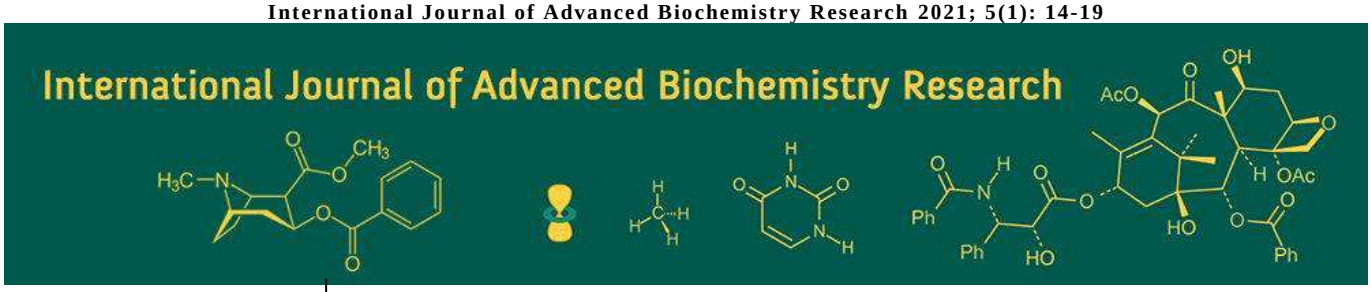

ISSN Print: 2617-4693
ISSN Online: 2617-4707
IJABR 2021; 5(1): 14-19
www.biochemjournal.com
Received: 10-10-2020
Accepted: 17-11-2020

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Lipid profile in patients of type 2 diabetes mellitus with myocardial infarction

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DOI: https://doi.org/10.33545/26174693.2021.v5.i1a.59

Abstract
In NIDDM, studies from Steno Memorial Hospital in Denmark and the Joslin clinic in Boston have shown increased coronary heart disease (CHD) mortality compared with the non-diabetic population. During the Joslin clinic study, one-third of male and female patients with NIDDM died from CHD before the age of 60. Normal cases were 30 and were selected at Random from different wards of the Hospital. The venous blood was collected for both fasting and postprandial for blood sugar estimation. The fasting blood samples were collected for the estimation of serum Total cholesterol, serum Triglycerides and serum HDL cholesterol estimation.

Keywords: Lipid profile, type 2 diabetes mellitus, HDL cholesterol

Introduction

Diabetes Mellitus type 2 is a complex metabolic disorder characterized by hyperglycemia and associated with a relative deficiency of insulin secretion, along with a reduced response of target tissues to insulin [1].

Diabetes mellitus is a major global health problem; an estimated 30 million people worldwide had diabetes in 1985. By 1995, this number had shot up to 135 million. Now, WHO predicts a rise to an alarming 300 million by 2025 [2].

Framingham's study and several subsequent studies showed that individuals with diabetes have a two to four times higher risk of cardiovascular morbidity and mortality than non diabetic subjects and increases in parallel with the degree of dyslipidemia.

By 2020 cardiovascular disease will dominate all other causes of death and surpass infectious disease as the world's greatest killer [3].

In NIDDM, studies from Steno Memorial Hospital in Denmark and the Joslin clinic in Boston have shown increased coronary heart disease (CHD) mortality compared with the non diabetic population. During the Joslin clinic study, one-third of male and female patients with NIDDM died from CHD before the age of 60 [3].

The dramatic worldwide increase in the prevalence of type 2 diabetes is posing a massive health problem in both developed and developing countries [1]. In developed countries, lower socioeconomic groups are most affected, while, in developing countries, the reverse applies [1]. The magnitude of the health care problem of type 2 diabetes results not just from the disease itself, but also from its association with obesity and cardiovascular risk factors, particularly dyslipidemia and hypertension [1].

Type 2 diabetes has now been recognized as one manifestation of the "metabolic syndrome" a condition characterized by insulin resistance and associated with a range of cardiovascular risk factors.

