

<https://doi.org/10.33472/AFJBS.6.6.2024.1949-1958>



African Journal of Biological Sciences

Journal homepage: <http://www.afjbs.com>



Research Paper

Open Access

Awareness of Diabetic Retinopathy Screening Among Diabetics in A Tertiary Care Center in Tamil Nadu

Dr. Shankar Chokkalingam, MS¹, Dr. Anantha Lakshmi Chittode Kodumudi, MBBS^{2*}, Dr. Premnath Gnaneswaran, MS³, Dr. Aarthi Rajamanickam, MS⁴, Dr. Abijith Vasan Kumaran, MBBS⁵, Dr. Trisha Govindaraju, MBBS⁶

¹Professor, Department of Ophthalmology, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. ORCID ID-0000-0002-9956-6703

^{2*}Post Graduate, Department of Ophthalmology, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. ORCID ID-0000-0002-8423-081X

³Professor, Department of Ophthalmology, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. ORCID ID-0000-0002-8867-2914

⁴Assistant Professor, Department of Ophthalmology, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. ORCID ID-0000-0001-7946-3080

⁵Post graduate, Department of Ophthalmology, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. ORCID ID-0009-0006-4560-7852

⁶Post Graduate, Department of Ophthalmology, Chettinad Academy of Research and Education, Chettinad Hospital and Research Institute, Kelambakkam, Tamil Nadu, India. ORCID ID-0000-0002-1409-2292

Corresponding author: Dr. Anantha Lakshmi Chittode Kodumudi,
No 5, Bhavani main road, Chittode, Erode-638102.

Article Info

Volume 6, Issue 6, June 2024

Received: 07 April 2024

Accepted: 12 May 2024

Published: 04 June 2024

doi: [10.33472/AFJBS.6.6.2024.1949-1958](https://doi.org/10.33472/AFJBS.6.6.2024.1949-1958)**ABSTRACT:**

Background: Diabetes mellitus (DM) is a prevalent condition in India, contributing to significant morbidity and mortality. Diabetic retinopathy (DR) is a common complication of DM that can lead to vision loss if not detected and managed early. Despite available screening and treatment options, awareness of DR screening among diabetics remains a concern, particularly in regions with diverse socioeconomic backgrounds like Tamil Nadu.

Aim: This study aimed to assess the level of awareness of Diabetic Retinopathy screening among diabetics at a tertiary care center in Tamil Nadu, India.

Methodology: A cross-sectional study was conducted over six months, enrolling 380 diabetics aged 18 years and above receiving treatment at the tertiary care center. Data were collected using a questionnaire, and participants were screened for DR in the ophthalmology department. Statistical analysis was performed using SPSS version 21.

Results: The study revealed that 36.3% of participants were aware of DR screening, indicating a significant knowledge gap. Factors such as gender, educational status, co-morbidities, duration of diabetes, regular checkups, and diabetic control were associated with awareness levels. Females, illiterate individuals, those with longer diabetes duration, poor diabetic control, and without regular checkups exhibited lower awareness.

Conclusion: The study highlighted disparities in DR screening awareness among diabetics in Tamil Nadu. Targeted educational interventions focusing on vulnerable populations identified in the study are crucial to improve awareness and promote early DR detection.

Keywords: Diabetes Mellitus, Diabetic Retinopathy, Awareness, Screening.

© 2024 Dr. Shankar Chokkalingam, MS, This is an open access article under the CC BY license (<https://creativecommons.org/licenses/by/4.0/>), which permits unrestricted use, distribution, and reproduction in any medium, provided you give appropriate credit to the original author(s) and the source, provide a link to the Creative Commons license, and indicate if changes were made

1. Introduction:

According to research from 2015, there are around 69.2 million people with diabetes in underdeveloped nations like India, where over half of cases go untreated.¹ Since diabetes mellitus encompasses a variety of conditions, it has emerged as a significant worldwide health concern.² Hyperglycemia is a metabolic disease called diabetes mellitus, which is characterised by abnormalities in insulin activity or secretion. The main cause of type 1 diabetes, which is prone to ketosis, is the autoimmune or idiopathic loss of beta cells. The main causes of type 2 diabetes are concurrent beta cell secretory defects or insulin resistance. Chronic hyperglycemia has been linked to the development of retinopathy, neuropathy, nephropathy, and vasculopathy, among other organ dysfunction and failures.³

