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The impact of diabetes control, type, duration, and family history on visual impairment

Authors

Khalil Ali Ibraheim[1-4]

Affiliations

[1]*Department of Surgery, Faculty of Medicine, University of Kordofan, EL-Obeid, Sudan.*
[2]*Doctor Khalil Ophthalmology Center, El-Obeid, Sudan.*
[3]*El-Obeid Teaching Hospital, Ophthalmology Department, El-Obeid, Sudan.*
[4]*Medicine program, Sheikan College, El-Obeid, Sudan.*

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Edited By:
Eldisugi Hassan M. Humida
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- Esraa Dafallah
University of Kordofan, El-Obeid, Sudan
Correspondence to: Khalil Ali Ibraheim.
Email: drkhalil74@gmail.com
ORCID: 0000000301369611
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ABSTRACT

Background: November 14 is the International United Nations (UN) Day to promote patient health education and professional training to reduce diabetes-related blindness. Due to economic hardship, drug shortages, and medical personnel exodus, Sudan's three-year war impairs diabetes glycemic management. To address these difficulties, we examined the impact of glycemic control in conflict zones, where many factors contributed to the deterioration of vision among diabetic patients. **Methodology:** This prospective descriptive study was conducted between May 15, 2025, and October 20, 2025, at Doctor Khalil Clinic, located in El-Obeid, North Kordofan, Sudan. The study encompassed all individuals with diabetes who visited the clinic for follow-up related to ophthalmic complaints. Visual acuity (VA) was evaluated for 120 individuals, including all patients exhibiting uncorrected poor vision, regardless of the use of glasses or other means of correction. A comprehensive ophthalmic examination was conducted utilizing a slit lamp, ophthalmoscope, 90D lens, A-scan, and optical coherence tomography (OCT). Blood tests, including fasting blood glucose and HbA1C, were performed to determine the causes of poor vision. **Results**: This study analyzed 120 patients with impaired vision, comprising 70 females (58%) and 50 males (42%), resulting in a female-to-male ratio of 1.40:1.00. The age group most affected was 65-70 years, accounting for 38% of the sample. Type 2 diabetes (T2DM) is prevalent in 88% of patients, with 70% having diabetes durations exceeding 10 years. Additionally, 75% of patients utilized tablets for glycemic control, while fasting blood glucose (FBG) and HbA1c levels were elevated in 62% and 58% of patients, respectively. **Conclusion:** Because of the war in Sudan, most diabetic patients encounter difficulties in maintaining glycemic control, which deteriorates their vision.

Keywords: glycemic control, diabetes, low vision, Sudan, Visual acuity

INTRODUCTION

World Diabetes Day, held on November 14 each year by the UN, focuses on patient health education and professional training to prevent diabetes-related blindness. The nearly three-year war in Sudan has negatively

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impacted diabetes glycemic control due to economic challenges, a shortage of essential drugs, and the emigration of most medical staff. These factors together impacted most patients with comorbidities in most parts of the Sudan. Diabetes, particularly T2DM, is one of the most comorbid diseases that needs continuous control. Thus, diabetic patients must control their FBG and HbA1c to reduce eyesight deterioration and improve quality of life [1], because these are important factors in modulating the complications of diabetes and preserving the patient's reserve vision. Accordingly, one study stated that patient education is essential to increase their knowledge and awareness of glycemic control and nutrition [2]. Patient education and the availability of essential diabetic drugs are important factors because knowledge about the disease raises awareness of its complications. Furthermore, the study on glycemic control concentrates on health coaching to decrease blood sugar and recommends doing further evidence-based studies [3]. Additionally, health coaching is an important method for controlling diabetes, and a study demonstrated a significant decrease in HbA1c levels and improvements in diet after 6 months of coaching, leading to recommendations for further research on health coaching with higher-quality evidence [4]. As the war is one of the most important factors for depression, one study finds a strong association between depression and poor glycemic control and recommends further longitudinal studies to explore the mechanism underlying these associations [5]. Also, the intermittent fasting regimen emerges as an important tool for glycemic control, but in this study, they recommend constant monitoring to reduce the risk of hypoglycemia and its related complications [6]. This study investigated the impact of impaired glycemic control on ocular health in conflict zones, where numerous factors impair diabetic patients.

