

ORIGINAL ARTICLE

Risk Factors Leading to Diabetic Retinopathy Among Diabetic Patients Presenting to DHQ Hospital DI Khan

Muhammad Usman¹, Muhammad Kamran Khalid², Muhammad Abdullah³ and Uroosa Kawal⁴

^{1,2,3,4} Department of Ophthalmology, DHQ Teaching Hospital, Dera Ismail Khan

ABSTRACT

Background: Diabetic retinopathy is a common microvascular complication of type 2 diabetes mellitus and a major cause of preventable vision loss. Poor glycemic control, hypertension, and prolonged diabetes duration are important risk factors associated with disease progression.

Methods: This cross-sectional study was carried out at the Department of Ophthalmology, DHQ Hospital DI Khan, over a six-month period following ethical approval. Using non-probability consecutive sampling, 166 patients diagnosed with type 2 diabetes mellitus and diabetic retinopathy were enrolled. Demographic and clinical data including age, gender, duration of diabetes, hypertension status, family history of diabetes, and HbA1c levels were recorded on a structured proforma. Fundoscopic examination was performed by a consultant ophthalmologist with a minimum of five years of post-fellowship experience. Disease severity and associated risk factors, namely dyslipidemia and albuminuria, were documented and analyzed using SPSS version 26.0.

Results: The average age of the participants was 55.44 ± 10.07 years, average HbA1c level was $8.01 \pm 1.31\%$, and average duration of the disease was 7.40 ± 3.40 years. Hypertension was present in 74.3% of the patients, while a family history of diabetes was observed in 54.8%. The prevalence rate for each of the severity grades of retinopathy was as follows: grade 1 - 47.6%, grade 2 - 28.9%, grade 3 - 14.5%, and grade 4 - 9.0%. Total hypercholesterolemia occurred in 43.4%, LDL cholesterol elevation in 51.8%, and albuminuria in 36.1% of the patients. Stratification analysis did not show any statistically significant relationship between lipid disorders and albuminuria with the other variables considered (age, location of residence, hypertension)

Conclusion: Diabetic retinopathy was a common occurrence within this group of type 2 diabetics, with most being in the mild to moderate category. Diabetes mellitus duration, poor glycemic control, high blood pressure, and abnormal lipid profile were the main risk factors found. Retinal examination and strict metabolic control are essential in preventing further deterioration and loss of vision.

Keywords: Diabetic retinopathy, Type 2 diabetes mellitus, Dyslipidemia, Albuminuria, HbA1c, Hypertension.

This article may be cited as: Usman M, Khalid MK, Muhammad Abdullah, Kawal U. Risk factors leading to diabetic retinopathy among diabetic patients presenting to DHQ Hospital DI Khan. *Int J Pathol*;24(2). DOI: <https://doi.org/10.59736/IJP.24.02.1076>

Introduction

Diabetes mellitus is a condition which results in the chronic presence of hyperglycemia, due to either the inadequate production of insulin or problems with its function(1).

CORRESPONDING AUTHOR:

Muhammad Kamran Khalid

Department of Ophthalmology,
DHQ Teaching Hospital, Dera Ismail Khan
Email: drkamrankhalid786@gmail.com

Diabetes mellitus type 2, commonly known as T2DM, constitutes the vast majority of all cases of diabetes worldwide and presents a well-known problem related to microvascular and macrovascular complications, which play an important role in morbidity and early death among patients(2,3). Among the microvascular complications, diabetic retinopathy (DR) can be considered one of the most notable contributors to visual impairment and loss of vision within the adult population(4,5). In essence, diabetic retinopathy represents a progressive condition of retinal microangiopathy as a result of hyperglycemia. Pathologically, there are processes like oxidative stress, endothelial cell damage, thickened basement membrane, and deposition of advanced glycation end-products, leading to retinal ischemia and increased vascular permeability(6,).Clinically, this disease manifests itself in the appearance of microaneurysms, retinal hemorrhage, cotton wool spots, hard exudates, and even neovascularization eventually ending with tractional retinal detachment(7,8). Regarding epidemiology, this disease creates significant burden both for society and medical professionals. As per 2019 estimates, it was reported that about 463 million adults have been diagnosed with diabetes worldwide, of whom about one-third had developed retinopathy(9,10). In spite of successful development in terms of therapeutic approaches such as anti-VEGF treatment, laser photocoagulation, and pars plana vitrectomy, this condition imposes considerable economic burden, especially in developing and low- to medium-income countries due to a lack of specialists(11). The profile of risk factors in relation to DR is very heterogeneous. Some of them

