

The Impact of Duration of Type 2 Diabetes Mellitus on Retina and Overall Eye Health in Pakistan's Population

Diabetes Mellitus
on Retina and
Overall Eye Health

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ABSTRACT

Objective: With reference to the study conducted in Pakistan, the following hypotheses were postulated with the view to establish relationship between the longevity of T2DM and retina health; moreover, to establish factors that affects its progression over time.

Study Design: Cross-sectional study

Place and Duration of Study: This study was conducted at the Mehboob Charity Vision International Eye and General Hospital in Mansehra from May 2023 to January 2024.

Methods: This study examines 420 diabetic patients from Mehboob Charity Vision International Eye and General Hospital in Mansehra, Pakistan, diagnosed with type 2 diabetes for at least five years. The sample was diverse, representing both genders and ethnic backgrounds, and was selected using a simple random sampling procedure.

Results: A study conducted on 3865 patients with diabetes, focusing on their demographics, sociodemographic, and diabetes-related data. The majority of participants were male and female, with a majority residing in rural areas. The majority of patients had Type 2 diabetes, with 90.75% (n=380) having the condition. The study revealed varying familial contexts, with 31.90% (n=134) having no diabetes history and 8.58% (n=36) having a family history from both parents. The majority of patients had uncontrolled blood sugar levels and hypertension. The duration of diabetes was found to be between 1-5 years, with most diagnosed within the last 1-5 years. Discomfort levels decreased with diabetes duration, and mild non-proliferative diabetic retinopathy (NPDR) and proliferative diabetic retinopathy (PDR) cases decreased. The study suggests a potential decline in visual acuity functions in later years, particularly in terms of perception of light, hand movement, and counting figures. Hence, suggesting the higher complications in first 10 years of diabetic duration.

Conclusion: Diabetes duration is a threat to eyes as the 1-10 years group complained of more complications. Because diabetic retinopathy and cataracts relate to long-term glucose control, sustained measures are necessary to prevent or cure the illnesses.

Key Words: T2DM, eye health, retina, diabetic retinopathy, glycemic control, blindness, HTN.

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INTRODUCTION

T2DM is a multifaceted disorder that develops from multiple factors of risk such as; the unhealthy habits of physical inactivity, eating habits that lead to obesity, genetics, age, race and ethnic factors.

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PCOS, conditions associated with insulin resistance and other diseases and previous history of gestational diabetes also increases the risk¹. Diabetes has acute compounding effects such as diabetic ketoacidosis, hypoglycemia, and hyperglycemia that largely contribute to the severe and fatal complications in diabetes². Chronic complications are, hepatitis, myositis and muscle weakness, osteoporosis and arthritis, diabetic retinopathy, renal complications, diabetes neuropathy, diabetic foot, and increased susceptibility to infections³.

Diabetes mellitus is still a threat to the global population; it is the 10th leading cause of death that claims over one million lives per year⁴. Diabetes prevalence has also been published by the International Diabetes Federation; 537 million people out of the population of people aged 20-79 years, have the disease⁵. This research proposal focuses on examining the effects of T2DM lasting on retina and the eye health of the population in Pakistan.

METHODS

This is a hospital-based cross-sectional study that investigates a sample of 420 diabetic patients suffering from type 2 DM who attended Mehboob Charity Vision International Eye and General Hospital, Mansehra, Pakistan between May 2023-January 2024.

Source Population: The source population of this study was all diabetic patients from Mehboob Charity Vision International Eye and General Hospital, Mansehra, Pakistan.

Study Population: T2DM patients who are 40 years and above duration of disease for at least 5 years. Regarding the participants, they were both male and female, and of different ethnic origin.

Sampling Procedure: In the study, a technique of random sampling was applied in such a way that the likelihood of choosing a participant was equal.

