Awareness of Diabetic Retinopathy Among Type II Diabetic Patients Attending at King Salman Armed Forces Hospital-Primary Health Care, Tabuk 2019

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Abstract

 background: Diabetic retinopathy refers to vascular disease of the retina that affects patients who have been diagnosed with type II diabetes mellitus. Information about DR must be spread the population, especially diabetic patients. Tools for DR screening are available and easy to access. No similar study was carried out in Tabuk to assess awareness of DR among type II diabetic patients up to our knowledge.

 AIM: To assess awareness of diabetic retinopathy among type II diabetic patients.

 METHODS: A cross-sectional study carried out in Tabuk city at King Salman Armed Forces Hospital-Primary Health Care Centers among type II diabetic patients attending at the period of study (n = 382) to assess their awareness about diabetic retinopathy.

 RESULTS: Out of 382 diabetics patients, (41.4%) had DM less than 5 years, (34.8%) had DM more than 10 years, and (23.8%) had DM between 5-10 years, (30.1%) had university degree, (42.4%) considered having low income, (57.6%) were screened for DR in the past year, (18.1%) of participant think that Seeing optometrist is enough for DR diagnosis. The total knowledge score about DR with a mean ± SD of 6.4 ± 1.5, indicating poor knowledge level, where 180 (47.1%) had poor knowledge, 106 (27.7%) had moderate knowledge, and 96 (25.2%) had good knowledge.

 CONCLUSION: Almost the Awareness of Type II Diabetic Patients Attending at King Salman Armed Forces Hospital-Primary Health Care centre regarding Diabetic Retinopathy needs to be improved.

Introduction

Diabetic retinopathy refers to the vascular disease of the retina that affects patients who have been diagnosed with type II diabetes mellitus. In the United States, the condition has been known to be the leading cause of blindness among people aged between 20 and 60 years [1].

With Diabetes mellitus becoming increasingly common in the majority of countries, the prevalence of diabetic retinopathy has also been anticipated to grow exponentially. This condition has been estimated to cause blindness to close to 34 million diabetic patients worldwide. Several factors have been associated with the condition. Some of these factors include hypertension, renal failure, glycemic control, and hyperlipidemia, among other factors.

Across the globe, many diabetic patients are unaware of the severity of this condition, yet research anticipates that patient knowledge can be key to improve management of the condition in the future, especially in a country like Saudi Arabia. In this study, therefore, we are interested in researching about the level of knowledge that diabetic patients have regarding diabetic retinopathy in PHC clinics at KSAFH in Tabuk region. To understand the severity of diabetic retinopathy, it is important also to have a look
at the manifestation of the condition. Its manifestation often begins with diabetes damaging the minor blood vessels located in the retina [1]. These blood vessels are the tissues that are sensitive to light at the back of the eye. By damaging the light-sensitive blood vessels at the back of the eye. This condition would then progress by causing leakage of the blood vessels in the retina. As a result, the condition would lead to a distortion of vision. In advanced stages, new blood vessels would multiply on the retinal surface. This condition would then progress by causing leakage of the blood vessels in the retina. This condition would then progress by causing leakage of the blood vessels in the retina. This condition would then progress by causing leakage of the blood vessels in the retina. As a result, the condition would lead to a distortion of vision. In advanced stages, new blood vessels would multiply on the retinal surface. This condition further caused scarring and loss of cells in the retina, which further leads to blindness. Therefore this study aims to assess the awareness of diabetic retinopathy among type II diabetic patients attending King Salman Armed Forced Hospital primary health care, Tabuk, Saudi Arabia.

Methods

Study Design: A cross-sectional study.

Study area: The study was carried out in Tabuk City in northwestern Saudi Arabia, which is located 2200 feet above sea level; it has a population of 535443 (2015 census).

Study setting: King Salman Armed Forced Hospital-Primary Health Care Center Tabuk, Saudi Arabia.

Study population:

Therefore, diabetic patients visiting the KSAFH-PHC throughout the study period from February to April 2019.

Sample Size:

For this study.

For the sample size, the equation below was used to calculate:

\[
n = \frac{2(Z_{\alpha} + Z_{1-\beta})^2 \sigma^2}{\Delta^2}
\]

From the equation,

\(Z\) refers to a constant set by convention to accept the alpha level of significance. Additionally, \(\sigma\) refers to the estimated standard deviation. \(\Delta\) stands for the effect difference of two required interventions, called the estimated effect size.

