






Research



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 Mohammed Abumhadi, Othman Amin, Sigoud Mohammed,  Anas Mohamedelkhair, Esra Osman,  Mohamed Issak,  Wadah Mohammed, Omer Abdelmajid, Asjed Abdoun,  Mohamed Abdelaziz

Corresponding author: Mohammed Abumhadi, Faculty of Medicine and Health Science, University of Dongola, Dongola, Northern State, Sudan. mohammed.r.i.abumhadi@gmail.com

Received: 26 Apr 2024 - **Accepted:** 02 Jun 2024 - **Published:** 28 Jun 2024

Keywords: Diabetes mellitus, diabetic retinopathy, knowledge, attitude, practice, barrier, Dongola, Sudan

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Cite this article: Mohammed Abumhadi et al. Knowledge, attitudes, and practices regarding diabetic retinopathy among patients with diabetes in Dongola, Northern State, Sudan, 2022: a cross-sectional study. Pan African Medical Journal. 2024;48(77). 10.11604/pamj.2024.48.77.43765

Available online at: <https://www.panafrican-med-journal.com//content/article/48/77/full>

Knowledge, attitudes, and practices regarding diabetic retinopathy among patients with diabetes in Dongola, Northern State, Sudan, 2022: a cross-sectional study

Mohammed Abumhadi^{1,8}, Othman Amin¹, Sigoud Mohammed¹, Anas Mohamedelkhair², Esra Osman¹, Mohamed Issak¹, Wadah Mohammed¹, Omer Abdelmajid³, Asjed Abdoun¹, Mohamed Abdelaziz⁴

¹Faculty of Medicine and Health Science, University of Dongola, Dongola, Northern State, Sudan, ²Faculty of Medicine Health Science, Elrazi University, Khartoum, Sudan, ³Faculty of Medicine Health Science, Omdurman Islamic University, Khartoum, Sudan, ⁴Department of Internal Medicine, Faculty of Medicine Health Science, University of Dongola, Dongola, Northern State, Sudan

&Corresponding author

Mohammed Abumhadi, Faculty of Medicine and Health Science, University of Dongola, Dongola, Northern State, Sudan

Abstract

Introduction: diabetic retinopathy (DR) is a potential complication of diabetes mellitus (DM). Both are a significant public health burden globally, affecting millions of people. The aim of this study was to assess the knowledge, attitude and practice toward DR among patients with diabetes in Dongola, Northern State, Sudan. **Methods:** this was a cross-sectional hospital-based study conducted among patients with diabetes attending Al-Jemaih Diabetic Center, from September 2022 to June 2023. The data were collected through face-to-face interview using a semi-structured questionnaire. Data was analyzed using Statistical Package for Social Science (SPSS), version 26. Statistical tests like Chi-Square, logistic regression tests were performed to explore association and its strength, considering statistical significance at $p \leq 0.05$. **Results:** among the 241 patients who participated in the study, about two-third, 63.9% ($n=154$) being females. About half, 55.2% ($n=133$) had good DR knowledge, which was significantly associated with urban residence (aOR: 2.58, 95% CI: 1.45-4.62; $p=0.001$). Majority, 79.3% ($n=191$) reported favorable DR attitude. About two-third, 63.9% ($n=154$) reported good DR practice. However, only 27.8% ($n=67$) routinely go for eye check-up. Knowledge was significantly associated with practice (aOR: 2.18; 95% CI: 1.13-4.20; $p < 0.019$). The most common barrier reported hindering regular eye check-up was misconception that the eye check-up is not necessary, 39.4% ($n=65$). **Conclusion:** despite the good knowledge, favorable attitude and good practices, the regular eye check-up practice was significantly low. Urban residence was significantly associated with knowledge. Similarly, knowledge was found to be significantly associated with practice level. The most common barrier to regular eye check-up was the misconception that it is not important.

