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ORIGINAL RESEARCH

Knowledge, Attitude, and Practices (KAP) of Diabetics Towards Diabetes and Diabetic Retinopathy in Riyadh, Saudi Arabia: Cross-Sectional Study

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Background: Diabetes mellitus (DM) and its complication present a major morbidity burden among Saudi population. Awareness and proper knowledge of this highly prevalent disease is crucial to enhance early detection and proper intervention. Therefore, the main aim of this study was to identify the knowledge, attitude, and practices (KAP) of diabetic patients towards diabetes and diabetic retinopathy in Riyadh, Saudi Arabia.

Methods: This cross-sectional study was conducted in 50 randomly selected primary care centers and two university hospitals in Riyadh, Saudi Arabia, between May and December 2018. Diabetic patients ≥18 years old were enrolled in the study. A validated KAP-45 questionnaire was used to assess the KAP levels of diabetics towards diabetes and diabetic retinopathy.

Results: A total of 313 participants were enrolled in the study. The majority were males 168 (59.8%). The median age was 49 ±24, and the median duration of diabetes was 8 ±11 years. The average knowledge score for diabetes was 10 (good). While the average knowledge score for diabetic retinopathy was 4.5 (suboptimal). The average attitude scores for both diabetes and diabetic retinopathy were 0 and 2 (suboptimal), respectively. The average practice score for diabetes was 5 (good) while it was 3 (low) for diabetic retinopathy. The most common barrier to comply with regular follow-up was inadequate knowledge about the importance of periodic eye exam 47.1% (107). Patients with low socio-economic status had a significantly poor knowledge regarding diabetes (P<0.0001) and diabetic retinopathy (P<0.015), respectively. However, patients with low educational level had a significantly poor knowledge (p<0.0001) and poor practice regarding diabetes (P<0.013), respectively.

Conclusion: It is important to improve education and awareness of DM and diabetic retinopathy among diabetics, as it's essential for controlling the disease and reducing its complications, by improving patient compliance to treatment and follow-up.

Keywords: DM, diabetes mellitus, DR, diabetic retinopathy, regular eye exam, primary care, diabetes awareness, knowledge, attitude and practice

Background

Diabetes mellitus (DM) is a chronic metabolic disease related to insulin and is one of the most significant worldwide health problems. In 2014, the WHO estimated that globally, 422 million people were affected by DM.[1] This number is expected to rise to 592 million by 2035.[2] Alnozha et al reported that DM prevalence in Saudi Arabia was 23.7% in 2011, the second highest among Middle Eastern countries and

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the seventh highest worldwide according to the WHO ranking.[3] This number is expected to increase further in the upcoming years.

Diabetic retinopathy (DR) is one of many devastating ischemic complications of DM.[4] It is a silent, progressive disease that can lead to irreversible blindness. Studies estimate that 2% of diabetic patients will go blind within 15 years of diagnosis.[5] Nevertheless, the condition is responsible for 4.8% of blindness worldwide.[6] DR is common among Saudi diabetics. A prevalence of 36% was reported in Al-Medina city, and 33% in Al Ahsa region of Saudi Arabia.[7,8] Studies found that high blood sugar, long duration of DM, and associated high blood pressure are major risk factors for the development of DR. Tight control of the blood sugar is highly effective in delaying the onset of and preventing the progression of DR. Nevertheless, sudden tight control of blood sugar after a long period of poor control, might initially worsen the retinopathy.[9] Almost all patients are asymptomatic in the early stages of DR, but RCTs found that early screening and intervention could prevent visual loss in patients with DR by 57%.[9] Therefore, early detection and treatment are vital to prevent visual loss.[10]

Awareness and proper knowledge of this highly prevalent disease is crucial to enhance early detection and proper intervention.[9] Patients with higher-than-average knowledge of the condition were found to have a positive attitude and a good practice pattern, which gave them the advantage of earlier presentation in their course of illness. In addition, patients with a lack of awareness showed poorer control of DR risk factors.[11] Therefore, the aim of this study was to identify the Knowledge, Attitude, and Practices (KAP) of diabetics towards diabetes and diabetic retinopathy in Riyadh City, Saudi Arabia.