The calculated minimum sample size is:

\[
n = \frac{2(1.96 + .8416)^2(72)^2}{(.15)^2} = 362
\]

Selection Criteria

Inclusion Criteria: Type II Diabetic Patients, Saudi Male and Female.

Exclusion Criteria: Type 1 diabetic patients, Non-Saudi, Patients with chronic eye disease.

Data Collection tool

For data collection, the study was used as a pre-designed valid questionnaire that was used in a previously published study conducted in Taif [12]. Permission to use the questionnaire was obtained through personal communication with the author. The questionnaire included information regarding Socio-demographic characteristics: gender, age, educational level, salary, duration of diabetes, type of medication, smoking, physical examination. Awareness and knowledge toward DR. The questionnaire has contained a total of 10 questions: three of the questions about knowledge of DR, 5 others for screening and the remaining 2 for prevention and treatment.

Data entry and analysis

All collected data were entered, stored and analysed using the Statistical Package for Social Science (SPSS) version 20.

Ethical consideration

Approval by the local research ethics committee at King Salman Armed Forced Hospital was obtained before conducting the study. Permission to use the questionnaire requested through an e-mail communication with the corresponding author of the research, written consents of participants were taken before data collection. The privacy of the information was considered. Ethical consideration was taken through all research steps.

Budget/Funding: Self-funded

Utilisation

With this study, however, there can be an insight to improve education for low-income families and increase their exposure to the knowledge of diabetic retinopathy.

Conflict of interest: None.
Results

Out of 382 diabetics patients, 198 (51.8%) were male, and 184 (48.2%) were female, 156 (40.8%) were from group age 41-55 years, and 123 (32.2%) were from group age 26-40. Almost the third 115 (30.1%) had a university degree, and 108 (28.3%) attend high school, 162 (42.4%) had monthly income less than 5000. Less than fifth 59 (15.4%) were smokers, and 50 (13.1%) reported physical activity (Table 1).

Table 1: Demographic data

| Variable                  | N   | %    |
|---------------------------|-----|------|
| Gender                    |     |      |
| Female                    | 198 | 51.8 |
| Male                      | 184 | 48.2 |
| Age                       |     |      |
| Less than 25              | 8   | 2.1  |
| 26-40                     | 123 | 32.2 |
| 41-55                     | 156 | 40.8 |
| 56-70                     | 95  | 24.9 |
| Education                 |     |      |
| Elementary                | 57  | 14.9 |
| Intermediate              | 55  | 14.4 |
| High school               | 108 | 28.3 |
| University                | 115 | 30.1 |
| Other                     | 47  | 12.3 |
| Monthly income            |     |      |
| Less than 5000            | 162 | 42.4 |
| 5000-10000                | 116 | 30.4 |
| 10001-15000               | 66  | 17.3 |
| More than 15000           | 38  | 9.9  |
| Smoking                   |     |      |
| No                        | 323 | 84.6 |
| Yes                       | 59  | 15.4 |
| Physical activity         |     |      |
| No                        | 332 | 86.9 |
| Yes                       | 50  | 13.1 |

Less than half 158 (41.4%) had DM less than 5 years. 133 (34.8%) had DM more than 10 years, and 91 (23.8%) had DM between 5-10 years. Half of the patients 191 (50.0%) received pills, 96 (25.1%) received insulin, and 95 (24.9%) received both treatments. Almost two thirds 239 (62.6%) reported controlling blood sugar (Table 2).

The majority of the participants reported the following information; “blood sugar controlling reduce and prevent retinopathy” by 359 (94.0%), “there is relation between DM and retinopathy” by 332 (86.9%), “seeing optometrist (regular eyeglass store) is not enough for people with diabetes” by 313 (81.9%), “DM can cause blindness” by 300 (78.5%), “periodic eye examination is required even blood sugar is under control” by 274 (71.7%) and “eye problems can occur at the same time of Diabetes diagnosis” by 255 (66.8%). Less than half reported the following information; “diabetes patients should undergo an eye checkup at the same time of diagnosis” by 176 (46.1%), “diabetes patients should undergo an eye checkup annually” by 61 (16.0%). More than half 215 (56.3%) reported: “don’t know the treatment methods” (Table 3).

