

# Association of Serum Lipid Profile with Diabetic Retinopathy in a Tertiary Care Center in Tamilnadu, India

Sreevibya. S<sup>1</sup>, Sridevi. V<sup>2</sup>, Nithya. M<sup>3</sup>, Manavalan. S<sup>4</sup>, Ramya. M<sup>5</sup>

<sup>1</sup>Postgraduate, Department of Ophthalmology, RMMCH, Annamalai University

<sup>2</sup>Professor and Head, Department of Ophthalmology, RMMCH, Annamalai University

<sup>3</sup>Senior Resident, Department of Ophthalmology, RMMCH, Annamalai University

<sup>4</sup>Professor, Department of Ophthalmology, RMMCH, Annamalai University

<sup>5</sup>Senior Resident, Department of Ophthalmology, RMMCH, Annamalai University

Corresponding Author: Sreevibya S.

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## ABSTRACT

**Background:** Diabetes mellitus (DM) is considered to be a pandemic which impose a significant financial burden on developing nations in terms of resource management. As per the International Diabetes Federation 10th edition, the global prevalence in 2021 is 536.6 million, which is projected to increase to 783.2 million by 2045. The prevalence of Diabetic Retinopathy and its risk factors have generally received minimal attention, and eye screening compliance is often low. In order to further research and gain a better knowledge of the risk variables, this study is being done.

**Methods:** The present study was cross sectional descriptive conducted in the Department of Ophthalmology, at a tertiary care centre in South India for 24 months. All patients who were diagnosed with Type 1 or Type 2 diabetes mellitus were included in the study while patients with cataract or retinopathy due to other pathologies were excluded. A recent lipid profile values of the participants were assessed. Their fundus was viewed and analyzed.

**Results:** A total of 84 diabetic patients were included. Diabetic retinopathy, irrespective of the type, was found in 83 patients with a prevalence of 98.8%. Majority of the patients fell under the category moderate NPDR in our study. Among the lipid parameters, most of the cases have deranged triglyceride values of more than 150mg/dl. The association between the serum triglycerides and the severity of diabetic

retinopathy as well as the association between the serum total cholesterol and the HbA1c was found statistically significant.

**Conclusion:** The results of the current study clearly highlight the statistical association between the various lipid profile parameters and diabetic retinopathy. It enlightens the importance of proper lipid control in diabetic patients which in turn reduces the severity of diabetic retinopathy.

**Keywords:** Type 2 diabetes mellitus, Diabetic retinopathy, Blindness, Lipid, Triglycerides

## INTRODUCTION

Diabetes mellitus (DM) is seen as a pandemic that will place an economic burden on developing countries in terms of resource management.<sup>[1]</sup> A total of 422 million people worldwide have diabetes, the majority of whom dwell in low- and middle-income nations and is directly responsible for 1.5 million fatalities annually.<sup>[2]</sup> According to the 10th edition of the World Diabetes Federation, there are 536.6 million cases of diabetes worldwide in 2021, and that number is expected to rise to 783.2 million by 2045. India ranked 2<sup>nd</sup> with a prevalence of 74.2 million in 2021 to 124.9 million by 2045.<sup>[3]</sup> In the South Indian population, the incidence of diabetes, prediabetes, and "any dysglycemia" was

found to be 22.2, 29.5, and 51.7 per 1000 person-years, respectively, based on a ten-year incidence study.<sup>[4]</sup>

Diabetes mellitus is a complex metabolic disease caused by a vicious interaction between hereditary and environmental factors.<sup>[5]</sup> Diabetic Retinopathy (DR) is a common and well-known cause of blindness and irreversible visual loss worldwide, becoming a global concern.<sup>[6]</sup> According to WHO, 3-7% of total blindness in Asia is caused by diabetic retinopathy.<sup>[7]</sup> In India, the prevalence of diabetic retinopathy is 3.5% among the general population and 18.0% among people with diabetes mellitus.<sup>[8]</sup> The most important risk factor is a duration of diabetes (more than 15 years of diabetes results in a 6.5 times increased risk).<sup>[9,10]</sup> Other risk factors include obesity, type 1 diabetes, poor glycemic control (HbA1c), abnormal serum lipids and family history of retinopathy.<sup>[11,12]</sup>

Nitric oxide bioavailability is known to be decreased by high lipid levels, which can lead to endothelial dysfunction. This endothelial dysfunction has been associated with the formation of retinal exudate in DR.<sup>[13]</sup> The association between the lipid profile has been studied few and its variation between the ethnicity, methodology and geographic variation has to be investigated. This study aimed to explore the association between the lipid profile and the severity of diabetic retinopathy in a tertiary care center in south India.

