Original Article

Association of Fasting Serum Lipid Level with Diabetic Retinopathy

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Abstract

Background: Diabetic eye disease is now one of the major causes of blindness in the world. Elevated serum lipids have been speculated to cause or exacerbate diabetic retinopathy by several mechanisms. **Objective:** To observe the relationship of serum lipids with diabetic retinopathy. **Methods:** This cross sectional observational study was carried out in the Department of Ophthalmology, Combined Military Hospital Dhaka, from July 2016 to December 2016. A total of 150 patients were selected for the study and divided into three groups. Group I comprises 50 patients with different stages of retinopathy. Group II comprises 50 diabetic patients without retinopathy, and group III comprises 50 non diabetic healthy control people. **Results:** The age range was 27 to 70 years; Male and female ratio was 1.54:1. The mean duration of diabetes in group I was 9.82 ± 4.04 years and 8.38 ± 3.39 years in group II. Measuring Fasting lipid profile in between group I and group II and between group I and III were statistically significant ($p< 0.001$). **Conclusion:** Patients with diabetic retinopathy have been found to have a close association with elevated serum lipid levels.

Key words: Diabetes mellitus, Diabetic retinopathy, Serum lipid profile, Hyperglycaemia,

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Introduction

Diabetes mellitus (DM) is a clinical syndrome characterized by an increase in plasma blood glucose (hyperglycaemia). Hyperglycaemia causes both short-term and long-term complications. High blood glucose and insulin deficiency can cause acute symptoms & metabolic decompression.Chronic Hyperglycaemia is responsible for diabetes specific micro vascular complication affecting the eyes (retinopathy), Kidneys (nephropathy) and feet (neuropathy).[1]

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Diabetic retinopathy (DR) is one of the leading causes of blindness in the world. Intensive treatment of risk variables such as excessive blood sugar and blood pressure has been found in previous trials to help prevent the start and progression of DR.[2] High cholesterol levels in the blood have also been suggested as a risk factor for DR.

The mechanism through which elevated serum lipids may contribute to DR development is unknown. The formation of hard exudates is thought to be caused by an increase in blood viscosity and changes in the fibrinolytic system in hyperlipidaemia. Triglycerides may also be incorporated into the cell membrane, causing changes in membrane fluidity and plasma component leakage into the retina. This results in haemorrhage and oedema in the retina. Retinal hard exudates are waxy yellow deposits that commonly appear around the oedematous retina's edge. Endothelial cells in the retinal capillaries lose their tight connections and leak lipoproteins, crystalloid, and water into the extracellular space of the retina, causing them to grow[3]. When hard exudates build up in the macula's center, it might cause visual acuity to deteriorate.[4]

Endothelial dysfunction is known to be caused by

high lipid levels due to diminished nitric oxide bioavailability, and this endothelial dysfunction has been linked to the production of retinal exudate in DR.[5] The objective of the study was to find out the possible association between serum lipid levels and DR.

Material and Methods: This cross-sectional observational study was carried out in the Department of Ophthalmology, Combined Military Hospital Dhaka, from July 2016 to December 2016. A total of 150 patients were selected for the study and divided into three groups. Group I comprises 50 patients with different stages of retinopathy. Group II comprises 50 diabetic patients without retinopathy, and group III comprises 50 non diabetic healthy control people.

Non-insulin dependent diabetes mellitus (NIDDM) patients of both sexes with or without retinopathy and duration of diabetes more than 5 years were included in this study. Patients who have thyroid or liver disease, non-diabetic renal disease, pregnancy, acute or chronic inflammatory disease, alcoholism, malnutrition, episode of diabetic ketoacidosis were excluded from the study. Moreover, patients on diuretics, β-blockers, lipid lowering agents were also excluded.

All the study subjects had a thorough ophthalmic evaluation, which included a slit lamp biomicroscopic examination of anterior segment, as well as direct and indirect ophthalmoscopy for fundus evaluation. Blood samples were collected from all the study subjects in the morning to carry out the following tests: 1.Serum fasting total cholesterol, 2. Serum fasting triglyceride, 3. Serum fasting low density lipoprotein, and 4. Serum fasting high density lipoprotein. Data were checked and cleaned before incorporating into statistical software (SPSS- version 26). Descriptive statistics were expressed as percent, mean & standard deviation. Statistical analysis was performed by Independent Sample t test. Statistical significance was considered as $p<0.05$.