Table 3: Knowledge about DM retinopathy

| Variable                                                                 | N   | %    |
|--------------------------------------------------------------------------|-----|------|
| There is a relationship between diabetes and damage or retinopathy       | 50  | 13.1 |
| No                         | 332 | 86.9 |
| Yes                        | 23  | 6.0  |
| Diabetic retinopathy can be prevented or reduced by control blood sugar level | 332 | 86.9 |
| No                         | 23  | 6.0  |
| Yes                        | 300 | 78.5 |
| Diabetes mellitus may lead to blindness                                  | 82  | 21.5 |
| No                         | 300 | 78.5 |
| Yes                        | 82  | 21.5 |
| Diabetes patient have eye problems at the same time of Diabetes diagnosis | 127 | 33.2 |
| No                         | 255 | 66.8 |
| Yes                        | 127 | 33.2 |
| How frequently should a person with diabetes undergo an eye check-up     |     |      |
| After one year of diagnosis                                             | 55  | 14.4 |
| At the same time of diagnosis                                           | 176 | 46.1 |
| Only when vision affected                                               | 151 | 39.5 |
| In your opinion how many times should visit Ophthalmology doctor to screen eye and retina |     |      |
| Annually or every two years                                            | 61  | 16.0 |
| Only if there are eye symptoms                                          | 63  | 16.5 |
| Every six months                                                        | 258 | 67.5 |
| Retinopathy is a treatable condition                                    | 329 | 86.1 |
| No                         | 53  | 13.9 |
| Yes                        | 329 | 86.1 |
| Treatment methods                                                       |     |      |
| Good control of diabetes alone is sufficient                            | 92  | 24.1 |
| Laser treatment                                                         | 57  | 14.9 |
| Surgical treatment                                                      | 18  | 4.7  |
| I do not know                                                           | 215 | 56.3 |
| Seeing optometrist (regular eyeglass store) is enough for people with diabetes |     |      |
| No                         | 313 | 81.9 |
| Yes                        | 69  | 18.1 |

More than half 220 (57.6%) reported “checking eyes last year”. The main reason for checking eyes was “referral from the doctor” by 241 (63.1%), while, the mean reasons for not checking were “Lack of awareness of the knowledge of eye diseases of diabetes” by 148 (38.7%) and “Difficulty getting appointments or not having an ophthalmologist” by 108 (28.3%) (Table 4).

Table 4: Eye checking

| Variable                                                                 | N   | %    |
|--------------------------------------------------------------------------|-----|------|
| Checking eye by a doctor last year                                       |     |      |
| No                         | 162 | 42.4 |
| Yes                        | 220 | 57.6 |
| Reason to check eye                                                     |     |      |
| referral from the doctor                                                | 241 | 63.1 |
| Through awareness and knowledge                                         | 141 | 36.9 |
| The reason not to check eye                                             |     |      |
| Material costs                                                          | 28  | 7.3  |
| Fear of discovering something dangerous                                 | 37  | 9.7  |
| Difficulty getting appointments or not having an ophthalmologist        | 108 | 28.3 |
| Lack of awareness of the knowledge of eye diseases of diabetes           | 148 | 38.7 |
| Not enough time                                                          | 61  | 16.0 |

The mean knowledge score was 6.4 ± 1.5, indicating poor knowledge level, where 180 (47.1%) had poor knowledge, 106 (27.7%) had moderate knowledge, and 96 (25.2%) had good knowledge (Table 5).
The results revealed no significant difference in knowledge level regarding demographic data, even that female, those who were younger age, those who had higher educational level, those who had higher monthly income, those who were non-smokers, those who were physically active, those who had longer duration of DM, and those who controlled blood sugar had better knowledge (Table 6).

