



ORIGINAL ARTICLE

# Determining the Prevalence of Retinopathy and Its Related Factors among Patients with Type 2 Diabetes in Kerman, Iran

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**KEYWORDS:**

hemoglobin A1c (HbA1c),  
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**Abstract**

**Objectives:** To determine the prevalence of retinopathy and its associated factors in diabetic patients referred to a diabetes center in an Iranian city.

**Methods:** This was a cross-sectional, descriptive–analytical study in which a researcher-made checklist was used to collect the data of patients with type 2 diabetes in 2015. The statistical population consisted of 11,770 health records of diabetic patients registered in a second-level diabetes center. Of the 11,770 health records, 206 records with the most complete data about patients with type 2 diabetes were selected through census method. Chi-square test and logistic regression through SPSS were used for data analysis.

**Results:** In this study, 93/206 diabetic patients (45.1%) had retinopathy. Female sex, age over 60, lower education level, being housewife, family history of having diabetes, longer years of having the disease, and higher level of hemoglobin A1c (HbA1c) were associated with higher risk of retinopathy. However, the association was statistically significant only for the HbA1c level ( $p \geq 0.05$ ).

**Conclusion:** According to this study, HbA1c level is a predictor of diabetes complications. Therefore, it is necessary for health authorities to improve diabetes management through different strategies to prevent complications to control blood sugar effectively.

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## 1. Introduction

Type 2 diabetes is a complex disease in which several pathophysiological abnormalities are seen including decreased insulin secretion, increased glucose production in the liver, and increased insulin resistance. Type 2 diabetes epidemic is a major public health problem [1–3]. In 2003, the worldwide prevalence of diabetes among people aged 20–79 years was 5.1% and is estimated to reach 6.3% by 2025 [4]. The prevalence of diabetes among Iranian population between 20 years and 79 years of age was 8.43%, which accounted for 4.4 million of the total 20–79-year-old population in 2013 [5]. Some of the main causes of this growing trend can be attributed to population growth, aging, urbanization, the prevalence of obesity, and decreased physical activity [2].

Diabetes is associated with short- and long-term complications, which in many cases are irreversible [6]. One of the most important complications of diabetes is diabetic retinopathy, which is a specific complication of type 1 and 2 diabetes. This complication causes thousands of people to become blind annually. The risk of blindness from diabetic retinopathy in people with diabetes is 29 times higher than in those without diabetes [7]. In developed nations, diabetes-related eye diseases have been reported as the main cause of blindness in adults younger than 75 years of age. This disease accounts for approximately a quarter of registered blindness in the Western world. Visual impairment due to diabetic retinopathy will have a large impact on quality of life and imposes a heavy financial burden on society every year [7,8]. It is estimated that more than 75% of patients with a 15–20-year history of diabetes have retinopathy [9,10]. Many factors have been mentioned as risk factors in the development of retinopathy in diabetic patients. The most important ones include older age, higher hemoglobin A1c (HbA1c) level, duration of diabetes, hypertension, high body mass index, smoking, poor blood glucose control, pregnancy, and high blood cholesterol [11–13]. The most effective treatment to prevent the progression of diabetic retinopathy is “prevention”. Effective blood sugar control prevents the progression of the disease. Research has shown that for every 1% reduction in the HbA1c level, the risk of microvascular diseases such as retinopathy decreases by 37% [14].

After 20 years of having diabetes, nearly all patients with type 1 diabetes and 58% of patients with type 2 diabetes show symptoms of retinopathy, and the worsening of this problem may cause a loss of vision in 5–10% of the patients [15]. Considering the increasing prevalence of diabetes and its debilitating complications and the existence of multiple factors affecting the progression of the disease, this study was conducted to investigate the prevalence of retinopathy and its related factors among patients with type 2 diabetes attending a

diabetes center in Kerman, Iran. A better understanding of this issue and related factors can help provide more disciplined and better ways to control this disease.

## 2. Materials and methods

This was a descriptive–analytical, cross-sectional study conducted in 2015. Health records of diabetic patients who were registered in a second-level diabetes care center in Iran were used. From 11,770 health records of diabetic patients, 206 health records with the most complete information about the patients with type 2 diabetes were selected. Inclusion criteria were having type 2 diabetes and having a full health record at the center where the patients undergo regular eye examination and have their HbA1c level recorded. Exclusion criteria were having type 1 diabetes and incomplete information related to retinopathy and HbA1c. For data collection, a researcher-made checklist was used from which data on variables such as age, sex, duration of diabetes, level of education, employment status, family history, and the level of HbA1c were extracted from the patients’ health records. Data analysis was carried out using Chi-square test and logistic regression through SPSS version 16 (SPSS Inc., Chicago, IL, USA). It should be noted that the severity of retinopathy was not examined in this study due to lack of access to required data.