Dyslipidemia is an important component of the metabolic syndrome observed in type 2 diabetes patients and is characterized by elevated levels of triglyceride, normal levels of total cholesterol and LDL-C, reduced levels of total HDL-C, elevated levels of Apolipoprotein B, a preponderance of small, dense LDL particles and, increased levels of cholesterol rich VLDL [4].

Type 2 diabetes mellitus is associated with various patterns of dyslipidemia that predispose patients to macrovascular like coronary heart disease. Once the clinical disease develops the patients have a poorer prognosis than normoglycemic individuals with normal lipids.

Similarly, hypertriglyceridemia, low HDL-C and high LDL-C represent a high-risk group for CHD morbidity and mortality in type 2 DM [5]. Hypertriglyceridemia itself is an independent itself is an independent risk factor for CHD [5].
Elevated serum triglycerides are commonly associated with insulin resistance and represent a valuable clinical marker of metabolic syndrome, that is atherogenic dyslipidemia, hypertension, elevated plasma glucose and prothrombotic state further increases the risk of CHD [5]. Worsening of glycemic control deteriorates lipid and lipoprotein abnormalities, particularly total and LDL-C is elevated with poor control of diabetes mellitus [5].

Methodology
The study included a total of 30 patients with Type 2 diabetes mellitus with diagnosed cardiovascular disease, who were admitted to ICCU and in medicine.
Normal cases were 30 and were selected at Random from different wards of the Hospital.
The venous blood was collected for both fasting and postprandial for blood sugar estimation. The fasting blood samples were collected for the estimation of serum Total cholesterol, serum Triglycerides and serum HDL cholesterol estimation.
The Random blood samples were collected between 6 to 12 hours in myocardial infarction patients for the estimation of serum CK-MB, serum SGOT and serum Lactate dehydrogenase in the following bulbs,

Fluoride Bulb – Blood sugar.
Plain Bulb - Serum Lipid profile, CK-MB, SGOT, and LDH.

All the above mentioned Biochemical investigations were carried out in the clinical chemistry laboratory of the biochemistry department of the medical college, Baroda.
The methods used in the study are in accordance with the facilities available in the clinical Biochemistry Laboratory of Medical College, Baroda. The techniques are recent and used in many Indian laboratories and the results are easily reproducible.

Method used for Estimation of Blood sugar levels
Glucose Oxidase and Peroxidase Method

Principle
The substrate β D-Glucose is oxidized by Glucose oxidase to form gluconic acid and hydrogen peroxide. The hydrogen peroxide, so generated, oxidizes the chromogen system consisting of 4-amino antipyrine and phenolic compounds to a red Quinoneimine dye. The intensity of the colour produced is proportional to the glucose concentration and is measured colourimetrically at 505 nm (490-530) or with green filter.

Reaction

$$\text{Glucose} + O_2 \xrightarrow[\text{POD}]{\text{GOD}} \text{Gluconic Acid} + H_2O_2$$