The most prevalent microvascular consequence of diabetes mellitus that causes vision loss in the elderly is diabetic retinopathy (DR). In the beginning phases of diabetic retinopathy, hyperglycemia and changed metabolic pathways cause oxidative pressure and the beginning of neurodegeneration.⁴ In 2012, it was projected that 34.6% of patients with diabetes mellitus (DM) globally had diabetic retinopathy (DR).⁵ With the highest frequency in North America and Africa and a relatively low prevalence in South-East Asia, a recent meta-analysis combining 59 studies indicated a lower prevalence estimate of 22.27%.⁶ It was predicted in 2000 that by 2030, there will be close to 80 million DM patients living in India.⁷ But with an expected 77 million diabetics in 2019, India has already seen the anticipated ten-year increase

in the disease burden. According to the updated prognosis, 130 million Indians would have diabetes by 2045.8

Despite advancements in medical science and the availability of effective screening and treatment modalities for DR, many individuals with diabetes stay uninformed about the significance of routine eye assessments for early detection and intervention. In the state of Tamil Nadu, which hosts a diverse population with varying socioeconomic backgrounds, access to healthcare services plays a crucial role in disease management and prevention of complications. Tertiary care centers serve as pivotal hubs for managing complex medical conditions, including diabetes and its complications. However, the effectiveness of DR screening programs within these centers relies not only on the availability of services but also on the awareness and proactive participation of patients. With this background, the present study was conducted with the objective to assess the level of awareness of Diabetic Retinopathy screening among diabetics at a tertiary care center in Tamil Nadu.

2. Material and Method:

Study design, setting and duration:

This was a cross sectional study conducted in a tertiary care hospital for a period of 6 months.

Study Population:

Inclusion Criteria:

- Patients with an established diagnosis of diabetes mellitus (type 1 and type 2) receiving treatment at the tertiary care center.
- Both male and female patients aged 18 years and above.

Exclusion Criteria:

- Patients with impaired higher functions or cognitive abilities that may affect their understanding of the study or ability to provide informed consent.
- Patients who have undergone treatment for diabetic retinopathy.

Sampling:

The sample size was calculated to be 380, with p as 61%9 and relative error as 5%. Consecutive sampling was used to enrol the participants.

Data collection:

Enrolment was preceded by participants giving informed permission. An established questionnaire was utilised to gather data. Patients diagnosed with diabetes at the research institution were consistently sent to the ophthalmology department for screening of diabetic retinopathy. The screening involved evaluating visual acuity, examining the anterior segment of the eye, measuring intraocular pressure, fundus examination specifically for issues connected to diabetes such as retinopathy, and conducting further tests as necessary. Patients have the option to either undertake screening on the same day or make a separate appointment.

Statistical analysis:

Collected data were entered using MS EXCEL and analysed using SPSS-version 21. Categorical variables were expressed in frequencies and percentages. Test of significance for categorical variables was done using Chi-square test and p-value <0.05 was considered statistically significant. Bivariate logistic regression was done to obtain unadjusted odds ratio and those variables with a p-value <0.05 were added to the multivariate model to obtain adjusted odds ratio and 95% CI was constructed to gauge the estimate.

3. Results:

Table 1: Socio-demographic variables of the study participants

S.No	Variable	Frequency (n=380)	Percentage %
1.	Gender		
	Male	148	38.9
	Female	232	66.1
2.	Age		
	≤ 60 years	241	63.4
	> 60 years	139	36.6
3.	Educational status		
	Illiterate	145	38.2
	Schooling	151	39.7
	College/Professional	84	22.1
4.	Co-morbidities		
	Present	164	43.2
	Absent	216	56.8
5.	Duration of diabetes		
	< 5 years	120	31.6
	5 – 10 years	122	32.1
	> 10 years	138	36.3
6.	Regular checkup		
	Yes	130	34.2
	No	250	65.8
7.	Diabetic control		
	Poor	74	19.5
	Average	218	57.4
	Good	88	23.2

TABLE 1 shows the demographic variables among the study participants. (N=380). In terms of gender distribution, there were more females (66.1%) than males (38.9%) in the sample. Regarding age, a larger proportion of participants were aged 60 years or younger (63.4%) compared to those over 60 years (36.6). In terms of education, a significant number were either illiterate (38.2%) or had completed schooling (39.7%), and a smaller percentage had college or professional degrees (22.1%). 43.2% of participants had additional health conditions, while 56.8% did not report any co-morbidities. The duration of diabetes was evenly distributed, with around a third having it for less than 5 years, 5-10 years, or over 10 years. Among the study participants (65.8%) did not have regular checkups for their diabetes, while only 34.2% reported getting regular checkups. Diabetic control varied, with 19.5% having poor control, 57.4% having average control, and 23.2% achieving good control. Overall, these results provide insights into the demographic characteristics, health status, and management practices among the studied population with diabetes.

