# Study of Serum Lipid Profile in Diabetics and Its Relation with Complications

[1]Dr.Satyendra Kumar Singh, [2]Dr.Gregory Minj

[1]*(Department of Medicine/Associate Professor/R.I.M.S/Ranchi University/India)*
[2]*(Department of Medicine/Associate Professor/R.I.M.S/Ranchi University/India)*

*Abstract*
*Introduction: Diabetes mellitus is commonest endocrine metabolic disorder affecting the people all over the world. Diabetes as a group tends to have higher lipid levels than non diabetics and this abnormality is exaggerated in patients having poor diabetes control. hyperlipidemia is associated with micro and macro vascular impairments like retinopathy, nephropathy, neuropathy, endothelial cell dysfunction and atherosclerosis.*
*Material and methods: The subjects for the study are selected from patients who are admitted to Rajendra Institute of Medical Sciences Ranchi, Jharkhand*
*Study design:- case-control clinical study*
*Sample size:- 100*
*Result:-TG, VLDLC, was significantly higher and HDLc level lower in diabetics than healthy controls.TC and LDLc were other fractions which were slightly above optimal level in diabetics. Among the complication, diabetic retinopathy was the commonest complication (42%), followed by neuropathy (36%) and IHD (34%), nephropathy (28%), PVD (12%) and cerebrovascular accidents (8%)*
*Conclusion:- hyperlipidemia is quite common in diabetics and hypertriglyceremia is most common abnormality. In this study diabetic retinopathy was amongst commonest complication followed by peripheral neuropathy, ischemic heart disease, nephropathy, PVD and CVA in decreasing order of frequency.*
*Keywords: Complications, diabetes, lipid profile*

## I. Introduction

Diabetes mellitus is commonest endocrinal metabolic disorder affecting the people all over world. Hyperlipidemia and altered lipid metabolism is commonly seen in diabetes. Diabetes as a group tends to have higher lipid level than non- non diabetes and this abnormality is exaggerated in patients with poor diabetes control. There are several reasons for this association. First insulin plays in important role in the regulation of intermediary lipid metabolism and fluctuations in the degree of diabetes control thus produce variable effect on plasma lipoprotein metabolism. Secondly, many non insulin dependent diabetic patients are obese, and obesity may lead to development of hyperlipidemia[1]. Over 200 risk factors for cardiovascular disease, the most important are abnormal lipids. Both type 1 and type 2 diabetes are characterized by a high risk of developing chronic complications, with micro- and macrovascular impairments in multiple organs, including retinopathy, nephropathy, neuropathy, endothelial dysfunction and atheroscelorosis. Although the pathogenic mechanisms of both form of diabetes are different, the symptoms and consequences, including lack of insulin, metabolic disturbances, impaired lipid balance, are common features. Lipid abnormality in diabetic patients is likely to play an important role in development of atherogenesis. These lipid disorders not only include quantitative but also qualitative abnormalities of lipoprotein which are potential atherogenic[2]. Because so many risk factor inter-relate, hence it is difficult to isolate the effect of specific risk factor on lipid profile[3].

There is a reciprocal influence of dislipidemia on beta-cell function and inversely of beta cell dysfunction on lipid metabolism and micro-and macrovascular complications. Vascular complications have replaced acidosis as the most frequent cause of death in diabetics[4]

## II. Material And Methods

The present study was carried out in the Department of Medicine, Rajendra Institute of Medical Sciences, Ranchi.

### Inclusion Criteria

Both type -1 and type-2 diabetes mellitus are included in this study. The diagnosis of diabetes is based on revised criteria according to consensus panel of experts from national diabetes data group and WHO.[5, 6]
Criteria for Diagnosis of DM

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-Fasting plasma glucose≥7.0mmol/l or 126 mg/dl
Or
-Hba1c≥6.5%
Or
-2 hour plasma glucose≥11.1mmol/l or ≥200 mg/dl during an oral glucose tolerance test
Or
-Symptoms of diabetes plus random blood glucose concentration≥11.1mmol/l or ≥200mg/dl.