MATERIALS AND METHODS

This prospective descriptive study was conducted from May 15, 2025, to October 20, 2025. The study was conducted in Doctor Khalil Clinic, located in El-Obeid, North Kordofan, Sudan. This study encompassed all diabetic individuals who attended the clinic for follow-up (120 patients). We evaluated their VA and identified all individuals with uncorrected suboptimal vision, regardless of corrective measures such as glasses or alternatives. An exhaustive ophthalmic evaluation was conducted utilizing a slit lamp, ophthalmoscope, 90D lens, A-scan, and optical coherence tomography (OCT). Moreover, blood tests, such as FBG and HbA1C, were performed to ascertain the causes of impaired vision.

Data Analysis

Data sets were imported into the Statistical Package for Social Sciences (SPSS Inc., Chicago, IL, version 24), from which frequencies, percentages, and cross-tabulations were computed.

RESULTS

This study examined 120 patients with poor vision: 70 were females (58%) and 50 were males (42%), resulting in a female-to-male ratio of 1.40:1.00. The

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most affected age group was 65-70 years (38%), followed by those over 70 years (30%), and then both the age groups < 50 years and 60-64 years (26%); see Table1.

Table 1 demonstrates the distribution of gender in the age group of the study populations.

Age group	Males	Females	Total
<60 years	14	12	26
60-64	8	18	26
65-70	16	22	38
>70	12	18	30
Total	50	70	120

In relation to visual acuity (VA), the most common category was VA <6/60, accounting for 68%, followed by VA 6/60 at 26%, VA 6/24 at 14%, and finally VA 6/36 at 12%. Refer to Table 2.

Table 2 demonstrates the distribution of the VA in the age group of the study populations.

Age group	6/24	6/36	6/60	<6/60	Total
<60 years	0	4	6	16	26
60-64	2	2	8	14	26
65-70	8	2	8	20	38
>70	4	4	4	18	30
Total	14	12	26	68	120

Regarding the distribution of factors affecting diabetic patients with low vision, type 1 diabetes mellitus (T1DM) was found in 14 patients (12%), including 12 (86%) males and 2 (14%) females. T2DM was found in 106 patients (88%), including 38 males (36%) and 68 females (64%). Regarding duration, most patients have had diabetes for more than 10 years, totalling 84 patients (70%), comprised of 30 males (36%), and 54 females (64%). About 36 patients have had diabetes for 10 years or less (30%), including 20 males (56%) and 16 females (44%). Referring to diet, tablets, and insulin. Only 4 patients (3%) used diet control, involving 2 males and 2 females. Tablets were used by 90 patients (75%), comprising 36 males (40%) and 54 females (60%). Insulin was used by 26 patients (22%), including 12 males (46%) and 14 females (54%). FBG was abnormal in 74 patients (62%), including 34 males (46%) and 40 females (54%). About 62 (52%) patients have a family history of diabetes, including 18 males (29%) and 44 females (71%), while 58 patients (48%) do not have a family history, comprising 32 males (55%) and 26 females (45%). See Table 3 and Figure 1.

Table 3 shows the gender distribution of factors that affect glycemic control.

Category	Variable	Males	Females	Total
	T1DM	12	2	14

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Type of diabetes	T2DM	38	68	106
Duration of	≤10 years	20	16	36
	>10 years	30	54	84
Type of control	Diet	2	2	4
	Tabs	36	54	90
	Insulin	12	14	26
FBG	Normal	16	30	46
	Abnormal	34	40	74
HBA1c	Normal	22	28	50
	Abnormal	28	42	70
Family history	Yes	18	44	62
	No	32	26	58