Introduction

Diabetes Mellitus (DM) is a chronic metabolic disorder characterized by elevated blood glucose levels due to the body's inability to produce insulin, effectively utilize it, or both [1]. It is a significant public health burden globally, with an estimated 537 million adults (20-79 years) living with diabetes in 2021 [2]. This number is steadily increasing, projected to reach 643 million by 2030 and 783 million by 2045 [2]. The prevalence is more common in low and middle-income countries, where access to healthcare services and awareness about the condition may be limited [2]. Diabetes mellitus has potential consequences on various organs within the body, with diabetic retinopathy (DR) being one of its many potential microvascular complications [3]. In DR, small blood vessels in the retina are damaged by high blood glucose, leading to leakage, swelling, formation of abnormal new blood vessels, and if left untreated, vision loss and irreversible blindness [4]. The prevalence of DR is significantly high, with a global prevalence of 22.27% [5]. The prevalence of DR is highest in Africa (35.90%) [5,6]. In Sudan, older studies from 1991 and 1995 reported a DR prevalence of 17.2% and 43%, [7,8]. A recent study from Makka eye complex in Khartoum reported a significantly higher prevalence of DR at 82.6% [9]. Several risk factors for developing DR among patients with DM include prolonged duration of diabetes, poor glycemic control, hypertension, dyslipidemia, and genetic factors [10]. Conversely, several strategies for preventing it have been proposed, such as maintaining normal blood glucose, blood pressure, and cholesterol levels; exercising; and regular eye check-ups [11]. Regarding the knowledge, attitudes, and practices (KAP) of patients with diabetes towards DR, several studies reported variable rates. For instance, a study from Eastern India reported average good knowledge (56.3%), a positive attitude (68.0%), and poor DR practices (66.6%) [12]. Another study from Northwest Ethiopia revealed an average level of good knowledge (47.4%) and poor practices (39.6%) [13]. Locally, a study from Khartoum reported poor eye

check-up practices (35.5%) [14]. While DM is more prevalent in Dongola, no previous study has assessed the KAP of patients with diabetes towards DR there. This is crucial for developing effective strategies for prevention, early detection, and management of the condition. This study aimed to assess the KAP towards DR among patients with diabetes in Dongola and determine the common barriers hindering good practice.

Methods

Study design and setting: the design used in the current study was a cross-sectional hospital-based study design, conducted between September 2022 and June 2023. The study setting was Al-Jemaih Diabetic Center, which is a large tertiary hospital that serves the patients with diabetes in the Northern State, Sudan. The study strictly adhered to the cross-sectional reporting guidelines of Strengthening of Reporting of Observational Studies in Epidemiology (STROBE) [15].

Study population: the study targeted patients with diabetes attending Al-Jemaih Diabetic Center for follow-up. Any adult (>18 years) diabetic patient, attending at Al-Jemaih Diabetic Center who provided consent for interview was included in the study. Patients with poor communication problems, severely ill, pregnant ladies, patients with mental illness, and those who did not give consent or complete the survey were excluded. A sample size was calculated using Rao soft sample size calculator and considering a confidence interval of 95%, a hypothesized prevalence of DM among the population of 16%, and margin of error of 5% as 207 [16]. It was increased up to 241 to compensate for low response rates, or incomplete responses. The sampling method was convenience sampling procedure.

Study variables: the independent study variables were the socio-demographic information which included sex, age, monthly income, educational level and residence. The dependent (outcome) variables were the knowledge, attitude, and practice of the participants towards DR. The both

variables were summarized and presented inform of frequencies and percentages. Comparative analysis was conducted between the independent and outcome variables, while considering the possible confounders.

Data collection: a semi-structured questionnaire developed, modified and adopted from several previous studies was used to collect data [12-14]. It was translated in to Arabic for avoidance of bias in simultaneous translation variations among the investigators. The tool consisted of 5 sections: i) sociodemographic data of the participants, comprised of 5 domains; ii) knowledge dimension, consisting of 10 questions; iii) attitudes dimension, consisting of 10 statements; iv) practices dimension, consisting of 6 questions; and (5) other relevant information section, consisting of 5 questions. The questionnaire was piloted on 15 patients using the questionnaire to evaluate the overall suitability, understandability and clarity of the instrument for the participants. For content validation, two experts in the researched topic (a consultant in internal medicine, and a clinical biochemist) reviewed and approved the questionnaire. To determine the reliability of the questionnaire, Cronbach's alpha coefficient was calculated, and was found to be 0.72, which is considered reliable [17]. The primary research data were collected via face-to-face interviews for over 6 months, in two separate times; from September to December 2022, and from March to May 2023. Prior to the interviews, participants were asked to answer each question honestly and based on the truth. A unique identification number was assigned for each data and to keep confidentiality, no personal identification information was collected.

