Original Article

Awareness and knowledge of diabetic retinopathy and associated factors in Goa: A hospital-based cross-sectional study

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Purpose: To assess the awareness and knowledge about diabetic retinopathy (DR) and associated factors among patients visiting the tertiary health center in Goa. **Methods:** A cross-sectional descriptive study was conducted using a standard predesigned and pretested closed-ended structured questionnaire to assess the awareness, knowledge, attitude and practice about DR among patients visiting a tertiary health center. **Results:** Three hundred and fifty-eight subjects participated in the study. Only 125 (34.9% [95% CI: 30.0–40.1]) subjects were aware of DR and 122 (34.1% [95% CI: 29.2–39.2]) had adequate knowledge about DR. Awareness and knowledge of DR were significantly high among the subjects who completed college level of education (66.7%, OR = 2.78; 95% CI: 1.73–4.48, $P < 0.001$ and 55.9%, OR = 3.92; 95% CI: 2.41–6.38, $P < 0.001$) and who spoke English (52.5%, OR = 3.37; 95% CI: 2.14–5.30, $P < 0.001$ and 50.4%, OR = 3.26; 95% CI: 2.07–5.14, $P < 0.001$). Christians reported better knowledge about DR compared to other religions (48.8%, OR = 2.27; 95% CI: 1.38–3.75, $P = 0.005$). Negative association was noted between the knowledge of DR and presence of diabetes (29.4%, OR = 0.64; 95% CI: 0.41–0.99, $P = 0.048$). The practice pattern was strongly associated (OR = 7.47; 95% CI: 4.51–12.38, $P < 0.001$) with the knowledge of DR. Attitude was not influenced by any of the factors. **Conclusion:** We found that awareness and knowledge about DR were unsatisfactory; literacy contributed significantly toward it. These findings also suggest that there is an immediate need to enhance the awareness and knowledge of diabetic eye diseases in order to reduce the burden of visual impairment.

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According to the Global Burden Disease Study, the prevalence of diabetes mellitus (DM) in India was 31.7 million in the year 2010, and the prevalence is expected to upsurge to 79.4 million by the year 2030.[1] This stipulates that DM is a significant public health burden in the country. Also, the reported prevalence of DM in Goa increased to approximately 44.0% in 2016 compared to 1990.[2] It is a well-established fact that DM leads to several systemic and ocular complications.[1-3] Diabetic retinopathy (DR) is one of the most common causes of blindness and visual impairment around the globe. This contributes to 2.8% and 2.1% and 2.6% and 1.9% of blindness and visual impairment in southern Asia and worldwide, respectively.[3]

In India, the prevalence of DR ranges between 1.4% and 33.9%.[4-12] Also, cataract is a well-known diabetic ocular complication, which increases the proportion of visual impairment significantly.[13,14] The treatment of cataract has been well approved to reverse the visual impairment by providing a significant visual prognosis.[15] Concurrently, it is well-acknowledged that early detection and timely treatment of DR can alleviate the progress of vision impairment.[16] New treatment modalities of DR and regular screening contribute significantly toward the reduction of complications among diabetic patients.[16,17]

Awareness about DR and other diabetes-related ocular complications ranged between 16.1% and 71.3% among various community-based Indian studies.[18-21] Among the patients with DM, awareness about DR ranged between 17.01% and 93.2%.[22-24] Furthermore, knowledge about eye-related complications in diabetes ranged between 37.1% and 55.6% among the Indian population.[21,25] These findings suggest that there is a considerable amount of disparity among various locations in the country regarding awareness about DR and diabetic ocular complications.

Vaz *et al*.[6] reported the prevalence of diabetes-related ocular complications in Goa to be 35.4% (15.4% DR and 20.0% cataract). These numbers suggest that there is a pressing need to create awareness and raise understanding among the public about eye-related diabetes complications in Goa. To date, there remains a paucity of studies about patient's awareness and knowledge about diabetes-related ocular complications in Goa. Thereby, this study was designed to assess the awareness and

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knowledge about DR and associated factors among patients visiting a tertiary health center in Goa. Patient's awareness about diabetes and its complications is fundamental toward proper compliance in seeking timely and appropriate treatment. Also, it will help in designing a prevention program for diabetes and its complications.