Results: The age range was 27 to 70 years; the maximum patients included in the 40–60 year age group. The mean age of the patients in group I, II and III were 56.78±6.99 years, 53.64± 6.65 years, and 41.58± 10.83 years respectively (table I).

Table-I: Mean age distribution of study population.

Study Group	Age (in years) Mean SD
Group I (n=50)	56.78 ± 6.99
Group II (n=50)	53.64 ± 6.65
Group III (n=50)	41.58 ± 10.83

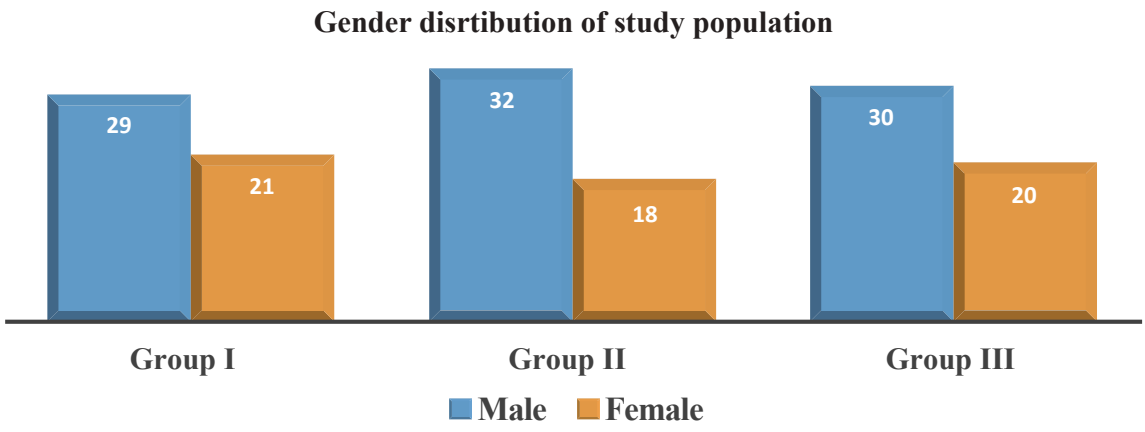


Figure-I: Gender distribution of study population

Among the study group, 91 patients were male and 59 were female, and the ratio was 1.54: 1 (figure I).

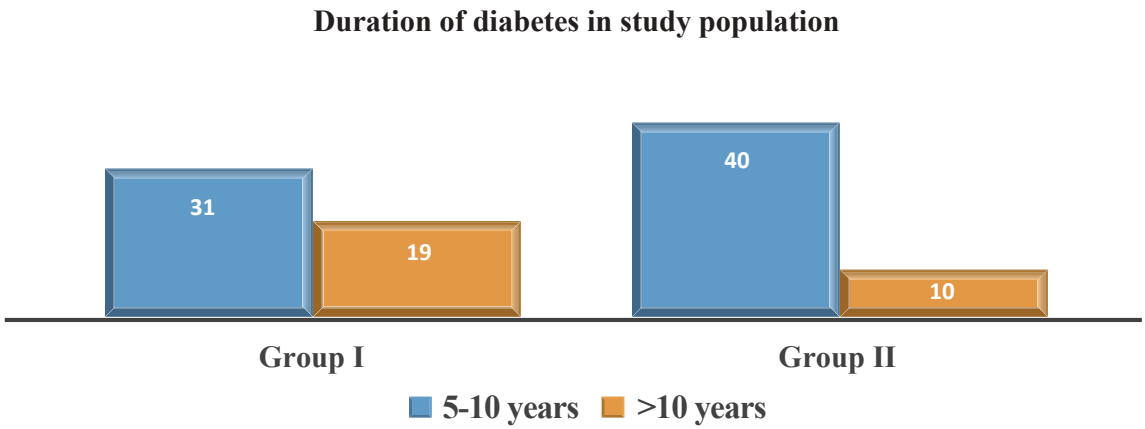


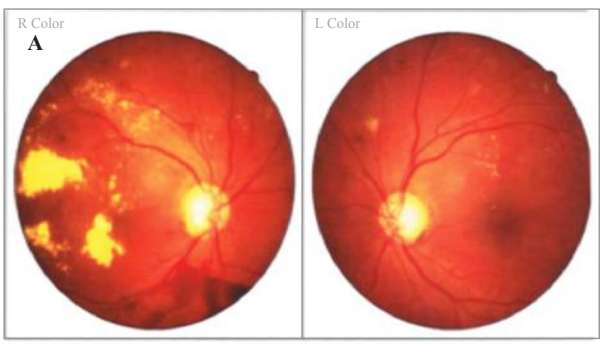
Figure-2: Distribution of study population of diabetes in group I and group II.
In group I, 31 (62.0%) patients had duration of diabetes from 5-10 years while in group II, 40 (80.0%) patients had duration of diabetes from 5-10 years The mean duration of diabetes in group I was 9.82 ± 4.04 years and 8.38 ± 3.39 years in group II (figure II).

