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COMPARATIVE STUDY OF LIPID FRACTIONS IN TYPE- I AND TYPE- II DIABETES IN RELATION TO ITS DURATION, SEVERITY AND TYPE OF MEDICATION

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ABSTRACT

Background and Objective: Diabetes mellitus comprises a group of common metabolic disorder that share the phenotype of hyperglycemia. The aim of present study was to evaluate the serum lipid and lipoprotein profile in diabetes.

Materials and Methods: In the present study a total of 200 patients diagnosed for diabetes mellitus (both Type-I and Type-II) were included in the study. All the participants were subjected to the procedures like a detailed history, Urine analysis, Biochemical analysis for fasting blood sugar, Fasting Serum triglycerides, Total cholesterol, HDL, LDL and VLDL. Students't' test, one way ANOVA followed by Tukey's test was used to find out the significance of difference using SPSS version 11. P values less than 0.05 was considered the level of significance.

Result: It was observed that there was an increase in the levels of Triglycerides (TG), Total cholesterol (TC), Low Density Lipoprotein-cholesterol (LDLc) and Very Low Density Lipoprotein-cholesterol (VLDLc) with increasing severity of diabetes. The difference in the values of these lipid fractions between Grade-I and Grade-III severity of diabetes was statistically significant ($p<0.01$). Even though the High Density Lipoprotein-cholesterol (HLDc) values did not show statistically significant difference between the groups, the HLDc /TC ratio was significantly reduced ($p<0.01$) between Grade-I and Grade-III severity of diabetes.

Conclusion: Diabetes Mel1itus has real impact on lipid metabolism which was substantiated by the fact that all the lipid fractions were elevated in diabetics.

Keywords: Hyperlipidemia, TG, TC, LDLc, VLDLc, HDLc

1. Introduction:

Diabetes Mellitus comprises a group of common metabolic disorder that share the phenotype of hyperglycemia. It is caused by a complex interaction of genetics, environmental factors and lifestyle choices. Type-II Diabetes Mellitus is a heterogeneous group of disorders characterized by variable degrees of insulin resistance, impaired insulin secretion and increased glucose production. Distinct genetic and metabolic defects in insulin action or secretion give rise to the common phenotype of hyperglycemia in Type-II Diabetes Mellitus. The chronic hyperglycaemia of diabetes is associated with long-term damage, dysfunction, and failure of various organs, especially the eyes, kidneys, nerves, heart, and blood vessels.[1]

According to Sushruta, the chief characteristic of diabetes mellitus is "if walking he would like to stand, if standing he would like to sit; if sitting he would like to lie down and if lying down he would like to sleep". The criterion for cure is "when urine is no longer sticky, is clear pungent or bitter and flies and ants are no longer attracted to it". Hyperlipidemia and altered lipid metabolism is commonly seen in diabetes. The relationship between elevation of serum lipids and vascular complication of diabetes has long been of interest because both tend to occur with greater frequency in diabetes .mellitus than in general population. The increased risk of vascular disease in diabetic patients may be in part due to the associated hyperlipidemia.[2]

Hyperlipidemia is a relatively common problem in patients with poorly controlled diabetes mellitus. Diabetes as a group tends to have higher lipid levels than non-diabetics and this abnormality is exaggerated in patients with poor diabetic control. There are several reasons for this association. Firstly, insulin plays in important role in the regulation of intermediary lipid metabolism[3] and fluctuations in the degree of diabetic control thus produce variable effects on plasma lipoprotein metabolism. Secondly, many non-insulin dependent diabetic patients are obese, and obesity may lead to the development

of hyperlipidemia. Thirdly, although diabetes and hyperlipidemia represent different genetic disorders, each of these disorders is common in the population and the two disorders may coexist by chance in the same individual.[4]

Lipid abnormalities in diabetic patients are likely to play an important role in the development of atherogenesis. These lipid disorders include not only quantitative but also qualitative abnormalities of lipoproteins which are potential atherogenic.[5] The exact relationship between altered lipid profiles in diabetes with cardiovascular complications is not yet fully understood. Since the pathogenesis of atherosclerosis and diabetic micro angiopathy remains obscure, a close and critical evaluation of serum lipid and lipoprotein profile in diabetes continues to be important and was the objective of the present study.