Methods

A cross-sectional descriptive study was conducted among patients visiting a tertiary health center in Goa. The sample size was calculated based on the knowledge about DR reported by Rani *et al*.[25] amounting to 37.1%. With a precision of 5% and an alpha error of 0.05, the calculated sample size was 358. The inclusion criteria were the residence of Goa and age ≥30 years. The subjects with a known history of ocular pathologies and who were unaware of DM were excluded. The patients who registered themselves at the general medicine outpatient department with their local address proof were approached to fill the questionnaire. Written consent was obtained from all the participants. The study was conducted in accordance with the Declaration of Helsinki and approved by the institutional ethics committee.

The questionnaire was designed based on the available literature.[18-40] It comprised questions addressing demographics, awareness, knowledge, attitude, and practice amalgamating various aspects of diabetes-related ocular complications. Questions 1–9 addressed awareness (2) and knowledge (7) about diabetic ocular complications and DR, questions 10–11 comprised attitude toward eye care in diabetes, and questions 12–13 comprised practice patterns in the event of eye-related complaints. The questionnaire was designed in English then translated into Konkani and Hindi. The questionnaire was self-administered by the study participants.

To ascertain the reliability of the questionnaire, face validation of the questionnaire was done by eye care practitioners and physicians. The psychometric reliability of the questionnaire was also pretested in terms of internal consistency and test-retest reliability. Items displayed moderate to substantial reliability with a Cronbach's α value of 0.71, and intraclass correlation ranged within 0.51–0.82.

Data were analyzed using the statistical package SPSS (IBM SPSS Statistics for Windows, Version 20.0. IBM Corp). Response-related to knowledge (7), attitude (2), and practice (2) were classified into the correct and incorrect responses. Knowledge was further classified as no knowledge (incorrect response to all 07 questions), adequate knowledge (>50% of correct responses), and the rest were marked with fair knowledge. Similarly, correct responses of attitude and practice were classified as a positive attitude and correct practice, respectively. Frequency and percentages were used for all categorical variables. The association was formulated with an odds ratio with $P \leq 0.05$.

Results

Four hundred and seventeen patients were approached; of which 21 (5.03%) patients were not willing to participate and 38 (9.1%) were excluded. Self-reported vision-threatening ocular pathologies (cataract [15/36; 41.6%], unknown retinal problems [8/36; 22.2%], glaucoma [5/36; 13.9%] and unknown eye condition [8/36; 22.2%]), and unaware of diabetes (2/38; 5.3%) were the reason for exclusion. Overall, 358 subjects with a mean age of 53.3 ± 11.6 years (age range: 30–88 years) responded to the questionnaire. Among them, two-third (237) responded to the English version of the questionnaire, 110 (30.7%) the Konkani version, and the rest 11 (3.1%) to the Hindi version. The response rate of the questions on language spoken, religion, educational qualification, occupation, and socioeconomic status were 100%, 100%, 98.3%, 99.2%, and 8.6%, respectively. The majority of the participants (93.3%) were spectacle users in the present study; among which 44.3% had presbyopia, 47% wore glasses following cataract surgery, 6% had myopia, and 2.7% wore glasses for an unknown prescription.

Among the participants, 188 (52.5%) reported that they underwent ocular examination in the last 6 months, 74 (20.7%) reported that they got their eye examined 1 year ago, and 60 (16.8%) had their eye examination 2 years ago. Eighteen (5.0%) subjects reported that they go for an eye examination whenever presented with any complaint, and no eye investigation was carried out for them in the last 2 years. The rest 18 (5.0%) subjects mentioned that they never underwent an eye examination. An ophthalmologist (320; 89.4%) was the most preferred health care professionals in the event of the eye and vision problems followed by an optometrist chosen by 31 (8.7%) subjects.

