JHWCR
Journal of Health, Wellness, and Community Research
Volume III, Issue IV
Open Access, Double Blind Peer Reviewed.
Web: https://jhwcr.com, **ISSN**: 3007-0570
https://doi.org/10.61919/xwjwjy12

Article

Pattern and Risk Factors of Diabetic Retinopathy Among Diabetic Patients in Age Group 40 to 65 Years

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Cite this Article

Received	2025-04-07
Revised	2025-04-26
Accepted	2025-04-30
Published	2025-05-03
Conflict of Interest	None declared
Ethical Approval	Respective Ethical Review Board
Informed Consent	Obtained from all participants
Data/supplements	Available on request.
Funding	None
Authors' Contributions	Concept, methodology: AB, AZ; data collection, formal analysis: AH, NR, SB; writing, review, and editing: AZ, NR, SB, AH.

ABSTRACT

Background: Diabetic retinopathy (DR) is a leading cause of visual impairment and blindness among diabetic individuals worldwide. Despite the global burden, limited local data exists on the prevalence and associated risk factors of DR in middle-aged diabetic populations in Pakistan, necessitating targeted epidemiological investigations to guide clinical strategies.

Objective: This study aimed to determine the prevalence and patterns of diabetic retinopathy and to identify significant risk factors—particularly glycemic control—among diabetic patients aged 40 to 65 years attending eye centers in Lahore.

Methods: A cross-sectional observational study was conducted among diabetic patients (n = 384) recruited via random sampling from selected ophthalmology centers in Lahore, Pakistan, between February and July 2024. Eligible participants included males and females aged 40–65 years with confirmed diabetes, excluding pregnant women and those unwilling to consent. Data were collected using structured self-administered questionnaires and clinical assessments, including fundus examination, anthropometric measures, and blood glucose levels. The study adhered to the Declaration of Helsinki and obtained informed consent from all participants. Statistical analysis was performed using SPSS v27, applying chi-square tests and significance at $p < 0.05$.

Results: The overall prevalence of DR was 65.4%, with moderate non-proliferative DR being the most common (26.6%). Fasting and random glucose levels were significantly higher in DR patients ($p < 0.001$), while age, BMI, blood pressure, gender, smoking, family history, and physical activity were not significantly associated.

Conclusion: Diabetic retinopathy is highly prevalent among middle-aged diabetic individuals in Lahore, with poor glycemic control being the most significant modifiable risk factor. These findings underscore the urgent need for routine ocular screening and intensive blood glucose management in this population to prevent vision-threatening complications.

Keywords: Diabetic Retinopathy, Diabetes Mellitus, Blood Glucose, Visual Impairment, Risk Factors, Cross-Sectional Studies, Glycemic Control

INTRODUCTION

Diabetic retinopathy (DR), a major microvascular complication of diabetes mellitus (DM), represents a significant global public health concern due to its strong association with visual impairment and blindness. Globally, DR is the fifth leading cause of visual impairment and ranks fourth among the causes of blindness, affecting nearly 103.12 million individuals worldwide, a number that reflects the increasing prevalence of diabetes (1, 2). Patients with diabetes are at a 25-fold increased risk of developing vision-related complications compared to the general population (3). Approximately 50% of individuals with type II diabetes and 75% of those with type I diabetes are projected to develop DR at some stage in their lives (4). Encouragingly, advancements in early detection and improved diabetes management have led to notable reductions in vision loss caused by DR over the past few decades (5). Nonetheless, the potential for irreversible visual disability remains substantial, especially in low-resource settings where timely screening and intervention may be lacking. Diabetic retinopathy manifests in two primary clinical forms: non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR).

