

Correlation between Apolipoprotein-B and lipid profile as markers of atherosclerotic risk in type 2 diabetes mellitus

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Abstract

Background: Diabetes mellitus (DM) is described as a metabolic disorder with multiple etiology which is characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism which results from defects in insulin secretion, action or both with reduced life expectancy, significant morbidity and diminished quality of life. **Aim and Objectives:** To estimate Apolipoprotein-B, fasting blood sugar and lipid profile in diabetic individuals with respect to healthy controls. To study the correlation between apolipoprotein-B and routine parameters of lipid profile as markers of atherosclerotic risk in type 2 diabetic patients with respect to healthy controls. **Material and Methods:** A hospital-based, analytical case-control study was conducted during the year 2018- 2019 in the Department of Biochemistry, in a private medical college among two hundred subjects of which 100 subjects belonged to Group-1 who were with type-2 DM and another 100 subjects who were healthy and matched with age and gender. Patients who were clinically diagnosed with type 2 DM as cases and aged 18 years and above and those who were not on lipid lowering drugs and gave their consent to participate in the study were included. **Results:** Mean FBS in cases under study was 222.8 ± 63.7 mg/dl and in controls was 100 ± 6.79 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001. The mean serum Apolipoprotein B in cases under study was 176.8 ± 33.8 mg/dl and in controls was 91.2 ± 9.6 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001. There is a positive correlation between serum apolipoprotein B, fasting blood sugar and lipid profile (which includes Total Cholesterol, Triglycerides, LDL, and non-HDL). The p value (< 0.05) is significant for the correlation between serum apolipoprotein B and lipid profile. **Conclusion:** Apo-B can help identify additional dyslipidaemia phenotypes among patients with normal cholesterol and normal LDL-C signifying routine estimation of Apolipoprotein B (Apo-B) in the atherosclerotic risk assessment in Type 2 Diabetes Mellitus.

Key Words: Fibrinogen, stroke.

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Received Date: 28/10/2019 Revised Date: 16/11/2019 Accepted Date: 05/12/2019

DOI: <https://doi.org/10.26611/10021233>

Access this article online

Quick Response Code:



Website:

www.medpulse.in

Accessed Date:
07 December 2019

INTRODUCTION

Diabetes mellitus (DM) is described as a metabolic disorder with multiple etiology which is characterized by chronic hyperglycemia and disturbances of carbohydrate, fat and protein metabolism which results from defects in insulin secretion, action or both with reduced life expectancy, significant morbidity and diminished quality of life.¹ The spectrum of diabetic dyslipidaemia may include all the phenotypes identified among general population but one phenotype is particularly common in DM which is attributed mainly to insulin resistance and deficiency.² It has a characteristic pattern consisting of high plasma triglycerides (TG), low HDL cholesterol

How to cite this article: K Ravi Sankar, Aruna Yarasani. Correlation between apolipoprotein-b and lipid profile as markers of atherosclerotic risk in type 2 diabetes mellitus. *MedPulse International Journal of Biochemistry*. December 2019; 12(3): 84-87.

<https://www.medpulse.in/Biochemistry/>

(HDL- C) and increased concentrations of small dense LDL cholesterol (LDL-C) particles which may be more susceptible to oxidation.³ Typically, in the assessment of atherosclerotic risk in diabetic dyslipidaemia a fasting lipid profile is done. This consists of total cholesterol (TC), triglycerides, HDL-C and LDL-C. Some facilities also include TC/HDL-C ratio. Ideally this should be done at the time of diagnosis of diabetes mellitus and then as clinically indicated. Diabetic patients have abnormalities in lipoprotein and lipid metabolism which mainly consists of increased triglycerides mainly triglyceride-rich VLDL particularly post-prandially, low levels of HDL-C and the increased concentrations of small dense LDL-C.^{4,5} The main defect that results in above characteristic triad is hepatic overproduction of VLDL particles, particularly VLDL1.⁶

AIM and OBJECTIVES

1. To estimate Apolipoprotein-B, Fasting blood sugar and lipid profile in diabetic individuals with respect to healthy controls.
2. To study the correlation between Apolipoprotein-B and routine parameters of lipid profile as markers of atherosclerotic risk in type 2 diabetic patients with respect to healthy controls.