H_2O_2 + Phenolic compound + 4 Amino-antipyrine Red Quinoneimine + H_2O

- GOD – Glucose oxidase
- POD – Peroxidase

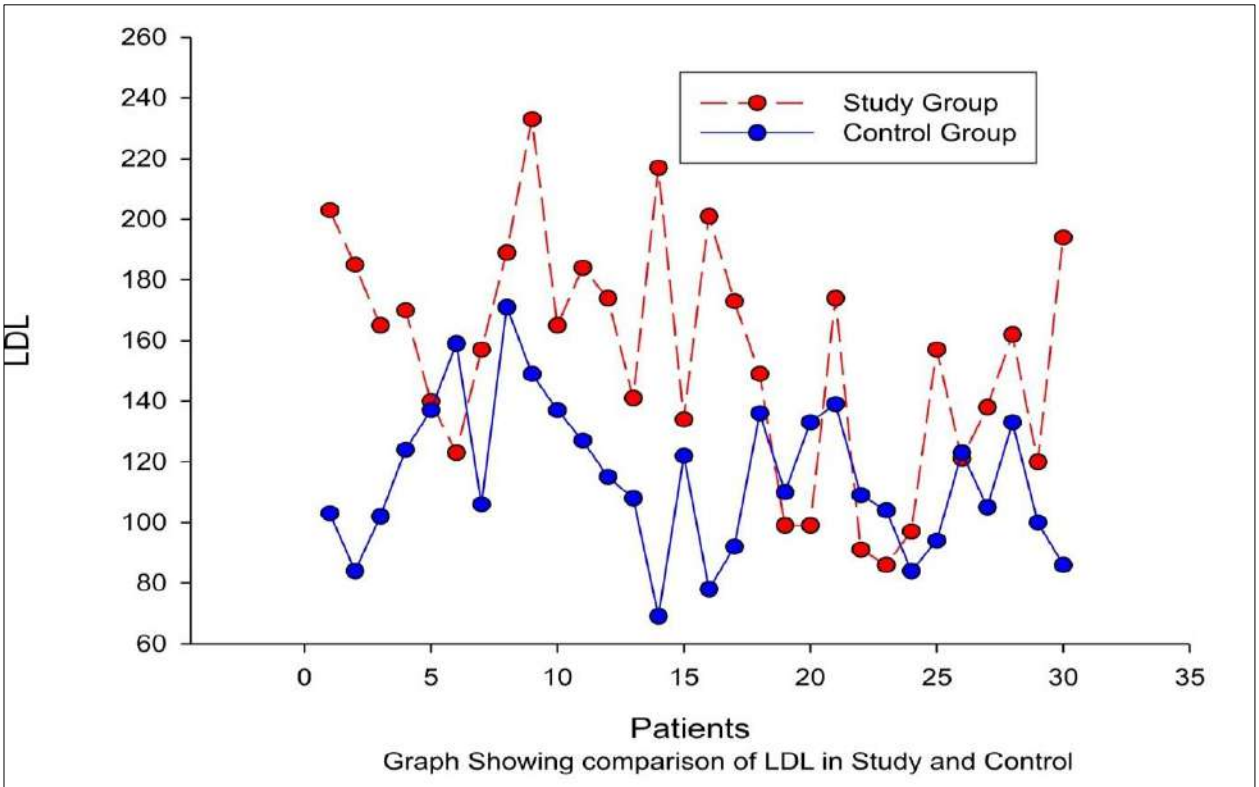
Reagents: Components of GOD / POD
1. Phosphate Buffer
2. Glucose Oxidase
3. Peroxidase
4. Amino-antipyrine
5. phenol
6. Stabilizers.

Results
The fasting serum total cholesterol levels in the study group are elevated which is significant when compared to controls.
In diabetic dyslipidemia normally fasting total cholesterol levels are in a normal range and hence there was only a slight increase in total cholesterol value in diabetic subjects compared with controls although it was not statistically significant.
The serum total cholesterol concentration is a clear risk factor for coronary disease with the risk increasing progressively with higher values for serum total cholesterol
Fasting serum triglyceride levels were found significantly elevated in study groups compared to non-diabetic control groups (p<0.001).
Hypertriglyceridemia results from both increased substrate availability (glucose and free fatty acids) and decreased lipolysis of very-low-density-lipoprotein (VLDL) triglyceride which is common in type 2 diabetes.
It was found that fasting HDL cholesterol level is low in the study group which is statistically significant compared to controls.
Low serum HDL (hypoalphalipoproteinemia) is associated with an increased risk of overt CHD [6]. Based upon data from the Framingham Heart Study, the risk for myocardial infarction increases by about 25% for every 5 mg/dl decrement below median values for men and women [7]. In contrast, a high serum HDL above 60 mg/dL is cardioprotective.
In the study group, it was found that Fasting serum LDL cholesterol levels were elevated compared to control.
Elevated LDL cholesterol is not a characteristic of the dyslipidemia of insulin resistance in type 2 diabetes. In insulin resistant state, the composition and distribution of LDL particles are altered, resulting in a preponderance of small, dense LDL cholesterol.
Fasting VLDL-C levels were found elevated in the study group compared with the control group.
In the study group patients with type 2 diabetes who were suspected to be suffering from acute myocardial infarction, all had elevated levels of CK-MB compared to non-diabetic controls. (p<0.001)
CK-MB is the molecular marker of choice for the evaluation of patients with suspected acute MI. After myocardial injury, the concentration of CK-MB in myocardium increases according to Ingwall JS *et al*. [8].
CK-MB rises early 4 to 12 hours but remains elevated for only 36 to 48 hours; thus, an elevated serum CK-MB in the appropriate setting is indicative of a recent acute MI and repeat elevations may indicate recurrent myocardial injury.
Serum SGOT levels were found elevated in all patients in the study group but at normal levels in non-diabetic control group.
The elevated levels of SGOT in patients with acute myocardial infarction were first reported by La-Due J.S, Sima J.S and Worblewski F [9].