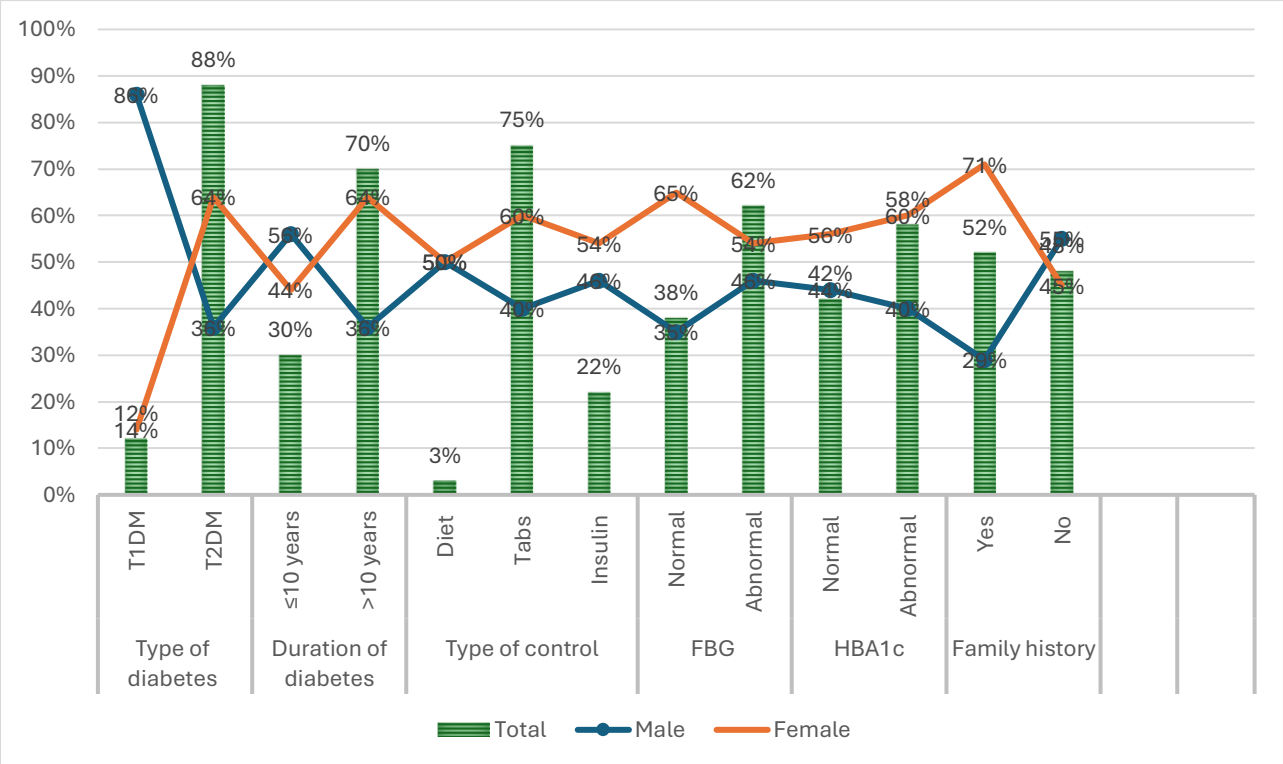

Figure 1 illustrates the proportion of gender distributed by factors affecting glycaemic control.

Regarding the distribution of factors affecting diabetic patients by age group, we observe that among those with diabetes, 88% have T2DM, and the most affected age group was 65–70 years old, represented by 35%. The remaining 12% have T1DM, with the most affected age group being those under 60 years old.

Regarding the duration of diabetes, 70% of patients have had the disease for more than 10 years, while 30% have had it for less than 10 years. People with diabetes for more than 10 years are mostly between the ages of 65 and 70 (33%), while people with diabetes for less than 10 years are mostly between the ages of 60 and 64 (33%). In terms of glycemic control, most patients manage their blood glucose with tablets (74%), followed by insulin (22%) and diet (3%).

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Among tablet users, the most common age group was 65–70 years, at 40%. Concerning fasting blood glucose, it was mostly high in the 65–70-year-old group at 30% and mostly normal in the same age group at 35%. As for HbA1c, it was mostly high in the <59-year group at 31% and mostly normal in the 65-70-year group at 44%. A family history of diabetes was present in 52% of patients, mostly in the 65-70-year-old group at 32%.

Table 4 shows the distribution of age by factors affecting glycemic control.