include both the modifiable and non-modifiable risk factors. Diabetes mellitus, prolonged duration of the condition, poorly controlled glycemic levels, high blood pressure, abnormal lipid levels, older age, presence of obesity, kidney disease, and family history of DM have all been considered to be risk factors for developing DR(12). Out of these risk factors, increased HbA1c levels and poorly controlled hypertension have been found to be strongly correlated with deteriorated retinal vascular damage and worsening retinopathy(13). While abnormalities of lipid metabolism and albuminuria are indicators of widespread endothelial cell dysfunction and have been associated specifically with the formation of retinal hard exudates and increased DR severity(14,15).

Within the population of Pakistan, prevalence rates for DR among T2DM vary greatly ranging from 24% to over 50%. These variations are mainly due to differences in the demographic composition, diabetes mellitus course, and the level of glucose regulation of patients in different healthcare facilities(16). Nevertheless, the lack of regional statistics concerning DR in Khyber Pakhtunkhwa and particularly Dera Ismail Khan prevents efficient prevention and treatment of the disease in this area.

In this regard, the present study was conducted to establish the prevalence of risk factors contributing to the development of diabetic retinopathy among patients with T2DM attending DHQ Hospital, Dera Ismail Khan. Hopefully, the results will help in identifying the prevalence of local risk factors and developing effective prevention and treatment strategies for the target population.

Methods

This cross-sectional study was conducted at the Department of Ophthalmology, DHQ Hospital Dera Ismail Khan, from 15th September 2025 to 15th February 2026. A non-probability consecutive sampling technique was used for recruitment of study participants.

The sample size was calculated to be 166 patients using the WHO sample size calculator by taking the prevalence of high total cholesterol (28.79%) among patients with diabetic retinopathy in type 2 diabetes mellitus from a previous study, (10) with a confidence level of 95% and a margin of error of 6.9%.

Patients aged 30–70 years, of either gender, diagnosed with type 2 diabetes mellitus for at least one year and having diabetic retinopathy were included in the study. Patients with retinopathy secondary to other causes including hypertensive retinopathy, central retinal vein occlusion, and central serous retinopathy were excluded. Patients with cataract causing obscuration of fundus visualization or other confounding retinal pathologies were also excluded from the study.

Ethical approval was obtained from the Ethical Review Committee, Gomal Medical College, Dera Ismail Khan (Approval No. 273/GJMS/IC dated 13-06-2025) prior to commencement of the study. Written informed consent was obtained from all participants after explaining the objectives and procedures of the study.

Demographic and clinical information including age, gender, duration of diabetes mellitus, hypertension status, family history of diabetes, and recent HbA1c levels were recorded using a structured proforma. A detailed medical and ophthalmic examination was performed in all patients.

Fundoscopy examination was carried out by a consultant ophthalmologist having at least five years of post-fellowship experience to assess the severity of diabetic retinopathy.

Risk factors including elevated total cholesterol, raised low-density lipoprotein (LDL) cholesterol, albuminuria, hypertension, and family history of diabetes were evaluated against predefined operational definitions established prior to data collection. Strict data confidentiality was maintained throughout; all records were stored in password-protected files accessible exclusively to the investigating team.

Results
A total number of 166 patients suffering from type 2 diabetes mellitus accompanied by diabetic retinopathy were enrolled in this study. The average age of the subjects was 55.44 ± 10.07 years, the average HbA1c value was $8.01 \pm 1.31\%$, while the average length of diabetes mellitus was 7.40 ± 3.40 years. The existence of hypertension among the patients was noted in 124 (74.7%). Considering the age composition of the subjects, the group aged between 51 and 60 years formed the highest percentage, consisting of 60 (36.1%) subjects, followed by the subjects aged more than 60 years, which formed 47 (28.3%). The male gender comprised 92 (55.4%) of the total subjects, while females comprised 74 (44.6%). There was a family history of diabetes mellitus in 91 (54.8%) of the subjects. Regarding the location of residence, 85 (51.2%) of the subjects lived in the countryside, while 81 (48.8%) resided in urban settings.