Methods

Study Settings

Approval from the institutional review board was obtained from King Saud University (KSU) prior to the start of the study. Consent was received from all patients via a consent form to allow for inclusion of their non-identifiable information in the study. This was a cross-sectional study of type 1 and 2 adult diabetic patients, ≥18 years old, conducted between May and December 2018 in Riyadh, Saudi Arabia. A list of all 418 primary care centers in the Riyadh region was drawn up from the Ministry of Health website. The list was further filtered to include only centers inside Riyadh City. A random number table was used to select 50 primary care centers from each region of Riyadh City (West, East, Center, North, South). In addition, two university hospitals affiliated with KSU in Riyadh were included to compare patients in two different settings, university hospitals versus primary care centers.

Sample Size and Sampling Technique

The sample size was calculated using Roasoft software. The single proportion sample size formulae was used, with a precision of 5%, and a confidence interval of 95%. The percentage of diabetic patients with significant knowledge was assumed to be 85%. Participants were selected by a systematic random sampling method. All patients that attended clinics in the selected centers during the period of the study were included.

Questionnaire

The demographic variables included in the study were: gender, age, marital status, educational level, and monthly income. The Knowledge, Attitude, and Practice −45 points (KAP-45) questionnaire was formulated by Srinivasan et al .[11] Permission to use the KAP-45 questionnaire was granted after communication with its main authors. The KAP-45 questionnaire is divided into: 13 questions in the knowledge section (five to assess patients' knowledge of diabetes and eight to assess patients' knowledge of diabetic retinopathy), eight questions in the attitude section (four to assess patients' attitude towards diabetes and four to assess patients' attitude towards diabetic retinopathy), and 24 questions in the practice section (six to assess patients' practice patterns regarding diabetes and 18 to assess patients' practice patterns regarding diabetic retinopathy). Some of the questions in the knowledge and practice sections of the questionnaire were constructed as open-ended questions, whereas questions in the attitude section were framed as statements.

Participants were categorized as having "sufficient knowledge" if they answered nine or more of the "must know" questions regarding diabetes and if they answered five or more of the "must know" questions regarding diabetic retinopathy. In addition, participants were categorized as having "good practice" if they answered four or more of the "must do" questions regarding diabetes and if they answered four or more of the "must do" questions regarding diabetic retinopathy. In the attitude section of the questionnaire, participants were categorized as having

a "positive attitude" when they scored three or higher in statements that were indicative of a positive attitude towards diabetes and diabetic retinopathy.

The KAP-45 questionnaire was validated by a face validity method into Arabic. Two bilingual Arabic-English speakers translated the original English version of the questionnaire into Arabic, then an expert committee was formed to review and culturally adapt the KAP-45 questionnaire. Finally, a feedback from the pilot study, initially done, was taken into consideration to finalize the Arabic version of KAP-45 questionnaire.

Statistical Analysis

The analysis was performed using SPSS version 22.0 software (SPSS Inc., Chicago, IL, U.S.), to calculate the demographics and responses to the questionnaire. Categorical data were expressed as frequencies and percentages. Continuous data were expressed using medians and interquartile ranges (IQ) or means and standard deviations (SD), as indicated. Chi-Square and Fisher's exact tests were used to compare between the variables, A P-value of less than 0.05 was considered statistically significant for all analysis. Construct validity was done by exploratory factor analysis using principal component analysis extraction and Varimax rotation after conducting Kaiser-Meyer-Olkin Measure and Bartlett's test of sphericity of Sampling Adequacy Test on KAP questionnaire. Only factors equivalent or greater to 1 were included, items were deleted if they did not exceed a 0.4 factor loading cut off. No cross loading was detected.

Result

A total of 313 participants were enrolled in the study. 59.8% (168) were males and 40.2% (125) were females. Most of our study respondents 64.2% (194) were between the age of 30–60. Among them, 64% (199) were married. Of the 313 recruited, 12.3% (38) were illiterate and 45.4% (141) had at least a bachelor's degree. The median duration of diabetes was 8 ±11 years and 78% (244) had a positive family history of diabetes (Table 1).