## 3. Results

According to the study results, of the 206 patients with type 2 diabetes, 82.5% were women. The mean age of patients was  $60.4 \pm 8.3$  years and their duration of diabetes was 13 years. In this study, 45.1% of patients (93/206) were diagnosed with retinopathy.

As shown in Table 1, a significant relationship between retinopathy and sex, age, disease history, family history, education, and duration of the disease was not observed. However, there was a significant relationship between the level of HbA1c and diabetic retinopathy ( $p = 0.002$ ).

In Table 2, demographic characteristics associated with retinopathy were examined after adjusting for the confounding effect using multivariate logistic regression and no significant relationship was observed between retinopathy and sex, age, history of disease, family history, education, and duration of the disease. However, there was a significant relationship ( $p = 0.006$ ) between the level of HbA1c and diabetic retinopathy.

## 4. Discussion

In this study, the prevalence of retinopathy among diabetic patients was 45.1%. Several studies about the

**Table 1.** Relationship between demographic characteristics of patients with type 2 diabetes and risk of retinopathy.

Variable		Total	Retinopathy		$p \geq 0.05$
			Yes, <i>n</i> (%)	No, <i>n</i> (%)	
Sex	Men	36	18 (50)	18 (50)	0.322
	Women	170	75 (44.1)	95 (55.9)	
Age category (y)	30–49	14	3 (21.4)	11 (78.6)	0.073
	50–59	78	32 (41)	46 (59)	
	≥ 60	114	58 (50.9)	56 (49.1)	
Level of education	Illiterate	42	20 (47.6)	22 (52.4)	0.542
	Primary	87	44 (50.6)	43 (49.4)	
	Guidance	24	9 (37.5)	15 (62.5)	
	High school	35	14 (40)	21 (60)	
Working status	University	18	6 (33.3)	12 (66.7)	0.960
	Housewife	154	69 (44.8)	85 (55.2)	
	Practitioner	16	7 (43.8)	9 (56.2)	
	Retired	36	17 (47.2)	19 (52.8)	
Family history of having diabetes	Yes	98	50 (51)	48 (49)	0.070
	No	108	43 (39.8)	65 (60.2)	
Years with diabetes	1–5	46	17 (37)	29 (63)	0.12
	6–10	45	15 (33.3)	30 (66.7)	
	11–15	50	21 (42)	29 (58)	
	> 15	65	40 (61.5)	25 (38.5)	
Hemoglobin A1c level	< 7	40	10 (25)	30 (75)	0.002
	≥ 7	125	66 (52.8)	59 (47.2)	

prevalence of retinopathy in diabetic patients have been conducted in which the prevalence rate varied from 6.8% to 50.3% [16–22]. In most studies that have been conducted in different regions of Iran, the prevalence of retinopathy has been reported between 30% and 40% [23].

In the study by Javadi et al [24], the prevalence of retinopathy in Tehran was 37%. A Swedish study by Jerneld and Algvere [25] indicated that 47% of patients with diabetes had diabetic retinopathy and in those who had diabetes for more than 30 years, this figure was 100%.

**Table 2.** Relationship between demographic characteristics of patients with type 2 diabetes and risk of retinopathy after adjusting for the confounding effect using multivariate logistic regression.

Variable		Odds ratio	Confidence interval	$p \geq 0.05$
Sex	Men	—	—	—
	Women	0.3	0.05–2.03	0.233
Age category (y)	30–49	—	—	—
	50–59	2.04	0.4–9.4	0.360
	≥ 60	2.5	0.5–11.7	0.250
Level of education	Illiterate	—	—	—
	Primary	1.4	0.5–3.6	0.485
	Guidance	1.3	0.4–4.9	0.664
	High school	1.02	0.3–3.3	0.973
Working status	University	1.1	0.2–5.9	0.862
	Housewife	—	—	—
	Working	0.4	0.05–3.7	0.440
Family history of having diabetes	Retired	0.8	0.1–3.9	0.761
	No	—	—	—
Years with diabetes	Yes	1.5	0.7–2.9	0.288
	1–5	—	—	—
	6–10	0.6	0.2–1.7	0.343
	11–15	1.5	0.5–4.01	0.462
Hemoglobin A1c level	> 15	1.8	0.7–4.7	0.230
	< 7	—	—	—
	≥ 7	3.3	1.4–7.7	0.006