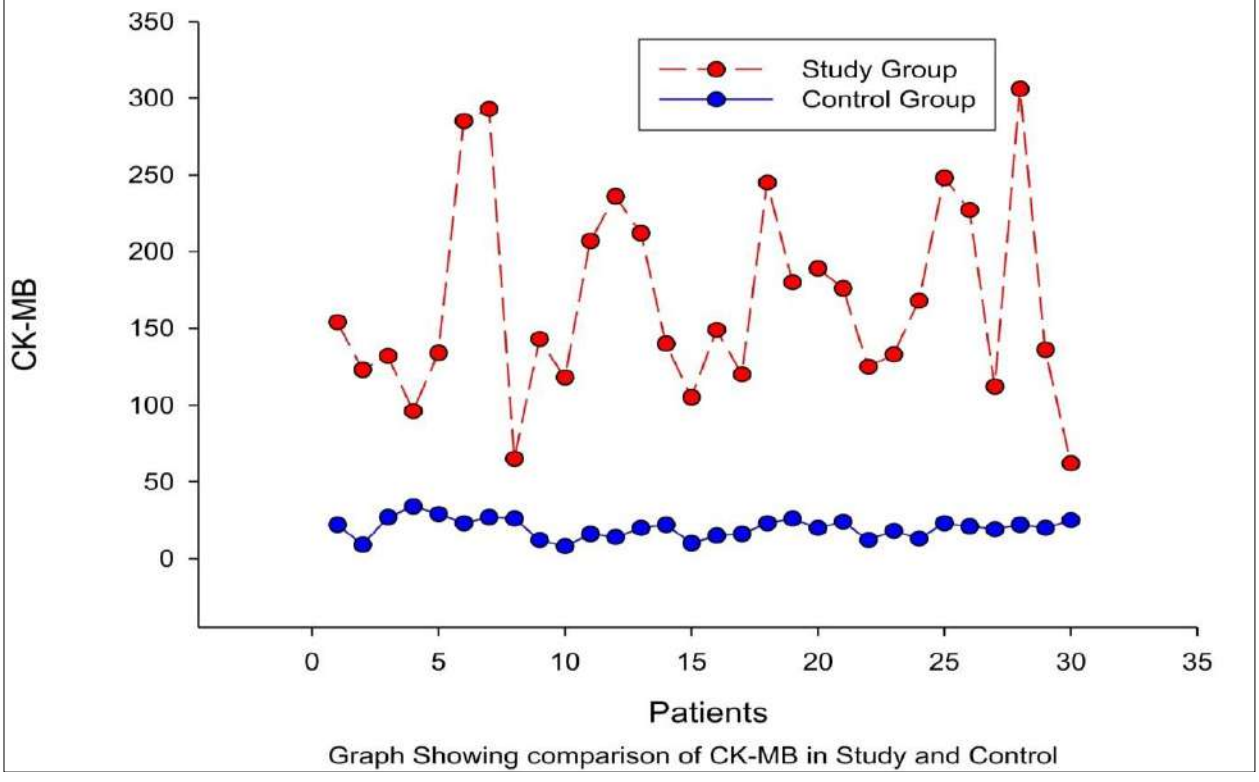
SGOT activity usually exceeds the normal range within 8 – 12 hours following onset of chest pain, peak levels occur 12-36 hours after infarction and fall within 3-4 days. SGOT is relatively non-specific for the detection of acute myocardial infarction because of its frequent presence in other tissues like liver, kidney, skeletal muscle and red blood cells and may be liberated from these extra cardiac stores. SGOT is less widely used than before because of its lack of specificity and because of its time course which is intermediate between CK-MB and LDH. It was found that serum LDH levels were slightly above the normal range in study group when compared to the non-diabetic controls.