NPDR represents the early stage of the disease and is characterized by retinal microaneurysms, hemorrhages, exudates, and increased vascular permeability, which can culminate in ischemia and retinal atrophy, thereby impairing vision (6). In contrast, PDR denotes a more advanced and vision-threatening stage, marked by neovascularization, vitreous hemorrhage, tractional retinal detachment, and infarcts within the nerve fiber layer (6). At the initial stage, DR is often asymptomatic and poses minimal threat to vision, making early detection via systematic screening vital. As emphasized by the International Council of Ophthalmology, regular screening, timely referral, and resource-appropriate treatment strategies are crucial for preventing DR-related vision loss (11, 12).

Numerous studies have identified modifiable and non-modifiable risk factors for DR. These include the duration of diabetes, poor glycemic control, systemic hypertension, hyperlipidemia, obesity, and a family history of diabetes (8, 9). While clinical interventions focusing on blood pressure, lipid levels, and blood glucose control remain central to DR management, emerging evidence underscores the importance of addressing behavioral and lifestyle-related factors as well (7). However, discrepancies in the reported prevalence of DR across different countries and population subgroups persist. For instance, DR prevalence in Armenia, Nepal, Iran, and China ranges from 11.9% to 44.7%, significantly lower than rates reported in certain African nations such as Sudan (82.6%) and Zambia (52.0%) (16–21). These differences may stem from variations in diagnostic techniques, study methodologies, and sample demographics.

Despite the global efforts to curb its progression, there is limited data from Pakistan regarding the specific patterns and contributing factors of DR among the adult diabetic population. This gap in local epidemiological knowledge underscores the need for region-specific studies that account for cultural, socioeconomic, and healthcare access variables. Consequently, this study aims to investigate the frequency and risk factors associated with DR among diabetic individuals aged 40 to 65 years attending selected eye care centers in Lahore, Pakistan. By identifying the predominant forms of DR and examining their relationship with clinical and demographic variables, this research seeks to inform targeted prevention strategies and enhance local clinical practices. Therefore, the research question guiding this study is: "What is the prevalence and pattern of diabetic retinopathy among diabetic patients aged 40 to 65 in Lahore, and which risk factors are significantly associated with its development?"

MATERIALS AND METHODS

This study employed a cross-sectional observational design to assess the prevalence and associated risk factors of diabetic retinopathy (DR) among diabetic patients aged 40 to 65 years in Lahore, Pakistan. The study population consisted of male and female patients diagnosed with diabetes mellitus who visited selected eye care centers in Lahore over a six-month period, from February 2024 to July 2024. Individuals were included if they were within the specified age range, had a confirmed diagnosis of diabetes, and voluntarily agreed to participate in the study. Patients who were pregnant or unwilling to provide informed consent were excluded. Participants were recruited using a simple random sampling method, ensuring unbiased selection from the target population. Prior to participation, all subjects were informed of the study objectives and procedures, and written informed consent was obtained from each participant in accordance with ethical guidelines.

The primary outcome of the study was the prevalence of diabetic retinopathy, including its classification into mild, moderate, and severe non-proliferative diabetic retinopathy (NPDR) as well as proliferative diabetic retinopathy (PDR). Secondary outcomes included the association between DR and potential risk factors such as age, body mass index (BMI), blood pressure, blood glucose levels, gender, family history of diabetes, smoking status, and exercise habits. Data were collected through a structured, self-administered questionnaire in English, which captured demographic details, clinical measurements, and lifestyle factors. Clinical parameters such as height, weight, and blood pressure were recorded, and laboratory investigations were conducted to determine fasting and random blood glucose levels. The presence and severity of diabetic retinopathy were identified via fundus examinations conducted by qualified ophthalmologists at the participating centers.

All procedures involving human participants were conducted in accordance with the ethical principles outlined in the Declaration of Helsinki. Participants were assured that their data would remain confidential and were anonymized during data handling and analysis.

Statistical analysis was performed using SPSS version 27. Descriptive statistics, including means and standard deviations, were used to summarize continuous variables, while frequencies and percentages were reported for categorical data. To determine associations between diabetic retinopathy and various risk factors, the chi-square test was applied. A p-value of less than 0.05 was considered statistically significant, indicating a meaningful relationship between the studied variables and the presence of diabetic retinopathy. All analyses were conducted with a 95% confidence interval, ensuring the reliability of the reported findings.

