Introduction

Diabetes mellitus (DM) is a chronic metabolic disorder characterized by high levels of blood glucose. It causes damage to different organs and body tissues, such as the heart, nerves, kidneys, eyes, and blood vessels. DM is classified into three major types: type 1 diabetes, type 2 diabetes, and gestational diabetes.[3] Diabetic retinopathy (DR) is one of the microvascular complications for DM. It can affect 24% of diabetic patients who have had the disease for 10–15 years.[3] It is estimated that globally around 35% of all diabetic patients develop some form of DR.[4,5] In Saudi Arabia, the prevalence for DR was found to be 28%–36% among diabetic patients in studies from different areas of the country.[6-9] DR is the leading cause of avoidable visual impairment and blindness worldwide.[10] Diabetes glycemic awareness, knowledge, and practices related to diabetic retinopathy among diabetic patients in primary healthcare centers at Riyadh, Saudi Arabia

Manal H. AlHargan1, Khalid M. AlBaker2, Abdulmajeed A. Alfadhel2, Mohammed A. AlGhamdi2, Salman M. AlMuammar3, Haifa A. AlDawood3

1Department of Family Medicine and PHC, King Abdul‑Aziz Medical City, Ministry of National Guard Health Affairs, 2Department of Family Medicine and PHC, College of Medicine, King Saud bin Abdulaziz University for Health Sciences, King Abdulaziz Medical City, Ministry of National Guard‑Health Affairs, 3Department of Family Medicine and PHC, College of Medicine, AlFaisal University, Riyadh, Saudi Arabia

Abstract

Context: Diabetic retinopathy (DR) is a microvascular complication for diabetes mellitus (DM), with around 35% of diabetic patients developing some form of DR. Aims: This study assessed the awareness toward DR, practice of regular eye examination, and DM control among diabetic patients. Settings and Design: This was a cross‑sectional study among diabetics at two primary healthcare centers in Riyadh, Saudi Arabia, who were selected by convenience sampling. Methods and Materials: The questionnaire contained sections for demography, knowledge, attitude, and practice toward DR, and compliance to DM treatment. The association of awareness about retinopathy with demographics was compared. Statistical Analysis Used: The association of awareness about retinopathy and education level with demographics and compliance with treatment were compared using Chi‑square test. Results: In total, 280 diabetic patients were included, 187 (67%) were males, mean age was 58.9 ± 10.1 years, and median duration of diabetes was 10 years. There was good awareness about DR, diabetes was well controlled in 170 (61%) patients, but less than half (45%) had their eyes checked within 1 year. Patients with education level of high school and above had higher awareness than those with no formal education (P < 0.001). Also, those with income level >10,000 SR had higher awareness than those with income ≤5,000 SR (P < 0.05). Conclusion: There was high awareness among the diabetic patients regarding DR but annual check‑up was done in less than half of the patients. Improvement is required for scheduling annual eye examinations for the early detection of DR.

Keywords: Awareness, compliance, diabetes mellitus, diabetic retinopathy, eye examination

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control is an important factor in DR. People with poor glycemic control have a higher risk for DR,[6,11] a recent study from Australia showed that diabetic patients with poor indicators of glycemic control had three to four times more chances of DR as compared with those with better control.[12] The duration of having DM is also an important and significant factor in developing DR. The longer the duration of DM, the higher is the risk for DR.[13,14] The majority of DR patients present in late stages due to the silent nature of the disease.[13,14] Hence, screening annually is essential for early detection as it decreases the prevalence of visual impairment and blindness in diabetic patients and allows intervening in a timely manner.[9,14-16]

Diabetes mellitus is a public burden on Saudi Arabia as 23%–32% of its adult population suffers from the disease.[17-18] Saudi Arabia is also among the top 10 countries with the prevalence of the disease.[20] As mentioned earlier, DR prevalence was found to be 31% among diabetic patients in Riyadh region, Saudi Arabia.[4] Understanding the level of public awareness of a disease condition helps the educators to plan a future program that increases the level of knowledge in the diagnosis, complications, and management among patients. The level of awareness and knowledge about DR is a crucial part for the early diagnosis, management, and prevention of potential visual impairment.[9,20] Awareness of DR has been found to have a positive effect on practices related to prevention of retinopathy.[21] Recent studies on DR have been published from Al Jouf and Hail provinces and Jeddah in Saudi Arabia among diabetic patients,[22,23] To the best of our knowledge, no such study has been published on DR awareness, knowledge, and practice in Riyadh, Saudi Arabia.

