

Study of Association of Serum Lipids with Diabetic Retinopathy in Type 2 Diabetes Mellitus

Rabia Aftab¹, Afaq Naeem², Sharoon Sabir³, Muhammad Kashif Azeem⁴, Muhammad Umer⁵, Ghazanfar Zulfiqar⁶

- ¹ House Officer, Department of ENT, Shaikh Zayed Hospital, Lahore Pakistan
Data collection, Perform experimental work, Paper writing
- ² House Officer, Department of Medicine, Jinnah Hospital, Lahore Pakistan
Data Collection and Result Analysis
- ³ Ex House Officer, Department of Medicine, Shaikh Zayed Hospital, Lahore Pakistan
Compiled the paper
- ⁴ Ex House Officer, Department of Medicine, Shaikh Zayed Hospital, Lahore Pakistan
Data analysis and review the paper
- ⁵ House Officer, Department of Medicine, Shaikh Zayed Hospital, Lahore Pakistan
Data analysis, Sample collection
- ⁶ House Officer, Department of Orthopedic, Shaikh Zayed Hospital, Lahore Pakistan
References write up

CORRESPONDING AUTHOR

Dr. Afaq Naeem
House Officer, Department of Medicine, Jinnah Hospital, Lahore Pakistan
Email: afaqdx7@gmail.com

Submitted for Publication: 14-06-2021
Accepted for Publication 17-07-2022

How to Cite: Aftab R, Naeem A, Sabir S, Azeem MK, Umer M, Zulfiqar G. Study of Association of Serum Lipids with Diabetic Retinopathy in Type 2 Diabetes Mellitus. APMC 2022;16(1):172-175. DOI: 10.29054/APMC/2022.1087

ABSTRACT

Background: About 10% of diabetic people are at risk for developing diabetic retinopathy (DR), a leading cause of blindness globally. **Objective:** To compare serum lipid level in T2DM patients with vs. without retinopathy in population of Pakistan. **Study Design:** It was a randomized controlled trial. **Settings:** This study was carried out at Jinnah Hospital, Lahore Pakistan. **Duration:** Eight months from 17/2/2020 to 17/10/2020. **Methods:** Patients with type 2 diabetes were split into two groups: patients without diabetic retinopathy DR (Group-I) and those with diabetic retinopathy DR (Group-II). Measurements were taken of HDL, LDL, total cholesterol and TG in the serum. **Results:** 100 patients in total, with ages ranging from 31 to 70 for both sexes and a mean age of 56.20 ± 7.75 . The gender distribution of the study participants revealed that males were more than females by a ratio of 1:1, with 43% of the patients being of the female sex and 57% of the patients being male. Serum lipid mean values for subjects with vs. without DR are compared. The mean total cholesterol for those with DR is 249 ± 27.04 , while the mean for those without DR is 213 ± 43.03 . As a result of DR, serum HDL levels are lower, with a mean of 41.94 ± 5.87 compared to 49.6 ± 9.931 in people without DR. **Conclusion:** A positive correlation between elevated serum lipids (Triglycerides (TG), Low Density Lipoprotein (LDL), Total Cholesterol (TC) has been established and also high serum lipid levels have also been proposed as a risk factor for DR.

Keywords: Diabetic retinopathy, Triglycerides, Low density lipoprotein, Total cholesterol, Serum lipid, Type 2 diabetes mellitus.

INTRODUCTION

Hyperglycemia due to abnormalities in insulin production or insulin resistance or both characterises the diabetes mellitus disease category. One of the most common and fast expanding chronic diseases, diabetes is a global health crisis.^{1,2} In 2000, it was estimated that 2.8% of the global population had diabetes; by 2030, that number is expected to rise to 4.4%. The ageing of the population, shifts in lifestyle as a result of economic progress, and the rise of obesity and its related decline in physical activity are all factors contributing to this trend.^{3,4}

More than 62 million people in India have diabetes, making it a potential epidemic³. Consequences that develop over time are a given with diabetes.