The median knowledge score for diabetes was 10 (good knowledge range 9–17) and 4.5 (good knowledge range 5–11) for diabetic retinopathy. Most of the participants 95.2% (295) knew that high sugar levels could be detected by blood testing. However, only 25.2% (78) knew that high sugar levels could be detected in urine as well. Surprisingly, only half of the participants knew that diabetes could lead to visual problems, 53% (166) of participants knew that the condition affects the retina, and 40.6% (127) knew that it can cause cataracts. Only a few patients 10.2% (32) knew that DM increases the risk of infections. Higher educational levels and younger age were significantly associated with good levels of knowledge of DM ($p<0.0001$) and ($p<0.049$) respectively. (Table 2) Meanwhile, good knowledge of DM and DR were significantly associated with higher monthly income ($p<0.0001$) and ($p<0.015$) respectively. (Table 3) There was no significant association between gender, the duration of DM, and the level knowledge of DM and DR ($p<0.386$), ($p<0.711$), ($p<0.441$) and ($p<0.447$) respectively. (Table 2 and 3)

Only 237 of the total 313 participants responded to the question regarding the effect of poor glucose control on worsening DR. Fifty-four 22.8% believed that poor glucose control is a factor which can worsen diabetic retinopathy. While more than half of the respondents 54.4% (129) believed that kidney problems could worsen diabetic retinopathy.

Table 1 Demographics

Variables		Frequency (%)
Age (n=302)	**<30**	55(18.2%)
	30–60	194(64.2%)
	>60	53(17.5%)
Gender (n=311)	**Male**	168(59.8%)
	Female	125(40.2%)
Marital status (n=311)	**Sinlge**	67(21.5%)
	Married	199(64%)
	Widow	32(10.3%)
	Divorced	13(4.2%)
Educational level (n=310)	**Illiterate**	38(12.3%)
	Primary	31(10%)
	Secondary	30(9.7%)
	High school	70(22.6%)
	Collage	104(33.5%)
	Post graduate	37(11.9%)
Family monthly income (n=289)	**<5K**	62(21.5%)
	5–10K	66(22.8%)
	10–15K	76(26.3%)
	15–20K	50(17.3%)
	>20K	35(12.1%)
Family member has DM (n=313)		244(78%)
Duration of DM (n=308)	**≤10 years**	200(64.9%)
	≤20 years	83(26.9%)
	>20 years	25(8.1%)