Table 1: Demographic and Clinical Characteristics of Study Participants (n=166)

Variables	Frequency (%) / Mean $\pm$ SD
Age (years)	55.44 $\pm$ 10.07
HbA1c (%)	8.01 $\pm$ 1.31
Duration of diabetes (years)	7.40 $\pm$ 3.40
Hypertension	
Yes	124 (74.7)
No	42 (25.3)
Age Groups	
30–40 years	20 (12.0)
41–50 years	39 (23.5)
51–60 years	60 (36.1)
>60 years	47 (28.3)
Gender	
Male	92 (55.4)
Female	74 (44.6)
Family History of Diabetes	
Yes	91 (54.8)
No	75 (45.2)
Residence Area	
Urban	81 (48.8)
Rural	85 (51.2)

Grade 1 diabetic retinopathy was the most frequently observed severity grade, present in 79 (47.6%) patients, followed by Grade 2 in 48 (28.9%), Grade 3 in 24 (14.5%), and Grade 4 in 15 (9.0%) patients. Elevated total cholesterol

was observed in 72 (43.4%) patients, while raised LDL cholesterol was found in 86 (51.8%) patients. Albuminuria was present in 60 (36.1%) patients (Table 2).

Table 2: Severity of Diabetic Retinopathy and Associated Risk Factors (n=166)

Variables	Frequency (%)
Severity of Diabetic Retinopathy	
Grade 1	79 (47.6)
Grade 2	48 (28.9)
Grade 3	24 (14.5)
Grade 4	15 (9.0)
Risk Factors	
High Total Cholesterol	72 (43.4)
Raised LDL Cholesterol	86 (51.8)
Albuminuria	60 (36.1)

Stratification analysis demonstrated no statistically significant association between raised LDL cholesterol and age groups ($p=0.74$), hypertension ($p=0.24$), family history of diabetes mellitus ($p=0.19$), or residence area ($p=0.11$). Similarly, no significant association was observed between

elevated total cholesterol and age groups ($p=0.41$), hypertension ($p=0.81$), family history of diabetes mellitus ($p=0.08$), or residence area ($p=0.12$). Furthermore, albuminuria also showed no statistically significant association with age groups ($p=0.24$), hypertension ($p=0.57$), family

history of diabetes mellitus ($p=0.53$), or residence area ($p=0.92$) (Table 3).

Table 3: Stratification of Risk Factors with Respect to Different Clinical and Demographic Variables (n=166)

Raised LDL Cholesterol			
Variables	Yes n (%)	No n (%)	p-value
Age Groups			0.41
30-40 years	9 (12.5)	11 (11.7)	
41-50 years	21 (29.2)	18 (19.1)	
51-60 years	22 (30.6)	38 (40.4)	
>60 years	20 (27.8)	27 (28.7)	
Hypertension			0.81
Yes	54 (75.0)	69 (73.4)	
No	18 (25.0)	25 (26.6)	
Family History of Diabetes			0.08
Yes	34 (47.2)	57 (60.6)	
No	38 (52.8)	37 (39.4)	
Residence Area			0.12
Urban	40 (55.6)	41 (43.6)	
Rural	32 (44.4)	53 (56.4)	
High Total Cholesterol			
Variables	Yes n (%)	No n (%)	p-value
Age Groups			0.24
30-40 years	11 (18.3)	9 (8.5)	
41-50 years	12 (20.0)	27 (25.5)	
51-60 years	19 (31.7)	41 (38.7)	
>60 years	18 (30.0)	29 (27.4)	
Hypertension			0.57
Yes	46 (76.7)	77 (72.6)	
No	14 (23.3)	29 (27.4)	
Family History of Diabetes			0.53
Yes	31 (51.7)	60 (56.6)	
No	29 (48.3)	46 (43.4)	
Residence Area			0.92
Urban	29 (48.3)	52 (49.1)	
Rural	31 (51.7)	54 (50.9)	
Albuminuria			
Variables	Yes n (%)	No n (%)	p-value
Age Groups			0.24
30-40 years	11 (18.3)	9 (8.5)	
41-50 years	12 (20.0)	27 (25.5)	