Inclusion and Exclusion Criteria

Inclusion Criteria: Suffers from T2DM for not less than 5 years. They are equal to or more than 40 years of age. Compliant to give an informed consent

Exclusion Criteria: So diagnosed with any other form of diabetes. Excluding participants who have other diseases that can harm the eyes other than diabetes. Incapable of giving informed consent.

Operational Definitions:

Diabetic Retinopathy: An eye condition that can cause vision loss and blindness in people with diabetes, affecting blood vessels in the retina (National Eye Institute 2019).

Visual Acuity: A measure of vision clarity, typically assessed using the Snellen chart, expressed as a Snellen fraction (e.g., 20/20).

Visual Impairment: A condition where eyesight is significantly affected, ranging from mild to severe.

Blindness: Visual acuity worse than 3/60.

Statistical Analysis: Microsoft Excel was used to enter the data, and SPSS Software version 20.0 was used to clean and transport the data for analysis. Descriptive statistics, in particular the mean and standard deviation, were used to describe continuous data. Frequencies and percentages were used to describe categorical variables. It was estimated how common DR was overall, confirmed or diagnosed by an eye exam. Gender and age-specific reports on DR prevalence are also provided. The descriptive statistics about effect of duration of diabetes in years on complications related to eye health are the major focus of study.

Data Collection and Quality Control Procedure: It was crucial to devise a systematic questionnaire; therefore, the board of the institution approved the recruitment process. Subjects were required to be aged 40 years and above, and have diabetes for not less than 5 years. The Clinical assessments were done by an Optometrist and two Ophthalmologists. A one-day training was provided to data collectors to ensure data

quality. 420 patients met the inclusion criteria, and 3445 did not meet the outcome measure. The interview and examination were done after participants provided signed informed consent.

RESULTS

Among the 3865 patients who reported to the Outpatient Department (OPD) for eye examinations, 420 met the inclusion criteria for study. The participants' sociodemographic and diabetes related data is summarized in table 1.

Among the 420 participants, the age distribution showed that 0.61% (n=3) were aged 1-20, 4.90% (n=20) were 21-40, 47.23% (n=199) were 41-60, and 46.01% (n=193) were 61 and above. Gender-wise, 44.1% (n=185) were males and 55.8% (n=235) were females. Most participants resided in rural areas (69.32%, n=291), with 19.01% (n=79) from urban areas, and 11.65% (n=50) unspecified. The study reported 90.75% (n=380) with Type 2 diabetes and 9.20% (n=39) with Type 1 diabetes. Family history revealed 31.90% (n=134) had no diabetes history, 23.92% (n=100) had a paternal history, 35.58% (n=149) had a maternal history, and 8.58% (n=36) had both. BMI distribution showed 28.83% (n=121) normal, 60.73% (n=255) overweight, and 10.42% (n=44) obese. Most patients (73.01%, n=305) had uncontrolled blood sugar levels, while 14.2% (n=60) had normal levels. Additionally, 46.03% (n=193) had hypertension, while 53.97% (n=225) did not.

Table No.1: Sociodemographic and Disease-Related Characteristics of Participants

Variables	Categories	%
Age (Years)	1-20	0.61%
	21-40	4.90%
	41-60	47.23%
	61 and above	46.01%
Sex	Male	44.1%
	Female	55.8%
Place of Residence	Rural	69.32%
	Urban	19.01%
	Nil	11.65%
Type of Diabetes	Type 1	9.20%
	Type 2	90.75%
Family History	No Family History	31.90%
	Father	23.92%
	Mother	35.58%
	Both	8.58%
BMI	Normal	28.83%
	Overweight	60.73%
	Obesity	10.42%
Glycemic Control	Normal	14.2%
	Un-controlled	73.01%
Hypertension	Yes	46.03%
	No	53.97%

Table No.2: Education and Occupation Related Data of participants.