Total LDH is sensitive but not specific. False elevation can occur in patients of haemolysis, megaloblastic anemia, leukemia, liver disease, renal disease and skeletal muscle disease.

LDH or LDH isoenzymes analysis for diagnosis of acute myocardial infarction is done for patients in which CK-MB has fallen to normal that is when infarction is suspected to have occurred 2 to 4 days earlier.



Graph Showing comparison of LDL in Study and Control



Graph Showing comparison of CK-MB in Study and Control

Fig 1: Comparison of CKMB

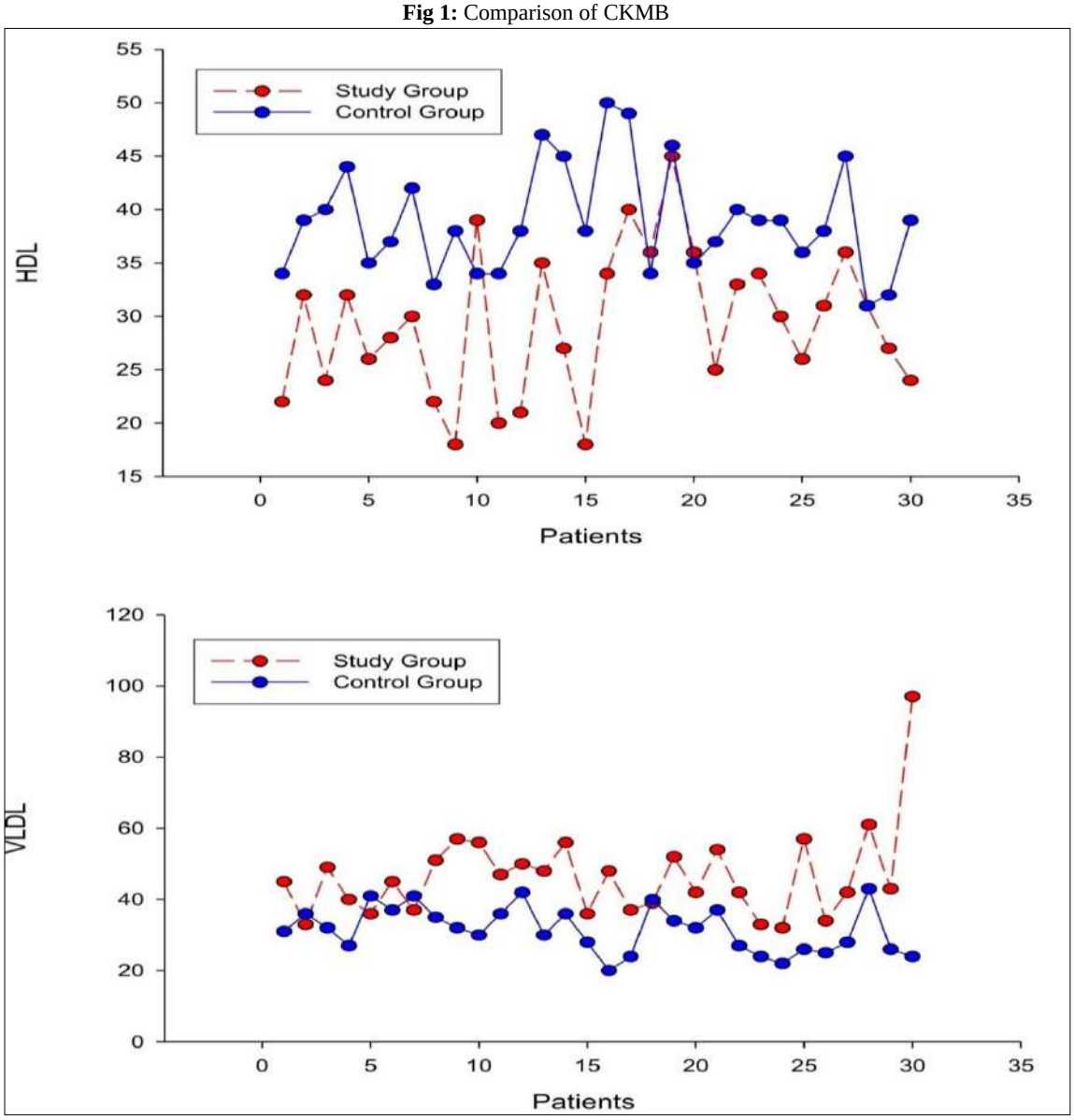
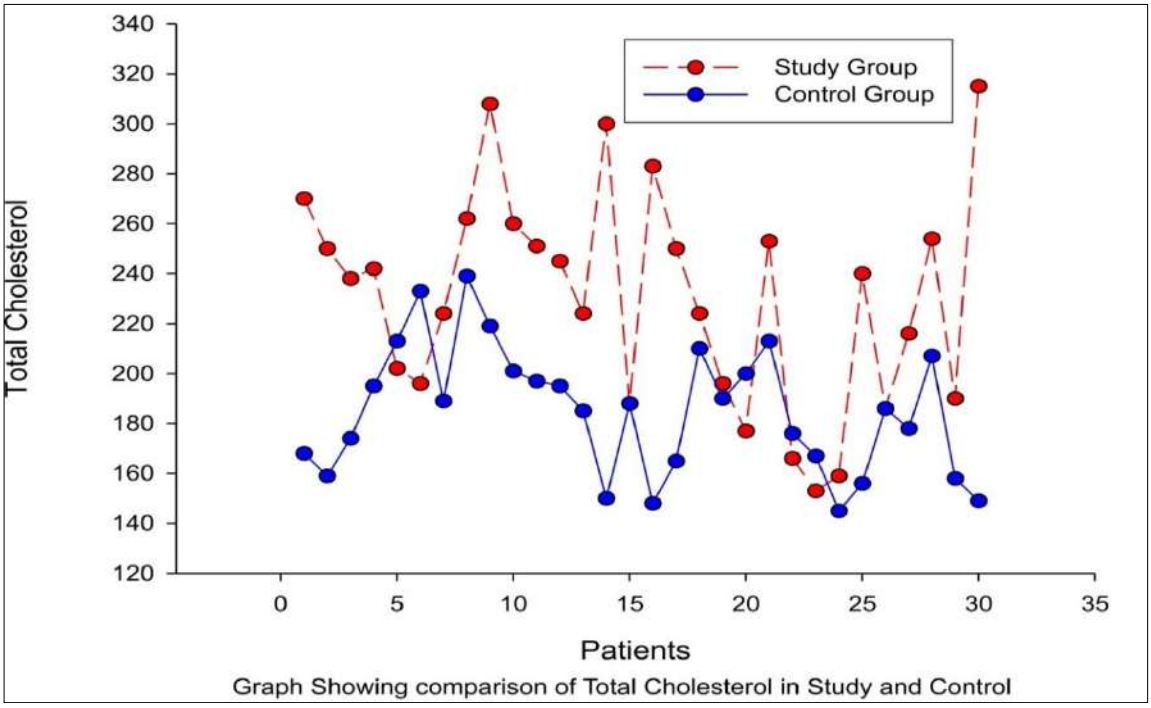