Microvascular problems, including neuropathy, nephropathy, and retinopathy, and macrovascular complications, including cerebrovascular disease, peripheral vascular disease and cardiovascular disease are all linked to diabetes mellitus.⁵

Eye problems might include things like glaucoma, cataracts, retinopathy, and issues with the cornea or the pupils. Although early retinopathy does not significantly impact vision, it can proceed to a more advanced stage of retina called proliferative diabetic retinopathy, which is the most common ocular consequence of diabetes.⁶ Diabetic retinopathy is a leading cause of blindness, and as diabetes rates rise, so does the number of people affected by this condition. This has led to the development of cutting-edge diagnostic and therapeutic methods that

place a premium on early detection and progression arrest.⁷

The amount of time a person has had diabetes is a major factor in the progression and severity of diabetic retinopathy. Diabetes is a leading cause of both death and disability, and its complications can have catastrophic outcomes.⁸ Complications of DM have been associated to risk variables such as diabetes duration, systolic blood pressure, glycemic control (HbA1c), dyslipidemias, smoking, and microalbuminuria.⁹

Diabetic retinopathy (DR) is more likely to develop over time in people with T2DM. Multiple studies have found a link between high levels of serum lipids (triglycerides (TG), and, low density lipoprotein (LDL), total cholesterol (TC) and macrovascular problems such ischemic heart disease. Some research has also linked raised serum lipid levels to an increased risk of DR.¹⁰ Retinal exudate generation in DR has been linked to endothelial dysfunction, which is triggered by high lipid levels due to a decrease in nitric oxide bioavailability. Contradictory results were found in big clinical investigations of the correlation between serum lipids and the development of DR or DME (DME).¹¹

The Early Treatment of Diabetic Retinopathy found a correlation between elevated total cholesterol and low-density lipoprotein (LDL) levels and the presence of retinal hard exudates. An effort was undertaken in this study, titled "Comparative Study of Serum Lipid Level in Type 2 Diabetes with and Without Diabetic Retinopathy," to evaluate the serum lipid levels of patients with Type 2 DM who had DR to those who did not have diabetic retinopathy and to associate lipid levels with disease manifestations.

METHODS

The cross-sectional study was conducted in Jinnah Hospital, Lahore from 17/2/2020 to 17/10/2020. After conducting a thorough ophthalmic examination on each patient, information was recorded in a custom-made proforma and then imported into a master sheet. Patients with Type-2 diabetes who visited the Ophthalmology OPD and had the disease for more than 5 years having age in the 30-70 years range and diabetic patients taking insulin or oral hypoglycemic were included in this study. Patients with primitive onset diabetes, already have dyslipidemia. The patients' HbA1c levels and blood lipid profiles were analysed to see how well their diabetes was managed. Fundoscopy and slit lamp examinations were done by an ophthalmologist, and the results were classified using the severity score indicated on the proforma. SPSS 23.0 was utilised in the process of doing the analysis of the data gathered from the variables.

RESULTS

100 patients in total were involved in the study, of which 50% (n=50) had diabetic retinopathy and 50% (n=50) did not. 100 patients in total, with ages ranging from 31 to 70 for both sexes and a mean age of 56.20 ± 7.75 included. The oldest patient was 70 years old, while the youngest patient was 31. The gender distribution of the study participants revealed that males outnumbered females by a ratio of 1:1, with 43% of the patients being of the female sex and 57% of the patients being male. 3. NPDR and PDR patient study percentage. PDR was 8% (n=4), Mild NPDR was 22% (n=11), Moderate NPDR was 26% (n=13), Severe NPDR was 32% (n=16), and Very Severe NPDR was 12% (n=6). In patients with diabetic retinopathy, the average time off diabetes was 13.94 years, compared to 9.46 years for diabetics with normal fundi. Patients with diabetic retinopathy had higher serum HbA1c values, with a mean of 8.79 ± 1.36 compared to patients without DR, with a mean of 6.75 ± 0.67 .

Serum lipid mean values for patients with DR versus without DR are compared in Table 2. The mean total cholesterol for those with DR is 249 ± 27.04 , while the mean for those without DR is 213 ± 43.03 . As a result of DR, serum HDL levels are lower, with a mean of 41.94 ± 5.87 compared to 49.6 ± 9.931 in people without DR. With a mean of 147.28 ± 12.41 , serum LDL is significantly greater in DR than in those who do not have DR (121.36 ± 10.21). The mean serum TGL in DR is 166.70 ± 25.38 , while in those without DR it is 145 ± 29.36 .