Fig.1.Awareness about diabetic retinopathy screening among the study participants

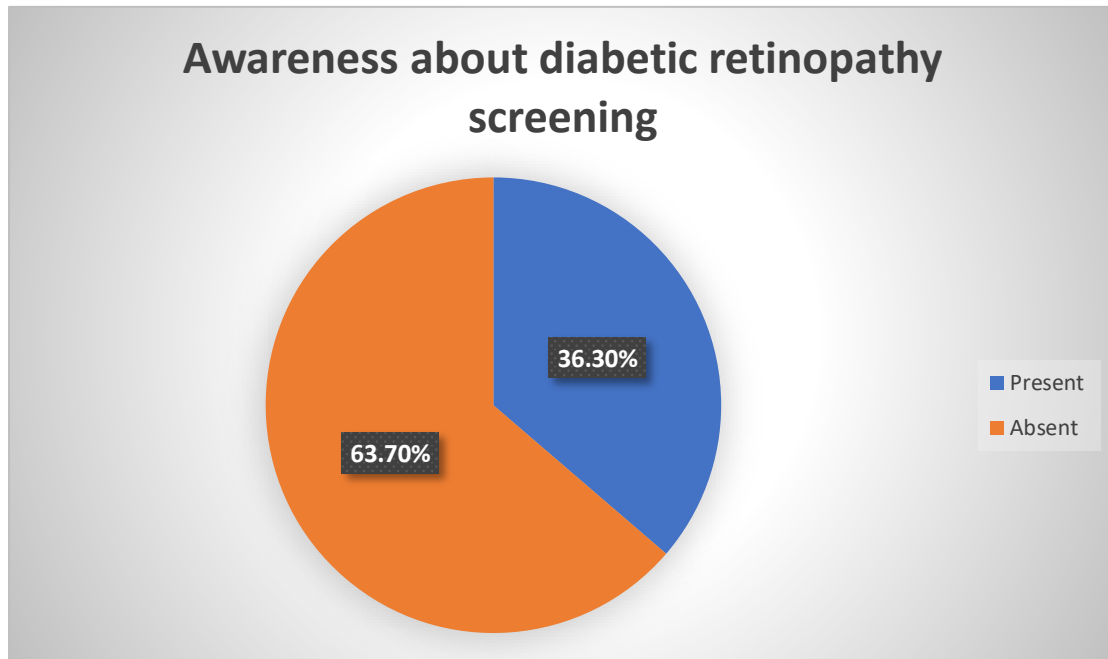


Fig.1 shows that among the study participants around 36.3% were aware about diabetic retinopathy screening and about 63.7% showed lack of awareness.

Table 2. Association between demographic variables and awareness about diabetic retinopathy screening

S.NO	Variable	Awareness		Total (N = 380)	Chi-square	Unadjusted odd's ratio (95% CI)	P Value
		No n (%) n = 242 (63.7%)	Yes n (%) n = 138 (36.3%)				
1.	Age						
	< 60 years	154 (12.8%)	87 (63%)	241 (63.4%)	0.013	1.026 (0.665 – 1.583)	0.908
	> 60 years	98 (36.4%)	51 (237%)	139 (36.6%)		1	
2.	Gender						
	Female	172 (71.1%)	60 (43.5%)	232 (66.1%)	28.146	3.194 (2.065 – 4.942)	0.002*
	Male	70 (28.9%)	78 (56.5%)	148 (38.9%)		1	

