The trends of ocular problems among Type II diabetes patients in El-Obeid

Sahar Alshareef Hasbsedo[1], Hussain Gadelkarim Ahmed[2,3] .

1Department of ophthalmology El-Obeid Teaching Hospital. ORCID:0009-0004-7435-6330.

2Prof Medical Research Consultancy Center, NK, El-Obeid, Sudan. ORCID: 0000-0001-6579-0574.

3Department of Histopathology and Cytology, FMLS, University of Khartoum, Sudan.

ABSTRACT

Background Diabetic retinopathy (DR) and manuclopathy (DM) are the primary causes of vision loss in the global working population. The objective of this study was to evaluate the prevalence of diabetic retinopathy (DR) and diabetic maculopathy (DM) among individuals with diabetes in Sudan during the Sudan War in 2023. **Methodology:** A prospective descriptive study was carried out at El-Obeid International Hospital in North Kordofan State, Sudan, from August 2023 to April 2024. Approximately 100 individuals took part. This study recruited known cases of diabetes mellitus who attended a diabetes mullet's clinic, as well as 100 non-diabetic people as the control group. **Results:** Among a group of 100 people diagnosed with diabetes, 30% were found to have eye problems. Specifically, 57% of these patients had diabetic maculopathy, while 43% had diabetic retinopathy. The majority of patients with diabetic maculopathy were between the ages of 37 and 47, while 23.5% of patients fell within the age category of 48 to 58 years. When it comes to gender, the majority of patients with diabetic retinopathy were girls, accounting for 84.6%. Similarly, in the case of maculopathy, 64.7% of the patients were female. **Conclusion:** Diabetic retinopathy and maculopathy are widespread in Sudan. Dementia is more prevalent among the elderly population, although diabetes mellitus can be seen in individuals of all age groups. The prevalence of both DR and DM is greater in females than in males.

Keywords: Diabetes, retinopathy, maculopathy, eye disease, Sudan

INTRODUCTION

Type 2 diabetes (T2D) is a complex illness that arises from various physiological processes and molecular mechanisms, which are frequently unique to certain cell types [1]. Type 2 diabetes is linked to cognitive impairment and a doubled risk of dementia compared to people of the same age who do not have diabetes. Due to their same embryologic genesis and structural similarities, the retina provides a distinct perspective on the brain. A study was conducted to investigate whether there were disparities in retinal imaging-based neuronal and vascular indicators between patients with type 2 diabetes who had moderate cognitive impairment (MCI) and those without MCI [2]. Diabetic nephropathy and diabetic retinopathy have numerous parallels in their underlying pathophysiological mechanisms. Preclinical research has demonstrated that sodium-glucose cotransporter 2 inhibitors (SGLT2is) play a protective role in reducing the incidence of diabetic retinopathy [3]. The utilization of sodium-glucose cotransporter 2 inhibitors was linked to a reduced likelihood of sight-

threatening diabetic retinopathy in persons with type 2 diabetes and moderate cardiovascular disease risk when compared to alternative glucose-lowering treatments. Glucagon-like peptide-1 receptor agonists do not pose a higher danger to the retina compared to DPP-4i and sulfonylurea drugs [4]. Although it is widely known that individuals with diabetes have a higher chance of developing eye disorders connected to the retina, there has been less research conducted on the direct connection between diabetes and non-retinal eye conditions, such as age-associated cataracts and glaucoma [5]. Research conducted in Sudan revealed a significant prevalence of diabetic retinopathy among patients with diabetes who visit Makkah Eye Hospital in the capital city of Khartoum [6]. Immediate measures are required to oversee and manage high blood pressure and enhance diabetes management in patients with diabetes. There is an urgent need for increased investment in diabetes services. Hence, the objective of this study was to evaluate the prevalence of ocular conditions in individuals with Type 2 diabetes at El-Obeid International Hospital in North Sudan.