Fig 2: Comparison of HDL & VLDL



Graph Showing comparison of Total Cholesterol in Study and Control

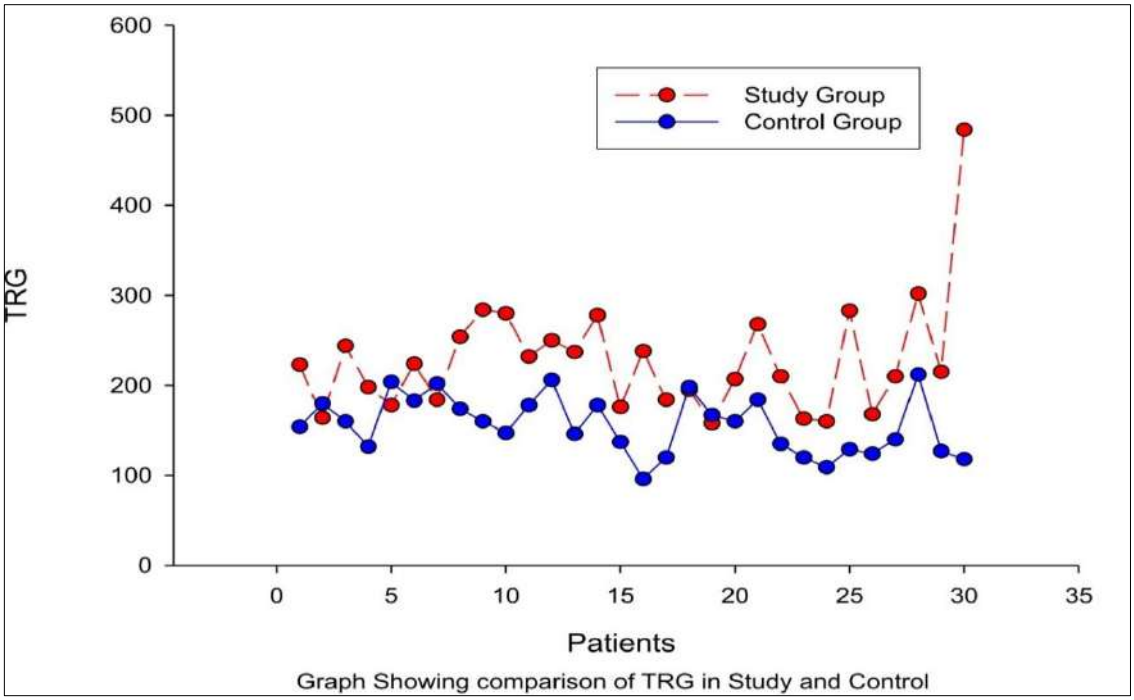


Fig 3: Cholesterol and TRG

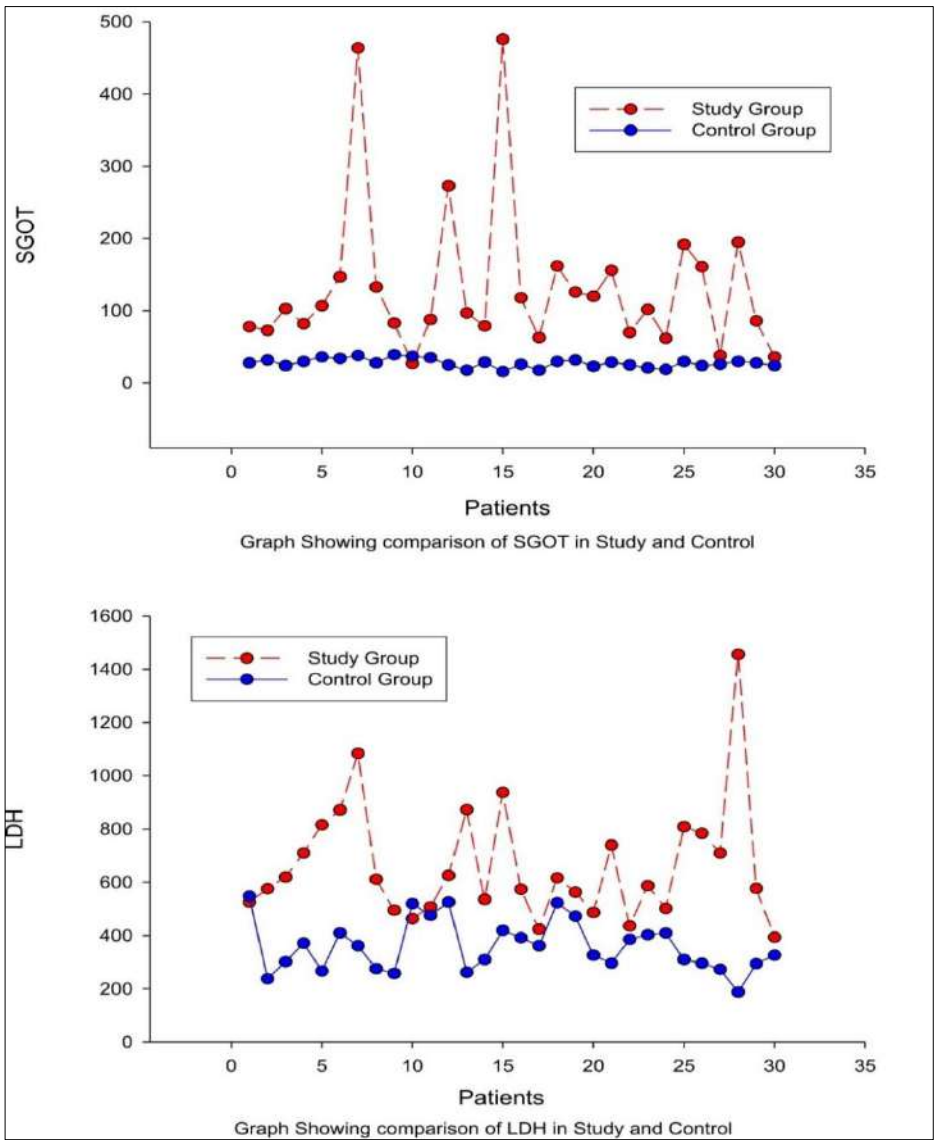


Fig 4: LDH and SGOT

Discussion

The present study showed that CVD in type 2 diabetes mellitus was more prevalent in males (73%) as compared to females (27%) and the mean age was 62±12. These findings were matched to a study carried out in the Rawalpindi region which showed that it was more in males whereas age was comparable.

UKPD with the aim to compare fasting lipids amongst Type 2 DM showed that lipid concentration increased with age but reached the plateau at the age of 50 yrs. King *et al* [5] in their study reported risk of CHD in diabetic females is related to age, reproductive and hormonal status as well as HDL-C, and Triglycerides. Brochier *et al*. are of opinion that after menopause women may develop coronary atherosclerosis much faster, therefore men with type 2 DM have a two-fold increased risk whereas women have a four-fold increased risk of CHD. Gender based difference in prevalence, presentation and treatment of CHD remains an important area of controversy and research [10].

Hypertension and smoking were commonly noted in diabetic male patients, these risk factors along with obesity enhance atherosclerosis because of diabetic dyslipidemia. Smoking disturbs lipoprotein metabolism and causes harmful effects on blood vessels by oxidation of LDL cholesterol which results in a significant increase in triglycerides and a fall in HDL-C and is thought to be due to insulin resistance.[5]

The pattern of dyslipidemia found in this study was raised serum total cholesterol, triglyceride and LDL levels, and low HDL cholesterol levels which is a contributory risk factor for cardiovascular disease. Dyslipidemia was more pronounced in patients who had a long history of diabetes.

Conclusion

Total cholesterol levels were found significantly increased in type 2 diabetics.

Fasting triglycerides levels were found to be significantly increased in type 2 diabetics compared to controls mainly due to decreased lipoprotein lipase and decreased catabolism of VLDL-C.

Fasting HDL cholesterol levels were found significantly decreased in the diabetic group than in non-diabetic controls due to decreased levels of lipoprotein lipase in type 2 diabetes mellitus.

VLDL-C levels were found to be increased in type 2 diabetic individuals compared to controls.

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