Employment Status	Employed	39.26%
	Unemployed	60.73%
Education	No Fromal Education	80.95%
	Primary-Middle	0.00%
	Secondary	3.17%
	Higher	1.78%
	Graduate	14.28%
Occupation	Housewife	41.71%
	Driver	1.84%
	Teacher	2.45%
	Jobless	7.97%
	Other	7.97%

Table No.3: Duration of Diabetes and DR Complications

Variables	Categories	Frequency %
Duration of Diabetes	1-5	21.47%
	6-10	24.53%
	11-15	15.95%
	16-20	9.00%
	21-25	6.13%
	25 and above	1.22%
Examination Frequency at Hospital (For Retinal Diseases)	1 st	39.87%
	2 nd	12.88%
	3 rd	7.36%
	Already Diagnosed	33.74%
Visual Acuity	6/60 or Less	R=11.65% L=14.11%
	6/38 To 6/19	R=31.28% L=28.22%
	6/15 To 6/6	R=51.53% L=47.85%
Cataracts	Posterior Sub Capsular	14.72%
	Lenticular Changes	19.01%
	Senile Mature	3.06%
	Cortical Cataract	0.00%
	Nuclear Sclerosis	0.00%
Fundus	Normal	53.96%
	Mild NDPR	9.52%
	Moderate NDPR	6.34%
	Severe NDPR	0%
	PDR	6.34%

Table 3 is offering insights into the duration of diabetes and associated complications. The temporal aspects of diagnosis of diabetes are depicted by the duration of diabetes which showed that majority had been diagnosed within the last 1-5 years (21.47%, n=90), followed by 6-10 years (24.53%, n=103), 11-15 years (15.95%, n=67), 16-20 years (9.00%, n=38), 21-25 years (6.13%, n=26), and 25 years and above (1.22%, n=5).

Examining the examination frequency at the hospital for retinal diseases, 39.87% (n=167) attended their first examination, 12.88% (n=54) their second, 7.36% (n=31) their third, and 33.74% (n=141) had already

been diagnosed. Visual acuity was assessed based on Snellen chart reading. For visual acuity of 6/60 or less, the right eye (R) had 11.65%, and the left eye (L) had 14.11%. For visual acuity between 6/38 to 6/19, R was at 31.28%, and L was at 28.22%. For visual acuity between 6/15 to 6/6, R was at 51.53%, and L was at 47.85%. As far as cataracts is concerned, 14.72% (n=62) presented with posterior sub-capsular cataracts, 19.01% (n=79) with lenticular changes, 3.06% (n=13) with senile mature cataracts, 0.00% with cortical cataracts, and 0.00% with nuclear sclerosis. 3.96% (n=226) exhibited a normal fundus, 9.52% (n=40) had mild non-proliferative diabetic retinopathy (NDPR), 6.34% (n=27) had moderate NDPR, and 6.34% (n=27) had proliferative diabetic retinopathy (PDR)⁷.