RESULTS

A total of 384 diabetic patients aged between 40 and 65 years participated in this cross-sectional study, with a mean age of 54.96 ± 5.89 years. The cohort was nearly gender-balanced, comprising 51.8% males and 48.2% females. Diabetic retinopathy (DR) was identified in 65.4% of the study population, indicating a high prevalence of retinopathy in this age group. The stratification of DR revealed that moderate non-proliferative diabetic retinopathy (NPDR) was the most frequently observed subtype, followed by mild NPDR, severe NPDR, and proliferative diabetic retinopathy (PDR). The detailed breakdown of DR staging is provided in Table 1.

The results revealed that fasting glucose and random glucose levels were significantly higher among patients with diabetic retinopathy compared to those without, with p-values of <0.001 for both metrics. These findings suggest a robust association between poor glycemic control and the presence of DR, indicating that hyperglycemia is a statistically and likely clinically

significant determinant in DR development. Other variables—including age, weight, height, BMI, blood pressure (both systolic and diastolic), gender, family history of diabetes, smoking status, and exercise habits—did not show statistically significant differences between groups. Although smoking approached significance (p = 0.070), it did not meet the conventional threshold, but it may merit further exploration in future studies given the elevated percentage of smokers in the DR group (32.2%).

Table 1. Prevalence and Staging of Diabetic Retinopathy (N = 384)

Stage of Diabetic Retinopathy	Frequency (n)	Percentage (%)
Mild NPDR	89	23.2
Moderate NPDR	102	26.6
Severe NPDR	43	11.2
PDR	17	4.4
Total DR Cases	251	65.4

To examine the relationship between demographic and clinical parameters with the presence of diabetic retinopathy, participants were divided into two groups: those with DR (n = 289) and those without DR (n = 95). The descriptive statistics and inferential analyses are presented in Table 2.

In summary, while demographic and anthropometric factors showed no significant association with DR, elevated fasting and random glucose levels emerged as strongly correlated with DR prevalence in this cohort.

Table 2. Comparison of Demographic and Clinical Characteristics by DR Status

Variable	Without DR (n = 95)	With DR (n = 289)	Total (N = 384)	p-value
Age (years)	54.94 ± 5.67	54.97 ± 5.96	54.96 ± 5.89	.975
Weight (kg)	73.69 ± 16.10	75.70 ± 14.40	75.20 ± 14.84	.255
Height (inches)	59.29 ± 5.31	59.28 ± 5.37	59.29 ± 5.35	.986
BMI (kg/m^2)	34.68 ± 11.13	35.18 ± 8.85	35.05 ± 9.45	.657
Fasting Glucose (mg/dL)	160.25 ± 8.50	179.78 ± 11.83	174.95 ± 13.93	<.001***
Random Glucose (mg/dL)	193.48 ± 9.53	214.30 ± 12.31	209.15 ± 14.73	<.001***
Systolic BP (mmHg)	131.02 ± 9.69	132.92 ± 10.10	132.45 ± 10.02	.108
Diastolic BP (mmHg)	84.29 ± 6.03	85.46 ± 5.91	85.17 ± 5.95	.098
Male, n (%)	45 (47.4%)	154 (53.3%)	199 (51.8%)	.345
Female, n (%)	50 (52.6%)	136 (46.7%)	185 (48.2%)	
Family History of Diabetes	32 (33.7%)	106 (36.7%)	138 (35.9%)	.624
Smokers, n (%)	21 (22.1%)	93 (32.2%)	114 (29.7%)	.070
Physically Inactive, n (%)	76 (80.0%)	221 (76.5%)	297 (77.3%)	.572

p < 0.001 indicates statistical significance.

These findings highlight the importance of stringent glycemic control as a potentially modifiable risk factor in reducing the burden of diabetic retinopathy.