Table II: Distribution serum lipid profile level in study population

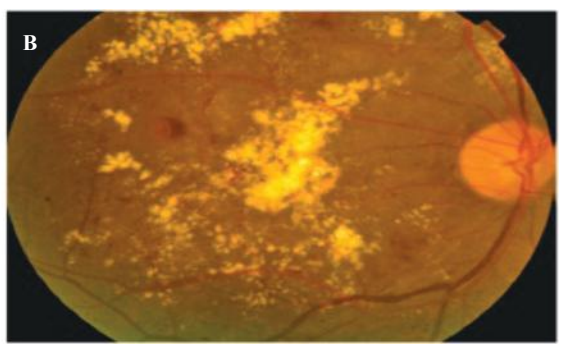
Serum fasting lipid profile (mg/dl)	Group I (n=50)	Group II (n=50)	Group III (n=50)
S fasting total cholesterol	246.98 ± 41.50	188.66 ± 28.16	181.80 ± 14.68
S fasting triglyceride	229.10 ± 57.76	125.12 ± 25.50	121.60 ± 22.69
S fasting LDL	169.02 ± 29.86	98.42 ± 18.79	93.14 ± 19.96
S fasting HDL	39.02 ± 6.65	50.12 ± 8.83	51.34 ± 8.70

LDL=low-density lipoproteins; HDL=high-density lipoproteins.

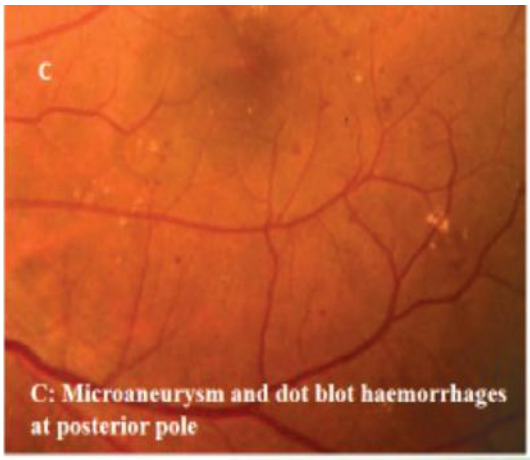
Measuring serum total cholesterol levels between group I and group II and between group I and III was significant ($p < 0.001$). There was a significant ($p < 0.001$) difference in measured serum triglyceride levels between groups I and II and groups I and III. The difference in measured serum low density lipoprotein levels between groups I and II and groups I and III was significant ($p < 0.001$). The difference in serum high density lipoprotein levels between groups I and II, as well as between groups I and III, was significant ($p < 0.001$).

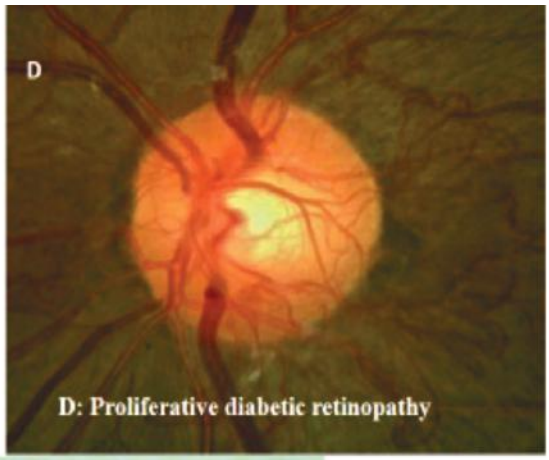


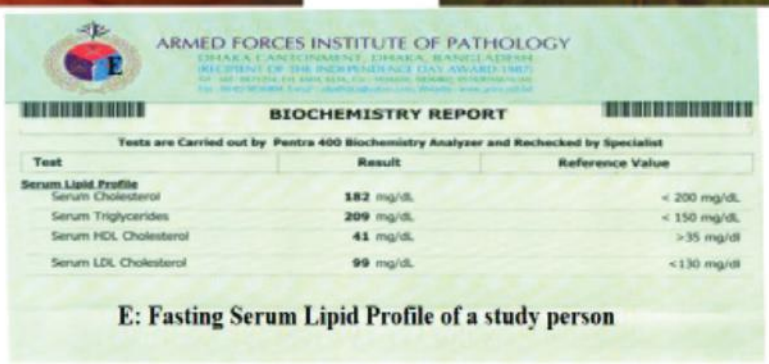
A: Color fundus photograph of a study person.