Table 2 KAP Regarding Diabetes

		Knowledge (n=304)		P-value	Attitude (n=277)		P-value	Practice (n=214)		P-value
		Good	Poor		Good	Poor		Good	Poor	
Gender	**Male** **Female**	68(56.2%) 92(51.1%)	53(43.8%) 88(48.9%)	0.386	0 2(1.2%)	109(100%) 163(98.8%)	0.519	29(37.2%) 66(48.5%)	49(62.8%) 70(51.5%)	0.108
Marital status	**Single** **Married** **Widow** **Divorced**	42(64.6%) 95(48.7%) 16(53.3%) 7(58.3%)	23(35.4%) 100(51.3%) 14(46.7%) 5(41.7%)	0.165	0 3(1.7%) 0 0	61(100%) 173(98.3%) 25(100%) 12(100%)	0.639	21(38.9.%) 60(47.6%) 10(43.5%) 4(50%)	33(61.1%) 66(52.4%) 13(56.5%) 4(50%)	0.737
Educational level	**Illiterate** **Primary** **Secondary** **High school** **Collage** **Post graduate**	12(32.4%) 14(46.7%) 12(40%) 30(44.8%) 62(60.8%) 31(83.8%)	25(67.6%) 16(53.3%) 18(60%) 37(55.2%) 40(39.2%) 6(16.2%)	<0.0001	0 1(4%) 0 1(1.7%) 1(1.1%) 0	32(100%) 24(96%) 28(100%) 58(98.3%) 93(98.9%) 36(100%)	0.668	16(57.1%) 10(40%) 10(52.6%) 27(57.4%) 27(38.6%) 3(14.3%)	12(42.9%) 15(60%) 9(47.4%) 20(42.6%) 43(61.4%) 18(85.7%)	0.013
Family monthly income (n=)	**<5K** **5–10K** **10–15K** **15–20K** **>20K**	20(33.9%) 33(50.8%) 45(60.8%) 33(67.3%) 26(76.5%)	39(66.1%) 32(49.2%) 29(39.2%) 16(32.7%) 8(23.5%)	<0.0001	1(1.9%) 0 2(2.8%) 0 0	51(98.1%) 58(100%) 69(97.2%) 46(100%) 34(100%)	0.495	19(43.2%) 24(54.5%) 28(54.9%) 9(29%) 7(30.4%)	25(56.8%) 20(45.5%) 23(45.1%) 22(71%) 16(69.6%)	0.065
Family member has DM		128(53.8%)	110(46.2%)	0.666	2(0.9%)	218(99.1%)	0.495	71(42%)	98(58%)	0.136
Place of follow-up	**University** **Primary care**	53(52%) 108(53.5%)	49(48%) 94(46.5%)	0.804	2(2.2%) 1(0.5%)	91(79.8%) 183(99.5%)	0.222	24(48%) 71(43.3%)	26(52%) 93(56.7%)	0.558
Age	**<30** **30–60** **>60**	38(69.1%) 95(50.5%) 26(52%)	17(30.9%) 93(49.5%) 24(48%)	0.049	0 1(0.6%) 1(2.4%)	49(100%) 176(99.4%) 41(97.6%)	0.200	16(39%) 63(47.4%) 11(35.5%)	25(61%) 70(52.6%) 20(64.5%)	0.380
Duration of DM	**≤10** **≤20** **>20**	102(52.6%) 47(58%) 11(44%)	92(47.4%) 34(42%) 14(56%)	0.441	1(0.6%) 0 1(4.8%)	178(99.4%) 72(100%) 20(95.2%)	0.192	66(45.8%) 25(46.3%) 4(30.8%)	78(54.2%) 29(53.7%) 9(69.2%)	0.565

Out of 305 respondents, 82.6% (252) chose the eye as the first organ that would be affected by DM, followed by the kidneys 54.4% (129). Interestingly, 54.9% (134) believed that they need a fundus examination once every five years, while only 28.7% (70) believed that they need it once every year.

The median attitude score for diabetes was 0 (good attitude range 3–4) and 2 (good attitude range 3–4) for diabetic retinopathy. Surprisingly, out of 279 respondents, 58.1% (162) thought it was fine not to comply with diabetic diet occasionally. While, out of 280 respondents, 23.9% (67) thought it was fine to forget to take their medications. 62.9% (175) did not believe it was important to check their eyes regularly, as long as they were asymptomatic. However, 75.8% (210) believed that they should follow-up with an ophthalmologist even if their blood sugar was under control. The level of attitude toward DR was significantly lower in respondents attending a primary care clinic than respondents in a university hospital ($p<0.0001$). (Table 3)

The median practice score for diabetes was 5 (good practice range 4–5) and 3 (good practice range 4–5) for diabetic retinopathy. Most of the respondents, 60.4% (166), follow-up regularly to have their funduscopic