2. Materials and Methods:

The present study was conducted at the University Medical center of Kasturba Medical College, Mangalore, after the institutional ethical clearance and informed, written consent from all the participants. A total of 200 patients diagnosed for diabetes mellitus based on WHO criteria were included in the study. Age and Sex matched 50 non-diabetic subjects were recruited as controls. Both Type- l and Type- II diabetics were included in this study. The patients with stress factors like trauma, infection, surgery, myocardial infarction, pregnancy, diabetic keto-acidosis were excluded from the study. All the participants were subjected to the procedures like a detailed history, Urine analysis, Biochemical analysis for fasting blood sugar, Fasting Serum triglycerides, Total cholesterol, High density lipoprotein, Low density lipoprotein and Very low density lipoprotein. The total cholesterol to HDL ratio is determined by dividing the total cholesterol by the HDL cholesterol.

The lipid fractions were analyzed in patients, who were divided into different groups as follows,

A. Degrees of glycemic control –The patients were divided into three groups on the basis of the fasting blood sugar level. The degree of glycemic control was graded as Grade – I (FBS=135-200mg %), Grade –**II (**FBS= 200- 300mg %) and Grade—III (FBS >300mg %). **B. Mode of treatment -** The diabetics were divided into 3 groups depending on the type of therapy as those on insulin, those on oral hypoglycemic drugs (OHD) and those having of treatment. **C. Hypertension**: It was defined to be positive if, systolic BP was greater than 160mm- Hg or a diastolic BP was greater than 95mmHg or both. **D. Duration of diabetes** into four groups and **E. Types of diabetes** into two as type-I and type-II diabetes.

2.1 Statistical Analysis: The mean levels of various lipid fractions were correlated with the all above mentioned parameters. Students't' test, one way ANOVA followed by Tukey's test was used to find out the significance of difference using SPSS version 11. P values less than 0.05 was considered the level of significance.

3. Result:

The lipid fraction of different groups of diabetics on the basis of duration was shown in Table-1. It was observed that the mean values of triglycerides and total cholesterol are showing slight increase with the increasing duration of diabetes. But this increase was not statistically significant. The HDL-cholesterol levels showed trend of decrement with prolonged duration of diabetes but again this difference was also statistically insignificant. Table - 2 shows the mean and standard deviations of various serum lipid fractions in relation to severity of diabetes assessed by fasting blood sugar levels. It was observed that there was an increase in the levels of triglycerides (TG), Total cholesterol (TC), Low Density Lipoprotein-cholesterol (LDLc) and Very Low Density Lipoprotein-cholesterol (VLDLc) with increasing severity of diabetes. The difference in the values of these lipid fractions between grade I and Grade III severity of diabetes was statistically significant ($p<0.01$). Even though the High Density Lipoprotein-cholesterol (HDLc) values did not show statistically significant difference between the groups the TC/HDLc ratio was significantly different reduced ($p<0.01$) between grade I and grade III severity of diabetes.

The comparison of lipid levels between Type- I (IDDM) and Type -II (NIDDM) diabetes was shown in Table-3. The levels of lipids in controls are also given the table for comparison. All lipid fractions in both type of diabetes are increased ($p<0.01$) when compared to controls. The values of TGs, cholesterol, LDLc and VLDLc are found to be higher in type II diabetes when compared with type I diabetes. And the HDLc levels are low in type II diabetes but were slightly high in type I diabetics when compared to controls. TabIe-4 shows the mean values of various lipid fractions in diabetics treated with only insulin and those who were treated with oral hypoglycemic drugs. When compared between these two