MATERIALS AND METHODS

A prospective descriptive study was carried out at El-Obeid International Hospital in North Kordofan State, Sudan, from August 2023 to April

RESULTS

This study looked at 200 people, 100 of whom had diabetes mellitus and 100 who were case controls. There were 128 females and 72 males, ranging in age from 18 to 85 years, with a mean age of 46 years. The majority of participants in this study were aged 48–58, followed by 26–36 and 37–47 years, >25 years, 70–80 years, ≥80 years, and 59–69 years, representing 59/200

2024. Approximately 100 individuals took part. This study recruited known cases of diabetes mellitus who attended a diabetes mullet's clinic, as well as 100 non-diabetic subjects as a control group. Each study participant was chosen at random using a simple random sampling approach, without considering their gender, age, or place of residence.

Ethical consent: Authorization was acquired from the authorities of El-Obeid International Hospital.

Ethical Approval: The study protocol received approval from the Human Research Ethics Committee (HREC) at the Prof. Medical Research Center (MRCC).

Statistical Analysis

The data was first organized on a data sheet and then inputted into computer software called Statistical Package for Social Sciences (SPSS) version 24, developed by the University of Chicago in the United States. Data was collected on percentages, frequencies, and cross-tabulations. We will embrace values that are statistically significant at a 95% confidence level. The study assessed the relative risk (RR) and the 95% confidence interval (95%CI). A chi-square test was conducted, and a P-value below 0.05 was deemed to be statistically significant.

(29.5%), 44/200 (22%), and 29/200 (14.5%), 24/200 (12%), 20/200 (10%), 19/200 (9.5%), and 5/200 (2.5%), respectively. Of the 200 participants, 188 (94%) were from urban areas, with the remaining 12 (6%) from rural areas. The majority of the participants were urban among the age group 48-58 years 57/188 (30.3%), whereas the majority of rural contributions were aged ≤25 years 3/12(25%), as reflected in Table 1 and Figure 1.

Table 1: Distribution of the study population by demographic characteristics

Variable	Urban	Rural	Total

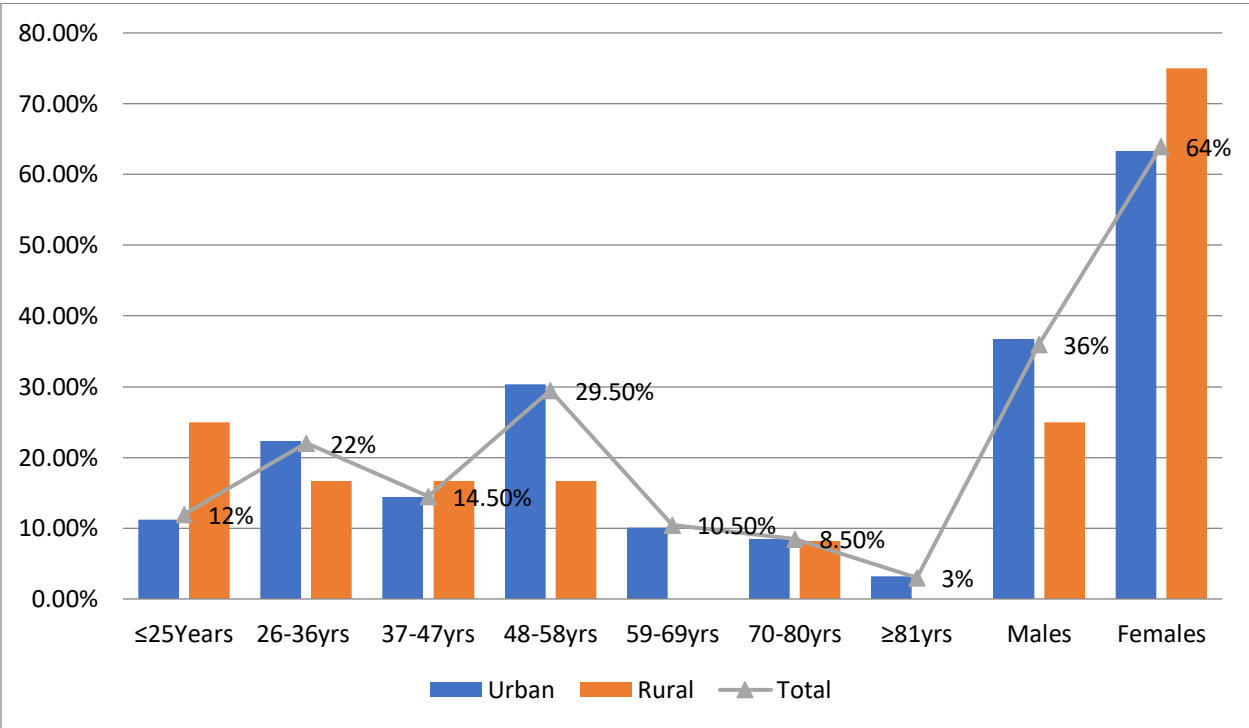| Age Group			
≤25 years	21	3	24
26-36	42	2	44
37-47	27	2	29
48-58	57	2	59
59-69	19	2	21
70-80	16	1	17
≥81	6	0	6
Total	188	12	200
Gender			
Males	69	3	72
Females	119	9	128
Total	188	12	200