Table 3 KAP Regarding Diabetic Retinopathy

		Knowledge (n=177)		P-value	Attitude (n=277)		P-value	Practice (n=68)		P-value
		Good	Poor		Good	Poor		Good	Poor	
Gender (n=175)	**Male** **Female**	36(48.6%) 52(51.5%)	38(51.4%) 49(48.5%)	0.711	51(47.2%) 56(33.7%)	57(52.8%) 110(66.3%)	<0.025	11(40.7%) 12(30%)	16(59.3%) 28(70%)	0.364
Marital status (n=)	**Single** **Married** **Widow** **Divorced**	26(60.5%) 49(45.4%) 8(50%) 3(37.5%)	17(39.5%) 59(54.6%) 8(50%) 5(62.5%)	0.353	17(27.9%) 79(44.9%) 8(32%) 4(33.3%)	44(72.1%) 97(55.1%) 17(68%) 8(66.7%)	0.095	2(20%) 19(38%) 1(16.7%) 1(50%)	8(80%) 31(62%) 5(83.3%) 1(50%)	0.519
Educational level (n=)	**Illiterate** **Primary** **Secondary** **High school** **Collage** **Post graduate**	7(36.8%) 5(35.7%) 7(53.8%) 14(41.2%) 37(54.4%) 18(64.3%)	12(63.2%) 9(64.3%) 6(46.2%) 20(58.8%) 31(45.6%) 10(35.7%)	0.268	11(34.4%) 8(32%) 12(42.9%) 24(42.1%) 36(37.1%) 16(45.7%)	21(65.6%) 17(68%) 16(57.1%) 33(57.9%) 61(62.9%) 19(54.3%)	0.847	3(50%) 1(16.7%) 4(57.1%) 2(15.4%) 8(33.3%) 5(45.5%)	3(50%) 5(83.3%) 3(42.9%) 11(84.6%) 16(66.7%) 6(54.5%)	0.328
Family monthly income (n=)	**<5K** **5–10K** **10–15K** **15–20K** **>20K**	12(41.4%) 14(35.9%) 18(40%) 19(67.9%) 17(68%)	17(58.6%) 25(64.1%) 27(60%) 9(32.1%) 8(32%)	0.015	23(44.2%) 22(37.9%) 29(40.8%) 16(34.8%) 16(47.1%)	29(55.8%) 36(62.1%) 42(59.2%) 30(65.2%) 18(52.9%)	0.792	3(23.1%) 7(63.6%) 7(30.4%) 1(8.3%) 5(55.6%)	10(76.9%) 4(36.4%) 16(69.6%) 11(91.7%) 4(44.4%)	0.121
Family member has DM (n)		74(52.1%)	68(47.9%)	0.252	80(36.5%)	139(63.5%)	0.135	15(28.8%)	37(71.2%)	0.78
Place of follow-up	**University** **Primary care**	28(50.9%) 60(49.2%)	27(49.1%) 62(50.8%)	0.831	56(61.5%) 52(28%)	35(38.5) 134(72%)	<0.0001	14(34.1%) 9(33.3%)	27(65.9%) 18(66.7%)	0.945
Age	**<30** **30–60** **>60**	22(62.9%) 57(50.9%) 8(33.3%)	13(37.1%) 55(49.1%) 16(66.67%)	0.084	16(39%) 74(42%) 17(40.5%)	25(61%) 102(58%) 25(59.5%)	0.439	2(22.2%) 17(36.2%) 3(30%)	7(77.8%) 30(63.8%) 7(70%)	0.747
Duration of DM	**≤10** **≤20** **>20**	60(53.6%) 20(42.6%) 7(50%)	52(46.4%) 27(57.4%) 7(50%)	0.447	68(38.2%) 32(44.4%) 6(27.3%)	110(61.8%) 40(55.6%) 16(72.7%)	0.330	14(32.6%) 7(36.8%) 1(25%)	29(67.4%) 12(63.2%) 3(75%)	1

screening examination. However, only 33.1% (92) of the respondents continue to follow-up despite a normal initial funduscopic screening examination. The most common reasons not to comply with regular follow-ups were: "they thought it was not important" followed by "lack of family support" 47.1% (107) and 41.4% (94), respectively. Out of 74 respondents, 32.4% (24) did not attend their annual funduscopic screening visits because they had good vision and did not feel the need for an annual checkup. High level of education of respondents was significantly associated with poor practice of DR ($p<0.013$). (Table 2) There was no significant association between age, gender and the level practice of DM and DR. (Table 2 and 3)

Discussion

Diabetes is a worldwide growing burden.[2] Therefore, the incidence of diabetic retinopathy is also expected to increase. This risk can be reduced by effective screenings and tight control of blood sugar.[4] Lack of awareness in the community regarding diabetes and diabetic retinopathy greatly impacts delivery of care.[12] In our study, our goal was to identify the Knowledge, Attitude, and Practice (KAP) of diabetics in Riyadh, Saudi Arabia, towards

diabetes and diabetic retinopathy and correlate it with socio-demographic factors. As well as, to identify the barriers of poor compliance in both follow-up and treatment.