Table 1: The clinical and biochemical characteristics of the participants in the trial

Variables	Characteristics	With DR	Without DR
Age	Mean \pm SD	56.14 ± 7.76	56.26 ± 7.82
Gender	Male	22 (44%)	21 (42%)
	Female	28 (56%)	29 (58%)
NPDR	Mild	11 (22%)	0 (0%)
	Moderate	13 (26%)	0 (0%)
	Severe	16 (32%)	0 (0%)
	Very Severe	6 (12%)	0 (0%)
	Proliferative	4 (8%)	0 (0%)
HBA1C%	<6	0 (0%)	6 (12%)
	6-9	29 (58%)	43 (86%)
	>9	21 (42%)	1 (2%)
Smoker	Smoking	22 (22%)	41 (41.87%)
Duration of DM	Mean \pm SD	13.94 ± 5.95	9.46 ± 4.13

Non-proliferative diabetic retinopathy (NPDR), PDR.

Table 2: Values of lipid subfractions in different groups

Variables	With DR	Without DR	Total	P-value
Total Cholesterol (mg/dl)	249.60 ± 27.04	177.06 ± 18.03	213.33 ± 43.03	<0.001**
HDL (mm Hg)	41.94 ± 5.87	57.44 ± 4.26	49.69 ± 9.31	<0.001**
LDL (mg/dl)	147.28 ± 12.41	121.36 ± 10.21	134.32 ± 17.25	<0.001**
TGL (mg/dl)	166.70 ± 25.38	124.78 ± 14.19	145.74 ± 29.36	<0.001**

DISCUSSION

Diabetes mellitus incidence rates in Pakistan range from 15% to 56.9%. About 10% of those with diabetes have sight-threatening DR, making it a serious consequence of the condition. Too far, there is insufficient evidence linking hyperlipidemia or dyslipidemia to DR.¹²

Hyperlipidemia and diabetes mellitus were found to be unrelated to DR in a population-based survey conducted in Tehran and published by Javadi et al.¹³ Conversely, Malay such discovered that higher levels of BMI, serum triglycerides, and LDL, cholesterol were all linked to a lower prevalence of DR.¹⁴ It has been discovered, however, that the lipid profiles of people with DR are significantly different from those of whether healthy controls or persons without DR. Serum cholesterol levels were found to be significantly higher in patients with sight-threatening DR compared to those who didn't DR in a study performed on the Pakistani such patients by Ahsan et al.¹⁵ Severity of DR was found to be somewhat positively connected with age and duration of DM and positively correlated with HbA1c, serum LDL-C, TC, and TG. The severity of DR was inversely related to both smoking and serum HDL-C levels, albeit only to a minor extent. DR was not significantly linked to either sex in any statistical analysis. According to research conducted by Ahsan et al., retinopathy is significantly predicted by male gender (3.5 times), long duration of diabetes (10 years, 5.46 times).¹⁵

Agroivi et al. found a strong inverse correlation between serum HDL-C and DR severity, while a positive correlation was found with duration of DM, smoking, TG and LDL-C.¹⁶ Oral atorvastatin therapy in individuals with type 2 diabetes decreases the severity of calcifications and subfoveal lipid migration in cases of clinically severe macular edoema, as reported by Gupta A MD et al.¹⁷

Cetin et al.¹⁸ found a significant correlation between mean HbA1c and serum TC and TG, while a separate investigation found a significant correlation between mean plasma glucose and serum TC and LDL-C.

Although Prakash et al. found that individuals who had severe DR had longer time of diabetes and greater A1C, these factors did not correlate with DR severity and blood sugar.¹⁹

CONCLUSION

A positive correlation between elevated serum lipids (Triglycerides (TG), Low Density Lipoprotein (LDL), Total Cholesterol (TC) has been established and also high serum lipid levels have also been proposed as a risk factor for diabetic retinopathy.

LIMITATIONS

Sample size was very small and it was a single centre study.

SUGGESTIONS / RECOMMENDATIONS

This and similar studies provide confidence to the notion that rigorous measures should be taken to address modifiable risk factors linked with DR's progression and growth in order to minimise the disease's related morbidity.

CONFLICT OF INTEREST / DISCLOSURE

None.

ACKNOWLEDGEMENTS

Authors of this study highly appreciated the cooperation of hospital and related departments.