Figure 1. Description of the participants by demographical characteristics

Table 2 and Figure 2 summarize the distribution of diabetic eye disorders by demographic variables. Out of 100 diabetic patients, 30/100 (30%) were diagnosed with eye disorders, including 17/30 (57%) with diabetic maculopathy and 13/30 (43%) with diabetic retinopathy. The majority of diabetic maculopathy patients were between the ages of 37 and 47, with 4/17 (23.5%) falling into the 48-58 age range. In terms of gender, the majority of diabetic retinopathy and maculopathy patients were female, with 11/13 (84.6%) and 11/17 (64.7%), respectively. In diabetic retinopathy and maculopathy, the majority of patients were urban, with 11/13 (84.6%) and 17/17 (100%), respectively.

Table 2: Distribution of the Diabetic Eye Diseases by Demographic Characteristics

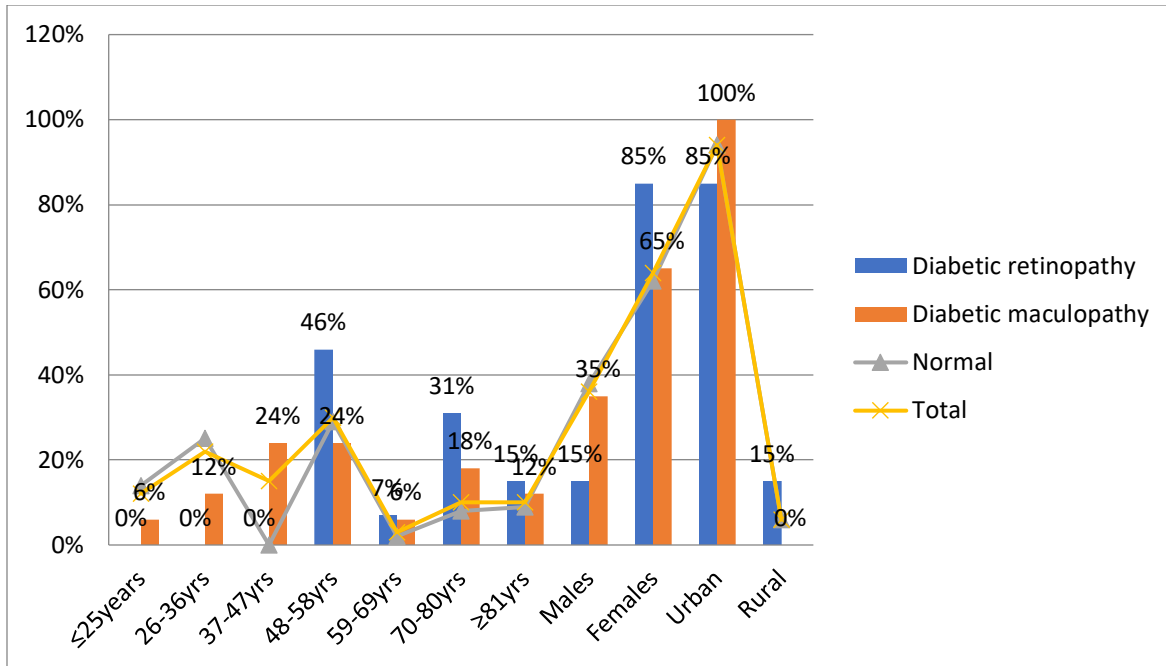| Variable	Diabetic retinopathy	Diabetic maculopathy	Normal	Total
Age Group				
≤25 years	0	1	23	24
26-36	0	2	42	44
37-47	0	4	25	29
48-58	6	4	49	59
59-69	1	1	3	5
70-80	4	3	13	20
≥81	2	2	15	19
Total	13	17	170	200
Gender				
Males	2	6	64	72
Females	11	11	106	128
Total	13	17	170	200
Residence				
Urban	11	17	160	188
Rural	2	0	10	12
Total	13	17	170	200