groups, it was evident that all the lipid fractions (TG, TC, VLDLc & LDLc) were greater ($p<0.01$) in diabetics taking OHD than those who were taking only insulin. The difference in the values of TC & LDLc was statistically significant ($p<0.01$). But the difference in TG levels was statistically insignificant. The values of HDLc and TC/HDLc ratio was significantly low ($p<0.01$) in patients taking OHD than those who were taking insulin therapy. The levels of lipids in patients who were taking both insulin and OHD were almost similar to those who were on only OHD. The lipid level was compared between diabetics with and without hypertension and was represented in Table -5. It was observed that the levels of TG, TC, LDLc, and VLDLc were elevated in diabetics with hyper tension than in those without hypertension. However the difference was not statistically significant. The HDLc and TC/HDLc ratio was low in patients with hypertension than in those without hypertension.

4. Discussion:

The serum lipid profiles of 200 diabetic patients were studied and the serum lipid levels were correlated with various clinical profile of diabetes like duration, severity of diabetes, type of therapy and the type of diabetes. The mean values of all the lipid fractions (TC, TG, LDLc and VLDLc) were higher in diabetics, which is in accordance with most of the previous reports.[6, 7] Several studies have shown significantly low levels of HDL in diabetics, [8] whereas in the present study, even though the mean values of HDL were seen to be decreased in few age groups it was not statistically significant. Even though there was lack of correlation between lipid levels and duration of diabetics in the initial periods, the diabetics with duration of more than 10 years showed elevations of TG and TC with decreases in HDLc levels.

Most workers have reported a complete lack of correlation between the duration of diabetes and the serum lipids.[9, 10] The findings of the present study were similar except that, the triglycerides showed slight increase with increase in duration of diabetes. It was also found that all lipid fractions profoundly increased with increasing severity of diabetes. The similar results were observed by Ahuja et.al. who observed higher values of TG and Cholesterol in patients with FBS greater than 139mg%.[11] Whereas, Verges et.al. 1983 found linear relationship between the glycosylated hemoglobin and triglyceride levels.[12]

All lipid fractions showed a progressive Increase with increasing severity of diabetes. The differences were statistically significant. The HDLc and TC/HDLc ratio was shown to be a good predictor of coronary risk showed lower levels i.e., increased risk in severe diabetics. The triglycerides, cholesterol, VLDLc and LDLc levels were high in diabetics taking oral hypoglycemic chugs than those who were on insulin therapy, and patients taking oral hypoglycemic drugs had low HDLc and TC/HDLc ratio when compared to patients taking insulin. All the lipid fractions except HDL were found to be higher in Type-II (NIDDM) than in Type - I (IDDM) diabetes. And the HDL levels were slightly higher in Type - I than Type - II diabetes. These findings substantiate the observations of Nikkila and Hormila, (1978) who also found slightly high HDL levels and low TC and TG in insulin treated diabetics.[13] All lipid fractions like TC, TG, LDLc and VLDLc were greater in type- II than type- I diabetes. The HDLc levels lower in type-II diabetes. In the present study all the serum lipid fractions except HDL were higher in diabetic patients treated with OHD than in those treated with insulin. The HDL levels and TC/HDLc ratio was found to be higher in insulin taking patients than the patients taking OHD. In the present study the diabetics with hypertension had greater levels of TC, TG, VLDL and LDL than those without hypertension. These findings are consistent with other reports.[14-16] The HDL levels were low ill diabetics with hypertension than those without it. From the present study it was evident that diabetes mel1itus has real impact on lipid metabolism. This was substantiated by the fact that all the lipid fractions were elevated in diabetics. So hyperlipidemia is quite common in diabetes.