51-60 years	19 (31.7)	41 (38.7)	
>60 years	18 (30.0)	29 (27.4)	
Hypertension			0.57
Yes	46 (76.7)	77 (72.6)	
No	14 (23.3)	29 (27.4)	
Family History of Diabetes			0.53
Yes	31 (51.7)	60 (56.6)	
No	29 (48.3)	46 (43.4)	
Residence Area			0.92
Urban	29 (48.3)	52 (49.1)	
Rural	31 (51.7)	54 (50.9)	

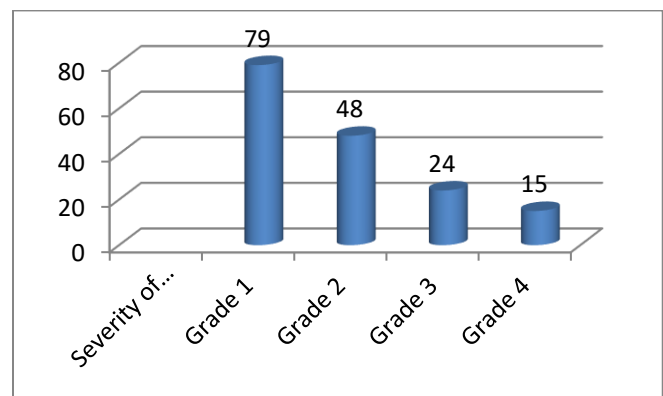


Fig 1: Frequency of patients on the basis of Severity of Diabetic Retinopathy

Discussion

The present study was conducted to determine the frequency of risk factors associated with diabetic retinopathy among patients with type 2 diabetes mellitus presenting to DHQ Hospital Dera Ismail Khan. The findings of the study demonstrated that diabetic retinopathy was commonly observed among diabetic patients, with mild to moderate grades being the predominant presentation. The study also identified poor glycemic control, longer duration of diabetes mellitus, hypertension, dyslipidemia, and albuminuria as important associated risk factors.

In the present study, Grade 1 diabetic retinopathy was the most frequently observed

stage, followed by Grade 2 disease, whereas advanced grades were comparatively less common. These findings are comparable to previous national and international studies reporting that non-proliferative diabetic retinopathy constitutes the majority of cases detected during routine ophthalmic evaluation(17,18). Early-stage disease predominance in the present study may reflect increasing awareness and improved access to ophthalmic screening services among diabetic patients.

Indeed, the average HbA1c value found among participants surpassed the threshold set for optimal glycosylated hemoglobin value, suggesting poor glycemic control as a characteristic trait of this study sample. Notably, prolonged hyperglycemia constitutes an indispensable factor in the development of diabetic retinopathy by contributing to such phenomena as oxidative stress, impairment of the endothelium, thickening of the capillary basement membrane, and gradual retinal microvascular damage. Consequently, hyperglycemia leads to retinal ischemia, vascular permeability, and progressive degeneration of the retina. These findings correlate with the results of previous research, in which HbA1c was found to be a strong predictor of the risk of developing diabetic retinopathy and its further progression(19,20,21).

Notably, most participants suffered from hypertension. It can be assumed that this factor also contributed to the development of retinal disease by increasing permeability of the vessels and leading to progressive damage of the capillaries. Therefore, the significance of hypertension in the development of diabetic retinopathy is consistent with the findings of studies showing that tight control of blood pressure substantially reduces the likelihood

of retinal disease progression in type 2 diabetes mellitus patients(22,23).

In addition, dyslipidemia was a common characteristic, evidenced by significant numbers of patients with high total cholesterol and increased LDL cholesterol. The stratification analysis failed to show any statistically significant correlation between the abnormalities of lipids metabolism and the demographic factors studied. However, this does not mean that no association exists since dyslipidemia is known to play a role in the development of retinal hard exudates and vascular damage in diabetic patients. This has been confirmed in several previous studies conducted on similar populations(24,25). The lack of statistical significance can be attributed in part to the insufficient number of samples analyzed.

Over a third of patients showed signs of albuminuria, highlighting that there is also endothelial dysfunction affecting microvessels outside the retina. It is clear that the existence of diabetes nephropathy and retinopathy is linked because both conditions result from the same pathogenetic process of microangiopathy caused by chronic hyperglycemia of small vessels of susceptible organs. Similar observations regarding the relationship between the severity of albuminuria and retinopathy have been made previously(26,27).