**Exclusion Criteria**
-Patients with stress factor, infection pregnancy, diabetic ketoacidosis.
-Conditions affecting lipid levels like hypothyroidism, on lipostatic drug.
50 cases of diabetic patients and 50 controls were undertaken to study the level of various lipid fractions and their relationship with various micro and macro vascular complication.

**The Following Investigation Have Been Done In Our Study**
-Routine blood and urine analysis
-Fasting plasma glucose, postprandial plasma glucose and random blood glucose.
-Fasting serum triglyceride, total cholesterol, HDLc, LDLc, VLDLc.

## III. Statistical Analysis

Descriptive and inferential statistical analysis has been carried out in the present study. Result on continuous measurements are presented on mean ± SD and results on categorical measurements are presented in number (%).significance is assessed at 5% level of significance.

**The following assumptions on data are made:**
1. Dependent variable should be normally distributed.
2. Sample drawn from the population should be random
3. Cases of the sample should be independent

Analysis of Variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups inter group analysis) on metric parameters. Chi-square/fisher exact test has been used to find the significance of study parameters on categorical scale between two or more groups.

## IV. Results

Lipid profile of 50 diabetes mellitus patients was compared to 50 control subjects who were non diabetics, non hypertensive and were not taking any drug affecting lipid profiles.Serum lipid level was correlated with various clinical parameters like gender distribution, duration of diabetes, incidence of complications and type of therapy.In the study that was conducted in RIMS the average duration of diabetes was 7 years. Out of 50 diabetes patients 68% were males and 32% were females. All of diabetes under survey was on therapy for diabetes. 24 patients were on oral hypoglycemic drugs, 16 were taking both oral hypoglycemic and insulin, and 10 were on only insulin.TG, VLDLc, was significantly higher and HDLc levels lower in diabetics than healthy controls.TC and LDLc were other fractions which were slightly above optimal level in diabetics. Among the complications, diabetic retinopathy was commonest complication (42%), followed by neuropathy (36%) and IHD (34%), then nephropathy (28%), PVD (12%) and cerebrovascular accident (8%)

## V. Tables and Figures
**Table1.**Age distribution of patients studied

| Age in years | cases | controls |
|---|---|---|
| 11-20 yrs | 2 | 5 |
| 21-30 yrs | 4 | 7 |
| 31-40 | 14 | 13 |
| 41-50 | 18 | 16 |
| 51-60 | 6 | 5 |
| 61-70 | 3 | 3 |
| 71-80 | 2 | 1 |
| 81-90 | 1 | 0 |
| Total | 50 | 50 |

**Table3.**Gender distribution of patients studied

| Gender | cases | controls |
|---|---|---|
| Male | 34 | 33 |
| Female | 16 | 17 |
| Total | 50 | 50 |

**Table4.**Distribution of sugar parameters in two groups of patients studied

| Sugar parameters | Cases (n =50) | Controls(n=50) |
|---|---|---|
| FBS mg/dl | | |
| <100 | 0(0%) | 39(78%) |
| 100-125 | 9(18%) | 11(22%) |
| ≥126 | 41(82%) | 0(0%) |
| PPBS mg/dl | | |
| <140 | 0(0%) | 24(48%) |
| 140-199 | 0(0%) | 26(52%) |
| ≥200 | 50(100%) | 0(0%) |

**Table5.**Comparison of sugar parameters in two groups of patients studied

| Sugar parameters | cases | controls | P value |
|---|---|---|---|
| FBS mg/dl | 176.02±42.65 | 94.04±15.15 | <0.001 |
| PPBS mg/dl | 310.50±55.78 | 139.78±12.78 | <0.001 |