Among the 358 respondents, 282 (78.8% [95% CI: 74.2–82.9]) were aware of the fact that diabetes could affect the eye and/or vision. Only 125 (34.9% [95% CI: 30.0–40.1]) subjects were aware of DR. Fig. 1 depicts various sources of information regarding the awareness of DR among the study participants. Table 1 compiles information about frequency distribution and factors associated with awareness and knowledge about DR. One hundred and twenty-two (34.1% [95% CI:

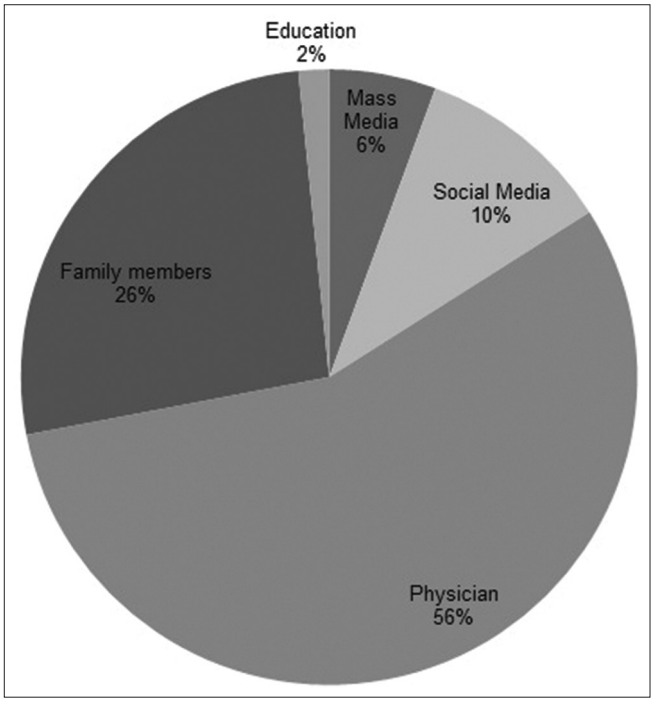

Figure 1: Source of information regarding awareness about diabetic retinopathy

Table 1: Frequency distribution and factors influencing awareness and knowledge about diabetic retinopathy