Study Limitations

This research involves several limitations that are intrinsic to its nature. As a single-center cross-sectional study, the results cannot be generalized to other groups of people, and the study design itself cannot help establish any causality between risk factors involved in the development of diabetic retinopathy. There is a need for multi-center longitudinal research

to better describe this correlation among the local community.

Conclusion

Among type 2 diabetics in this hospital cohort study, the prevalence of diabetic retinopathy is high, and mild to moderate disease is most commonly observed. The main risk factors for developing diabetic retinopathy include the duration of the condition, inadequate glycemic control, hypertension, dyslipidemia, and albuminuria. Collectively, these results highlight the need for effective screening protocols for diabetic retinopathy in those with prolonged disease course and poor systemic risk factor control. Effective control of blood glucose levels, blood pressure, and lipids together will be critical to prevent further progression of retinopathy in such diabetics.

Conflict of Interest: The authors declare no conflict of interest.

Funding: No external funding was received for this study.

Ethical Approval

Ethical approval for the study was obtained from the Ethical Review Committee, Gomal Medical College, Dera Ismail Khan (Approval No. 273/GJMS/IC dated 13-06-2025).

References

1. Yameny AA. Diabetes mellitus overview 2024. *J Biosci Appl Res.* 2024;10(3):641–5.
2. Tomic D, Shaw JE, Magliano DJ. The burden and risks of emerging complications of diabetes mellitus. *Nat Rev Endocrinol.* 2022;18(9):525–39.
3. Antar SA, Ashour NA, Sharaky M, Khattab M, Ashour NA, Zaid RT, et al. Diabetes mellitus: Classification, mediators, and complications; A gate to identify potential targets for the development of new effective treatments. *Biomed Pharmacother.* 2023; 168:115734.
4. ZakirM, Ahuja N, Surksha MA, Sachdev R, Kalariya Y, Nasir M, et al. Cardiovascular complications of diabetes: from microvascular to macrovascular pathways. *Cureus.* 2023;15(9).
5. Mansour A, Mousa M, Abdelmannan D, Tay G, Hassoun A, Alsafar H. Microvascular and macrovascular complications of type 2 diabetes mellitus: Exome wide association analyses. *Front Endocrinol.* 2023; 14:1143067.
6. Yang Z, Tan TE, Shao Y, Wong TY, Li X. Classification of diabetic retinopathy: Past, present and future. *Front Endocrinol.* 2022; 13:1079217.
7. Yavuz DG. Classification, risk factors, and clinical presentation diabetic neuropathy. In: *Diabetic neuropathy.* Elsevier; 2022. p. 1–9.
8. Mounirou BA, Adam ND, Yakoura AK, Aminou MS, Liu YT, Tan LY. Diabetic retinopathy: an overview of treatments. *Indian J Endocrinol Metab.* 2022;26(2):111–8.
9. Ansari P, Tabasumma N, Snigdha NN, Siam NH, Panduru RV, Azam S, et al. Diabetic retinopathy: an overview on mechanisms, pathophysiology and pharmacotherapy. *Diabetology.* 2022;3(1):159–75.
10. Lundeen EA, Burke-Conte Z, Rein DB, Wittenborn JS, Saaddine J, Lee AY, et al. Prevalence of diabetic retinopathy in the US in 2021. *JAMA Ophthalmol.* 2023;141(8):747–54.
11. Benhamza M, Dahlui M, Said MA. Determining direct, indirect healthcare and social costs for diabetic retinopathy