**Table6.**Distribution of lipid parameters in two groups of patients studied

| Lipid parameters | Cases (n=50) | | Controls (n=50) | | P value |
|---|---|---|---|---|---|
| | No. | % | NO. | % | |
| Total cholesterol (mg/dl) | | | | | |
| • <200 | 18 | 36 | 39 | 78 | <0.001 |
| • ≥200 | 32 | 64 | 11 | 22 | |
| LDL (mg/dl) | | | | | |
| • <130 | 27 | 54 | 40 | 80 | <0.001 |
| • ≥130 | 23 | 46 | 10 | 20 | |
| Triglycerides (mg/dl) | | | | | |
| • <150 | 1 | 2 | 27 | 54 | <0.001 |
| • ≥150 | 49 | 98 | 23 | 46 | |
| HDL (mg/dl) | | | | | |
| • <40 | 34 | 64 | 13 | 26 | <0.001 |
| • ≥40 | 16 | 32 | 37 | 74 | |
| VLDL (mg/dl) | | | | | |
| • <30 | 1 | 2 | 26 | 52 | <0.001 |
| • ≥30 | 49 | 98 | 24 | 48 | |

**Table7.**Comparison of lipid parameters in two groups of patients studied

| Lipid parameters | cases | controls | P value |
|---|---|---|---|
| Total cholesterol Mg/dl | 209.02±27.15 | 180.78±24.21 | <0.001 |
| LDL mg/dl | 126.82±25.63 | 106.80±27.41 | <0.001 |
| Triglyceride mg/dl | 223.54±46.98 | 152.26±27.81 | <0.001 |
| HDL mg/dl | 36.24±4.96 | 41.54±3.46 | <0.001 |
| VLDL mg/dl | 45.18±9.72 | 30.34±5.59 | <0.001 |

**Table8.**Distribution of complications of patients studied

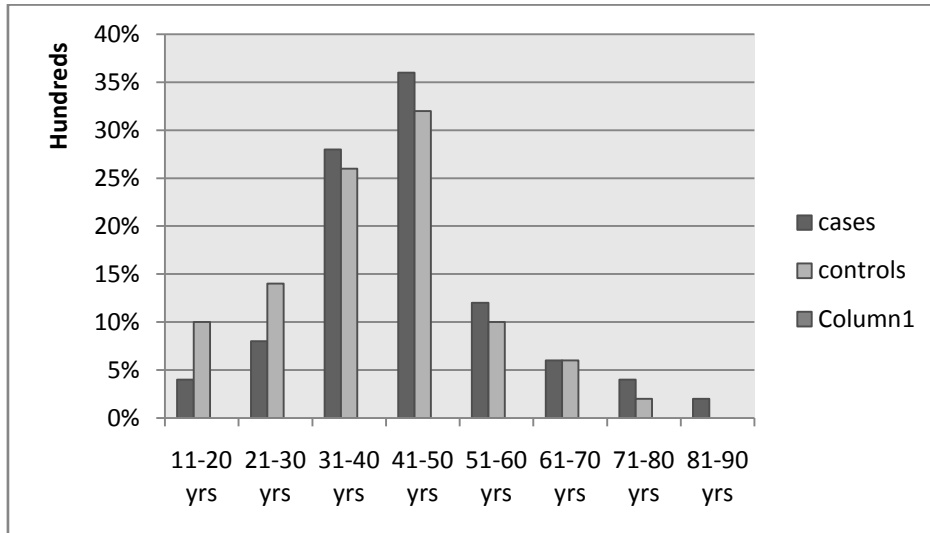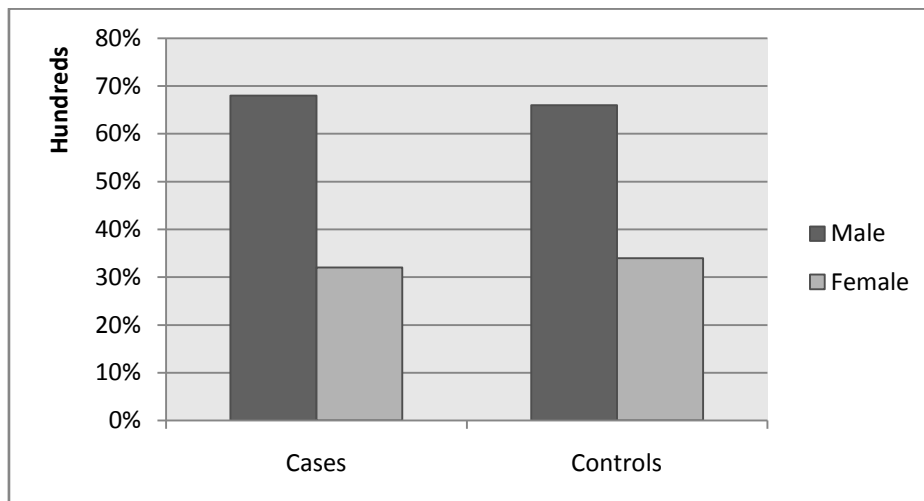| complications | No of patients | % | P value |
|---|---|---|---|
| retinopathy | 21 | 42 | <0.001 |
| neuropathy | 18 | 36 | <0.001 |
| nephropathy | 14 | 28 | <0.001 |
| CVS | 17 | 34 | <0.001 |
| CVA | 4 | 8 | |
| PVD | 6 | 12 | |