Among our participants, the average knowledge score of DM was good which is consistent with another study conducted by Zibran et al in Fiji, that reported a good knowledge level with a mean knowledge score of 23.3 out of 30 (SD ±3.25).[13] In contrast, John et al, in India, reported that 58% of their sample had poor knowledge. Although our participants showed good DM knowledge, their knowledge regarding DR was suboptimal. In our study, participants knew that they needed screening for DR, however they did not know how frequently they should do it. In Jordan, only 20.7% said that eye examination should be done annually.[14] In Turkey, only 41.9% stated that annual eye examination was necessary.[15] On the other hand, the majority of our participants (82.6%) knew that DM can affect different structures of the eyes, which was consistent with another local study done in Al Jawf region in Saudi Arabia, where 75.62% of their respondents knew about ocular complications of DM.[16] Other studies in the Middle Eastern region were conducted in Jordan and Oman which revealed that 88.2% and 72% knew that DR is a complication of DM, respectively.[14,17] In India, a similar study revealed that only 27% of respondents knew about DM effect on the eye.[18] Therefore, we suggest that patients newly diagnosed with DM should be referred to a diabetes educator, to educate them about the possible ocular complications, how to prevent them, and the importance of regular ocular screening and follow-up. Socio-economic status was another contributing factor to poor knowledge in our study, a significant association was found between low monthly income and poor knowledge regarding DM and DR ($P<0.0001$) and ($P<0.015$). This was consistent with another study done in South Korea, where they found poor awareness and significant decreases in screening for DR with low socio-economic status.[19]

It is well known that the prevalence of DR is dependent on glycemic control,[20] as well as blood pressure control.[21] However, only 22.8% of our respondents believed that poor glycemic control was an important factor that worsens diabetic retinopathy. Hypertension is commonly associated with DM as part of a metabolic syndrome. High blood pressure increases the risk of both the development and progression of DR.[21] Studies have shown that tight control of blood pressure in diabetic and hypertensive patients can delay the onset of DR.[21] Unfortunately, a small number of respondents in our study, knew that uncontrolled blood pressure worsens DR. These two reasons maybe major contributors to the high prevalence of DR in diabetic patients in Saudi Arabia.[22]

The diabetic retinopathy attitude score in our sample was poor. In contrast, John et al, reported that 61.4% of their sample had a good attitude score towards DR.[11] Most of our respondents agreed on the importance of follow-up with an ophthalmologist regardless of their blood sugar level. However, the majority of them do not believe it is important to follow-up when their vision is good (62.9%). This is believed to be one of the important barriers that limit our sample to seek annual eye examinations. Similarly, John et al in India reported that 30.56% of their sample did not believe in the importance of annual eye examination.[11] These Findings emphasize the importance of educating patients about the nature of the disease, which can affect the eyes silently, and the importance of regular ocular screening and follow-up.

The overall score for DR practice was below the acceptable range. This can be explained by, the low level of knowledge and attitude in our sample. More than half of our sample (60.4%), follow-up regularly for a funduscopic screening examination. Ali Raza et al,[23] reported a similar finding, 73% of his sample had regular funduscopic screening examination. However, our results are slightly lower than a previous local study done in Al Jawf region in Saudi Arabia, which had a much higher percentage (95%) of follow-up.[16] This could be due to the fact that a notable number of our respondents do not continue to follow-up, once their eyes screening is normal. This reflects people's lack of knowledge about the silent nature of the disease. Although patients suffering from DM might have a good knowledge about the disease effects on the eyes, that does not necessarily mean that they will have good practice. Funatsu et al,[24] reported that while more than 98% of patients were aware of diabetic eye disease, only 69.5% of the patients visited the ophthalmologist for periodic eye examinations. The same finding has been described by Alzahrani et al,[25] which revealed that 82.6% of his sample were aware of DM complications in their eyes, however, only 65% had their eye checkups regularly. This could be due to many reasons other than lack of knowledge, such as, lack of time, transportation difficulties, and lack of family support. So, in addition to patient education, we suggest having the fundoscopic screening examination for

diabetic patients done at the same time and place in their regular diabetes follow-up.

Limitations

This study was conducted across multiple centers and included patients from every demographic level. However, it was limited by a questionnaire and did not include values of the glycemic control level or the severity of diabetic retinopathy.