**Table 6: The relation between knowledge level and demographic and DM characteristics**

| Variable          | Mean ± SD | Range (min-max) | P-value |
|-------------------|-----------|-----------------|---------|
| Gender            | Male      | 6.29 ± 1.58     | 0.089   |
|                   | Female    | 6.56 ± 1.42     |         |
| Age               | Less than 25 | 7.50 ± 0.53    |         |
|                   | 26-40     | 6.41 ± 1.45     | 0.245   |
|                   | 41-55     | 6.41 ± 1.49     |         |
|                   | 56-70     | 6.38 ± 1.62     |         |
|                   | 71-80     | 6.33 ± 1.48     |         |
|                   | Intermediate | 6.36 ± 1.53   |         |
|                   | High school | 6.32 ± 1.59    | 0.414   |
|                   | University | 6.66 ± 1.35     |         |
|                   | Other      | 6.29 ± 1.65     |         |
|                   | Less than 500 | 6.42 ± 1.49   |         |
|                   | 500-10000 | 6.43 ± 1.43     |         |
|                   | 10001-15000 | 6.41 ± 1.67   | 0.992   |
|                   | More than 15000 | 6.50 ± 1.52 |         |
| Smoking           | No        | 6.49 ± 1.42     | 0.056   |
|                   | Yes       | 6.08 ± 1.86     |         |
| Physical activity | No        | 6.41 ± 1.49     | 0.577   |
|                   | Yes       | 6.54 ± 1.59     |         |
| Duration          | Less than 5 years | 6.29 ± 1.62 |         |
|                   | 5-10 years | 6.56 ± 1.42     | 0.398   |
|                   | More than 10 years | 6.52 ± 1.42 |         |
| Controlling sugar | blood No  | 6.36 ± 1.36     | 0.243   |
|                   | Yes       | 6.55 ± 1.58     |         |

Discussion

Knowledge of retinopathy is an essential step for an appropriate and timely referral. Delay in seeking care is one of the key factors leading to eye complications [3]. Therefore, sufficient knowledge of retinopathy is fundamental to diabetic patients for proper medical care services [4]. On the other hand, poor knowledge of retinopathy delays seeking cares and finally greater risk of blindness. Raising awareness for diabetic patients to know about retinopathy would improve early detection of problems and reduces the delay of seeking ophthalmology care [3, 4]. The present study aimed to evaluate knowledge of 382 diabetic patients about retinopathy and the factors associated with insufficient knowledge among them. Results of this study showed that almost the half of diabetic patients attending King Salman Armed Forced Hospital-Primary Health Care had poor knowledge regarding retinopathy, while fourth of them had moderate knowledge, and (25%) had good knowledge. The levels of diabetic patients' knowledge regarding retinopathy have been reported by several studies, which are lower than Alasiri and Bafaraj study in Jeddah, reported that (61.0%) of diabetic patients had good knowledge about retinopathy [5]. A similar result was reported in Hail-Saudi Arabia, where the awareness level of DR showed a 76% awareness [6]. Also, in Myanmar, where retinopathy awareness rate amongst diabetic outpatients was 86% [7] and in Nigeria was 84.3% [8].

This result showed that it is well known that awareness is a vitally important step in the creation of a successful program to battle against any disease in the community [5].

In this study, most of the patients, 332 (86.9%), were seen to be aware that diabetes can affect the eye and cause retinopathy, were fourth of them, 108 (28.3%), said that with controlled diabetes, they need not undergo eye screening and 151 (39.5%) also felt the need to go for eye checkup only when vision is affected. The awareness about treatment options available for diabetic retinopathy was less than half (43.7%). In this study, most of the patients, 332 (86.9%), we're aware that diabetes can affect the eye which is higher as compared to studies done in Jeddah where 82% were aware, [11] in India 58.7% were aware, [12] in Bagalkot (13) 45.7% were aware and 37.1% were aware in the study done in Tamil Nadu (14). This awareness was low as compared to studies from Jordan (98.3%) (15), Switzerland (96%) (16), and Oman (93%) (17). This difference could be due to the variety of socio-economic factors and geographic areas.

Majority of the patients 94% believed that patients with controlled diabetes would prevent or reduce eye problem which is higher as compared to the findings done in India (83.3%), (12) in Bagalkot (68%) (13) and Malaysia (51.1%) (18).

Only 28.3% of patients felt the need for eye checkup when his/her diabetes was uncontrolled. Nevertheless, Larger proportions of patients (71.7%) were under the correct impression that eye checkups are still necessary even for slight controlled diabetes mellitus. This was low when compared to studies done in India (52.7%), (12) in Bagalkot (76.6%) (13) and Malaysia (91.2%) (18) where most of them felt the need for eye checkup when his/her diabetes was uncontrolled and only 23.3% felt the need for eye checkup even with controlled diabetes as per study was done in Bagalkot, (13) whereas 67.2% as per Malaysia study (18), and 30% as per India study (12).