3.	Educational status						
	Illiterate	138 (56.2%)	9 (6.5%)	145 (38.2%)	58.952	125.8 (47.926 – 330.86)	<0.001 *
	Schooling	97 (40.1%)	54 (39.1%)	151 (39.7%)		14.969 (6.949 – 32.243)	<0.001 *
	College/Professional	9 (3.7%)	75 (54.3%)	84 (22.1%)		1	1
4.	Co-morbidities						
	Absent	159 (65.7%)	57 (41.3%)	216 (56.8%)	21.325	2.722 (1.770 – 4.188)	<0.001 *
	Present	83 (34.3%)	81 (58.7%)	164 (43.2%)		1	
5.	Duration of diabetes						
	< 5 years	93 (38.4%)	27 (19.6%)	120 (31.6%)	15.558	2.893 (1.680 – 4.984)	0.026*
	5 – 10 years	74 (20.6%)	48 (34.8%)	122 (32.1%)		1.295 (0.790 – 2.123)	0.305
	> 10 years	75 (31%)	63 (45.7%)	138 (36.3%)		1	1
6.	Regular checkup						
	No	198 (81.8%)	52 (37.7%)	250 (65.8%)	36.068	7.442 (4.630 – 11.963)	<0.001 *
	Yes	44 (18.2%)	86 (62.3%)	130 (34.2%)		1.	
7.	Diabetic control						
	Poor	62 (25.6%)	12 (8.7%)	74 (19.5%)	24.458	13.020 (6.014 – 28.190)	<0.001 *
	Average	155 (64%)	63 (45.7%)	218 (57.4%)		6.200 (3.584 – 10.726)	0.003*
	Good	25 (10.3%)	63 (45.7%)	88 (23.2%)		1	1

The table.2 presents the association between awareness levels across various demographic variables among the 380 study participants. Significant associations were found between awareness and gender ($p = 0.002$), educational status ($p < 0.001$), co-morbidities ($p < 0.001$), duration of diabetes ($p = 0.026$), regular checkup ($p < 0.001$), and diabetic control ($p < 0.001$). Female participants were less aware compared to males (odds ratio [OR] = 3.194, 95% confidence interval [CI] = 2.065 - 4.942). Those with schooling and college/professional education were significantly more aware compared to illiterate participants (OR = 125.8 times lesser awareness among illiterate participants). Participants with co-morbidities, longer duration of diabetes (> 10 years), regular checkups, and good diabetic control also showed higher awareness levels. These findings indicate specific demographic and health-related factors influencing awareness levels among the study participants.

Table.3 Binomial logistic regression between demographic variables and awareness about diabetic retinopathy screening

S.No	Variable	P Value	Adjusted Odds Ratio	95% CI
1.	Educational status			
	Illiterate	<0.001*	10.466	6.4 – 16.8
	Schooling	<0.001*	7.309	3.34 – 14.6
2.	Presence of co-morbidities	0.003*	3.023	1.4-6.2
3.	Duration of diabetes <5 years	0.024*	3.607	1.2-10.9
4.	Diabetic control			
	Poor	<0.001*	4.98	1.6- 11.2
	Average	0.004*	4.5	1.2 – 10.8

On bivariate analysis, variables that were found to have a statistically significant association with lack of awareness about diabetic retinopathy screening were analysed using binary logistic regression analysis to eliminate the confounders. Educational status, with categories including illiterate and schooling, demonstrates a strong relationship with adjusted odds ratios of 10.466 (95% CI: 6.4 - 16.8) and 7.309 (95% CI: 3.34 - 14.6), respectively. The presence of co-morbidities also shows a significant association ($p = 0.003$) with an adjusted odds ratio of 3.023 (95% CI: 1.4 - 6.2). Duration of diabetes less than 5 years ($p = 0.024$) and diabetic control status, categorized as poor and average, were also significantly associated with lack of awareness about diabetic retinopathy screening, with adjusted odds ratios of 3.607 (95% CI: 1.2 - 10.9), 4.98 (95% CI: 1.6 - 11.2), and 4.5 (95% CI: 1.2 - 10.8), respectively. (table.3)

5. Discussion:

The study included 380 participants, with a higher representation of females (66.1%) compared to males (38.9%). Most participants were aged 60 years or younger (63.4%), had completed

schooling (39.7%), and did not report co-morbidities (56.8%). The duration of diabetes was evenly distributed across less than 5 years (31.6%), 5-10 years (32.1%), and over 10 years (36.3%). In a study done by Animaw W and Seyoum Y,¹⁰ it was shown that the prevalence of DM is higher among females. The increasing prevalence of diabetes mellitus (DM) among females can be attributed to several factors. Hormonal influences, especially during puberty, pregnancy, and menopause, can affect insulin sensitivity and glucose metabolism, potentially leading to conditions like gestational diabetes mellitus (GDM) during pregnancy. Additionally, females in many societies tend to have higher rates of obesity and sedentary lifestyles compared to males, both of which are significant risk factors for type 2 diabetes. The excess adipose tissue associated with obesity can lead to insulin resistance and impaired glucose metabolism. Moreover, socioeconomic and cultural factors may also play a role, influencing dietary habits, physical activity levels, access to healthcare, and overall health behaviours among females, contributing to the increasing prevalence of DM in this demographic group.¹¹