- management: a systematic review. *BMC Ophthalmol.* 2024;24(1):424.
12. Zhang G, Chen W, Chen H, Lin J, Cen LP, Xie P, et al. Risk factors for diabetic retinopathy, diabetic macular edema, and sight-threatening diabetic retinopathy. *Asia-Pac J Ophthalmol.* 2024;13(3):100067.
13. Scanlon PH. Improving the screening of risk factors in diabetic retinopathy. *Expert Rev Endocrinol Metab.* 2022;17(3):235–43.
14. Yang J, Liu Z. Mechanistic pathogenesis of endothelial dysfunction in diabetic nephropathy and retinopathy. *Front Endocrinol.* 2022; 13:816400.
15. Li Y, Liu Y, Liu S, Gao M, Wang W, Chen K, et al. Diabetic vascular diseases: molecular mechanisms and therapeutic strategies. *Signal Transduct Target Ther.* 2023;8(1):152.
16. Jokhio AH, Talpur KI, Shujaat S, Talpur BR, Memon S. Prevalence of diabetic retinopathy in rural Pakistan: A population based cross-sectional study. *Indian J Ophthalmol.* 2022;70(12):4364–9.
17. Arabi A, Tadayoni R, Ahmadi H, Shahraki T, Nikkhah H. Update on management of non-proliferative diabetic retinopathy without diabetic macular edema; is there a paradigm shift? *J Ophthalmic Vis Res.* 2022;17(1):108.
18. Mogilevskyy SI, Serdiuk A, Ziablitsev S. Prognostic biomarkers of non-proliferative diabetic retinopathy progression in type 2 diabetes mellitus. *J Ophthalmol (Ukr).* 2024;(4):38-45. doi:10.31288/oftalmolzh202443845.
19. Washirasaksiri C, Srivanichakorn W, Borrisut N, Sitasuwan T, Tinmanee R, Kositamongkol C, et al. Fasting plasma glucose and HbA1c levels predict the risk of type 2 diabetes and diabetic retinopathy in a Thai high-risk population with prediabetes. *Front Pharmacol.* 2022; 13:950225.
20. Zhu C, Zhu J, Wang L, Xiong S, Zou Y, Huang J, et al. Development and validation of a risk prediction model for diabetic retinopathy in type 2 diabetic patients. *Sci Rep.* 2023;13(1):5034. doi:10.1038/s41598-023-31463-5.
21. Guo Y, Yonamine S, Ma CJ, Stewart JM, Acharya N, Arnold BF, et al. Developing and validating models to predict progression to proliferative diabetic retinopathy. *Ophthalmol Sci.* 2023;3(2):100276.
22. Zhang M, Wu J, Wang Y, Wu J, Hu W, Jia H, et al. Associations between blood pressure levels and diabetic retinopathy in patients with diabetes mellitus: A population-based study. *Heliyon.* 2023;9(6).
23. Do DV, Han G, Abariga SA, Sleilati G, Vedula SS, Hawkins BS. Blood pressure control for diabetic retinopathy. *Cochrane Database Syst Rev.* 2023;(3).
24. Li Z, Yuan Y, Qi Q, Wang Q, Feng L. Relationship between dyslipidemia and diabetic retinopathy in patients with type 2 diabetes mellitus: a systematic review and meta-analysis. *Syst Rev.* 2023;12(1):148. doi:10.1186/s13643-023-02321-2.
25. Chen X, Zhang X, Gong Z, Yang Y, Zhang X, Wang Q, et al. The link between diabetic retinal and renal microvasculopathy is associated with dyslipidemia and upregulated circulating level of cytokines. *Front Public Health.* 2023; 10:1040319.
26. Dash S, Chougule A, Mohanty S. Correlation of albuminuria and diabetic retinopathy in type II diabetes mellitus patients. *Cureus.* 2022;14(2): e21927. doi:10.7759/cureus.21927.

27. Gibelalde A, Amenabar Alonso A, Pinar-Sueiro S, Bilbao-Garay I, Juaristi Eizmendi L, Sampedro A. Albuminuria as a biomarker of severity in diabetic

retinopathy and in the response to intravitreal treatment in diabetic macular edema. *Int Ophthalmol.* 2023;43(6):2049-2056. doi:10.1007/s10792-022-02604-y

HISTORY	
Date received:	15-05-2026
Date sent for review:	21-06-2026
Date received reviewers comments:	23-06-2026
Date received revised manuscript:	01-07-2026
Date accepted:	03-07-2026

CONTRIBUTION OF AUTHORS	
AUTHOR	CONTRIBUTION
Conception/Design	MU,MKK,MA,UK
Data acquisition, analysis and interpretation	MU,MKK,MA,UK
Manuscript writing and approval	MU,MKK,MA,UK
All the authors agree to take responsibility for every facet of the work, making sure that any concerns about its integrity or veracity are thoroughly examined and addressed.	