Conclusions

Our study does not constitute a representative sample of Saudi Arabia. However, it gives a general picture of the awareness, attitude and practices of diabetics regarding diabetes and diabetic retinopathy in the country. These findings highlight the importance of diabetic education as awareness is critical for controlling diabetes and reducing the incidence of diabetes related complications, especially diabetic retinopathy where patient education, awareness of the nature of the disease, and importance of regular screening and follow-up will probably increase patient compliance to regular ocular screening which will help in controlling the disease and improving its outcome.

Abbreviations

DR, diabetic retinopathy; DM, diabetes mellitus; KAP, knowledge attitude and practice; SD, standard deviation.

Data Sharing Statement

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Ethical Approval and Consent to Participate

Approval from King Saud University institutional board headed by the research committee was obtained prior to the study and all participants were consented. The study adhered to the tenets of the Declaration of Helsinki.

Consent for Publication

All participants were given consent form. The informed consent was clear and indicated the purpose of this study and the right of the participant to withdraw at any time without any obligation on towards the study team.

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Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; have agreed on the journal to which the article will be submitted; reviewed and agreed on all versions of the article before submission, during revision, the final version accepted for publication, and any significant changes introduced at the proofing stage; and agree to take responsibility and be accountable for the contents of the article.

Disclosure

The authors report no conflicts of interest for this work.

References

1. World Health Organization. Global Report on Diabetes. Available from: https://apps.who.int/iris/bitstream/handle/10665/204871/9789241565257_eng.pdf;jsessionid=A7A9A29F9901F70E66D7FBB0A8359A82?sequence=1. 2016. Accessed September 1, 2020.
2. Guariguata L, Whiting D, Hambleton I, Beagley J, Linnenkamp U, Shaw J. Global estimates of diabetes prevalence for 2013 and projections for 2035. *Diabetes Res Clin Pract*. 2014;103(2):137–149. doi:10.1016/j.diabres.2013.11.002
3. Al-Nozha MM, Al-Maatouq MA, Al-Mazrou YY, et al. Diabetes mellitus in Saudi Arabia. *Saudi Med J*. 2004.
4. Tarr J, Kaul K, Chopra M, Kohner E, Chibber R. Pathophysiology of diabetic retinopathy. *ISRN Ophthalmol*. 2013;2013:1–13. doi:10.1155/2013/343560
5. world health organization. *Prevention of Blindness from Diabetes Mellitus*. Geneva: WHO; 2005. Available from: https://www.who.int/blindness/Prevention%20of%20Blindness%20from%20Diabetes%20Mellitus-with-cover-small.pdf?ua=1. Accessed September 1, 2020.
6. Memon M, Shaikh S, Shaikh A, Fahim M, Mumtaz S, Ahmed N. An assessment of knowledge, attitude and practices (KAP) towards diabetes and diabetic retinopathy in a suburban town of KARACHI. *Pak J Med Sci*. 2014;31(1):1. doi:10.12669/pjms.311.6317
7. Khan A, Wiseberg J, Lateef Z, Khan S. Prevalence and determinants of diabetic retinopathy in Al Hasa region of Saudi Arabia: primary health care centre based cross-sectional survey, 2007-2009. *Middle East Afr J Ophthalmol*. 2010;17(3):257. doi:10.4103/0974-9233.65502
8. Shawki FE-BM, AL-Sisi A. Retinopathy and risk factors in diabetic patients from Al-Madinah Al-Munawarah in the Kingdom of Saudi Arabia. *Clin Ophthalmol*. 2012;269. doi:10.2147/opth.s27363
9. Ting D, Cheung G, Wong T. Diabetic retinopathy: global prevalence, major risk factors, screening practices and public health challenges: a review. *Clin Experiment Ophthalmol*. 2016;44(4):260–277. doi:10.1111/ceo.12696
10. Huang O, Zheng Y, Tay W, Chiang P, Lamoureux E, Wong T. Lack of Awareness of Common Eye Conditions in the Community. *Ophthalmic Epidemiol*. 2013;20(1):52–60. doi:10.3109/09286586.2012.751429