## MATERIAL AND METHODS

The present study was cross sectional descriptive conducted in the Department of Ophthalmology, at a tertiary care centre in South India for a period of 2 years. Ethical clearance was obtained from the Institutional Ethics Committee. Informed consent was obtained from the participation for the participation and sample collection in the study. 84 Participants diagnosed to have type 2 diabetes mellitus were included in this study. Their fundus was viewed and analyzed. Participants with other known

systemic diseases which could manifest as retinal pathology, and with very hazy ocular media are excluded from the study. A general physical examination was performed followed by a complete ophthalmic examination. A detailed fundus evaluation was performed using a direct ophthalmoscopy, indirect ophthalmoscopy along with slit lamp biomicroscopy with +90D lens. Lipid profile (total cholesterol, HDL, LDL, and triglycerides) and HbA1c values were measured. Analysis of variance and chi square test were used to determine the relationship between various lipid values with severity of retinopathy and HbA1c.

## RESULTS

In the study period after applying the inclusion and exclusion criteria 84 cases of type 2 diabetes mellitus was included in the study. Most of the study participants (58 cases, 69%) were males in the age group of 41 to 60 years with male/female ratio 1.5:1. Most of the study participants (53 cases, 63.1%) were affected with diabetes less than 10 years. Most of the study participants were in the BMI group of 18.5 to 24.9. (Table – 1) Among the study participants, Moderate NPDR was seen in 48.8% (41) of the patients followed by 23.8% had mild NPDR. Proliferative Diabetic retinopathy was seen in 9 cases (10.8%). (Table – 2). The distribution of various lipid parameters is tabulated in Table – 3. Among the lipid parameters, most of the cases have deranged triglyceride values of more than 150mg/dl. The association between the serum triglycerides and the severity of diabetic retinopathy was found statistically significant with a p value of 0.024. Other lipid parameters did not show statistical significance with the severity of DR. Serum total cholesterol did not show statistical significance with the severity of DR. However the association between the serum total cholesterol and the HbA1c was found statistically significant with a p value of 0.014. Thus it indirectly contributes to the severity of diabetic retinopathy. Regardless

of the severity of retinopathy, 25% of cases had CSME.

**Table – 1: Demographic Factors of Study Participants**

Factors	Number of Cases, N= 84(%)
<b>Gender</b>	
Male	51 (60.7%)
Female	33 (39.3%)
<b>Duration of Diabetes mellitus</b>	
<10 years	53 (63.1%)
10-20 years	28 (33.3%)
20-40 years	3 (3.6%)
<b>Body Mass Index (BMI)</b>	
<18.5	1 (1.2%)
18.5-24.9	52 (61.9%)
25-29.9	27 (32.1%)
30-34.9	4 (4.8%)

**Table – 2: Prevalence of retinopathy**

Fundus	Number of Cases, N= 84(%)
No DR	1 (1.2%)
Mild NPDR	20 (23.8%)
Moderate NPDR	41 (48.8%)
Severe NPDR	12 (14.3%)
Very Severe NPDR	1 (1.2%)
PDR	2 (2.4%)
PDR VH	4 (4.8%)
PDR TRD	3 (3.6%)
Total	84 (100%)

\*DR – Diabetic Retinopathy, NPDR – Nonproliferative diabetic retinopathy, PDR VH – Proliferative diabetic retinopathy Vitreous Hemorrhage, PDR TRD – Proliferative diabetic retinopathy tractional retinal detachment