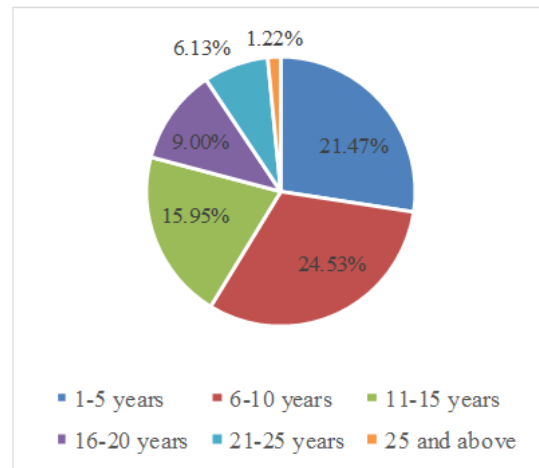


Figure No.1: Distribution of Respondents according to duration of diabetic years

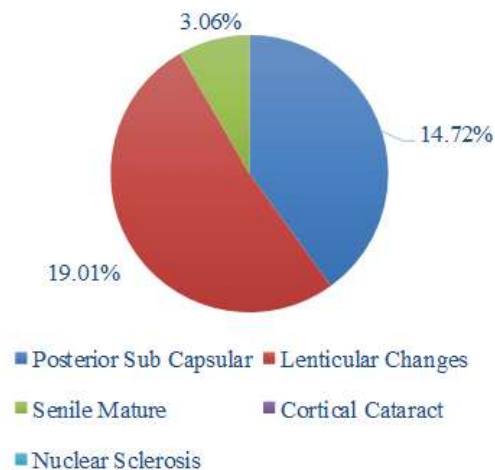


Figure No.2: Prevalence of Cataracts Complications In Diabetics

Table 4 depicts the effect of duration of diabetes on the outcomes related to diabetic retinopathy.

44% (n=185) of participants had a normal retina in first 10 years. Specifically, 17.76% (n=74) had been living with diabetes for 1-10 years, and 3.66% (n=15) for 11-20 years. Diabetic retina was present in 4% (n=17) of participants with duration of diabetes 1-10 years and

2% (n=8) in 11-20 years group. Discomfort levels have reported to decrease as 8% (n=34) reported mild discomfort, 16.2% (n=68) reported severe discomfort and 28.4% (n=119) reported disturbance while in duration of 1-10 years.

Table No.4: Classification of DR Complications according to Duration of Diabetes

Duration (Years)	Yrs. (1-10)	Yrs. (11-20)	Yrs. (21-30)
Normal retina	44%	17.76%	3.66%
Diabetic Retina	4%	2%	0%
Discomfort Level			
Mid Discomfort	8%	4.9%	0%
Severe enough to stop Work and take rest	16.2%	8.3%	2.5%
Normal	7.5%	1.2%	0.6%
Disturbs work	28.4%	12.3%	5.6%
Complications			
Mild NPDR	3.04%	2.44%	2.44%
Moderate NPDR	2.44%	1.2%	-
Severe NPDR	1.2%	1.8%	1.2%
PDR	4.8%	-	1.2%
PSC Cataract	21.5%	11.1%	3.68%
Lenticular Changes (Cataract)	2.56%	11.05%	6.8%
Senile Mature Cataract	14%	1.2%	3.06%
VA Perception of Light PL	4%	0%	0%
VA Hand Movement HM	2%	0%	0%
VA Counting Figures CF	8%	0%	0%

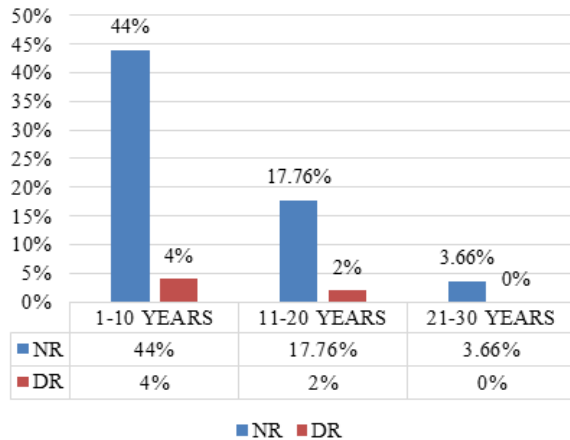


Figure No.3: Prevalence of Normal and Diabetic Retina

Mild NPDR has reported to decrease in successive years as 3.04% (n=13) in Yrs(1-10), 2.44% (n=10) in Yrs(11-20), 2.44% (n=10) in Yrs(21-30) showed its presence. Similarly moderate NPDR data showed same trend: 2.44% (n=10) in Yrs(1-10), 1.2% (n=5) in Yrs(11-20), no cases in Yrs(21-30). In first 10 years 1.2% (n=5) reported severe NPDR, 1.8% (n=8) in duration of 11-20 years and 1.2% (n=5) in duration of 21-30 years. PDR cases were reported in 4.8% (n=20)

in duration of 1-10 years and 1.2% (n=5) in duration of 21-30 years.