**Figure1.**age distribution of patients studied



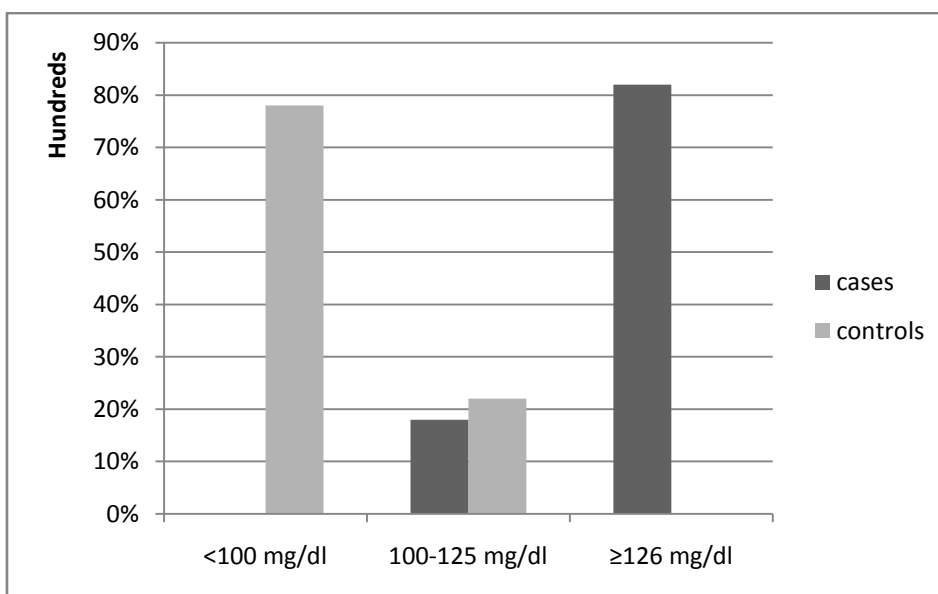**Figure2.**Gender distribution of patients studied