References:

1. Alvin C.Powers, Harrison's Principle of Internal Medicine. 16th edition, McGraw-Hill medical publication; Volume 2, pp- 2152.
2. Suri, R.K., Guptha, M.M. and Chakkravarthi, A.K. Hyperlipidaemias and vascular populations of diabetes mellitus. *J. Ass. Phys. India*., 1979, 27: 505.
3. Nikkila, B.A, Cheng SW, Ting AC, Wong J., Lipoprotein (a) and its relationship to risk factor and severity of atherosclrotic peripheral vascular diseases. *Eur J Vasc Endovasc Surg*, 1994, 14: 17-23.
4. Brunzell JD: Chylomicronernia syndrome. Med Clin North Am, 1982, 66: 455- 468.

5. Verges. Dyslipidacmia in diabetes mellitus. Review of the main lipoprotein abnormalities and their consequences on the development of atherogenesis. *Diabetes Metabol*. 1999, 25(3): 32- 40.
6. Mahallawy, M.N. Sabour, M.S., Osman, L.M. Metabolic Endocrine aspects of diabetic nephropathy. *Br. Med. J*., 1960, 1: 67-74.
7. Sharma D. Jansal B C, Prakash C. J. Incidence of coronary heart disease and lipoprotein cholesterol levels. *Ind. Med. Ass*., 1970, 54: 41-46.
8. Bijlani, P.K.and Kokila Shah. High density Lipoprotein cholesterol in Diabetes. *JAPI*, 1984, Vol 32: 309.
9. Valensi P, Girux C, seeboth- Ghalayini B, Attali JR.; Diabetic peripheral neuropathy: Effects of age, duration of diabetes, glycemic control, and vascular factors. *J Diabetes complications*. 1997:11,27-34.
10. Kennedy. L.: The effect of intensive dietary therapy on serum high density lipoprotein cholesterol in patients with Type 2 diabetes mellitus; a prospective study. *Diabetologia.* 1982: 1, 24-27.
11. Ahuja, M.M.S and Gossain V.V. Serum insulin, glucose and lipid levels among mild diabetics in relation to incidence of vascular complications. Lancet. 1971: 1: 80-88.
12. Verges, Dunn FL, Carroll PB, Beltz WF: Treatment with artificial beta- cell decreases very low- density lipoprotein triglyceride synthesis in type I diabetes. *Diabetes*, 1983: 36: 661-666.
13. Nikkila, Hormila, Ginsberg HN, Illingworth DR. Post prandial dyslipidemia: an atherogenic disorder common in patients with iabetes mellitus. *Am. J Cardiol*.1978: 20, 88-91.
14. Camerron N, Eaton SE, Cotter MA, Tesfay S. Vascular factors and Metabolic interactions in the pathogenesis of diabetic neuropathy. Diabetologia. 1979: 44, 88-96.
15. S. Matthaei, R. Bierwirth, A. Fritsche, B. Gallwitz, H.-U. Haring3, H.G. Joost,M. Kellerer, Ch. Kloos, T. Kunt, M. Nauck, G. Schernthaner, E. Siegel and F. Thienel. Medical Antihyperglycaemic Treatment of Type 2 Diabetes Mellitus. Exp Clin Endocrinol Diabetes 2009; 117: 522 – 557
16. Shand B, Scott R, Connolly S, Clarke R, Baker J, Elder P, Frampton C, Yeo J.Comparative study on the efficacy of pioglitazone in Caucasian and Maori-Polynesian patients with poorly controlled type 2 diabetes. *Diabetes Obes Metab*. 2007 Jul; 9(4):540-7.

Table-1: Lipid fractions in different groups of Diabetes with respect to its duration.

Lipid fractions (mg/dl)	Duration of Diabetes (In years)				P Value
	0-3 (n = 48)	4-6 (n = 51)	7-9 (n= 48)	>10 (n = 47)	
Triglycerides	209.7 ± 68.7	229.9 ± 44.4	231.5 ± 41.9	302.4 ± 24.0	(p<0.01)
Cholesterol	195.2 ± 49.6	202.8 ± 51.5	162.2 ± 25.5	249.3 ± 19.9	(p<0.01)
HDLc	42.7 ± 12.3	38.2 ± 12.3	35.2 ± 5.6	30.4 ± 8.1	(p<0.01)

Values are expressed as Mean ± S.D.