Statistical analysis: the data were analyzed using the Statistical Package for Social Science (SPSS), version 26. Descriptive and comparative analyses were performed, and are presented in the form of tables and figures. For scoring purposes, a one-point score was assigned for each correct option, and a total score of 50% or more was considered good. The Chi-square test was conducted to assess the association between variables. Similarly,

univariable and multivariable Logistic Regression tests were used to assess the magnitude of the associated variables, with adjusted odd ratio to control for confounding. Missing and incomplete responses were removed from the final analysis. All statistical tests were judged to be significant at a p -value ≤ 0.05 .

Ethical consideration: the study was carried out in accordance with the Declaration of Helsinki. Ethical approval was obtained from the Research Ethical Committee of the Northern State Ministry of Health (Approval Number: 7/2022) and the research office of Al-Jemaih Diabetic Center. Informed written consent was obtained from all respondents prior to interviewing them.

Results

General characteristics of the study population: a total of 241 fulfilling the inclusion criteria were interviewed for the study. About two-third (154 (63.9%)) were females. Most of them aged 50-64 years 117 (48.5%), resided from rural residencies 146 (60.3%), had a moderate monthly income level of 100.00-500.00\$ 174 (72.2%), and were educated up to primary level 86 (35.7%). The socio-demographic data are illustrated in Table 1.

Knowledge of the study population about diabetic retinopathy: regarding the knowledge, the first section addressed the general knowledge of the patients regarding DM. In the section, majority identified the correct test for diagnosing DM (69.3%), and the one that reflects control of blood sugar (76.8%). Similarly, majority acknowledged that DM is a treatable disease (85.1%), and requires life-long control (88.0%). However, only few correctly identified all the factors that help keep DM under control (22%). In the second section, the questions assessed the knowledge of the participants about DR. Most of them knew that DM affects the eye (74.7%), and that it causes retinopathy and cataract (53.1%). However, only few knew that once DR is formed, no normal vision restoring is possible (30.3%), that all DM should have periodic and regular eye check-up for DR

(37.3%), and if not treated, it causes blindness (37.8%). Overall, the participants revealed average (55.2%) knowledge level about DR. This data is shown in Table 2.

Attitude of the study population toward diabetic retinopathy: in the attitude section, majority agreed to the importance of going regular check-up even if the blood glucose is under control (91.3%), and the possibility of keeping blood sugar under control (86.3%). Similarly, most of them agreed to going regular eye check-up even if the blood glucose is under control (71.4%) or there is no indication of eye problem (68.5%). In addition, majority disagreed skipping medications (64.7%), taking medications without prescription (85.9%), or replacing it with herbal medicines (68.5%). Less than half disagreed eating sweets (40.7%) and that normal blood glucose can be maintained by daily activities without exercise (38.2%). In general, most of the participants reported favorable attitude (79.3%) towards DR. Attitude assessment questions are illustrated in Table 3.

Practice of the study population regarding diabetic retinopathy: regarding the practice towards DR, majority reported taking medications as prescribed by their physicians (92.5%), not altering dose without physician consultation (74.3%), and on regular follow-up (83.0%). About half reported either working in high physical effort jobs (33.2%) or exercising sufficiently (19.1%). However, only about half (56.8%) reported going for regular eye check-up, and among them only few checked for the recommended frequency of once in three months (15.4%), or as advised per their physicians (12.4%). Generally, the overall practice level was good (63.9%). Table 4 demonstrates these aspects.

Factors associated with poor knowledge, attitude and practice: regarding the risk factors, (illustrated in Table 5, Table 6) urban residents were found to be two times more knowledgeable about DR than rural residents (aOR: 2.58, 95% CI: 1.45 - 4.62; $p = 0.001$). Knowledge was also significantly associated with practice level; participants with good knowledge about DR reported almost two times

more good practice than those with poor knowledge (aOR: 2.18, 95% CI: 1.13-4.20; $p < 0.019$). Physicians were the most common source of information (51.0%). The self-reported prevalence of DR and other eye diseases were 14.9% and 36.5% respectively. Private clinics were the most common centre reported for eye check-up (41.8%). The most common barriers hindering the regular follow-up and eye check-up was misconception that it's not important (38.8%) (Table 7) only few checked for the recommended frequency of once in three months (15.4%), or as advised per their physicians (12.4%).