Factors	*n* (%)	Aware about DR (*n*=125) *n* (percentage [95% CI])	OR (95% CI)	*P*	Knowledge about DR (*n*=122) *n* (percentage [95% CI])	OR (95% CI)	*P*
Age group (year)							
30-39	44 (12.3)	21 (47.7 [32.5-633])	1.0	0.066	16 (36.4 [22.4-52.2])	1.0	0.873
40-49	89 (24.9)	33 (37.1 [27.1-48.0])	0.45 (0.17-1.19)		32 (36.0 [26.1-46.8])	0.84 (0.43-2.85)	
50-59	126 (35.2)	47 (37.3 [289-46.4])	0.69 (0.29-1.68)		42 (33.3 [25.2-42.3])	0.78 (0.48-2.61)	
60-69	68 (19.0)	15 (22.1 [12.9-33.8])	0.69 (0.29-1.62)		20 (29.4 [19.0-41.7])	0.57 (0.56-2.84)	
70 and above	31 (8.7)	9 (29.0 [14.2-48.0])	1.44 (0.55-3.79)		12 (38.7 [21.9-57.8])	0.36 (0.62-3.7)	
Gender							
Male	149 (41.6)	51 (34.2 [26.7-42.4])	0.95 (0.61-1.48)	0.818	51 (34.2 [26.8-42.7])	1.01 (0.65-1.58)	0.960
Female	209 (58.4)	74 (35.4 [28.9-42.3])			71 (34.0 [27.6-40.8])		
Language spoken							
English	139 (38.8)	73 (52.5 [43.9-61.0])	1.0	<0.001	70 (50.4 [41.8-58.9])	1.0	<0.001
Konkani	193 (53.9)	43 (22.3 [16.6-28.8])	0.42 (0.15-1.16)		46 (23.8 [18.0-30.5])	0.35 (0.12-1.03)	
Hindi	19 (5.3)	6 (31.6 [12.6-56.6])	0.61 (0.10-3.66)		5 (26.3 [9.1-51.2])	1.14 (0.39-3.34)	
Marathi	7 (2.0)	3 (42.9 [9.9-81.6])	1.61 (0.58-4.49)		1 (14.3 [0.4-57.9])	2.14 (0.20-5.48)	
Religion							
Hindu	251 (70.1)	84 (33.5 [27.7-39.7])	1.0	0.626	75 (29.9 [24.3-36.0])	1.0	0.005
Christian	84 (23.5)	33 (39.3 [28.8-50.5])	1.29 (0.77-2.14)		41 (48.8 [37.7-60.0])	2.24 (1.35-3.71)	
Muslim	23 (6.4)	8 (34.8 [16.4-57.3])	1.21 (0.46-3.18)		6 (26.1 [10.2-48.4])	2.70 (0.97-7.52)	
Educational qualification							
Primary	39 (10.9)	2 (5.1 [0.6-17.3])	1.0	<0.001	3 (7.7 [1.6-20.9])	1.0	<0.001
Secondary	211 (58.9)	60 (28.4 [22.5-35.0])	0.14 (0.03-0.58)		58 (27.5 [21.6-34.0])	21.0 (3.83-115.17)	
Undergraduate	91 (25.8)	60 (65.9 [55.3-75.5])	0.04 (0.01-0.18)		50 (54.9 [44.2-65.4])	4.62 (1.30-16.36)	
Postgraduate	11 (3.1)	8 (72.7 [39.0-94.0])	0.02 (0.01-0.14)		7 (63.6 [30.8-89.1])	1.44 (0.39-5.24)	
Occupation							
Working	181 (50.6)	71 (39.2 [32.1-46.7])	1.0	0.199	67 (37.0 [30.0-44.5])	1.0	0.82
Not working	143 (39.9)	42 (29.4 [22.1-27.6])	0.32 (0.03-3.62)		39 (27.3 [20.2-35.3])	0.29 (0.03-3.30)	
Retired	31 (8.7)	10 (32.3 [16.7-51.4])	1.35 (0.60-3.05)		14 (45.2 [27.3-64.0])	1.57 (0.97-2.52)	
Self-reported diabetes							
With diabetes	160 (44.7)	47 (29.4 [22.4-37.1])	0.64 (0.41-0.99)	0.048	50 (31.3 [24.2-39.0])	0.79 (0.51-1.24)	0.31
Without diabetes	198 (55.3)	78 (39.4 [32.5-46.6])			72 (36.4 [29.7-43.5])		
Locality							
Urban	56 (15.6)	21 (37.5 [24.9-51.5])	1.0	0.898	14 (25.0 [14.4-38.4])	1.0	0.27
Semi-urban	225 (62.8)	78 (34.7 [28.5-41.3])	0.85 (0.41-1.74)		82 (36.4 [30.2-43.1])	0.58 (0.3-1.13)	
Rural	77 (21.5)	26 (33.8 [23.8-45.4])	0.96 (0.56-1.66)		26 (33.8 [23.4-45.4])	0.65 (0.3-1.41)	

n: Number of participants, DR: Diabetic retinopathy, %: Percentage of participants, OR: Odds ratio, CI: Confidence interval, *P*: Probability value

29.2–39.2]) participants had adequate knowledge about DR whereas 176 (49.2% [95% CI: 43.9–54.5]) had a fair knowledge and 60 (16.8% [95% CI: 13.0–21.0]) had no knowledge. Awareness of DR was significantly higher among subjects who completed their college education (OR = 2.78; 95% CI: 1.73–4.48, $P < 0.001$) compared to school-level education. Subjects who preferred English as their primary language for communication had significantly higher awareness of DR (OR = 3.37; 95% CI: 2.14–5.30, $P < 0.001$) and better knowledge about DR (OR = 3.26; 95% CI: 2.07–5.14, $P < 0.001$) as compared to those who preferred local languages. Christians reported better knowledge about DR (OR = 2.27; 95% CI: 1.38–3.75, $P = 0.005$) compared to other religions.