**Table – 3: Association between serum triglycerides and severity of diabetic retinopathy**

Triglycerides	Mild to Moderate NPDR	Severe to Very severe NPDR	PDR	Total N=84	p-value
≤150mg/dl	21	6	1	28	0.024
>150mg/dl	41	7	8	56	
Total	62	13	9	84	

**Table – 4: Association between serum total cholesterol and HbA1c**

Total Cholesterol	HbA1c				Total N=84	p-value
	≤6.5%	6.6-8%	8.1-10%	>10%		
≤200mg/dl	1	17	16	12	46	0.014
>200mg/dl	0	7	8	23	38	
Total	1	24	24	35	84	

## DISCUSSION

The present study was conducted as a descriptive observational study to determine the correlation of lipid profile levels with diabetic retinopathy. In the study by Rajiv Raman et al<sup>9</sup> the prevalence of diabetic retinopathy was 18% in an urban population with diabetes mellitus in India. In our study the prevalence was found to be 98.8%. In our study the prevalence of DR was more in males which is similar to other studies.<sup>9,12-</sup>

<sup>16</sup> The mean age group in our study was 53.26 ± 10.70 years and major number of patients was in the age range of 41-60 years. This is in accordance with study by Chirang Singh, Kashwa et al. Emily Y. Chew, Shrestha RK and study by NamPerumalsamy et al in south India.<sup>[17-21]</sup> The mean duration of diabetes mellitus in the present study was 7.7 years with majority of study participants having duration of DM less than 10 years. In the study by Rema et al<sup>[14]</sup> a 5 year increase in duration of DM increased the risk of DR by 1.89 fold. In our study there was no positive correlation between BMI and severity of diabetic retinopathy. This is in accordance to the study by Kalaivani et al<sup>[22]</sup> which also did not show association between BMI and diabetic retinopathy. The study by Sabanayagam et al<sup>[23]</sup> observed an inverse association between obesity and diabetic retinopathy. In the present study among the lipid components tested only TGL showed positive correlation with severity of diabetic retinopathy whereas total cholesterol showed positive correlation with HbA1C. This is similar to the cross sectional study by Anjali et al<sup>[24]</sup> which showed TGL was strongly associated with severity of DR (p=0.0003). Study by Anurag et al also did not show any statistical significance between TC, LDL and DR. In contrast study by Jeyalekshmi et al<sup>[25]</sup> showed significant association of hyperlipidemia with diabetic retinopathy. Study by Pranay Kumar et al<sup>[16]</sup> showed significant association of hypercholesterolemia with severe and very severe NPDR. In study by Sanjeev et al<sup>[26]</sup> serum cholesterol, LDL, TGL levels were elevated and HDL levels decreased in patients with diabetic retinopathy. It is not fully understood how increased serum lipid levels contribute to the emergence and advancement of DR. The development of hard exudates has been suggested to be caused by hyperlipidaemia's increased blood viscosity as well as alterations to the fibrinolytic system. Changes in membrane fluidity and leaking of plasma components in the retina could result from triglyceride

incorporation into the cell membrane. This results in hemorrhage and edema in the retina. High lipid levels are known to cause endothelial dysfunction through a local inflammatory response, with subsequent release of cytokines and growth factors, hypoxia, increase in LDL oxidation, etc.<sup>[27,28]</sup>

## CONCLUSION

In the current study the association between the serum triglycerides and the severity of diabetic retinopathy as well as the association between the serum total cholesterol and the HbA1c was found statistically significant. There were found substantial variations in the prevalence of DR and DME among various ethnic groups. Although the known risk factors for DR, such as the duration of the illness, the severity of hyperglycemia, and hypertension, apply to all ethnic groups, ethnicity-specific risk factors may also be relevant. These risk factors may include genetic predisposition, insulin resistance, truncal obesity, and differential vulnerability to traditional risk factors. Serum lipid levels might also have an impact on these various populations, although this hypothesis has to be supported by additional research. Large multi-centric prospective studies are required on this topic, particularly to explain the differences in study results.

## Declaration by Authors

**Ethical Approval:** Approved

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

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