Figure 2. Description of the Diabetic Eye Diseases by Demographic Characteristics

Figure 3 and Table 3 summarize the distribution of diabetic retinopathy clinical findings by gender. Diabetic retinopathy is categorized into three kinds based on funduscopic examination: background retinopathy, pre-proliferative retinopathy, and proliferative retinopathy. The majority of background retinopathy patients were female, with 8/13 (61.5%) having hemorrhages and hard exudate. For pre-proliferative retinopathy, the majority of patients were females, with IRMAS (intra-retinal microaneurisms) and multiple CWS (cotton wool spots) in 2/13 (15%). For proliferative retinopathy, the majority of them had NVD and NVE, similarly in males and females (3/13; 23%).

Table 3. Distribution of the clinical findings of diabetic retinopathy and genders

Variable	Males	Females	Total
Background retinopathy			
Microanerysms	0	1	1
Hard exudate	1	1	2
Microanerysms+Haemorrhages+Hard exudate	0	6	6
none	68	111	179
Haemorrhages+Hard exudate	3	8	11
Microanerysms and haemorrhges	0	1	1
Total	72	128	200
Preproliferative retinopathy			

IRMAS (Intra Retinal Micro Aneurisms)	1	2	3
Multiple CWS (Cotton Wool Spots)	1	2	3
None	69	124	193
IRMAS and Multiple CWS	1	0	1
Total	72	128	200
Proliferative retinopathy			
NVD (New Vascularization of Disc)	1	0	1
none	68	124	192
NVD and vitreous haemorrhges or pre-retinal haemorrhges	0	1	1
NVD and NVE	3	3	6
Total	72	128	200

DISCUSSION

Eye diseases are a prevalent health issue in Sudan, especially those linked to diabetes. Due to the ongoing conflict in the country, the Sudanese population has been greatly affected by the lack of health services, leading to a significant burden of eye disease. This study primarily examined eye diseases related to type 2 diabetes, specifically diabetic retinopathy and maculopathy.

According to the results of this study, it was observed that 30% of patients with diabetes exhibited either diabetic retinopathy (13%) or maculopathy (17%). Diabetic retinopathy affects approximately 27.0% of individuals with diabetes worldwide, resulting in around 0.4 million cases of blindness [7]. DR is a significant contributor to visual impairment and blindness on a global scale. Since the initial recognition of DR as a significant complication of diabetes, numerous efforts have been made to precisely categorize the severity and stages of the disease [8]. Diabetic retinopathy (DR) is a prominent ocular complication associated with diabetes mellitus, posing a significant global health concern.