REFERENCES

1. American Diabetes Association. Diagnosis and classification of diabetes mellitus. *Diabetes care*. 2014 Jan 1;37(Supplement_1):S81-90.
2. Karalliedde J, Gnudi L. Diabetes mellitus, a complex and heterogeneous disease, and the role of insulin resistance as a determinant of diabetic kidney disease. *Nephrology dialysis transplantation*. 2016 Feb 1;31(2):206-13.
3. 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 May 1;27(5):1047-53.
4. Akhtar S, Nasir JA, Abbas T, Sarwar A. Diabetes in Pakistan: a systematic review and meta-analysis. *Pakistan journal of medical sciences*. 2019 Jul;35(4):1173.
5. Pradeepa R, Mohan V. Epidemiology of type 2 diabetes in India. *Indian Journal of Ophthalmology*. 2021 Nov;69(11):2932.
6. Kovacova A, Shottliff K. Eye problems in people with diabetes: more than just diabetic retinopathy. *Practical Diabetes*. 2022 Jan;39(1):34-9a.
7. Nentwich MM, Ulbig MW. Diabetic retinopathy-ocular complications of diabetes mellitus. *World journal of diabetes*. 2015 Apr 15;6(3):489.
8. Gelcho GN, Gari FS. Time to Diabetic Retinopathy and Its Risk Factors among Diabetes Mellitus Patients in Jimma University Medical Center, Jimma, Southwest Ethiopia. *Ethiopian Journal of Health Sciences*. 2022 Sep 20;32(5):937-46.
9. Chawla A, Chawla R, Jaggi S. Microvascular and macrovascular complications in diabetes mellitus: distinct or continuum?. *Indian journal of endocrinology and metabolism*. 2016 Jul;20(4):546.

10. Alattas K, Alsulami DW, Alem RH, Alotaibi FS, Alghamdi BA, Baeesa LS. Relation between lipid profile, blood pressure and retinopathy in diabetic patients in King Abdulaziz University hospital: a retrospective record review study. *International Journal of Retina and Vitreous*. 2022 Dec;8(1):1-5.
11. Alattas K, Alsulami DW, Alem RH, Alotaibi FS, Alghamdi BA, Baeesa LS. Relation between lipid profile, blood pressure and retinopathy in diabetic patients in King Abdulaziz University hospital: a retrospective record review study. *International Journal of Retina and Vitreous*. 2022 Dec;8(1):1-5.
12. Rema M, Srivastava BK, Anitha B, Deepa R, Mohan V. Association of serum lipids with diabetic retinopathy in urban South Indians—the Chennai Urban Rural Epidemiology Study (CURES) Eye Study—2. *Diabetic Med*. 2006; 23(9):1029-1036.
13. 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;9:12.
14. Wong TY, Cheung N, Tay WT, Wang JJ, Aung T, Saw SM, et al. Prevalence and risk factors for diabetic retinopathy: the Singapore Malay Eye Study. *Ophthalmology*. 2008;115:1869-1875.
15. Ahsan S, Basit A, Ahmed KR, Ali L, Khanam R, Fawwad A, et al. Risk indicators of diabetic retinopathy in patients with type 2 diabetes screened by fundus photographs: a study from Pakistan. *Int J Diabetes Dev Ctries*. 2015;35(Suppl3):333-338.
16. Agroiya P, Philip R, Saran S, Gutch M, Tyagi R, Gupta KK. Association of serum lipids with diabetic retinopathy in type 2 diabetes. *Indian J Endocr Metab*. 2013;17(Suppl S1):335-337.
17. Gupta A, Gupta V, Thepar S, Bhansali A; Lipid-lowering drug atorvastatin as an adjunct in the management of diabetic macular edema; *Am J Ophthal*, 2004 Apr;137(4):675-82
18. Cetin EN, Bulgu Y, Ozdemir S, Topsakal S, Akin F, Aybek H, et al. Association of serum lipid levels with diabetic retinopathy. *Intl J Ophthalmol*. 2013;6(3):346-349
19. Prakash G, Agrawal R, Satsangi SK, Prakash S. Comparison of Serum Apolipoproteins and Traditional Lipids in Eyes with Diabetic Retinopathy in Indian Population: A Case Series. *Middle East Afr J Ophthalmol*. 2016;23:212-214.