Among the 334 spectacle users, 103 (30.8% [95% CI: 25.9–36.1]) were aware of DR and 104 (31.1% [95% CI: 26.2–36.4]) had adequate knowledge about DR. Among 157 pseudophakic participants, 155 (98.7% [95% CI: 95.5–99.8]) were aware that diabetes could affect the eyes but only 47 (29.9% [95% CI: 22.9–37.8]) were aware of DR. However, significant association ($P > 0.05$) could not be established between awareness and spectacle usage and pseudophakic status. Similarly, no association ($P > 0.05$) was found between the level of education and choice of health care professionals in the event of an eye/vision problem.

In the present study, 160 (44.7% [95% CI: 39.5–50]) participants were known cases of diabetes. The majority (158; 98.7%) of them had an investigation done for diabetes in the last 6 months. However, only 71 (44.4%) diabetic subjects underwent an ocular examination in the last 6 months. Most of the diabetic subjects (69.3%) reported that they must go for periodic eye checkups. Nevertheless, only 35 (21.9%) diabetes subjects reported that they should undergo an eye examination every 6 months. Among the subjects with

diabetes, only 47 (29.4% [95% CI: 22.4–37.1]) were aware of DR and 50 (31.3% [95% CI: 24.2–39.0]) of them had adequate knowledge about DR.

Knowledge, Attitude, and Practice (KAP) of diabetic retinopathy

The association between knowledge about DR and the level of education is shown in Table 2. Table 3 depicts the association between attitude and practice about DR and level of education. Our findings also suggest that attitude pattern was not significantly associated with knowledge of DR (OR = 1.48; 95% CI: 0.91–2.42, $P = 0.07$) and presence of diabetes (OR = 0.68; 95% CI: 0.42–1.09, $P = 0.07$). However, a high percentage of subjects with a lack of knowledge had a wrong attitude pattern. On the other hand, practice pattern was strongly associated with knowledge of DR (OR = 7.47; 95% CI: 4.51–12.38, $P < 0.001$) but not with the presence of diabetes (OR = 0.67; 95% CI: 0.42–1.06, $P = 0.054$). In addition, no association ($P > 0.05$) was found between knowledge, attitude, and practice (KAP) of DR and remaining demographic factors such as age, gender, occupation, locality, socioeconomic status, duration of diabetes, spectacle usage and pseudophakic status.

Discussion

The present study reports the awareness and knowledge about DR among subjects visiting a tertiary health center in Goa. The awareness and knowledge about DR in the current study were 34.9% and 34.1%, respectively. Whereas, the prevalence of DR among diabetic subjects in Goa was 15.4%, which is quite high compared to the overall prevalence in Southern Asia.[3,6]

Physicians were quoted as the main source of information (56.0%) about DR in the current study. Various studies in India and abroad also reported similar results.[20,21,24,26] In the present study, 78.8% of the total subjects and 76.3% of the diabetic subjects were aware of the fact that diabetes could affect eye/vision. Similar results were also reported in southern India.[22,24,29] Also, 77.6% of subjects were aware of the fact that regular ocular examination is mandatory for diabetic subjects. However, only 26.1% of the subjects correctly understood that they should go for periodic eye examinations every 6 months; among which 69.4% were known cases of diabetes. This proportion varied from 12.3% to 80.0% in the literature.[19-21,25,27] This braces the vital role of physicians in creating awareness and embedding knowledge about diabetes and its complications among their patients. On the other hand, Kupitz *et al*.[28] reported a lack of awareness of DR among general practitioners. Strategies like continuing medical education can contribute to enhancing the knowledge of diabetes and its complications among general physicians.