Discussion

Diabetes mellitus and DR are growing burden that overwhelm both developing and developed countries, and unfortunately their incidences are on rise [2]. The current study aimed to explore the KAP of diabetic patients concerning DR at Al-Jemaih Diabetic Centre. The reported KAP levels were; average good knowledge (55.2%), positive attitude (79.3%), and good practice (63.9%). There was poor compliance to regular eye check-ups (27.8%), with the most common barrier reported being misconception that it is not important (39.4%). In the current study, 55.2% of participants had good knowledge about DR. This finding is consistent with similar studies from Northwest Ethiopia, and Saudi Arabia, which reported knowledge levels of 47.7%, and 52.9%, respectively [13,18], indicating a wider commonality in understanding DR among diabetic patients in these areas. The slightly higher percentage of knowledge in our study than in Ethiopia might reflect on differences in health education efforts or access to information. In contrast, two studies from Kenya and Yemen reported a significantly lower knowledge level of 33% and 32.2%, respectively [19,20]. The difference could be attributed to geographical, socio-cultural differences, and variations in the assessment tools used. Attitudes towards DR were notably positive in our study, with 79.3% of participants demonstrating a good attitude. This could be considered as a promising finding as positive

attitudes are crucial for proactive health behaviors [21]. Similar positive attitude rates (80.8% and 83.1%) were reported in the studies from Saudi Arabia and Egypt, respectively [18,22]. However, this contrasts sharply with studies from Mozambique and Pakistan, which reported poor attitude levels of 48.5%, and 27.5% (0.55 ± 0.15 out of a score of 2), respectively [22,23]. The disparity in attitude levels could be due to variations in the effectiveness of public health campaigns, healthcare access, and the overall health literacy of the populations studied.

Regarding practice, 64% of participants reported good overall practice scores. Similar good practice rates (66.6%) were reported in the study from Eastern India [12]. In contrast, the study from Northwest Ethiopia reported a lower good practice rate of 39.6% [13]. However, with this good practice rate in the current study, only 27.8% adhered to regular eye check-up practices. Similar low adherence rate (31%) was reported in a local study from Khartoum, indicating a local burden [14]. The lower adherence to regular eye check-ups is a significant concern because regular monitoring is essential for early detection and management of DR. The gap between general good practice and specific eye check-up practices suggests that while patients might adhere to general diabetes management routines, they may not fully recognize the importance of regular eye check-ups. This highlights the importance of targeted educational campaigns that emphasize the critical role of regular eye examinations in preventing vision loss. A study conducted in Egypt reported that diabetic patients' practice and attitude significantly improved after attending the health education sessions [24]. Urban residence was significantly associated with higher knowledge levels (aOR: 2.58, 95% CI: 1.45 - 4.62; $p = 0.001$) in the current study, a finding consistent with the study from Northwest Ethiopia (aOR: 2.65, 95% CI: 1.16 - 6.07; $p < 0.05$) [13]. Urban residents often have better access to healthcare facilities, educational resources, and media that disseminate health information, which likely contributes to their higher knowledge levels. This urban-rural disparity

underscores the need for focused health education and outreach programs in rural areas to bridge the knowledge gap. In addition, attitude was found to be significantly correlated with the practice level. Participants with a positive attitude towards DR were more than two times more likely to have better DR practices (aOR=2.18; 95% CI: 1.13-4.20; $p < 0.019$). These findings are consistent with those of the study from Eastern India and underscore the interconnectedness of KAP elements [12]. Promoting knowledge through education can positively influence and improve DR practices.

Regarding the barriers and low compliance to regular follow-up and eye check-up, the most common one identified in the current study was the misconception that regular check-ups are unnecessary (39.4%). This misconception was also reported in several studies from Khartoum, Kenya, and Pakistan, and highlights a critical area for intervention [14,19,23]. Misconceptions about the necessity of regular check-ups can lead to delayed diagnosis and treatment of DR, resulting in preventable vision loss. Addressing these misconceptions through targeted educational interventions is essential. Healthcare providers should emphasize the importance of regular eye examinations, regardless of the current state of blood glucose control, to prevent or manage DR effectively. Physicians were the main source of information for the patients in the current study (51%), which is consistent with studies from other regions, such as Khartoum, and Northwest Ethiopia [14,13]. These findings emphasize the crucial role that healthcare providers, play in educating patients about diabetes management and prevention of complications. The prevalence of DR in the current study was 14.9%, which aligns with the reported prevalence in the study of Khartoum, which was 13% [14]. This suggests that the burden of DR among patients with diabetes is relatively consistent across the country, highlighting the importance of regular eye screenings for individuals with diabetes to detect and manage this complication early. Additionally, the main center for regular eye check-ups reported in the current study being private clinics (41.8%) is

similar to the findings from the study of Khartoum, where 51% of patients also sought eye care at private clinics [14].