The awareness of diabetic retinopathy (DR) screening among the study participants, at 36.3%, reflects a notable gap in knowledge about this critical aspect of diabetes management. A comparison with previous studies reveals a wide variation in awareness levels across different regions of India. For instance, Kumar SS et al.⁹ reported a higher awareness rate of 42% among their study participants, indicating a relatively better understanding of DR screening in that population. On the other hand, studies conducted in Vellore¹² and Goa¹³ showed significantly lower awareness rates of 17.02% and 29.4%, respectively. Interestingly, a tertiary care center in Andhra Pradesh reported a higher awareness rate of 65.3%, suggesting regional disparities in awareness levels.¹⁴ Furthermore, the discrepancy between awareness of diabetic eye disease (84%) and specifically diabetic retinopathy (19%) in a previous study underscores the need for targeted education and awareness campaigns focusing specifically on DR.¹⁵ These findings highlight the importance of region-specific interventions and the potential impact of targeted educational initiatives in improving awareness and promoting early detection of diabetic retinopathy among patients with diabetes.

Statistically significant associations were found between awareness levels and gender ($p = 0.002$), educational status ($p < 0.001$), co-morbidities ($p < 0.001$), duration of diabetes ($p = 0.026$), regular checkup ($p < 0.001$), and diabetic control ($p < 0.001$). Female participants were less aware compared to males (OR = 3.194, 95% CI = 2.065 - 4.942). Those with schooling and college/professional education were significantly more aware compared to illiterate participants (OR = 125.8 times lesser awareness among illiterate participants). Participants with co-morbidities, longer duration of diabetes (> 10 years), regular checkups, and good diabetic control also showed higher awareness levels. Educational status (illiterate and schooling), presence of co-morbidities, duration of diabetes less than 5 years, and poor or average diabetic control were significantly associated with lack of awareness about diabetic retinopathy screening in the multivariate analysis. Adjusted odds ratios were notably high for educational status (illiterate: AOR = 10.466, 95% CI: 6.4 - 16.8; schooling: AOR = 7.309, 95% CI: 3.34 - 14.6) and presence of co-morbidities (AOR = 3.023, 95% CI: 1.4 - 6.2), indicating strong associations with lower awareness levels.

The findings highlight significant associations between demographic variables and awareness of diabetic retinopathy screening among diabetics in the tertiary care center. Notably, educational status emerged as a strong predictor of awareness, with illiterate participants showing the lowest awareness levels. Co-morbidities, shorter duration of diabetes, and suboptimal diabetic control were also linked to lower awareness. These results underscore the need for targeted education and outreach programs focusing on at-risk populations to improve awareness and promote early detection of diabetic retinopathy. This study emphasises the

necessity of consistent recommended practice patterns for patient education and timely referral for diabetic retinopathy screening by physicians in diabetes care facilities throughout our country. The National Programme for Control of Blindness (NPCB) in India has advised the implementation of opportunistic screening for diabetic retinopathy, with a focus on the responsibility of physicians in conducting these screenings.¹⁶

6. Conclusion:

The study highlighted significant disparities in awareness of diabetic retinopathy screening among diabetic patients in a tertiary care center in Tamil Nadu. The findings showed that a substantial proportion of participants lacked awareness about this crucial aspect of diabetes management. Factors such as educational status, presence of co-morbidities, duration of diabetes, and diabetic control were identified as key determinants of awareness levels. Females, illiterate individuals, those with longer duration of diabetes, poor diabetic control, and without regular checkups were particularly at higher risk of lacking awareness. These results underscore the urgent need for targeted educational interventions and health promotion strategies to enhance awareness and encourage regular diabetic retinopathy screening among diabetic patients, especially focusing on vulnerable populations identified in this study.