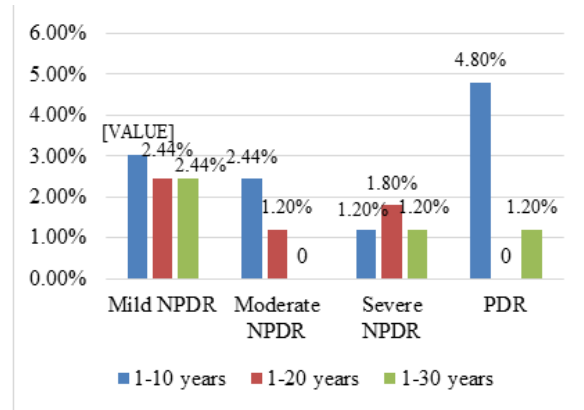


Figure No.4: NDPR and PDR prevalence

DISCUSSION

The demographic and selected health data of the participants are also described in the study, where greater than 40 years are the most represented and largest proportion. 1% (n=185) male participation and 55 among the females. 8% (n=235) though mostly females were involved in the study, the majority 69.32% (n=291) of them hailed from rural areas. BMI data showed 60. Regarding the weight status, 73% (n=255) were overweight which is consistent with WHO estimate for Pakistan⁸. Diabetic patients suffering from uncontrolled blood sugar was 73 per cent. 28% (n= 2025), similarly to earlier research⁹. Hypertension affected 46. Out of the participants, 03% (n=193) reported the level of participation as appropriate, which is in parity with⁶.

Patient had diabetes of different durations; 21. (n=90) with diabetes duration of 1-5 years, 24. It was 53% (n=103) for 6-10 years, which was followed by a gradual decrease in the proportion for higher years of involvement¹⁰. Initial examinations in hospitals contributed to 39.87% (n = 167) to have experienced at least one of the negative occurrences described and 63% (n = 120) for the second visit. Specifically, on the Snellen chart used to assess the level of visual acuity, performances were also varied¹¹. Cataract types included 14. : 72% (n = 62) of the patients had the posterior subcapsular form; 19.01% (n=79) patients showed lenticular changes¹².

With regard to DR trends, there was a significant difference by the diabetes duration¹³. The discomfort levels reduced in frequency and where patients had expressed mild discomfort in the first week, the respective score reduced from 8% (34) to 28.4% of the patients (n=119) reported disturbance during the first 10 years. Mild NPDR and PDR cases are evaluated separately, and both of them reduced over time: while mild NPDR fell from 3.04% (n=13) to 2.44% (n=10),

and PDR from 4. 8% (n=20) to 1. 2% (n=5). Again, there was a change with PSC cataract frequency reducing, but the lenticular changes increasing with the duration of the disease.

The study showed a reduced vision after the first 10 years of diabetes but no perception of light, hand movement or counting figures in the 11-20- and 21-30-years' duration groups. This points to the possibility of the absence or even the stabilization of these complications with long term diabetes. In accordance with the literature, the current study demonstrates that both poor glycemic control and a longer duration of diabetes harm the eyes¹⁴.

CONCLUSION

The findings point a high prevalence of overweight, high blood pressure and raised fasting blood sugar comparable to the national and international trends. The importance of the duration of the disease on the eyesight A description of the trends of eye complications according to the duration of the disease showing a trend of a higher frequency of complications among those who have been diabetic for 1-10 years¹⁵. The discoveries stress how longer time management of glucose is essential since signs like the diabetic retinopathy and cataracts prove it¹⁶. Thus, the given findings are valuable for policy makers and healthcare workers and stress the necessity of developing specific prevention measures to reduce the negative impact of diabetes on vision in the context of Pakistani population¹⁷.

Author's Contribution:

Concept & Design of Study:	Muhammad Junaid, Fawad Ahmed
Drafting:	Fawad Ahmed, Zia-ur-Rehman
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Revisiting Critically:	Muhammad Junaid, Fawad Ahmed, Zia-ur-Rehman
Final Approval of version:	By all above authors

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