**Figure3.**Distribution of sugar parameters (fasting) in two groups of patients studied
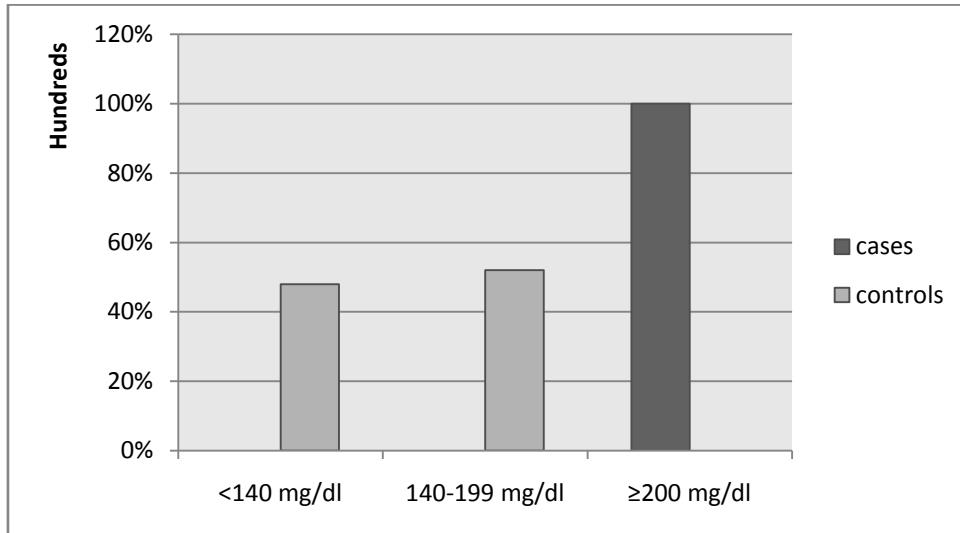
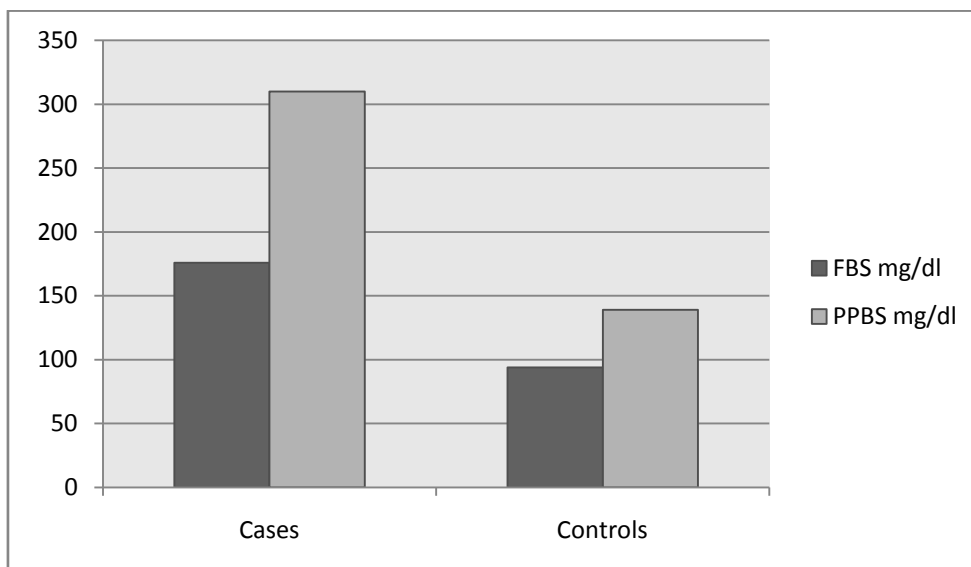**Figure4.**Distribution of sugar parameters (PP) in two groups of patients studied