Table-2: Various serum lipid fractions in relation to severity of diabetes as assessed on the basis of degrees of Glycmic control.

Serum Lipids (Mean ±SD)	Fasting Blood Sugar (mg/dl)			P- value
	Grade-I (135-200), n=59	Grade-II (201-300), n=48	Grade-III (>301), n=43	
Triglycerides	205.4±90.1	232.5±80.9	449.4±21.7	(p<0.01)
Cholesterol	184.2±41.9	196.2±67.1	327.6±91.8	(p<0.01)
VLDLc	34.5 ±8.2	41.1 ±15.9	89.9±21.5	(p<0.01)
LDLc	105.3±20.9	109.7±20.0	119.2±23.2	(p<0.01)
HDLc	41.1±12.1	39.7 ±7.1	36.9±8.3	(p<0.01)
TC/HDLc ratio	4.48:1	4.94:1	8.87:1	(p<0.01)

Values are expressed as Mean ± S.D.

Table-3: Various serum lipid fractions with respect to the type of Diabetes.

Lipid Fraction (mg/dl)	Type-I (n - 49)	Type-II (n = 55)	Controls (n= 50)	P Value
TC	195.2 ± 49.6	202.4 ±73.3	92.8 ±24.6	(p<0.01)
TG	209.7 ± 68.7	241.3 ± 28.8	125.4 ±78.3	(p<0.01)
LDLc	115.0±40.9	117.2±25.0	103.3 ± 38.2	(p<0.01)
VLDLc	38 .20 ± 13.7	41.9 ± 25.8	35.7 ± 13.2	(p<0.01)
HDLc	42.7 ± 12.3	36.13 ±9.7	47.7 ±l1.2	(p<0.01)

Values are expressed as Mean ± S.D.

Table-4: Comparison of lipid fractions between patients taking insulin and oral hypoglycemic drugs or both.

Lipid fractions (mg%)	Type of Therapy				P-value
	Insulin (n=50)	OHD (n=46)	Both (n=50)	Controls (n=50)	
Tirglycerides	207.80 ±76.9	241.9±94.6	253.0 ± 159.2	125.4±78.3	(p<0.01)
Cholesterol	173.46±40.5	212.6 ±63.1	216.4±79.8	92.8 ±14.6	(p<0.01)
VLDLc	41.60 ±15.4	48.4 ±18.9	43.4 ±19.6	28.0 ±13.8	(p<0.01)
LDLc	88.70 ± 38.9	127.9 ±55.8	125.7 ± 70.5	113.3 ±38.2	(p<0.01)
HDLc	47.2 ± 15.0	35.9 ±8.4	39.6 ±8.2	48.7 ± 11.2	(p<0.01)
TC/ HDLc ratio	4.40:1	6.74:1	6.38:1	2.57:1	(p<0.01)

Values are expressed as Mean ± S.D.

Table-5: Comparison of serum lipid fractions between diabetes with hypertension and diabetes without hypertension.

Lipid Fraction (mg/dl)	Diabetics with-out Hypertension n=46	Diabetics with Hypertension n=50	Statistical significance
Triglycerides	209.7 ± 68.7	268.6± 18.7	(p<0.01)
Cholesterol	191.1±51.3	230.8 ± 95.7	(p<0.01)
VLDLc	43.2 ± 16.7	53.7 ± 36.7	(p<0.01)
LDLc	104.4 ± 48.3	139.2 ± 79.3	(p<0.01)
HDLc	42.2 ± 13.4	37.8±7.4	(p<0.01)
TC/ HDLc ratio	4.54:1	6.11:1	(p<0.01)

Values are expressed as Mean ± S.D.