DISCUSSION

The present study highlights a notably high prevalence of diabetic retinopathy (DR) at 65.4% among diabetic individuals aged 40 to 65 years in selected eye centers in Lahore, Pakistan. This prevalence surpasses the rates reported in several regional and international studies. For instance, DR prevalence was found to be 36.2% in Armenia, 44.7% in Nepal, and 37% in one region of Iran (16–18). These figures contrast sharply with our findings and can be attributed to differences in demographic profiles, sample sizes, diagnostic methods, and levels of healthcare access. Additionally, screening practices—such as the use of dilated fundus examination in our study—may have contributed to more accurate and comprehensive detection of DR cases, similar to observations in Sudan, where a prevalence of 82.6% was reported using comparable methods (21).

Such variations underscore the need for standardized screening protocols to facilitate meaningful cross-regional comparisons and global disease burden assessments. The predominance of moderate non-proliferative diabetic retinopathy (26.6%) in our cohort, followed by mild NPDR (23.2%) and severe NPDR (11.2%), is consistent with the known natural history of DR, wherein most cases initially present as non-proliferative forms before advancing to proliferative stages (6). The lower prevalence of proliferative diabetic retinopathy (4.4%) in this study, compared to 10.6% in Al-Rubeaan et al.'s Saudi-based study (22), may reflect differences in disease duration or timely clinical intervention in our population. Conversely, our higher overall prevalence of NPDR (61%) compared to 9.1% in the same study might be explained by more thorough screening or a greater underlying burden of undiagnosed or poorly controlled diabetes in the local population. A key finding of this study is the significant association between elevated fasting and random glucose levels and the presence of DR (p < 0.001 for both), reinforcing the pathophysiological understanding that chronic hyperglycemia is a primary driver of microvascular damage in the retina (9).

Poor glycemic control increases oxidative stress, disrupts the blood-retinal barrier, and initiates pro-inflammatory pathways that accelerate retinal ischemia and neovascularization, ultimately leading to visual impairment (5, 6). While this finding

aligns with existing literature, other commonly reported risk factors—such as age, BMI, blood pressure, and family history—did not show significant associations in our study. Notably, the absence of a statistically significant link with hypertension and obesity deviates from previous research that has documented these variables as relevant contributors to DR risk (8). These discrepancies may stem from sample homogeneity, relatively narrow age distribution, or the cross-sectional design, which limits the ability to infer causal relationships.

Interestingly, smoking approached statistical significance ($p = 0.070$), suggesting a potential risk signal that deserves further attention. Smoking has been implicated in systemic endothelial dysfunction and inflammation, which could exacerbate diabetic microangiopathy. Though not statistically conclusive in this study, the trend indicates a possible clinically relevant association warranting larger and more targeted investigations. Similarly, the high proportion of physical inactivity (77.3%) in the cohort reflects a broader public health issue, though no direct statistical link with DR was established here.

The strengths of this study include its structured methodology, use of standardized diagnostic tools, and focus on a high-risk age group often underrepresented in DR research. However, several limitations must be acknowledged. The study's cross-sectional nature precludes conclusions about temporal relationships or disease progression. Furthermore, the single-city sample limits generalizability to the broader Pakistani population, particularly rural or socioeconomically diverse groups. Selection bias may also have been introduced by limiting participation to patients who presented at specific eye centers. Additionally, certain variables such as duration of diabetes, HbA1c levels, lipid profiles, and socioeconomic status—which are established risk modifiers—were not included in the analysis and should be explored in future studies.

To advance understanding of DR in Pakistan and similar contexts, future research should adopt prospective longitudinal designs with larger, more diverse populations. Inclusion of biochemical and behavioral variables could improve risk stratification and inform preventive strategies. Moreover, exploring the impact of public health interventions on DR screening and management outcomes could yield insights into scalable solutions for reducing visual disability in diabetic populations.

In summary, the study reveals a striking burden of diabetic retinopathy among middle-aged diabetic patients in Lahore, emphasizing the urgent need for robust glycemic control measures and regular ocular screenings. While some classical risk factors were not significantly associated with DR in this study, the strong link with hyperglycemia reaffirms its central role in DR pathogenesis and highlights the necessity for intensified metabolic control in diabetic care programs.