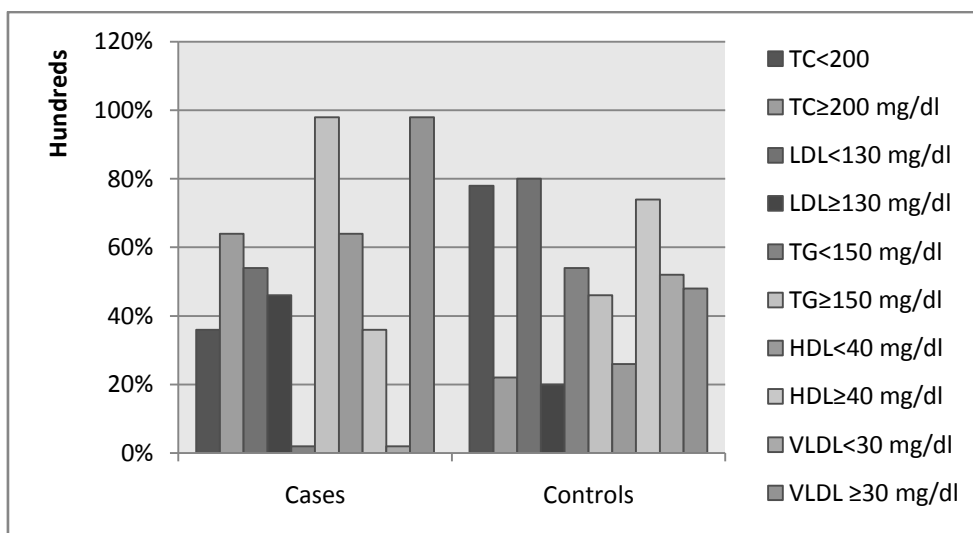**Figure5.**Comparison of sugar parameters in two groups of patients studied



**Figure6.**Distribution of lipid parameters in mg/dl in two groups of patients studied
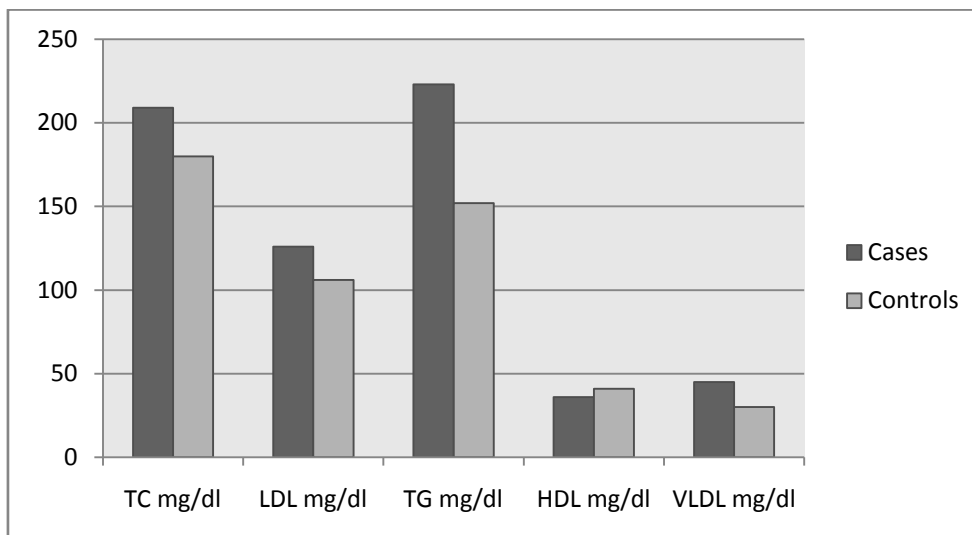
**Figure7.**Comparison of lipid parameters in two groups of patients studied
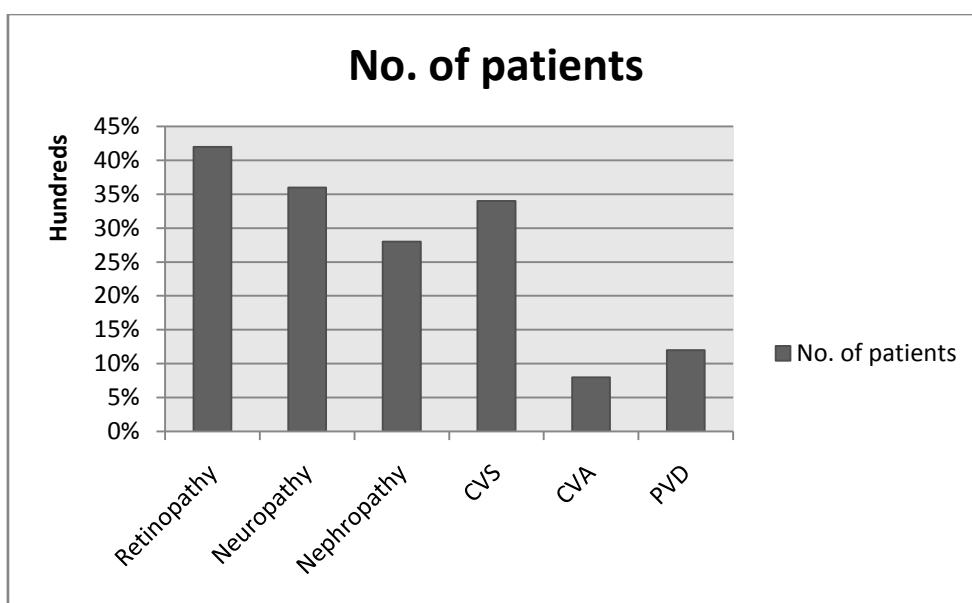