Table 4 illustrates the awareness and knowledge about DR among general and diabetes subjects in various parts of India and worldwide.[18-27,29-40] The awareness about DR ranged

Table 2: Association between knowledge about diabetic retinopathy and level of education

Knowledge questions	School level (*n*=250) *n* (percentage [95% CI])	College level (*n*=102) *n* (percentage [95% CI])	OR (95% CI)	*P*
Does diabetes affect vision/eye?				
Correct response	186 (74.4 [68.5-79.7])	90 (88.2 [80.4-93.8])	2.58 (1.33-5.02)	0.004
Incorrect response	64 (25.6 [20.3-31.5])	12 (11.8 [6.2-19.6])		
Can an individual with controlled Diabetes have eye problems?				
Correct response	84 (33.6 [27.8-39.8])	48 (47.1 [37.1-57.2])	1.76 (1.10-2.81)	0.018
Incorrect response	166 (66.4 [60.2-72.2])	54 (52.9 [42.8-62.9])		
Can timely treatment of diabetes prevent or delay damage in eyes?				
Correct response	122 (48.8 [42.5-55.2])	84 (82.4 [73.6-89.2])	4.90 (2.78-8.62)	<0.001
Incorrect response	128 (51.2 [44.8-57.5])	18 (17.6 [10.8-26.4])		
Which part of the eye gets affected because of diabetes?				
Correct response	59 (23.6 [18.5-29.4])	65 (63.7 [53.6-73.0])	5.69 (3.46-9.36)	<0.001
Incorrect response	191 (76.4 [70.6-81.5])	37 (36.3 [27.0-46.4])		
Can a small bleed in the retina (eye) lead to a reduction in vision?				
Correct response	56 (22.4 [17.4-28.1])	41 (40.2 [30.6-50.4])	2.33 (1.42-3.82)	0.001
Incorrect response	194 (77.6 [71.9-82.6])	61 (59.8 [49.6-69.4])		
How can Diabetic Retinopathy be treated?				
Correct response	20 (8.0 [5.0-12.1])	29 (28.4 [19.9-38.2])	4.57 (2.44-8.56)	<0.001
Incorrect response	230 (92.0 [87.9-95.0])	73 (71.6 [61.8-80.1])		
Can diabetic retinopathy treatment regain normal eyesight?				
Correct response	16 (6.4 [3.7-10.2])	7 (6.9 [2.8-13.6])	1.08 (0.43-2.70)	0.873
Incorrect response	234 (93.6 [89.8-96.3])	95 (93.1 [86.4-97.2])		

n: Number of participants, %: Percentage of participants, OR: Odds ratio, CI: Confidence interval, *P*: Probability value

Table 3: Association between attitude and practice about diabetic retinopathy and level of education

Questions	School Level (*n*=250) *n* (percentage [95% CI])	College Level (*n*=102) *n* (percentage [95% CI])	OR (95% CI)	*P*
Should a patient with diabetes go for regular eye checkups?				
Positive attitude	177 (70.8 [64.7-76.4])	96 (94.1 [87.6-97.8])	6.60 (2.77-15.73)	<0.001
Negative attitude	73 (29.2 [23.6-35.3])	6 (5.9 [2.2-12.4])		
How often patients with Diabetes should go for eye check-ups?				
Positive attitude	53 (21.2 [16.3-26.8])	39 (38.2 [28.8-48.4])	2.30 (1.39-3.80)	0.001
Negative attitude	197 (78.8 [73.2-83.7])	63 (61.8 [51.6-71.2])		
Choice of health care professionals in the event of eye problems?				
Correct practice	227 (90.8 [86.5-94.1])	93 (91.2 [83.9-95.9])	1.05 (0.47-2.35)	0.911
Wrong practice	23 (9.2 [5.9-13.5])	9 (8.8 [4.1-16.1])		
Can an individual with controlled diabetes avoid visiting an ophthalmologist?				
Correct practice	71 (28.4 [22.9-34.4])	52 (51.0 [40.9-61.0])	2.62 (1.63-4.22)	<0.001
Wrong practice	179 (71.6 [65.6-77.1])	50 (49.0 [39.9-59.1])		

n: Number of participants, %: Percentage of participants, OR: Odds Ratio, CI: Confidence interval, *P*: Probability value

Table 4: Awareness about diabetic retinopathy and knowledge about diabetes-related ocular complications among general and diabetes subjects in India and worldwide