CONCLUSION

This study identified a high prevalence (65.4%) of diabetic retinopathy among diabetic patients aged 40 to 65 years attending selected eye centers in Lahore, with moderate non-proliferative diabetic retinopathy being the most common pattern observed. The findings underscore that while demographic and lifestyle factors such as age, BMI, blood pressure, gender, family history, smoking, and physical inactivity showed no statistically significant associations with DR, elevated fasting and random blood glucose levels were strongly linked to its occurrence. These results emphasize the critical need for stringent glycemic control in diabetic management to prevent retinal complications. Clinically, the study advocates for routine retinal screening in middle-aged diabetic populations, especially those with poor glucose regulation. From a research perspective, the findings highlight the importance of further investigating metabolic and behavioral determinants of DR progression in broader, more diverse cohorts to inform effective public health interventions and tailored treatment strategies.

REFERENCES

1. World Health Organization South East Asia. Strengthening Diagnosis and Treatment of Diabetic Retinopathy in the South East Asia Region. Global Burden of Diabetes and Diabetic Retinopathy (IAPB Vision Atlas). June 2020. Available from: https://doi.org/10.4018/978-1-6684-2304-2.ch003

2. World Health Organization. TADDS WHO: Tool for Assessment of DR and Diabetes Management Systems. 2015. Available from: https://doi.org/10.1093/ww/9780199540884.013.283971

3. Zheng Y, He M, Congdon N. The Worldwide Epidemic of Diabetic Retinopathy. Indian J Ophthalmol. 2012;60(5):428–31. https://doi.org/10.4103/0301-4738.100542

4. Cohen SR, Gardner TW. Diabetic Retinopathy and Diabetic Macular Edema. Retinal Pharmacotherapeutics. 2016;55:137–46. https://doi.org/10.1159/000438970

5. Sabanayagam C, Yip W, Ting DSW, Tan G, Wong TY. Ten Emerging Trends in the Epidemiology of Diabetic Retinopathy. Ophthalmic Epidemiol. 2016;23:209–22. https://doi.org/10.1080/09286586.2016.1193618

6. Knickelbein JE, Abbott AB, Chew EY. Fenofibrate and Diabetic Retinopathy. Curr Diab Rep. 2016;16:1–6. https://doi.org/10.1007/s11892-016-0786-7

7. Sacks D, Baxter B, Campbell BC, Carpenter JS, Cognard C, Dippel D, et al. Multisociety Consensus Quality Improvement Revised Consensus Statement for Endovascular Therapy of Acute Ischemic Stroke. Int J Stroke. 2018;13(6):612–32. https://doi.org/10.1177/1747493018778713

8. Penman A, Hancock H, Papavasileiou E, James M, Idowu O, Riche DM, et al. Risk Factors for Proliferative Diabetic Retinopathy in African Americans With Type 2 Diabetes. Ophthalmic Epidemiol. 2016;23(2):88–93. https://doi.org/10.3109/09286586.2015.1119287

9. Yau JW, Rogers SL, Kawasaki R, Lamoureux EL, Kowalski JW, Bek T, et al. Global Prevalence and Major Risk Factors of Diabetic Retinopathy. Diabetes Care. 2012;35(3):556–64. https://doi.org/10.2337/dc11-1909

10. Orji A, Rani PK, Narayanan R, Sahoo NK, Das T. The Economic Burden of Diabetic Retinopathy Care at a Tertiary Eye Care Center in South India. Indian J Ophthalmol. 2021;69(3):666–70. https://doi.org/10.4103/ijo.IJO_1538_20

11. Solomon SD, Chew E, Duh EJ, Sobrin L, Sun JK, VanderBeek BL, et al. Diabetic Retinopathy: A Position Statement by the American Diabetes Association. Diabetes Care. 2017;40(3):412. https://doi.org/10.2337/dc16-2641