According to Henricsson et al [26], the prevalence of retinopathy was significantly increased with increase in HbA1c levels, and advanced retinopathy was associated with a high level of HbA1c. In the study by Stratton et al [13], the level of HbA1c was considered the strongest factor in the incidence and severity of retinopathy among patients with type 2 diabetes. In the study by Bek et al [17], the level of HbA1c was one of the factors that increased the risk of retinopathy. In this study, the incidence of retinopathy in people with HbA1c levels of 7 or more was 3.3 times more than those with HbA1c less than 7 and this relationship was statistically significant. Moreover, in this study, the incidence of retinopathy in people with a family history of the disease was 1.5 times higher than those without a family history. However, this relationship was not statistically significant neither in the single-variable nor in the multivariable model. Similar studies also reported no significant relationship between the prevalence of retinopathy and family history of diabetes [24,27,28].

This study showed that the risk of retinopathy increases with increasing age; in fact, the risk of retinopathy in age groups of 50–59 years and over 60 years was 2.4 times and 2.5 times more than that in the age group of 30–49 years, respectively, although this relationship was not statistically significant. These findings are consistent with the findings of other studies [25,29]. Manaviat et al [23] showed that the relative risk of retinopathy among people with a history of diabetes of 10 years or more is 1.5 times higher than those with a history of diabetes of less than 10 years. Santos Bueso et al [30] found out that prevalence of retinopathy in patients who had a history of diabetes of 5–10 years and in those who had a history of diabetes of more than 15 years was two times and 5.48 times more than those with a history of diabetes less than 5 years, respectively. The amount of retinopathy in patients older than 60 years of age was 23% more than those under the age of 60.

Although we could not explore the statistically significant relationship between the risk of retinopathy and increased duration of the disease, the prevalence of retinopathy raised with increasing the duration of the disease in a way that people with a history of the disease of 15 years or more were 1.8 times more likely to develop retinopathy than the basic group with a history of 1–5 years. Statistically, there was also no significant difference in the prevalence of retinopathy between sex, level of education, and employment. A study in India indicated that risk factors associated with the prevalence of retinopathy include age, duration of diabetes, being male, level of HbA1c, and the presence of the nephropathy [19]. However, in the study by Chen et al [22], factors such as sex, age, education level, and family history of diabetes were not significantly associated with retinopathy. In the study by Jenchitr et al [31], no relationships were found between the severity of retinopathy and duration of diabetes as well as

retinopathy and higher HbA1c levels. Duration of diabetes has been considered as a reflection of glycemic control and other diabetic risk factors that patients have been exposed to in the course of the disease [32,33].

In this study, the number of women attending to the Kerman Diabetes Center was 82.5% more than that of men. This difference could be due to that fact that the center is open in the mornings when most men are at work, unlike women who were mostly housewives. The prevalence of retinopathy in men was 0.3 times more than that in women, although a statistically significant relationship was not observed. However, this could be due to the fact that men had no access to the center as they were at work in the mornings, and also the severity of the disease in those who attended the center.

The prevalence of retinopathy in this study was similar to other studies and small differences in statistics could be due to lifestyle, geographical locations, and the level of patients' awareness about visual complications of diabetes. This indicates the need for active involvement of primary-level physicians in the management of diabetes who in turn should be satisfied to remain and work in primary health-care centers [34,35].

Diabetes Prevention and Control Program in the city of Kerman was initiated in 2010, although it practically started in 2011. One of the goals of this program is to prevent the complications of diabetes such as diabetic retinopathy, which is one of the most important complications of diabetes. This study showed that the prevalence of retinopathy in patients with type 2 diabetes was 45.1%, and there was a statistically significant relationship between the prevalence of retinopathy and the level of HbA1c; in other words, the lack of control in the level of HbA1c causes retinopathy. It could be said that the incidence of retinopathy somehow reflects the weakness in the management of diabetes, particularly at the primary level of care that requires close examination of problems associated with diabetes management and correcting them.

## Conflicts of interest

The authors have no conflicts of interest to declare.

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