**Figure 8.**Distribution of complications of patients studied

## VI.  Discussion

A case study was conducted among the patients who were admitted to Rajendra Institute of Medical Sciences, Ranchi, Jharkhand.

**1. Age and sex distribution:**

Most of the diabetics under the study were males(68%) compared to (32%) females which was comparable to Ajagnakar and Sathi et al 1989 and Vaishnava et al 1989 who's  studies implied that incidence of diabetes was greater among the male population compared to the females.

**2. Lipid Profile And Diabetes:**

Dyslipidemia was an obvious finding in the present study group. TG's and VLDL's were significantly raised to the tune of 98% in the study group compared to the control population.HDL were reduced among the diabetics compared to the non diabetics. These finding corroborated with the study conducted by Mazzone et al[7] (2000) where he documented an increase in triglyceride. In this study it was observed that apart from an increase in TGs and VLDL and increase in HDL, TC also was found to be slightly raised in the study. A study conducted by H.O Otamere et al also documented an increase in triglycerides, total cholesterol, LDL and decrease in HDL which was pretty much the picture in this study.

Chase and Glasgow et al (1976) conducted a study and documented elevated level of TGs, TC, LDL and depressed level of HDL, similar to that observed by P.K. Bijlaani et al[8] (1983) and Barr et al (1951), found that HDL levels were depressed in diabetics which was one of the finding in this study as well as mean HDL level of (36.24±4.96) among the diabetic population compared to HDL level of (41.54±3.46) among non diabetics.

**3. Duration Of Diabetes:**

The mean duration of diabetes among the study population was around 7 years. H.O. Otamere et al in their study inferred that age and duration of diabetes is not a reliable indicator to assess the impact of diabetes or its complications. similar results were published by author Barbara V H et al[9,10,11] 1984 ; James S reitman et al 1987; but some author like Baker et al 1982 have observed variant observation where there was no correlation between two. Likewise in this study the duration of diabetes had no bearing on alteration in lipid profile. A cross sectional study headed by Riffat sultana[12] was conducted by Khyber
Medical college Peshawar from 2009 to July 2009 to assess the impact of duration on lipid profile in type 2

**Diabetes And The Following Observation Were Made:**
1. Sharp and definite increase in the percentage of patients having >200mg/dl total cholesterol after four year of diabetes mellitus from (28-34%) to (14.2%)
2. There was sharp increase in the percentage of patients having >150 mg/dl of low density lipoprotein after 6 year of diabetes mellitus from (8-9%) to (14.2%).
3. There was also an increase in percentage of patients having <160mg/dl of triglyceride after four year of diabetes mellitus from 53% to 61% of diabetes .only the 1st observation of the Riffat sulthana[12] study was in confrontation with this present study with mean cholesterol levels around (209.20±29.26) for duration of diabetes more than 7 years and (208.75±24.39) for duration of diabetes more than 4 years but less than 7 years.