Strengths of the current study include the use of a content-validated and statistically reliable questionnaire, and a well-representative sample size. The content validity and statistical reliability of the questionnaire ensure that the findings are robust and reflective of the study population's actual KAP regarding DR. However, there are several limitations. The cross-sectional design limits the ability to establish causal relationships between knowledge, attitudes, and practices. Additionally, the reliance on self-reported data introduces the potential for response bias, although this was mitigated by conducting face-to-face interviews. In addition, there is temporal limitation as well, which may not allow continuous generalization of the findings, emphasizing the need for continuous monitoring and research to keep up with changes in KAP among patients with diabetes. Based on the findings in the current study, the researchers recommend addressing the reported barriers through providing comprehensive health education, and organizing routine, active awareness-raising campaigns and community-based strategic interventions regarding DR. Researchers also recommend further studies and interventions to promote eye check-up practices among the patients with diabetes.

Conclusion

The current study assessed the KAP among the patients with diabetes at Al-Jemaih Diabetic Center towards DR. Most participants demonstrated good knowledge, favourable attitude and good practices. However, the regular eye check-up practice was significantly low. Urban residence was significantly associated with good knowledge about DR. Similarly, knowledge was found to be significantly associated with practice level. The most common barrier to regular eye follow-up was the misconception that it is not important.

What is known about this topic

- *Diabetic retinopathy is a serious complication of diabetes mellitus with a global prevalence of 22.27%;*
- *Knowledge, attitudes, and practice rates towards diabetic retinopathy among the patients with diabetes revealed variations, most probably due to geo-socio-cultural differences;*
- *High proportion of patients with diabetes do not comply with DR screening protocol, mainly because of poor knowledge.*

What this study adds

- *The knowledge, attitudes, and practices towards diabetic retinopathy among the patients with diabetes from Al-Jemaih Diabetic Center were 55.2%, 79.3%, and 64%, respectively;*
- *Despite the average knowledge (55.2%), favourable attitudes (79.3%) and good practices (64.0%, only 27.8% reported going for regular eye check;*
- *The most common barrier to regular eye check-up was the misconception that it is not important (39.4%).*

Competing interests

The authors declare no competing interests.

Authors' contributions

Conception: Mohammed Abumhadi, Sigoud Mohammed, Anas Mohamedelkhair, and Esra Osman. Design of the study: Mohammed Abumhadi, Othman Amin, Sigoud Mohammed, Anas Mohamedelkhair, Esra Osman, Mohamed Issak, and Mohamed Abdelaziz. Data collection: Mohammed Abumhadi, Othman Amin, Sigoud Mohammed, Anas Mohamedelkhair, Esra Osman, Wadah Mohammed, Omer Abdelmajid, and Asjed Abdoun. Data analysis and interpretation: Mohamed Issak and Othman Amin. Supervision: Mohamed Abdelaziz. Writing original draft: Othman Amin, Sigoud Mohammed, Anas

Mohamedelkhair and Mohamed Issak. Writing review and editing: Mohammed Abumhadi, Esra Osman, Mohamed Issak, Wadah Mohammed, Omer Abdelmajid, and Asjed Abdoun, and Mohamed Abdelaziz. Equal contribution and joint first authorship: Mohammed Abumhadi, Othman Amin, Sigoud Mohammed, Anas Mohamedelkhair, Esra Osman, and Mohamed Issak. Guarantor of the study: Mohamed Abdelaziz. All the authors have read and agreed to the final manuscript.

Acknowledgments

The authors would like to express their thanks and gratitude to the administration of the Al-Jemaih Diabetic Centre and the State Ministry of Health for their collaboration in the ethical clearance process. The authors also thank all patients with diabetes who participated in the study for their time in participating in the survey.