Category	Variable	<60 years	60-64	65-70	>70	Total
Diabetes type	T1DM	10	2	2	0	14
	T2DM	16	24	36	30	106
Duration	≤10 years	10	12	10	4	36
	>10 years	16	14	28	26	84
Control type	Diet	2	0	0	2	4
	Tabs	14	16	36	24	90
	Insulin	10	10	2	4	26
FBG	Normal	6	14	16	10	46
	Abnormal	20	12	22	20	74
HBA1c	Normal	4	14	22	10	50
	Abnormal	22	12	16	20	70
Family history	Yes	10	14	20	18	62
	No	16	12	18	12	58

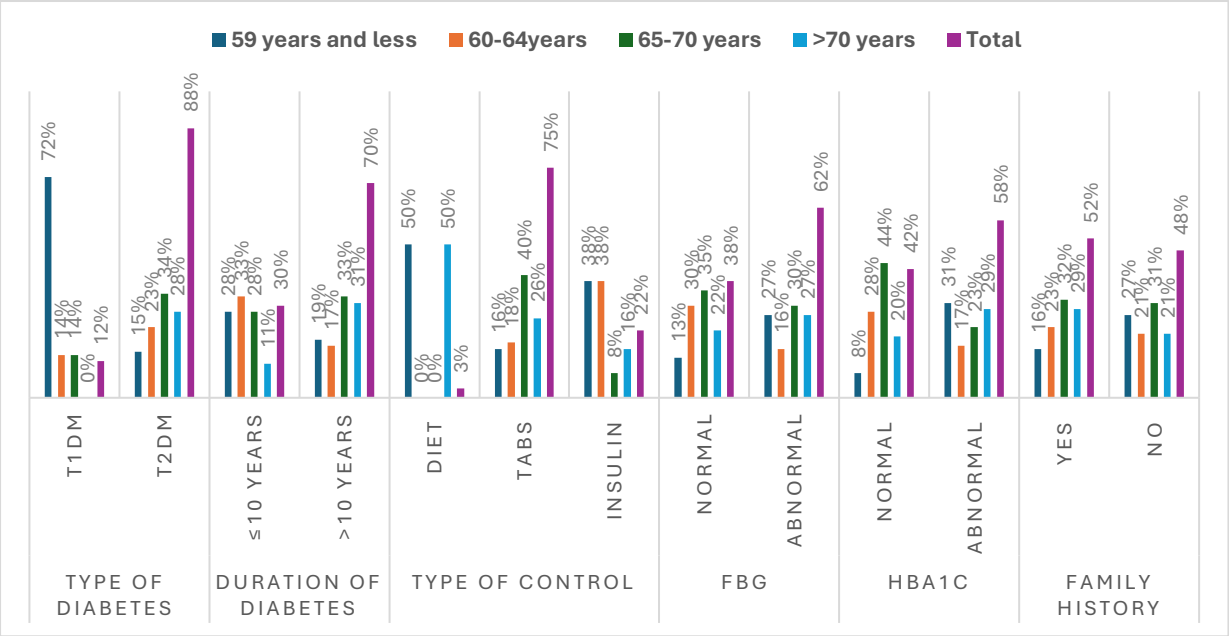

Figure 2 shows the proportion of age by factors affecting glycaemic control.

DISCUSSION

According to the findings of this study we found that the most common type of diabetes in the group is type 2 diabetes that constitute about 88% of the patients, and we find that incidence of decrease vision was increased when the duration of diabetes was increased, in this study we find that the patients with duration of more than 10 years constitute 70%, so this high percentage