In our study, when patients were asked about frequency of regular eye checkup, 39.5% felt that they need to go for it only when vision is affected which is inconsistent to the findings of a study done in Bagalkot (13) and Malaysia (18) where it was 38% and 21.9%, respectively. While it is lower in comparison to the findings (77.2%) were seen in a study done in Kerala (19) and India study (70.7%)
Awareness about treatment options for diabetic retinopathy was low as 56.3% did not know about it. These findings were lower in comparison to the studies done in India (90.0%), (12) in Bagalkot (74.7%) (13) and Malaysia (72.3%), (18) While, in the study done in Tamil Nadu (14) better knowledge about treatment options available was reported where only 22.5% who did not know about it.

The most common barrier for undergoing eye screening was the lack of knowledge about the importance of eye screening, followed by a lack of access to eye care and time limitations. Comparable reasons were given by patients in studies done in India, (12) Vellore (20), Jordan (15) and Taif (3).

These findings indicate the importance of receiving the correct education messages from their proper sources. Information given to diabetic patients should not just be on the nature of ocular complications of diabetes, but also on the risk factors for these complications and how to prevent them.

In conclusion, almost half of diabetic patients have poor knowledge regarding diabetic retinopathy, while fourth of them had good knowledge. The best correctly information about DM retinopathy among diabetic patients were the relationship between diabetes and damage or retinopathy. Diabetic retinopathy can be prevented or reduced by control blood sugar level, and Retinopathy is a treatable condition while the least correctly information about DM retinopathy were frequency of checking and screening and treatment methods. More than half of DM patients checked their eyes last year, where the main reason for checking was a referral from doctors, and the main reasons for not checking were lack of awareness and difficulty in taking appointment. Diabetic patients with good knowledge about diabetic retinopathy were female, younger age, higher education level, high monthly income, non-smokers, those who were physically active.

Based on the findings in this study, the following are recommended:

1) Primary health care providers are requested to provide the necessary health education about diabetic retinopathy for all diabetic patients through the regular visit and must be repeated at every visit.
2) Health education messages to diabetic patients about diabetic retinopathy should cover the main points of the knowledge gap, especially the frequency of screening and treatment methods.
3) Health education messages about diabetic retinopathy to diabetic patients should be enforced for those who are old, illiterate, unemployed, and low monthly income.
4) The administrators in Ministry Of Health should try to organise and conduct health education programs about diabetic retinopathy in simple and familiar language among the community through mass media to raise public awareness and knowledge regarding diabetic retinopathy.
5) Encourage the diabetic patients to talk about diabetic retinopathy with their doctors.
6) Further nation-wide studies on assessment of diabetic patients’ knowledge regarding diabetic retinopathy need to be conducted in larger sample size, to identify the level and distribution of different knowledge grades as well as the areas and topics of knowledge deficits.
7) To present the most key points in this study to PHCC doctors in training centres and to write a pamphlet about diabetic retinopathy to be distributed to diabetic patients.

Acknowledgements

The authors would like to thank and gratitude to all participants in this study.

References

1. 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; 44(4):260-77. https://doi.org/10.1111/ceo.12696 PMid:26716602
2. Alwin Robert A, Abdulaziz Al Dawish M, Braham R, Ali Musallam M, Abdullah Al Hayek A, Hazza Al Kahtany N. Type 2 diabetes mellitus in Saudi Arabia: major challenges and possible solutions. Current diabetes reviews. 2017; 13(1):59-64. https://doi.org/10.2174/1573399816661610126142605 PMid:26813972
3. Almalki NR, Almalki TM, Alsawat K. Diabetics retinopathy knowledge and awareness assessment among the type 2 diabetics. Open access Macedonian journal of medical sciences. 2018; 6(3):574. https://doi.org/10.3889/oamjms.2018.121 PMid:29610623 PMCID:PMC5974388
4. Bakkar MM, Haddad MF, Gammoh YS. Awareness of diabetic retinopathy among patients with type 2 diabetes mellitus in Jordan. Diabetes, metabolic syndrome and obesity: targets and therapy. 2017; 10:435-441. https://doi.org/10.2147/DMSO.S140841 PMid:29066926 PMCID:PMC5644565
5. Alasiri RA, Bafaraj AG. Awareness of diabetic retinopathy among diabetic patients in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Afr J Pure Appl Biomed Res. 2016; 2:42-5. https://doi.org/10.21276/ajpabr.2016.2.6.ME10
6. Al Zarea BK. Knowledge, attitude and practice of diabetic retinopathy amongst the diabetic patients of AlUoulafi Hail province of Saudi Arabia. J Clin Diagn Res. 2016; 10:NC05-8. https://doi.org/10.3829/jcdr.2016v10i05s2.24737254 PMCID:PMC4948430
7. Mohammed I, Waziri AM. Awareness of diabetic retinopathy amongst diabetic patients at the murtala mohammed hospital,
Kano, Nigeria. Nigerian medical journal. 2009; 50(2):38.