Significant progress in diagnostics, technology, and treatment has already brought about a revolutionary transformation in the management of DR in the early 21st century. For instance, the availability of imaging through optical coherence tomography, along with the advancement of anti-vascular endothelial growth factor (VEGF) treatment, are significant developments that have greatly influenced the field of diabetic retinopathy in recent decades. However, there continue to be additional noteworthy advancements being achieved. In anticipation of the year 2030, it is highly probable that numerous ongoing advancements will continue to revolutionize the field. Epidemiologic projections indicate that the global burden of DR is on the rise and is shifting from high-income countries to middle- and low-income areas. Furthermore, there is a growing focus on retinal neural dysfunction and non-vascular aspects of diabetic retinal disease due to improved comprehension of disease pathophysiology. Furthermore, there is a growing abundance of data from advanced imaging techniques like widefield imaging systems and optical coherence tomography and angiography. In addition, the accessibility and

significance of artificial intelligence in the field of screening, diagnosis, and prognostication of DR will continue to grow. In addition, researchers are currently working on developing new pharmacologic agents that target pathways other than VEGF, as well as exploring novel therapeutic strategies like gene therapy for DR [9].

DME is a prevalent complication of diabetic retinopathy and remains the primary factor contributing to vision loss in individuals with diabetes. Several factors, including metabolic disorders and inflammation resulting from high blood sugar levels, contribute to the development of diabetic macular edema (DME). However, the precise mechanism behind this condition remains uncertain [10]. The study's findings revealed a high prevalence of diabetic manuclopathy across all age groups, while diabtic retinopathy was found to be more prevalent among older individuals. Age-related macular degeneration (AMD) is currently the primary cause of irreversible vision loss in modern times. Genetic variants linked to diabetic retinopathy (DN) and its risk factors, including glycemic traits, lipidemic traits, systolic/diastolic blood pressure, obesity, and urate, were derived from previously published genome-wide association studies. Summary-level statistics for AMD were obtained from the FinnGen database. Recent research indicates that the influence of DN on the progression of AMD may be more significant than previously thought. In addition, it has been observed that higher levels of HDL-C may increase the risk of AMD, while triglycerides may have a potential protective effect [11]. The underestimated impact of aging on diabetic retinopathy (DR) is a topic of academic interest. The evaluation of biological aging was conducted by calculating the biological age (BA) and phenotypic age (PA) using clinical markers. DR was detected in individuals with diabetes mellitus (DM) when they displayed retinal microaneurysms or retinal blot hemorrhages during retinal imaging, with or without the presence of more severe lesions [12]. Based on the results of the study, it was observed that females had a higher prevalence of both DR and DM compared to males. Prior research has shown that females have a notably higher prevalence of DR compared to males (31.1% vs. 29.0%, P = 0.011). Research findings indicate that among patients with type 2 diabetes mellitus, females with a diabetic history of over 10 years, aged over 60 years, or with a relatively intermediate economic status had a higher prevalence of diabetic retinopathy compared to males [13]. Previous research has indicated that being male may increase the risk of developing diabetic retinopathy (P = 0.001; odds ratio [OR] 1.5, 95% confidence interval [CI] 1.18–1.98) [14]. Overall, it is worth noting that Sudan has a significant prevalence of diabetic retinopathy and maculopathy. Diabetic retinopathy is more prevalent among the elderly population, while diabetes mellitus can affect individuals of all ages. There is a noticeable difference in the rates of DR and DM between females and males. **In conclusion:** LIG is widespread in Sudan, primarily manifesting as Phacomorphic glaucoma. Females are more often impacted than males. LIG is notably prevalent among the elderly rural Sudanese population, highlighting the need for awareness and health education.

REFERENCES

1- Suzuki K, Hatzikotoulas K, Southam L, et al. Genetic drivers of heterogeneity in type 2 diabetes pathophysiology. Nature. 2024 Mar;627(8003):347-357. doi: 10.1038/s41586-024-07019-6.

2- Pedersen FN, Stokholm L, Lois N, Yang D, Cheung CY, Biessels GJ, Exalto L, Simó R, Peto T, Pouwer F, Grauslund J. Structural and Metabolic Retinal Changes Associated with Mild Cognitive Impairment in Type 2 Diabetes. Diabetes. 2023 Dec 1;72(12):1853-1863. doi: 10.2337/db23-0025.