**Complications:**

The commonest complication among the study population was retinopathy with an incidence of (42%) followed by peripheral neuropathy (36%), IHD (34%). According to ADA, the incidence of retinopathy at 10 years of diabetes is around 58%. The incidence of peripheral neuropathy in the study was around 36% which was similar to that observed by Mohan et al (1999) in their study which was around 34%.

**4.1 Incidence Of Complications And Gender Predisposition:**

It was reported in India, the incidence of diabetes is greater in males than in females. The results of present study are consistent with above reports. In this study the associated complication in the diabetic population were more in the males compared to the females. The commonest complication among male was retinopathy (52.9%) while the commonest complication among females was peripheral neuropathy (25%).

**4.2 Incidence Of Complication And Its Correlation With Lipid Parameters.**

The lipid level of each complication was studied separately. All the lipid fractions except HDLc were elevated in diabetics with complications when compared to diabetics without any complications as well as healthy controls. Lipid fractions like TG, VLDLc were significantly elevated (p<.05%) in diabetics with retinopathy, peripheral neuropathy, nephropathy and IHD. The HDLc was significantly low (p<.05) in diabetics with retinopathy, nephropathy, neuropathy, IHD, PVD, but less significant in case of CVA.
This observation might be due to different factors. These include alterations in platelet functions, clotting factors, arterial smooth muscle cell metabolism, and possibly, blood pressure regulation. In addition, associated changes in plasma lipid and lipoprotein levels in diabetes remain important in terms of explaining the accelerated atherosclerosis. Similar to non-diabetics patients increases in total and low-density lipoprotein cholesterol and decreases in high density lipoprotein cholesterol are more prevalent in diabetics with CHD than those without CHD. In addition increases in plasma triglyceride in some studies have been better predictor of CHD in diabetic patients than increase in cholesterol.

Increasing concentrations, low to high, of LDLc particles are associated with increasing amount of atherosclerosis and eventually resulting in higher incidence of strokes, IHD and other cardiovascular abnormalities. In this study the relationship between LDLc level and incidence of complication was not significant 0.46% cases had LDLc levels more than upper limit (>130mg/dl) whereas rest cases had above /near optimal levels (100-130mg/dl). Although this study did not show any significant correlation between LDLc level and complications in diabetics, but its role in genesis of cardiovascular complications cannot be ruled out. According to American heart association, NIH and NCEP guidelines[13, 14] optimal levels of LDLc should be below 100mg/dl to minimize rates for symptomatic cardiovascular events.

## VII. Conclusion

1. This study laid emphasis on the fact that diabetes mellitus influences lipid metabolism in a significant way. This was evident by the fact that certain lipid fraction such as triglycerides and very low density lipoproteins were elevated and HDLc was depressed in diabetics when compared to healthy controls. TC and LDLc were other fractions which were slightly above optimal levels in diabetics.

2. So hyperlipidemia is quite common in diabetes and hypertriglyceremia is the most common abnormality.

3. In this study the age and sex of patients did not have much of a bearing on the alteration of serum lipids. Duration of diabetes did not show significant influence in altering lipid profile.

4. In this particular study diabetic retinopathy was among the commonest complication seen among the diabetic patient followed by peripheral neuropathy, ischemic heart disease, nephropathy, PVD and CVA in decreasing order of frequency.

5. TG, VLDLc, were significantly higher and HDLc level lower in diabetics with complication than healthy controls.TC and VLDLc was also increased in diabetics. This suggests that there appears to be some relation between the genesis of various vascular complications (microvascular and macrovascular) and presence of lipid abnormality.

6. Hence control of diabetes could help keep the lipid levels in near normal range, thereby playing a role in the postponement of complication that may occur due to altered lipid metabolism.

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