11. Srinivasan N. Diabetes and diabetic retinopathy: knowledge, attitude, practice (Kap) among diabetic patients in a tertiary eye care centre. *J Clin Diagnostic Res*. 2017. doi:10.7860/jcdr/2017/27027.10174
12. Nirmalan P. Utilisation of eye care services in rural south India: the Aravind Comprehensive Eye Survey. *Br J Ophthalmol*. 2004;88 (10):1237–1241. doi:10.1136/bjo.2004.042606
13. Zibran M, Mohammadnezhad M. Determinants of knowledge, attitude and practice in patients with both type 2 diabetes and chronic kidney disease in Fiji. *F1000Res*. 2019;8:239. doi:10.12688/f1000research.18188.3
14. Bakkar M, Haddad M, Gammoh Y. Awareness of diabetic retinopathy among patients with type 2 diabetes mellitus in Jordan. *Diabetes Metabol Synd Obesity*. 2017;10:435–441. doi:10.2147/dmso.s140841
15. Çetin E, Zencir M, Fenkçi S, Akın F, Yıldırım C. Assessment of awareness of diabetic retinopathy and utilization of eye care services among Turkish diabetic patients. *Prim Care Diabetes*. 2013;7 (4):297–302. doi:10.1016/j.pcd.2013.04.002
16. Al Zarea B. Knowledge, attitude and practice of diabetic retinopathy amongst the diabetic patients of of Aljouf and Hail Province of Saudi Arabia. *J Clin Diagnostic Res*. 2016. doi:10.7860/jcdr/2016/19568.7862
17. Khandekar R, Al Harby S, Al Harthy H, Al Lawatti J. Knowledge, attitude and practice regarding eye complications and care among Omani persons with diabetes - a cross sectional study. *Oman J Ophthalmol*. 2010;3(2):60. doi:10.4103/0974-620x.64228
18. Rajesh B, Hussain R, Giridhar A, et al. Knowledge and awareness about diabetes mellitus and diabetic retinopathy in suburban population of a South Indian state and its practice among the patients with diabetes mellitus: a population-based study. *Indian J Ophthalmol*. 2016;64(4):272. doi:10.4103/0301-4738.182937
19. Lee Y. Socioeconomic differences among community-dwelling diabetic adults screened for diabetic retinopathy and nephropathy: the 2015 Korean Community Health Survey. *PLoS One*. 2018;13(1):e0191496. doi:10.1371/journal.pone.0191496
20. Stratton I, Kohner E, Aldington S, et al. UKPDS 50: risk factors for incidence and progression of retinopathy in Type II diabetes over 6 years from diagnosis. *Diabetologia*. 2001;44(2):156–163. doi:10.1007/s001250051594
21. Pescosolido N, Campagna O, Barbato A. Diabetic retinopathy and pregnancy. *Int Ophthalmol*. 2014;34(4):989–997. doi:10.1007/s10792-014-9906-z
22. Al-Rubeaan K, Youssef A, Subhani S, et al. Diabetic nephropathy and its risk factors in a society with a Type 2 diabetes epidemic: a saudi national diabetes registry-based study. *PLoS One*. 2014;9(2):e88956. doi:10.1371/journal.pone.0088956
23. Raza A, Khan I, Sami H, Ejaz A, Ahmed Z. Diabetic retinopathy – knowledge, attitude and practices (KAP) in diabetic patients admitted in Tertiary Care Centers of Peshawar – khyber Pakhtunkhwa. *Prof Med J*. 2019;26(08):1370–1376. doi:10.29309/tpmj/2019.26.08.3805
24. Funatsu H, Hori S, Shimizu E, Nakamura S. Questionnaire survey on periodic ocular examination in Japanese diabetic patients. *Am J Ophthalmol*. 2003;136(5):955–957. doi:10.1016/s0002-9394(03)00542-7
25. Alzahrani S, Bakarman M, Alqahtani S, et al. Awareness of diabetic retinopathy among people with diabetes in Jeddah, Saudi Arabia. *Ther Adv Endocrinol Metab*. 2018;9(4):103–112. doi:10.1177/2042018818758621