Study location	Author (Type of study)	Participants (*n*)	Aware that diabetes could affect eye/vision	Awareness about diabetic retinopathy	Knowledge about ocular complications
India					
Goa	Current study (Health center)	Nondiabetes subjects (198)	76.3%	39.4%	36.4%
		Diabetes subjects (160)	77.5%	29.4%	31.3%
Tamil Nadu	Mohan *et al.*[18] (Community)	General (4330)	16.3%	-	-
		Diabetes subjects (621)	14.7%	-	-
	Srinivasan *et al.*[24] (Eye Hospital)	Diabetes subjects (288)	71.9%	17.01%	4.5%
	Namperumalsamy *et al.*[20] (Community)	General (204)	52.9%	46.1%	-
	Rani *et al.*[25] (Community)	General (1938)	-	-	37.1%
Andhra Pradesh	Dandona *et al.*[19] (Community)	General (2522)	28.8%	-	-
	Lingam *et al.*[29] (Eye Hospital)	Nondiabetes subjects (101)	-	22%	-
		Diabetes subjects (101)	-	65.3%	-
Kerala	Hussain *et al.*[21] (Community)	General (6211)	-	71.3%	55.6%
	Saikumar *et al.*[22] (Health center)	Diabetes subjects (1000)	84%	19%	-
Punjab	Koshy *et al.*[23] (Health center)	Diabetes subjects (350)	48.6%	30.9%	-
Nepal	Thapa *et al.*[26] (Eye Hospital)	Diabetes subjects (210)	63.3%	-	-
Australia	Schmid *et al.*[27] (Through mail survey)	General (317)	78.5%	3.2%	45.7%
		Diabetes subjects (293)	96.2%	4.1%	71.3%
Kenya	Mwangi *et al.*[30] (Health center)	Diabetes subjects (100)	-	83%	60%
Pakistan	Memon *et al.*[31] (Community)	General (692)	51.9%	-	9.5%
Sri Lanka	Seneviratne & Prathapan[32] (Health center)	Diabetes subjects (200)	81%	-	31%
Saudi Arabia	Al-Mulla *et al.*[33] (Health center)	Diabetes subjects (479)	-	85.8%	53.2%
	Al Zarea BK.[34] (Health center)	Diabetes subjects (439)	75.6%	-	-
	Alzahrani *et al.*[35] (Health center)	Diabetes subjects (377)	82.6%	64%	-
Singapore	Lee *et al.*[36] (Health center)	Diabetes subjects (100)	29.0%	29.0%	-
Ghana	Ovenseri-Ogbomo *et al.*[37] (Health center)	Diabetes subjects (390)	49%	-	-
Malaysia	Addoor *et al.*[38] (Health center)	Diabetes subjects (351)	87.2%	77.9%	-
Nigeria	Bodunde *et al.*[39] (Health center)	Diabetes subjects (148)	77.7%	-	-
Timor-Leste	Ramke *et al.*[40] (Community)	General (413)	3.2%	-	-

n: Number of participants, %: Percentage of participants

from 17.01% to 30.9% among various hospital-based studies conducted in India.[21,23] In the present study, only 34.9% were aware of DR and 34.1% had adequate knowledge about DR. This can be attributed to the literacy level of the participants. Around 69.8% (250) of the participants completed the school level of education only. The likelihood of the inclusion of facts about diabetes complications in the school syllabus is less. The fact that education plays a fundamental role in enhancing awareness and knowledge has been well-established in the literature.[25] On that account, improving literacy rate can be considered as a long-term strategy. However, the literacy rate of Goa is 87.40%, which is quite high compared to other states of India.[41]

The KAP of DR was not associated with the presence of diabetes. However, a higher percentage of nondiabetic subjects (39.4%) were aware of DR in the present study. Similar reports were presented by Koshy *et al*.[23] and Hussain *et al*.[21] This draws our attention to the crucial role of medical practitioners in imparting diabetes-related knowledge among diabetic subjects.

The awareness and knowledge about DR were significantly higher among subjects speaking English, compared with those speaking regional languages in the current study. Whereas, Rani *et al*.[25] stated participants who spoke the regional language were more aware of DR in a study conducted in Tamil Nadu. Our findings also suggested that those who preferred English as well as completed college education were significantly more aware of DR. According to the 2011 census data, the strength of Konkani speakers out of the total population reduced from 28.0% to 19.0% in the last 50 years.[42] This designates the preference of the English language in the current era.

