

Comparative Study on Lipid Changes in Glycemic Uncontrolled Diabetes Type 1 and Type 2

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ABSTRACT

OBJECTIVES: To compare the lipid profile in glycemic uncontrolled type 1 diabetes mellitus (DM) with type 2 glycemic uncontrolled diabetes mellitus (DM) and with matched controls.

STUDY DESIGN: Comparative study.

PLACE AND DURATION: Diabetic Clinic Ward-7, Jinnah Postgraduate Medical Centre, Karachi-Pakistan, from March 2007 to June 2007.

METHODOLOGY: Total 120 adult subjects of either sex were included with set criteria in study and were distributed into three groups of 40 subjects. Group 1 glycemic uncontrolled diabetes type 1 using insulin regularly, Group 2 glycemic uncontrolled diabetes type 2 using oral hypoglycemic drugs regularly, and Group 3 non-diabetic controls. Lipid, lipoproteins, fasting serum sugar and HbA1c were analyzed and compared between both groups of diabetes as well as control group.

RESULT: Fasting serum glucose, HbA1c, total cholesterol, triglycerides, and LDL cholesterol were significantly increased whereas HDL cholesterol levels were found to be significantly decreased in both groups of diabetes than in control group. There was no significant difference between type 1 diabetics (group 1) and type 2 diabetics (group 2) in any parameter except that HDL cholesterol levels were increased significantly in type 2 glycemic uncontrolled diabetics, compared to type 1 glycemic uncontrolled diabetics.

CONCLUSION: Patients with glycemic uncontrolled diabetics type 2 have greater disturbance in lipid and lipoprotein metabolism as compare to type 1 glycemic uncontrolled type 1 as well as to controls.

KEYWORDS: Diabetes mellitus, Dyslipidemia, Glycosylated hemoglobin, (HbA1c).

INTRODUCTION

These days diabetes is a global problem. No nation or region is free of DM. Nearly 11.5% population is suffering from DM in Pakistan and their number will be double in next 20 years.¹ In recent years a great deal of emphasis has been placed on relationship between elevated serum cholesterol levels, especially LDL cholesterol.² There is evidence of close relationship between poor glycemic control and progression of dyslipidemia.³ Most frequent complication of DM is atherosclerosis; it affects major vascular beds leading to various metabolic abnormalities. Intensive glycemic control means the glycohaemoglobin (HbA1c) or blood glucose values are normal or near normal range, no matter how simple or complex the treatment regimen is.⁴⁻⁷ Diabetes Control and Complications Trial Group conclusively demonstrated the importance of glucose control in preventing and delaying the progression of classic microvascular complication of diabetes (retinopathy, nephropathy and neuropathy) in patients of type 1 diabetes.^{8,9} Marcelo F⁸ and Domanski⁹ reported that diabetes mellitus is predisposed to premature atherosclerosis due to dyslipidemia, which leads to increased risk of

vascular complications.

The present study was undertaken to compare the level of lipids and lipoproteins in type 1 glycemic uncontrolled with type 2 glycemic uncontrolled and also non-diabetic subjects.

MATERIALS AND METHODS

This comparative study was conducted at Diabetic Clinic Ward-7, Jinnah Postgraduate Medical Centre, Karachi – Pakistan, from March 2007 to June 2007. Previously diagnosed cases of type-1 and type-2 diabetes and non-diabetic were included in the study. Adults having no history of renal, liver, coronary, and thyroid disease were included in this study. Lactating mothers and those who were taking lipid lowering drugs, corticosteroids, and estrogens were not included in the study. Two groups of diabetics i.e. glycemic uncontrolled type 1 diabetics (Group 1) and glycemic uncontrolled type 2 diabetics (Group 2), were matched for age, sex, body mass index (BMI) and blood pressure levels (systolic and diastolic) with control group of non-diabetics (Group 3). Fasting serum glucose, HbA1c, total cholesterol, triglycerides, HDL cholesterol and LDL cholesterol levels were

compared between both case groups as well as with control group. Forty subjects for each study group were selected by non-probability purposive sampling technique.

The subjects were asked to come in the morning, after an overnight fast of at least 12-14 hours. About 5 ml of blood was taken from the anticubital vein. One ml of blood was saved in covered glass bottles containing 1 mg/dl EDTA powder and was stored in a refrigerator at 2-8°C, which was used for HbA1c estimation within 8 days. Rest of blood was allowed to clot in the syringe. After 30 minutes serum was transferred from the clotted bottle in the centrifuge tube. Centrifugation was done for 10 minutes at 40 cycles per second. Serum glucose was estimated on the same day by Enzymatic Calorimetric (GOD-PAP) methods, and rest of serum was preserved in plastic covered glass bottle at -20°C after proper labeling, HbA1c was estimated by fast ion exchange resin separation method using kit supplied by Human Germany. Serum total cholesterol and HDL were estimated using kit (Clonital Cervico (BG) Italy), while serum triglyceride by Spinreact SA Spain. PFBS level of HbA1c is main criteria for glycemic uncontrolled type 1, type 2 diabetics; moreover, LDL-cholesterol was calculated according to Fried Wald's formula.

A predesigned proforma was used to collect the data, which were analysed by using SPSS version 11.0. Mean±SEM of study variables were calculated and t-test was applied to determine the significance between the groups. P-value up to 0.05 was considered significant.