B: Exudates involving the fovea






ARMED FORCES INSTITUTE OF PATHOLOGY

BIOCHEMISTRY REPORT

Tests are Carried out by Pentra 400 Biochemistry Analyzer and Rechecked by Specialist

Test	Result	Reference Value
Serum Lipid Profile		
Serum Cholesterol	182 mg/dL	< 200 mg/dL
Serum Triglycerides	209 mg/dL	< 150 mg/dL
Serum HDL Cholesterol	41 mg/dL	>35 mg/dl
Serum LDL Cholesterol	99 mg/dL	<130 mg/dl

E: Fasting Serum Lipid Profile of a study person

Figure III: A: Colour fundus photography, **B:** Exudates involving the fovea, **C:** Microaneurysm and dot blot haemorrhage at posterior pole, **D:** Proliferative diabetic retinopathy, **E:** Fasting lipid profile.

Discussion

Discussion: The current study included the maximum number of patients in the 40–60 year age group. Mean age of group III was low as Type 2 is more common in older adults. In a study by Brown et al., the mean age was 48 years, ranging from 32-61 years.[6] In another study conducted by Larsson LI et al., where the age range was 15–50 years[7]. They included both IDDM and NIDDM patients, whereas the current study included only NIDDM patients.

A male predominance was observed in our study. The reason behind the increased number of male patients may be the social status of males, who get priority. In the study of Gupta et al., the male proportion was also higher.[8]

In our study, the mean duration of diabetes was 9.82±4.04 years in Group-I and 8.38±3. 39 years in Group-II. In the study of Brown et al., it was 10.8 years, ranging from 4–14 years.[6] Guerci et al.[9] showed the mean duration of diabetes was 20 years. But all of his study patients had IDDM, meaning early onset of diabetes.

In the current study, mean serum total cholesterol was 246.98±41.50 mg/dl in Group-I patients, 188.66 ±28.16 mg/dl in Group-II patients, and 181.80 ±14.68 mg/dl in Group-III patients. This result was similar to Brown et al.[6] whose mean serum cholesterol level in the retinopathy group was 338 mg/dl and in the control group was 247 mg/dl. Chew et al.[10] showed that patients with a serum cholesterol level of more than 240 mg/dl were twice as likely to have more hard exudates as those with a serum cholesterol level of 200 mg/dl. Chew et al. also showed that moderate to severe exudative diabetic retinopathy patients had serum cholesterol levels above 240 mg/dl.

In the current study, the mean serum triglyceride level was 229.10± 57.76 mg/dl in Group-I, the

mean serum triglyceride was 125.12 ±25.50 mg/dl in Group II, and in Group III it was 121.60± 22.69 mg/dl. Brown et al. found serum triglyceride levels quite higher (mean 332 mg/dl) in the retinopathy group and 113 mg/dl in the control group.6 Higher serum triglyceride levels may be due to a few cases with lipemia retinalis included in that study. Moreover, that study had a relatively small sample size with a high standard deviation (320 mg/dl). In a study by Larsson et al.[7] associations were found between higher levels of serum total cholesterol, declining ratios of high density lipoprotein (HDL) cholesterol/total cholesterol, higher levels of serum lipoprotein and more severe retinopathy in diabetes mellitus type I.

Conclusion:

Patients with diabetic retinopathy have been found to have a close association with elevated serum lipid levels. This study suggests that diabetic retinopathy patients need assessment of serum lipids and they may need lipid-lowering agents to halt the progression of diabetic retinopathy and also to protect the patients from systemic morbidity of hyperlipidaemia.

Limitations:

The limitations of the study were that the sample size was small, the study was a uni-centre study, and the duration of the study was only six months. Some important factors such as blood sugar level, control of diabetes, hypertension, smoking, diabetic chronic kidney disease, and anaemia were not taken into consideration.

Recommendations:

Large sample size, large centre-based longitudinal study should be performed.

Acknowledgement:

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Conflict of Interest:

The authors have no conflict of interests.

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