3- Yen FS, Wei JC, Yu TS, Hung YT, Hsu CC, Hwu CM. Sodium-Glucose Cotransporter 2 Inhibitors and Risk of Retinopathy in Patients with Type 2 Diabetes. JAMA Netw Open. 2023 Dec 1;6(12): e2348431. doi: 10.1001/jamanetworkopen.2023.48431.

4- Barkmeier AJ, Herrin J, Swarna KS, Deng Y, Polley EC, Umpierrez GE, Galindo RJ, Ross JS, Mickelson MM, McCoy RG. Comparative Effectiveness of Glucagon-Like Peptide-1 Receptor Agonists, Sodium-Glucose Cotransporter 2 Inhibitors, Dipeptidyl Peptidase-4 Inhibitors, and Sulfonylureas for Sight-Threatening Diabetic Retinopathy. Ophthalmic Retina. 2024 May 11: S2468-6530(24)00229-X. doi: 10.1016/j.oret.2024.05.003.

5- Chen R, Xu S, Ding Y, Li L, Huang C, Bao M, Li S, Wang Q. Dissecting causal associations of type 2 diabetes with 111 types of ocular conditions: a Mendelian randomization study. Front Endocrinol (Lausanne). 2023 Nov 22; 14:1307468. doi: 10.3389/fendo.2023.1307468.

6- Elwali ES, Almobarak AO, Hassan MA, Mahmooud AA, Awadalla H, Ahmed MH. Frequency of diabetic retinopathy and associated risk factors in Khartoum, Sudan: population-based study. Int J Ophthalmol. 2017 Jun 18;10(6):948-954. doi: 10.18240/ijo.2017.06.18.

7- Tilahun M, Gobena T, Dereje D, Welde M, Yideg G. Prevalence of diabetic retinopathy and its associated factors among diabetic patients at Debre Markos referral hospital, Northwest Ethiopia, 2019: Hospital-Based Cross-Sectional Study. Diabetes Metab Syndr Obes. 2020;13:2179.

8- Yang Z, Tan TE, Shao Y, Wong TY, Li X. Classification of diabetic retinopathy: Past, present and future. Front Endocrinol (Lausanne). 2022 Dec 16;13:1079217. doi: 10.3389/fendo.2022.1079217.

9- Tan TE, Wong TY. Diabetic retinopathy: Looking forward to 2030. Front Endocrinol (Lausanne). 2023 Jan 9;13:1077669. doi: 10.3389/fendo.2022.1077669.

10- Lai D, Wu Y, Shao C, Qiu Q. The Role of Müller Cells in Diabetic Macular Edema. Invest Ophthalmol Vis Sci. 2023 Jul 3;64(10):8. doi: 10.1167/iovs.64.10.8.

11- Chen X, Chen L, Lin Y, Li G. Causality of Diabetic Nephropathy and Age-Related Macular Degeneration: A Mendelian Randomization Study. Gene. 2023 Dec 30;889:147787. doi: 10.1016/j.gene.2023.147787.

12- Tang H, Luo N, Zhang X, Huang J, Yang Q, Lin H, Zhang X. Association between biological aging and diabetic retinopathy. Sci Rep. 2024 May 2;14(1):10123. doi: 10.1038/s41598-024-60913-x.

13- Li M, Wang Y, Liu Z, Tang X, Mu P, Tan Y, Wang J, Lin B, Deng J, Peng R, Zhang R, He Z, Li D, Zhang Y, Yang C, Li Y, Chen Y, Liu X, Chen Y. Females with Type 2 Diabetes Mellitus Are Prone to Diabetic Retinopathy: A Twelve-Province Cross-

Sectional Study in China. J Diabetes Res. 2020 Apr 21;2020:5814296. doi: 10.1155/2020/5814296.

14- Qian J, Haq Z, Yang D, Stewart JM. Male sex increases the risk of diabetic retinopathy in an urban safety-net hospital population without impacting the relationship between axial length and retinopathy. Sci Rep. 2022 Jun 13;12(1):9780. doi: 10.1038/s41598-022-13593-4.