Tables

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References

1. World Health Organization. Diabetes. Accessed on December 4, 2023.

2. International Diabetes Federation. IDF diabetes atlas 2021. Accessed on December 4, 2023.
3. Boyd K. Diabetic retinopathy: causes, symptoms, treatment. Accessed on December 4, 2023.
4. Burton MJ, Ramke J, Marques AP, Bourne RRA, Congdon N, Jones I *et al.* The lancet global health commission on global eye health: vision beyond 2020. *Lancet Glob Health.* 2021 Apr;9(4): e489-e551. **PubMed** | **Google Scholar**
5. Teo ZL, Tham YC, Yu M, Chee ML, Rim TH, Cheung N *et al.* Global prevalence of diabetic retinopathy and projection of burden through 2045: systematic review and meta-analysis. *Ophthalmology.* 2021 Nov;128(11): 1580-1591. **PubMed** | **Google Scholar**
6. Sun H, Saeedi P, Karuranga S, Pinkepank M, Ogurtsova K, Duncan BB *et al.* IDF Diabetes Atlas: Global, regional and country-level diabetes prevalence estimates for 2021 and projections for 2045. *Diabetes Res Clin Pract.* 2022 Jan;183: 109119. **PubMed** | **Google Scholar**
7. Elmahdi EMA, Kabbalo AMA, Mukhtar EA. Features of non-insulin-dependent diabetes mellitus (NIDDM) in the Sudan. *Diabetes Res Clin Pract.* 1991 Jan;11(1): 59-63. **PubMed** | **Google Scholar**
8. Elbagir MN, Eltom MA, Mahadi EO, Berne C. Pattern of long-term complications in Sudanese insulin-treated diabetic patients. *Diabetes Res Clin Pract.* 1995 Oct;30(1): 59-67. **PubMed** | **Google Scholar**
9. Elwali ES, Almobarak AO, Hassan MA, Mahmood 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 **PubMed** | **Google Scholar**
10. Yin L, Zhang D, Ren Q, Su X, Sun Z. Prevalence and risk factors of diabetic retinopathy in diabetic patients: a community based cross-sectional study. *Medicine (Baltimore).* 2020 Feb;99(9): e19236. **PubMed** | **Google Scholar**
11. Beaser RS, Turell WA, Howson A. Strategies to improve prevention and management in diabetic retinopathy: qualitative insights from a mixed-methods study. *Diabetes Spectr.* 2018 Feb;31(1): 65-74. **PubMed** | **Google Scholar**
12. Rana V, Sharma N, Bandopadhyay S, Sharma VK, Kakati K, Rao BV *et al.* Knowledge, attitude, and practices of diabetic patients toward diabetic retinopathy in a tertiary care hospital of eastern India: A cross-sectional study. *J Mar Med Soc.* 2023 Oct 10. **Google Scholar**
13. Assem AS, Tegegne MM, Alemu DS, Woredikal AT, Tefera TK. Knowledge about diabetic retinopathy, eye check-up practice and associated factors among adult patients with diabetes mellitus attending at debark hospital, Northwest Ethiopia. *BMC Ophthalmol.* 2020 Nov 18;20(1): 453. **PubMed** | **Google Scholar**
14. Ahmed M. Knowledge and awareness of diabetic retinopathy among diabetic Sudanese patients, Khartoum state, Sudan, 2018. *Sudan J Med Sci.* 2021;16(4): 476-488. **Google Scholar**
15. Elm E, Altman DG, Egger M, Von Elm E, Altman DG, Egger M, Pocock SJ, Gøtzsche PC, Vandembroucke JP *et al.* The strengthening the reporting of observational studies in epidemiology (STROBE) statement: guidelines for reporting observational studies. *Int J Surg.* 2014 Dec 1;12(12): 1495-9. **Google Scholar**
16. International Diabetes Federation. Sudan - International Diabetes Federation. Accessed on November 27, 2023.
17. Hajjar S. Statistical analysis: internal-consistency reliability and construct validity. *Int J Quan Qualit Res Meth.* 2018;6(1): 27-38. **Google Scholar**
18. Alqahtani TF, Alqarehi R, Mulla OM, Alruwais AT, Alsaadi SS, Algarni H *et al.* Knowledge, attitude, and practice regarding diabetic retinopathy screening and eye management among diabetics in Saudi Arabia. *Cureus.* 2023;15(9): e46190. **Google Scholar**
19. Faith LC, Kimani H. Knowledge, attitude and predictors of diabetic retinopathy screening among patients with type 2 diabetes in Nairobi County, Kenya. *J Health Soc Sci.* 2019;4(2): 253-264. **Google Scholar**