8. Tapp RJ, Zimmet PZ, Harper CA, De Courten MP, Balkau B, McCarty DJ, Taylor HR, Welborn TA, Shaw JE. Diabetes care in an Australian population: frequency of screening examinations for eye and foot complications of diabetes. Diabetes care. 2004; 27(3):688-93. https://doi.org/10.2337/diacare.27.3.688 PMid:1498286

9. Kristjansson JK. Diabetic retinopathy. Screening and prevention of blindness. A doctoral thesis. Acta Ophthalmol Scand Suppl. 1997; (223):1-76.

10. Al-Nozha MM, Al_Maatouq MA, Al_Mazrou YY, Al_Harthi SS, Arafah MR, Khalil MZ, et al. Diabetes mellitus in Saudi Arabia. Saudi Med J. 2004; 25:1603-10.

11. Alzahrani SH, Bakarman MA, Alqahtani SM, Alqahtani MS, Butt NS, Salawati EM, Alkatheri A, Malik AA, and Saad K. Awareness of Diabetic Retinopathy among Diabetic Patients in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Ther Adv Endocrinol Metab. 2018; 9(4):103-112. https://doi.org/10.1177/2042018818758621 PMid:29619207 PMCid:PMC5871062

12. Manu AS, Davalgi SB, Aithal SS,Bilip B. Awareness of diabetic retinopathy and barriers for eye screening among adults with type 2 diabetes mellitus attending tertiary care teaching hospital, Davanagere, Karnataka. Int JMed Public Health. 2018; 7(9):686-690. https://doi.org/10.5455/jmsph.2018.0514717052018

13. Shetgar AC, Patil B, Salagar MC, Nanditha A. Assessment of awareness of diabetic retinopathy among diabetics: A clinical survey. Indian J Clin Exp Ophthalmol. 2015; 1:260-3. https://doi.org/10.5958/2395-1451.2015.00024.4

14. Rani PK, Raman R, Subramani S, Perumal G,Kumarananikavel G, Sharma T. Knowledge of diabetes and diabetic retinopathy among rural populations in India and the influence of knowledge of diabetic retinopathy on attitude and practice. Rural Remote Health. 2008; 8:838.

15. El Khatib BA, AlHawari HH, Al Bdour MD. Assessment of awareness of diabetic retinopathy among patients with diabetes mellitus attending the endocrine clinic at Jordan university hospital. Madridge J Ophthalmol. 2017; 2:14-8. https://doi.org/10.4172/2329-8888.1000106

16. Konstantinidis L, Carron T, de Ancos E, Chinet L, Hagon-Traub I, Zuercher E, et al. Awareness and practices regarding eye diseases among patients with diabetes: A cross sectional analysis of the CoDiab-VD cohort. BMC Endocr Disord. 2017; 17:56. https://doi.org/10.1186/s12902-017-0206-2 PMid:28882117 PMCid:PMC5590154

17. Khandekar R, Harby SA, Harthy HA, Lawatti JA. Knowledge, attitude and practice regarding eye complications and care among Omani persons with diabetes - A cross sectional study. Oman J Ophthalm. 2010; 3:60-5. https://doi.org/10.4103/0974-620X.64228 PMid:21217897 PMCid:PMC3003852

18. Tajunisah I, Wong PS, Tan LT, Rokiah P, Reddy SC. Awareness of eye complications and prevalence of retinopathy in the first visit to eye clinic among Type 2 diabetic patients. Int J Ophthalmol. 2011; 4:519-24.

19. Hussain R, Rajesh B, Giridhar A, Gopalakrishnan M,Sadasivan S, James J, 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; 64:272-6. https://doi.org/10.4103/0301-4738.182937 PMid:27221678 PMCid:PMC4901844

20. Srinivasan NK, John D, Rebekah G, Kujur ES, Paul P, John SS,et al. Diabetes and diabetic retinopathy: Knowledge, attitude, practice (KAP) among diabetic patients in a tertiary eye careCentre. J ClinDiagn Res 2017; 11:NC01-NC07. https://doi.org/10.7860/JCDR/2017/27927.10174 PMid:28892947 PMCid:PMC5583928