Author Contribution:

All the listed authors provided Intellectual contributions and made critical revisions to this paper; authors Shankar Chokkalingam, Anantha Lakshmi Chittode Kodumudi, Premnath Gnaneswaran contributed to study conception and design; All co authors contributed to data acquisition; authors Anantha Lakshmi Chittode Kodumudi, Aarthi Rajamanickam, Abijith Vasan Kumaran contributed to data analysis and interpretation. All authors approved the final version of the manuscript

Declaration of interest statement: the authors of the study have no conflict of interest and have received no funding for the study

Funding: None

Figure and Table legends

Fig.1.Awareness about diabetic retinopathy screening among the study participants

Table 1: Socio-demographic variables of the study participants

Table 2. Association between demographic variables and awareness about diabetic retinopathy screening

Table.3 Binomial logistic regression between demographic variables and awareness about diabetic retinopathy screening

7. Reference:

1. Unnikrishnan R, Anjana RM, Mohan V. Diabetes mellitus and its complications in India. *Nature Reviews Endocrinology*. 2016 Jun;12(6):357-70.
2. Ting DS, Cheung GC, Wong TY. Diabetic retinopathy: global prevalence, major risk factors, screening practices and public health challenges: a review. *Clinical & experimental ophthalmology*. 2016 May;44(4):260-77.
3. Mota RI, Morgan SE, Bahnson EM. Diabetic vasculopathy: macro and microvascular injury. *Current pathobiology reports*. 2020 Mar;8:1-4.
4. Wong TY, Gemmy CC, Larsen M, Sharma S, Rafael S. Erratum: diabetic retinopathy. *Nature Reviews: Disease Primers*. 2016;2(1).

5. Yau JW, Rogers SL, Kawasaki R, Lamoureux EL, Kowalski JW, Bek T, Chen SJ, Dekker JM, Fletcher A, Grauslund J, Haffner S. Global prevalence and major risk factors of diabetic retinopathy. *Diabetes care*. 2012 Mar 1;35(3):556-64.
6. Teo ZL, Tham YC, Yu M, Chee ML, Rim TH, Cheung N, Bikbov MM, Wang YX, Tang Y, Lu Y, Wong IY. Global prevalence of diabetic retinopathy and projection of burden through 2045: systematic review and meta-analysis. *Ophthalmology*. 2021 Nov 1;128(11):1580-91.
7. Wild S, Roglic G, Green A, Sicree R, King H. Global prevalence of diabetes: estimates for the year 2000 and projections for 2030. *Diabetes care*. 2004 May 1;27(5):1047-53.
8. Saeedi P, Petersohn I, Salpea P, Malanda B, Karuranga S, Unwin N, Colagiuri S, Guariguata L, Motala AA, Ogurtsova K, Shaw JE. Global and regional diabetes prevalence estimates for 2019 and projections for 2030 and 2045: Results from the International Diabetes Federation Diabetes Atlas. *Diabetes research and clinical practice*. 2019 Nov 1;157:107843.
9. Kumar SS, Kamaldevi LV, Valsan SM. Utilization of diabetic retinopathy screening among diabetic patients at a tertiary care hospital in Kerala, India. *International Journal of Community Medicine and Public Health*. 2021 Oct;8(10):4938-43
10. Animaw W, Seyoum Y. Increasing prevalence of diabetes mellitus in a developing country and its related factors. *PloS one*. 2017 Nov 7;12(11):e0187670.
11. Gale EA, Gillespie KM. Diabetes and gender. *Diabetologia*. 2001 Jan;44:3-15.
12. Srinivasan NK, John D, Rebekah G, Kujur ES, Paul P, John SS. Diabetes and diabetic retinopathy: knowledge, attitude, practice (KAP) among diabetic patients in a tertiary eye care centre. *Journal of clinical and diagnostic research: JCDR*. 2017 Jul;11(7):NC01.
13. Venugopal D, Lal B, Fernandes S, Gavde D. Awareness and knowledge of diabetic retinopathy and associated factors in Goa: A hospital-based cross-sectional study. *Indian journal of ophthalmology*. 2020 Feb 1;68(2):383-90.
14. Lingam S, Rani PK, Sheeladevi S, Kotapati V, Das T. Knowledge, attitude and practices on diabetes, hypertension and diabetic retinopathy and the factors that motivate screening for diabetes and diabetic retinopathy in a pyramidal model of eye health care. *Rural and Remote Health*. 2018 Mar 1;18(1):1-4.
15. Saikumar SJ, Giridhar A, Mahesh G, Elias A, Bhat S. Awareness about eye diseases among diabetic patients: a survey in South India. *Community Eye Health*. 2007 Mar;20(61):16.
16. Vashist P, Singh S, Gupta N, Saxena R. Role of early screening for diabetic retinopathy in patients with diabetes mellitus: an overview. *Indian Journal of Community Medicine*. 2011 Oct 1;36(4):247-52.