12. Liu L, Geng J, Wu J, Yuan Z, Lian J, Desheng H, et al. Prevalence of Ocular Fundus Pathology With Type 2 Diabetes in a Chinese Urban Community as Assessed by Telescreening. BMJ Open. 2013;3(12):e004146. https://doi.org/10.1136/bmjopen-2013-004146

13. Walton OB, Garoon RB, Weng CY, Gross J, Young AK, Camero KA, et al. Evaluation of Automated Teleretinal Screening Program for Diabetic Retinopathy. JAMA Ophthalmol. 2016;134(2):204–9. https://doi.org/10.1001/jamaophthalmol.2015.5083

14. Shera AS, Rafique G, Khawaja IA, Baqai S, King H. Pakistan National Diabetes Survey: Prevalence of Glucose Intolerance and Associated Factors in Baluchistan Province. Diabetes Res Clin Pract. 1999;44(1):49–58. https://doi.org/10.1016/S0168-8227(99)00017-0

15. Wild S, Roglic G, Green A, Sicree R, King H. Global Prevalence of Diabetes: Estimates for the Year 2000 and Projections for 2030. Diabetes Care. 2004;27(5):1047–53. https://doi.org/10.2337/diacare.27.5.1047

16. Giloyan A, Harutyunyan T, Petrosyan V. The Prevalence of and Major Risk Factors Associated With Diabetic Retinopathy in Gegharkunik Province of Armenia: Cross-Sectional Study. BMC Ophthalmol. 2015;15:1–7. https://doi.org/10.1186/s12886-015-0032-0

17. Shrestha MK, Paudyal G, Wagle RR, Gurung R, Ruit S, Onta SR. Prevalence of and Factors Associated With Diabetic Retinopathy Among Diabetics in Nepal: A Hospital-Based Study. Nepal Med Coll J. 2007;9(4):225–9.

18. Javadi MA, Katibeh M, Rafati N, Dehghan MH, Zayeri F, Yaseri M, et al. Prevalence of Diabetic Retinopathy in Tehran Province: A Population-Based Study. BMC Ophthalmol. 2009;9:1–8. https://doi.org/10.1186/1471-2415-9-12

19. Hu Y, Teng W, Liu L, Chen K, Liu L, Hua R, et al. Prevalence and Risk Factors of Diabetes and Diabetic Retinopathy in Liaoning Province, China: A Population-Based Cross-Sectional Study. PLoS One. 2015;10(3):e0121477. https://doi.org/10.1371/journal.pone.0121477

20. Al-Maskari F, El-Sadig M. Prevalence of Diabetic Retinopathy in the United Arab Emirates: A Cross-Sectional Survey. BMC Ophthalmol. 2007;7:1–8. https://doi.org/10.1186/1471-2415-7-11

21. Machingura PI, Macheka B, Mukona M, Mateveke K, Okwanga PN, Gomo E. Prevalence and Risk Factors Associated With Retinopathy in Diabetic Patients at Parirenyatwa Hospital Outpatients' Clinic in Harare, Zimbabwe. Arch Med Biomed Res. 2017;3(2):104–11. https://doi.org/10.4314/ambr.v3i2.6

22. Al-Rubeaan K, Abu El-Asrar AM, Youssef AM, Subhani SN, Ahmad NA, Al-Sharqawi AH, et al. Diabetic Retinopathy and Its Risk Factors in a Society With a Type 2 Diabetes Epidemic: A Saudi National Diabetes Registry-Based Study. Acta Ophthalmol. 2015;93(2):e140–7. https://doi.org/10.1111/aos.12532

23. Chisha Y, Terefe W, Assefa H, Lakew S. Prevalence and Factors Associated With Diabetic Retinopathy Among Diabetic Patients at Arbaminch General Hospital, Ethiopia: Cross-Sectional Study. PLoS One. 2017;12(3):e0171987. https://doi.org/10.6084/m9.figshare.4658959