
	35 to 50	22 (31.9%)	47 (68.1%)		4 (28.6%)	10 (71.4%)	
	>50	8 (21.6%)	29 (78.4%)		7 (53.8%)	6 (46.2%)	
Gender	Male	21 (22.1%)	74 (77.9%)	0.031	9 (42.9%)	12 (57.1%)	>0.999
	Female	49 (35.3%)	90 (64.7%)		6 (42.9%)	8 (57.1%)	
Educational level	None	1 (16.7%)	5 (83.3%)	0.066	1 (33.3%)	2 (66.7%)	0.943
	Primary	0 (0.0%)	7 (100.0%)		0 (0.0%)	1 (100.0%)	
	Middle	0 (0.0%)	5 (100.0%)		3 (60.0%)	2 (40.0%)	
	High school	10 (21.7%)	36 (78.3%)		2 (33.3%)	4 (66.7%)	
	College	60 (34.7%)	113 (65.3%)		9 (45.0%)	11 (55.0%)	
Residency	Urban	66 (31.0%)	147 (69.0%)	0.303	14 (48.3%)	15 (51.7%)	0.207
	Rural	5 (20.8%)	19 (79.2%)		1 (16.7%)	5 (83.3%)	
Employment status	Not employed	5 (10.9%)	41 (89.1%)	0.005	4 (44.4%)	5 (55.6%)	0.958
	Employed	41 (39.8%)	62 (60.2%)		6 (40.0%)	9 (60.0%)	
	Student	20 (29.0%)	49 (71.0%)		1 (33.3%)	2 (66.7%)	
	Retired	5 (26.3%)	14 (73.7%)		4 (50.0%)	4 (50.0%)	
Socioeconomic status	Low	1 (10.0%)	9 (90.0%)	0.415	2 (40.0%)	3 (60.0%)	>0.999
	Middle class	61 (30.5%)	139 (69.5%)		13 (44.8%)	16 (55.2%)	
	High	9 (33.3%)	18 (66.7%)		0 (0.0%)	1 (100.0%)	

DISCUSSION

The objective of our research was to evaluate the KAP behavior regarding diabetes in Hail, Saudi Arabia, with a particular emphasis on DR, which is a prevalent long-term complication of poorly managed diabetes mellitus and is a leading cause of visual impairment and blindness in the Saudi population (7). According to Saeedi et al. (2019), the prevalence of diabetes worldwide is projected to rise by 25% in 2030 and 51% in 2045 (11). Routine screening programs for diabetic patients can prevent visual complications by enabling early detection, and proper habits towards diabetes, exercise programs, and nutrition control can also help.

Participants knowledge: In our study, we asked ten questions containing 26 scores and found that diabetic patients in Hail have poor general knowledge about diabetes and DR, particularly those aged >50 years, unemployed, and retired individuals compared to young and college students. Common mistakes in the survey included misconceptions about the complications of diabetes on the eye, factors that deteriorate eye health, what retinopathy is, and the duration of diabetic eye routine screening. This indicates suboptimal knowledge of the heavy impact of diabetes on the eye.

In contrast to a previous study in Riyadh, the average knowledge score for diabetes was good compared to retinopathy (12). We believe that the place of residency, level of education, and social level may be a more substantial factor than we imagine, as we found that those who live in the capital, civilized cities and completed their education have substantial knowledge regarding their conditions (13) in comparison to who live in peripheries even in the same country similar to a previous study done in Jazan (14).

Participants attitudes: In contrast to knowledge, we found that 70% of participants had a positive attitude towards diabetes and DR management, particularly among 18-34-year-old college students and employed females living in urban areas with middle to high-income levels. Earlier studies from AlJouf and Hail stated that most diabetes patients knew that diabetes could cause eye complications and that the importance of

ophthalmologist consultation (13) is consistent with our research. Older people>50 and those with low social income who lack medical information resources and have difficulties finding evidence-based answers through medical access or the internet might contribute to the poor attitude.

Participants practice: Regarding practice, we asked nine questions, including four about DR among patients with and without DR, and found that the results were below the acceptable range. This can be explained by the low level of knowledge, indicating that more than awareness alone is needed for better outcomes. Our result is the same as that of Riyadh (12) and Jazan (14) studies, which all showed poor practice, possibly due to cultural background and habits with food and exercise.

CONCLUSION & RECOMMENDATION

In conclusion, our study revealed a significant lack of patient knowledge and good practice for diabetes and DR, particularly among elderly, low-income, and uneducated patients. We found that education was related to good disease control, and we recommend that the Ministry of Education introduce curricula and subjects regarding disease pathophysiology, treatment, and prevention from a young age, especially for an epidemic like diabetes. Additionally, we suggest that the Ministry of Health in Hail launch more campaigns and events about diabetes and retinopathy, taking into account the social and cultural background of patients in the area. It is essential to note that primary/family and ophthalmology doctors have the most significant impact on patients and should ensure that patients understand their disease and how to control it for better outcomes.

LIMITATION OF THE STUDY

There were some limitations to our study. The online questionnaire format may have prevented older adults from participating, as they may not be as familiar with modern technology. The yes-no questions in the survey may have influenced participants' answers, and some questions had multiple answers, making it difficult for participants to answer correctly. Additionally, we did not include

values of the glycemic control level in our analysis.

RELEVANCE OF THE STUDY

The present study assesses diabetic patients' knowledge, attitudes, and practices towards diabetes and diabetic retinopathy in the Hail region of Saudi Arabia. It identifies knowledge gaps and negative attitudes, emphasizing the need for targeted educational interventions and support systems, especially for lower-income groups. The study's findings underscore the urgency of addressing disparities through policymaking and public health initiatives focused on diabetes education and awareness in Hail, Saudi Arabia.

AUTHORS CONTRIBUTION

All authors have contributed equally.

DECLARATION OF GENERATIVE AI AND AI ASSISTED TECHNOLOGIES IN THE WRITING PROCESS

The authors haven't used any generative AI/AI assisted technologies in the writing process.

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