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was due to methodology of this study so we select patients with low vision, so most of the patients were elderly with long duration, in one study stated that the complications of diabetes that lead to decrease vision such as diabetic retinopathy will increased when the duration of diabetes was increased, and also affect other factors that lead to decreased vision such and maculopathy and macular oedema[7], in study found that longer duration of diabetes (more than ten years) was associated with poor glycaemic control and it was found to be 7 times higher among diabetic patients with a duration of less than 10 years[8]. Most patients used tablets for glycemic control, accounting for 75% of the group, indicating that tablet use is predominant in this study and contributes to low glycemic control. FBG is abnormal in 62% of the patients, and HbA1c is abnormal in 58% of them. All these factors were affected by the war; most of the patients were unable to reach the health facility or obtain bad-quality drugs, and some stopped drugs. As a result, the standard deviation of the FBG is huge (SD = 49.3), while the standard deviation of HbA1c is 2.17; the mean FBG was 152.5, and the mean HbA1c was 8.6. In one study, the researchers found that the mean HbA1c was similar to that of our study, which was 8.9 with an SD of 1.6 [9]. Concerning diet control, only 4% of the patients used this type of glycemic control. A systematic review and meta-analysis concluded that dietary control of diabetes or prediabetes, using a prebiotic and a Mediterranean diet, is beneficial for improving gut microbes that help control FBG and HbA1c, although the mechanisms remain uncertain due to limited reports [10]. In our situation, due to war, we may benefit from telemedical intervention that was found to be of benefit in decreasing HbA1c concentrations, as found in a systematic meta-review [11]. Certain mechanisms, such as the increased incidence of diabetic retinopathy, cataracts, and glaucoma, affect diabetic patients' vision when they have poor glycemic control and high FBG. All factors influence the decreasing vision in diabetic patients, so in this study, the mean FBG was found to be 152.5 with a standard deviation of 49.3. In this study, the primary mechanism for decreasing vision in diabetic patients with high FBG and HbA1c levels is the development of diabetic retinopathy, which is the main factor contributing to vision loss in diabetics; it was noted that controlling these two factors can reduce the occurrence of diabetic retinopathy [12]. Therefore, this experiment led us to the importance of regular eye exams and checks of the FBG and HbA1c levels. In one cohort prospective study, it was stated that intensive glycemic control did not affect or correlate with changes in diabetic retinopathy, which is the major factor for decreased vision; further studies were recommended [13]. However, our study discovered a correlation between poor glycemic control and reduced vision. This study assessed glycemic control in individuals with type 2 diabetes using HbA1c. Their sample was larger than my study (290), but the percentage of females was relatively similar to our study, 58%. The mean (SD) age in their study was 54.9 (12.8), while in our study, the mean (SD) age was 64.9 (10.9), which is slightly higher because our sample includes patients with poor vision, indicating a longer duration of diabetes and the presence of complications. This was clear in the mean (SD) duration of

diabetes, which was 6.8 (5.5) years, but in our study 14.3 (5.9), concerning drugs for glycemic control, as our study (72.8%) used oral hypoglycemic drugs versus 75% in our study, and 21.4% used insulin compared to 22% in our study [14]. A study conducted in northern Sudan concluded that most patients have uncontrolled diabetes, are older, and are predominantly female, which aligns with our findings of female gender predominance, an older mean age, and nearly all patients having complications [15].

LIST OF ABBREVIATIONS

Abbreviation	Full term
UN	United nations
T1DM	Type 1 diabetes mellitus
T2DM	Type 2 diabetes mellitus
AB scan	AB ultrasonography
OCT	Ocular coherent tomography
90D	90 diopter lenses
VA	Visual acuity
HBA1c	Glycated hemoglobin A1c
FBG	Fasting blood glucose

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CONFLICT OF INTEREST

The author declares that they have no conflict of interest to disclose.

ETHICAL CONSIDERATIONS

Ethical approval was obtained from the Doctor Khalil Ophthalmology Center, and the clinic administration received administrative authorization before data collection. The study adhered to the principles of confidentiality and responsible use of routinely collected health information.

ETHICAL APPROVAL

The protocol of this study had been approved by the Human Ethics Committee at Prof MRCC. Approval number: HREC 0007/MRCC.3/24).

DISCLOSURE

This research was conducted without the use of artificial intelligence or assisted technologies, including the generation of figures.

DATA AVAILABILITY

The data supporting the conclusions of this article are included within the article, and further inquiries can be sent to the corresponding author.

AUTHOR'S CONTRIBUTION

Ibraheim: Conceptual, study design, data collection, manuscript drafting, and approval

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