20. Al-Eryani SA, Al-Shamahi EY, AlShamahi EM, Al-Shamahy HA. Knowledge and Awareness of Diabetic Retinopathy among Diabetic Patients, in Sana'a City, Yemen. *Ann Clin Case Rep.* 2023;8: 2441. **Google Scholar**
21. Ahmed NGA, Hamza MF, Hassan SN. Knowledge, Practice and Attitude of Diabetic Patients Regarding Prevention of Diabetic Retinopathy. *JSFS.* 2023;10(3S): 3896-3910. **Google Scholar**
22. Bambamba J, Fumo M, Bambamba A, Mazalo J, Pires P. Knowledge, attitude and practice about diabetic retinopathy among diabetic patients attending the department of endocrinology at Nampula Central Hospital in Mozambique during 20 Modern Research in Vision and Ophthalmology. 2022;1(1). **Google Scholar**
23. Javaeed A, Hameed Z, Ghauri SK, Mustafa KJ, Wajid Z. The Knowledge, Attitude, and Practices of diabetic retinopathy amongst diabetic patients of Azad Jammu, Kashmir. *RMJ.* 2021;46(1): 26-29. **Google Scholar**
24. Hamed MH. Effect of educational sessions about prevention of retinopathy on knowledge, attitude and practice of diabetic patients. *Egypt J Health Care.* 2022;13(1): 1783-1794. **Google Scholar**

Table 1: socio-demographics of the study participant, 2023

Characteristics	Frequency	Percent
Sex		
Male	87	36.1
Female	154	63.9
Age (years)		
< 50 years	60	27.4
50-64 years	117	48.5
>64 years	58	24.1
Monthly income (in USD)		
<100.00\$	54	22.4
100.00 - 500.00\$	174	72.2
>500.00\$	13	5.4
Educational level		
Uneducated	58	24.1
Primary school	86	35.7
Secondary school	57	23.7
University	40	16.6
Residence		
Rural	146	60.3
Urban	96	39.7

Table 2: knowledge of the study participant towards diabetic retinopathy, 2023

Question	Frequency	Percent (%)
What are the tests used in diagnosis of diabetes mellitus?		
Blood test	59	24.5
Urine test	5	2.1
Both	167	69.3
Others	10	4.1
What are the factors that help keeping diabetes mellitus under control?		
Medication only	51	21.2
Diet only	117	48.5
Exercise only	14	5.8
Weight reduction only	6	2.5
Regular follow-up only	0	0
All above	53	22.0
Diabetes mellitus is?		
Curable	16	6.6
Treatable	205	85.1
Malignant	5	2.1
Self-limiting	3	1.2
None of the above	12	5.0
Control of diabetes mellitus should be?		
Until sugar level gets under control	13	5.4
Life-long	212	88.0
Any other	16	6.6
Which test reflects control of blood sugar for a long period?		
HbA1c test	185	76.8
Other	56	23.2
Does diabetes mellitus affect eyes?		
Yes	180	74.7
No	61	25.3
What problems can patients with DM have in the eye?		
Retinopathy & cataract	129	53.1
Infection	1	0.4
Others	51	21.2
No effect	61	25.3
Can a person with DR have normal vision?		
Yes	54	9.1
No	174	30.3
I don't know	13	35.3
No effect	61	25.3
Can DR cause blindness?		
Yes	91	37.8
No	2	0.8
I don't know	87	36.1
No effect	61	25.3
Should patients with DM have regular eye check-up for DR?		
Yes	90	37.3
No	5	2.1
I don't know	85	35.3
No effect	61	25.3
Overall Knowledge Score		
Poor	108	44.8
Good	133	55.2
DR: diabetic retinopathy; DM: diabetes mellitus		

Table 3: attitude of the study participant towards diabetic retinopathy, 2023		
Statement	Frequency	Percent (%)
Options	Agree	Disagree
It is ok to eat sweets from time to time	143 (59.3%)	98 (40.7%)
It is acceptable to skip some medications	85 (35.3%)	(64.7%)
Going to regular check-up even if a blood glucose is under good control	220 (91.3%)	21 (8.7%)
Daily activities without exercises are enough to maintain normal blood glucose	149 (61.8%)	92 (38.2%)
It is possible to keep blood sugar under control, thus preventing some of the complications that related to DM	208 (86.3%)	33 (13.7%)
Regular use of herbal medicine can replace ordinary hypoglycemic agents	74 (31.5%)	165 (68.5%)
It's acceptable to take medications without physician prescription	34 (14.1%)	207 (85.9%)
Going to regular eye check-up even if a blood glucose is under control	172 (71.4%)	69 (28.6%)
Going to regular eye check-up even if there is no indicator for any eye problem	165 (68.5%)	76 (31.5%)
When eye vision becomes poor, its purposeless to take medication and continue regular checkup	51 (21.2%)	190 (78.8%)
Overall attitude score		
Negative	50 (20.7%)	
Positive	191 (79.3%)	
DM: diabetes mellitus		