More information is needed regarding the awareness, knowledge, and practices from diabetic patients about DR as the incidence and prevalence rate of diabetes is increasing in Saudi Arabia.[24] This study aimed to assess the awareness, knowledge level and practice toward DR, the compliance to regular eye examination, and DM control among diabetic patients in National Guard Comprehensive Specialized Clinics (NGCSC) and Health Care Specialty Center (HCSC), which are part of King Abdulaziz Medical City in Riyadh, Saudi Arabia.

Results

A total of 280 diabetic patients participated in the study. Of these patients, 187 (67%) were males and 93 (33%) were females. The youngest participant was aged 25 years, and the oldest was 90-year old, the mean age was 58.9 ± 10.1 years. The majority of the patients, i.e. 237 (85%) did not know about the type of diabetes (type 1 or 2) they had. The median duration since the diagnosis of diabetes mellitus was 10 years (IQR: 5, 15 years); there were 88 (22%) who were diagnosed with the disease within the last 5 years, whereas 108 (39%) had diabetes for >20 years (maximum reported duration was 40 years). Family history of DM was reported by 200 (71%) patients and most of the patients, i.e., 197 (70%) were taking only tablets for treatment of diabetes [Table 1]. The education level was generally low with only 49 (18%) patients reporting as completed high school or above. The income level for the majority, i.e., 175 (62%) was also reported as low being SR ≤5,000.

The patients’ responses to awareness about DR showed good awareness for the three questions. There were 247 (88%) who were aware that diabetes mellitus can affect the retina; whereas 214 (76%) were aware that control of blood sugar reduces the risk of DR, and 186 (66%) patients were aware that DR can lead to blindness. The main source of information about diabetes mellitus and DR was reported to be by doctors (58%), followed by family and friends (18%), whereas 42 (15%) stated they did not get any information [Table 2].

More than half, i.e. 170 (61%), respondents were stated that their diabetes was well controlled, whereas 247 (88%) said that they adhered to their current treatment plan. There were 192 (69%) respondents who checked their blood sugar at home; these included 60 (21%) who checked it every day, and another 47 (17%)
who checked their blood sugar at home at least once a week. With regards to eye examination, 135 (48%) had their eyes checked at least once a year, and another 20 (7%) had it every 2 years, whereas there were 125 (45%) who had >2 years since their eye examination. When asked about whom they would consult in the event of an eye problem, almost all of them, i.e., 259 (93%) said that they would go to an ophthalmologist (data not shown).

The awareness that DM is associated with DR, control of DM reduces the risk of DR, and that DR can lead to blindness was compared between different demographic variables [Table 3]. There was no difference in the awareness of males and females for all three questions ($P > 0.05$). The awareness was found to be associated with the level of education and monthly income. Awareness was highest in respondents with high school or above education for all three questions, followed by those with elementary/middle school education, and was lowest in those with no formal education ($P < 0.001$). Also, persons with income >10,000 SAR showed the highest awareness, followed by those with income from 5,001 to 10,000 SAR, and those with income of up to SAR 5000 had the lowest level of awareness ($P < 0.05$).

Figure 1 shows the compliance with the management of their diabetes was compared between those who were aware about DM affecting the retina and those who were not aware. There was no difference in the stated control of DM between the two groups ($P = 0.17$), but there was a significant difference with regards to the adherence to treatment and checking of blood sugar at home. It was found that in the group that was aware 91% were adhering to their current DM treatment as compared with 64% in the not aware group ($P < 0.001$). Also, 72% of the patients in the aware group were measuring their blood sugar at home as compared with 39% in the not aware group ($P < 0.001$).

**Discussion**

The aim of the study aim was to assess the level of diabetic patients’ awareness, attitude, practice, and compliance in Riyadh, Saudi Arabia. DR is a leading cause of avoidable visual impairment and blindness and patients’ awareness and compliance plays an important role in the prevention of DR. The study found awareness to high among the diabetic patients regarding DR with more than two-thirds being aware that DR can lead to blindness and almost all (88%) being aware that DM can affect the retina. Three-fourths of the patients were also aware that control of blood sugar may reduce the risk for DR. There were more than two-third of the patients who checked