Association was noted between Christianity and knowledge about DR but not with an awareness of DR. The proportion of Christian (57.9%) who completed college education was higher than other religions (43.8%). Similar results were stated by Rani *et al*.[25] owing to the high literacy rate among Christians. Hussain *et al*.[21] and Rani *et al*.[25] reported that the women had added knowledge about diabetes but not DR. In the current study, work status and gender were not associated with awareness and knowledge about DR. This can be connected to the literacy rate of males (92.8%) and females (81.8%) in Goa.[39] Ovenseri-Ogbomo *et al*.[37] also stated that the type of occupation was not a determinant of knowledge about the ocular effects of diabetes.

Other factors such as age and duration of diabetes were not associated with awareness and knowledge about DR in the present study. On the contrary, Dandona *et al*.[19] and Rani *et al*.[25] stated that subjects above 30 years of age had a better knowledge of DR. The current study did not include subjects below 30 years. Also, the awareness of DR was positively associated with the duration of diabetes in previous studies.[23,38] Dandona *et al*.[19] and Rani *et al*.[25] reported a significant association between socioeconomic status and awareness regarding DR. Unfortunately, the response rate about the socioeconomic status was low (8.6%) in the present study. Hence, the current study failed to establish an association.

The level of literacy was strongly associated with the correct attitude and good practice pattern. The present study findings suggested a strong impact of knowledge on the practice but not attitude pattern. The proportion of subjects with the correct attitude (21.9%) and practice pattern (25.0%) were quite low among diabetic subjects. Srinivasan *et al*.[24] and Rani *et al*.[25] reported that attitude, as well as practice, were related to knowledge among the subjects in southern India. However, subjects in their study were not aware of the treatment options of DR despite having sufficient knowledge. Almost 85% of the participants were not updated about the treatment options of DR in the current study. Similar results were stated by Hussain *et al*.[21] and Koshy *et al*.[23] This emphasizes the necessity to enhance detailed knowledge about the ocular complications of diabetes among the crowd. Strategies such as posters, pamphlets, and video display that are culturally and linguistically appropriate about the complications and management about DM, and DR has the potential to bridge the gap between awareness and practice pattern in tertiary health care setup. Also, health care and allied health service providers can create awareness about DR and refer/recommend diabetes patients to undergo a periodic eye examination.

Previous studies have used various questionnaires and scales to measure the KAP of DR.[18-40] Therefore, the comparison of knowledge about DR and ocular complications among the various studies remains arguable. To the best of our knowledge, ours is the first study to report KAP of DR and associated factors in a hospital-based set up in Goa. According to a cross-sectional study conducted in Goa (2011), the prevalence of DM was 10.3%.[43] The culture of Goa is unique, which contributes significantly toward the increasing incidence of diabetes, which includes population growth, demographic pattern, sedentary lifestyle, and a substantially higher proportion of obese individuals. Also, the prevalence of DR was reported to be 15.4%.[6] This implies that there is an urgent need to enhance awareness and knowledge of diabetes-related ocular complications that might result in a better understanding of disease progression and highlight the importance of regular eye examinations for early detection and the latest treatment.

A significant limitation of this study is that it is difficult to postulate our prevalence findings among the community. Therefore, we suggest population-based studies in rural and urban sectors of Goa to be planned and conducted in order to have a better and accurate understanding of the awareness and knowledge about diabetes complications. Also, an in-depth interview about diabetes and its ocular complications can be conducted among the subjects visiting the outpatient department to have detailed insight.

Conclusion

In summary, awareness and knowledge about DR were unsatisfactory; however, literacy played an indispensable role. There is an immediate need to augment awareness and knowledge of diabetic eye diseases among the mass in order to reduce the burden of visual impairment caused by diabetes. Creating awareness by means of distributing pamphlets, display posters, and television displays on ocular complications due to diabetes will improve the awareness level of DR among patients visiting the tertiary care center.

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Conflicts of interest

There are no conflicts of interest.

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