RESULTS

Total 120 subjects were included in this study i.e. 40 subjects in each group. There was no significant dif-

ference in age, BMI, and blood pressure levels (systolic and diastolic) of all three groups. However, the difference in values of fasting serum glucose, HbA1c, total cholesterol, triglyceride, HDL cholesterol, and LDL cholesterol was highly significant statistically when compared between glycemic uncontrolled diabetes type 1 (group 1) and controls (group 3); as well as between glycemic uncontrolled diabetes type 2 (group 2) and controls (group 3), as detailed in **Table I** and **Table II** respectively. Between type 1 diabetics and type 2 diabetics there was no statistically significant difference in duration of diabetes, fasting serum glucose, and HbA1c. Regarding lipids HDL cholesterol was found to be raised in type 1 diabetics (group 1) than in type 2 diabetics (group 2) at statistically significant level (**Table III**).

DISCUSSION

Diabetes mellitus is associated with increase in most adverse cardiovascular events including coronary heart disease, myocardial infraction and stroke. It is also associated with structural and functional metabolic abnormalities.⁹ Diabetes predisposes to premature atherosclerosis due to dyslipidemia,⁹ accelerated atherosclerosis may be related to diabetic control as reflected by the degree of hyperglycemia.

Many workers reported that rise in total cholesterol, triglyceride, LDL-cholesterol, while reduction in plasma HDL-cholesterol level in glycemic uncontrolled type 1 and type 2 diabetes occurs due to metabolic disturbance of lipids.¹⁰⁻¹⁶ They observed that increased hyperglycemia leads to decrease lipoprotein lipase for LDL pathway activity induces under insufficient insulin action. In present study similar findings were observed.

Mangeasis¹⁷ reported that low level of HDL-

**TABLE I:
COMPARISON OF DIFFERENT PARAMETERS BETWEEN GROUP 1 (DM TYPE 1) AND GROUP 3
(CONTROLS)**

Parameters	Group 1 (n=40)	Group 3 (n=40)	P-value
Age (years)	48.2±1.47	49.08±0.98	>0.05
Body Mass Index (kg/m ²)	23.79±0.64	22.7±0.34	>0.05
Systolic BP (mmHg)	112.0±1.37	116.0±1.12	>0.05
Diastolic BP (mmHg)	73.0±1.46	76.25±1.39	>0.05
Fasting serum glucose (md/dL)	238.3±13.49	87.04±2.13	<0.001
HbA1c (%)	9.06±0.19	5.42±0.09	<0.001
Total cholesterol (mg/dL)	207.8±10.13	146.4±5.56	<0.001
Triglyceride (mg/dL)	183.15±8.94	95.9±12.26	<0.001
HDL cholesterol (mg/dL)	37.6±2.03	50.2±3.2	<0.01
LDL cholesterol (mg/dL)	134.4±10.98	79.15±5.75	<0.001

All values are expressed as Mean±SEM

**TABLE II:
COMPARISON OF DIFFERENT PARAMETERS BETWEEN GROUP 2 (DM TYPE 2) AND GROUP 3 (CONTROLS)**

Parameters	Group 2 (n=40)	Group 3 (n=40)	P-value
Age (years)	51.05±0.9	49.08±0.98	>0.05
Body Mass Index (kg/m ²)	23.3±0.64	22.7±0.34	>0.05
Systolic BP (mmHg)	112.0±1.37	116.0±1.12	>0.05
Diastolic BP (mmHg)	79.5±2.24	76.25±1.39	>0.05
Fasting serum glucose (md/dL)	260.2±15	87.04±2.13	<0.001
HbA1c (%)	9.56±0.25	5.42±0.09	<0.001
Total cholesterol (mg/dL)	226.5±12.06	146.4±5.56	<0.001
Triglyceride (mg/dL)	192.45±10.63	95.9±12.26	<0.001
HDL cholesterol (mg/dL)	29.0±3.08	50.2±3.2	<0.001
LDL cholesterol (mg/dL)	159.1±12.49	79.15±5.75	<0.001

All values are expressed as Mean±SEM

**TABLE III:
COMPARISON OF DIFFERENT PARAMETERS BETWEEN GROUP 1 (DM TYPE 1) AND GROUP 2 (DM TYPE 2)**

Parameters	Group 1 (n=40)	Group 2 (n=40)	P-value
Duration of diabetes (years)	6.05±0.46	6.85±0.37	>0.05
Fasting serum glucose (md/dL)	238.3±13.49	260.2±15	>0.05
HbA1c (%)	9.06±0.19	9.56±0.25	>0.05
Total cholesterol (mg/dL)	207.8±10.13	226.5±12.06	>0.05
Triglyceride (mg/dL)	183.15±8.94	192.45±10.63	>0.05
HDL cholesterol (mg/dL)	37.6±2.03	29.0±3.08	<0.05*
LDL cholesterol (mg/dL)	134.4±10.98	159.1±12.49	>0.05

All values are expressed as Mean±SEM
* Statistically significant

cholesterol often results in type 2 because in diabetics increased level of free fatty acids (FFA) may occur as the result of insulin resistance. It may be related to fundamental defect in adipose tissue in which there is an abnormality in stimulation of free fatty acids in incorporation into triglycerides in the adipocytes. This results in an increased flux of FFA back to the liver resulting enhanced secretion of VLDL from liver in to blood stream involving two key proteins in lipoprotein metabolism – the cholesteryl ester transferase and hepatic lipase.¹⁸ The cholesteryl ester transfer protein for the triglycerides in VLDL producing a pylycerider enriched but cholesteryl ester depleted HDL. As well such triglycerides enriched HDL appears to be catabolized more rapidly by the kidney, decreasing HDL cholesterol level.¹⁹⁻²¹ The findings of present study agreed with their observation.

CONCLUSION

In conclusion the result of this study provide evidence for consistently greater adverse effects of glycemic uncontrolled type 1 and type 2 diabetes on lipid and lipoprotein levels, which may lead to atherosclerosis causing coronary, cerebral and peripheral artery diseases.

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