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**Table 1: Demographic characteristics of the patients (n=280)**

| Characteristic | n (%) |
|---------------|-------|
| Gender        |       |
| Male          | 187 (67) |
| Female        | 93 (33)  |
| Age in years (mean±SD) | 58.9±10.1 |
| Type of DM    |       |
| Type 1        | 7 (2)  |
| Type 2        | 36 (13) |
| Do not know   | 237 (85) |
| Duration since diagnosis (year) |   |
| ≤5            | 88 (31) |
| 6-10          | 84 (30) |
| ≥11           | 108 (39) |
| Family history of DM |   |
| Yes           | 200 (71) |
| No            | 80 (29)  |
| Type of treatment for DM |   |
| Tablets only  | 197 (70) |
| Injection only| 37 (13)  |
| Both tablets and injections | 46 (16) |
| Education level |       |
| No education  | 97 (34) |
| Elementary or middle school | 134 (48) |
| High school   | 27 (10) |
| University or higher | 22 (8) |
| Monthly Income (SAR) |   |
| ≤5,000        | 175 (62) |
| 6,000-10,000  | 69 (25) |
| 11,000-20,000 | 25 (9)  |
| ≥20,000       | 11 (4)  |

DM: Diabetes mellitus

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**Table 2: Diabetes patients’ awareness about diabetic retinopathy (n=280)**

| Awareness                                      | n   | Percentage |
|------------------------------------------------|-----|------------|
| Aware that diabetes mellitus can affect the retina | 247 | 88         |
| Aware that blood sugar control may reduce the risk of diabetic retinopathy | 214 | 76         |
| Aware that diabetic retinopathy can lead to blindness | 186 | 66         |
| Main source of information about diabetes mellitus and diabetic retinopathy:Doctors | 162 | 58         |
| Family and friends                             | 50  | 18         |
| Internet and magazines                         | 26  | 9          |
| I did not get any information                  | 42  | 15         |

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**Figure 1: Association between awareness about diabetic mellitus affecting the retina and compliance with management of diabetes mellitus**
their blood sugar at home; just over half of the patients got their eyes checked in 2 years, but there were almost half of the respondents who did not have an examination in the last 2 years.

The results of this study showed high level of self-reported awareness regarding DM affecting the eye, which is similar to other studies that has been done locally in Saudi Arabia in the areas of Hail and Al Jouf (76%) and Jeddah (83%).[22,23] Regionally, studies from Oman (93%),[23] Jordan (88%),[19] and Turkey (88%) also showed a similar high level of awareness regarding awareness about DM affecting the eyes as in our study results of 88%. Globally, Switzerland (96%),[27] and Malaysia (86%) also had high awareness, whereas one study from the rural Tamil Nadu area of India showed the lowest awareness (74%) with regards to eye disorder and DM.

The current study showed a significant association between having some formal education and awareness about all the three questions regarding awareness about DM and retinopathy. This was similar to the studies from Jordan[19] and Malaysia,[28] both of which showed that diabetic patients having primary level or above education had better awareness than those patients who had no formal education. The main source of information about DM and DR for more than half of the diabetic patients was from their doctors, followed by their family and friends; this is similar to the findings from the two studies from Jordan and Malaysia.[19,28]

The recommended practice to routine eye check-up for diabetic patients is to have a yearly eye exam. The purpose of routine eye examination is the early diagnosis of DR and the prevention of its complications because of the silent course of the disease. This shows a major issue that leads to avoidable complications of DM. The current study found that almost half (48%) of the participants had an annual eye exam, and another 7% had an eye exam within the last 2 years. This is lower than the proportion of diabetic patients who reported having an eye exam in the studies from Switzerland (71%) and Jordan (76%).[19] There were around half of the diabetic patients (45%) in this study who did not have an eye examination in the last 2 years.

The strength of this study included the relatively larger than the other previous studies reported in the literature. Also, the patients were selected from the primary health care centers instead of the eye clinics, which gave a better representation of the awareness and eye practice of the diabetic patients. The limitation of this study included that education level of the patients in this study was lower than that of the general population. So, the results may not reflect that of all the diabetic patients in Riyadh, but can be generalized more to the lower income group who also have lesser education levels. The results regarding awareness and practice were self-reported by the patients and not verified by checking with their medical records. So, there is a possibility of over-reporting by some of the patients.

Conclusion

The study found a high level of awareness about association between diabetes mellitus and eye problems among the diabetic patients. However, the practice of checking blood sugar regular and having annual eye examination was found to be low among the patients. There is need to increase the motivation of the patients for regular eye examination. The medical doctors can be the best source for providing this motivation since a high proportion of patients reporting that they received their information from their doctors.

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Ethical consideration

Approval was obtained from King Abdullah International Medical Center’s IRB before starting data collection and an agreement consent has been collected from participants. No disclosure of patients’ information has happened. Participants’ privacy was maintained, and a unique ID number/code was given for each participant. Only research team members had access to the data. The data were stored on a private computer.

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Conflicts of interest

There are no conflicts of interest.

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