Table 4: practice of the study participant towards diabetic retinopathy, 2023		
Question	Frequency	Percent (%)
Do you take medications for Diabetes mellitus as advised by the physician?		
Yes	223	92.5
No	18	7.5
Does your job demand high physical effort or exercise sufficiently?		
High physical effort job*	80	33.2
Sufficient exercise**	46	19.1
None	115	47.7
Do you alter medication dose depend on your meal habits without physician consultation?		
Yes	62	25.7
No	179	74.3
Do you visit your physician for regular follow-up?		
Yes	200	83.0
No	41	17.0
Do you go for regular eye check-up?		
Yes	137	56.8
No	104	43.2
How often do you go for regular eye check-up?		
Once every 3 months or as advised by the doctors	37	27.8
Once every 6 months	26	10.8
Once every year	44	18.3
None	104	43.2
Overall practice score		
Poor	87	36.1
Good	154	63.9

Table 5: correlation of basic characteristics of the studied participants with diabetic retinopathy, knowledge, attitude, and practice, using Chi-Square Test, 2023

Variable	Knowledge	Attitude	Practice
Correlation	P-value	P-value	P-value
Sex			
Male	0.059	0.728	0.910
Female			
Age			
<50 years	0.405	0.769	0.753
50-64 years			
>64 years			
Educational level			
Uneducated	0.227	0.085	0.478
Primary School			
Secondary School			
Monthly income (USD)			
<100.00\$	0.225	0.140	0.984
100.00-500.00\$			
>500.00\$			
Residence			
Rural	<0.001*	0.228	0.146
Urban			
Knowledge about DR			
Poor	NA	0.037*	0.031*
Good			
Attitude towards DR			
Negative	NA	NA	0.009*
Positive			
*: Statistically significant; NA: not applicable; DR: diabetic retinopathy			

Table 6: risk assessment of factors affecting the knowledge and attitude of the study participants towards diabetic retinopathy, using univariable and multivariable logistic regression test, 2023

Variable	cOR (95% CI)	P-value	aOR (95% CI)	P-value	
Knowledge	Residence				
	Rural	Reference			
	Urban	2.68 (1.56-4.62)	<0.001*	2.58 (1.45-4.62)	0.001*
Attitude	Knowledge about DR				
	Poor	Reference			
	Good	1.96 (1.04-3.68)	0.037*	1.82 (0.94-3.54)	0.077
Practice	Knowledge about DR				
	Poor	Reference			
	Good	1.79 (1.05-3.05)	0.031*	1.61 (0.91-2.84)	0.098
	Attitude towards DR				
	Negative	Reference			
Positive	2.39 (1.23-4.35)	0.009*	2.18 (1.13-4.20)	0.019*	
*: Statistically significant; cOR: crude odd ration; aOR: adjusted odd ratio; DR: Diabetic retinopathy					

Table 7: other relevant information from the study participant, 2023		
Variable	Frequency	Percent (%)
Source of knowledge about DR*		
Physician	75	51.0
Television	21	14.3
Books	7	9.5
Neighbors	30	20.4
Others	14	4.8
Diagnosed with DR?		
Yes	36	14.9
No	200	83.0
Not sure	5	2.1
Diagnosed with another eye disease?		
Yes	88	36.5
No	149	61.8
Not sure	4	1.7
Center for regular eye checkup? *		
Public hospital	26	38.8
Private hospital	28	41.8
Specialized eye center	10	14.9
Other	3	4.5
Barriers towards regular follow-up and eye check-up? **		
Misconception that it is not important	65	39.4
Lack of trust in the physician	11	6.7
Far distance of the healthcare center	19	11.5
Financial problem	15	9.1
Busy timetable	21	12.7
Others	34	20.6
*: Multiple response analysis; **: multiple response analysis (Only those who reported non-compliance to regular follow-up and eye check-ups were included) DR: diabetic retinopathy		