MATERIAL AND METHODS

A hospital-based, analytical case-control study was conducted during the year 2018- 2019 in the Department of Biochemistry, in a private medical college among two hundred subjects of which 100 subjects belonged to Group-1 who were with type-2 DM and another 100 subjects who were healthy and matched with age and gender. Patients who were clinically diagnosed with Type 2 DM as cases and aged 18 years and above and those who were not on lipid lowering drugs and gave their consent to participate in the study were included. Patients with Type-1 Diabetes and with associated confounders like metabolic disorders with hyperlipidaemia were excluded from the study. Anthropometric measurements, vitals were measured and under aseptic precautions, blood was collected and used for analysis of the parameters like fasting blood sugar (FBS), total cholesterol (TC), triglycerides (TG), low density

lipoprotein (LDL), non-high density lipoprotein (non-HDL) and Apo lipoprotein-B. Data obtained was entered in Microsoft Excel and analyzed in SPSS version-22 trial. The comparison of data was made by “t-Test Two-Sample Assuming Equal Variances”. A p-value of less than 0.05 was considered significant.

RESULTS

The present study included analysis of 100 cases and 100 controls who were age and gender matched. After excluding the exclusion criteria, the data was analyzed for the relation between fasting blood sugar, total cholesterol, triglycerides, low density lipoprotein, high density lipoprotein and Apolipoprotein-B was studied along with its correlation and preponderance and as a risk factor for causing atherosclerosis. The mean FBS in cases under study was 222.8 ± 63.7 mg/dl and in controls was 100 ± 6.79 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001 (Table-1). The mean TC in cases under study was 200.8 ± 40.4 mg/dl and in controls was 151.2 ± 31.9 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001 (Table-1). The mean TG in cases under study was 162.3 ± 82.1 mg/dl and in controls was 121.9 ± 24.2 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001 (Table-1). The mean serum LDL in cases under study was 125.8 ± 34.2 mg/dl and in controls was 96.4 ± 32.1 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001 (Table-1). The mean non-HDL in cases under study was 164 ± 37.5 mg/dl and in controls was 120.7 ± 32.5 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001 (Table-1). The mean serum Apolipoprotein B in cases under study was 176.8 ± 33.8 mg/dl and in controls was 91.2 ± 9.6 mg/dl, there was a statistically significant mean difference between the two groups with p-value less than 0.001 (Table-1). The mean age in the present study series among the cases was 47.4 ± 9.1 years and in controls were 48.3 ± 9.2 years respectively. The maximum numbers of participants fall in the age group of 40-49 years.

TABLE 1: COMPARISON OF VARIOUS PARAMETERS AMONG THE CASES AND CONTROLS

Parameter	Mean + SD		t	p-value
	Cases	Controls		
FBS	222.8±63.7	100±6.7	13.53	<0.001
Serum TC	200.8±40.4	151.2±31.9	6.80	<0.001
Serum LDL	162.3±82.1	121.9±24.2	3.33	<0.001
Serum LDL	125.7±34.2	96.4±32.1	4.43	<0.001
Serum non-HDL	164±37.5	120.7±32.5	6.18	<0.001
Serum Apolipoprotein B	176.8±33.8	91.2±9.6	17.19	<0.001

TABLE-2 SHOWING AGE AND MEAN FIBRINOGEN LEVEL

AGE GROUP	CASES		CONTROLS	
	NUMBER OF SUBJECTS	%	NUMBER OF SUBJECTS	%
30-39 YRS	20	20	18	18
40-49 YRS	46	46	46	46
50-59 YRS	18	18	20	20
60-69YRS	16	16	16	16
TOTAL	100	100	100	100
MEAN \pm SD	47.4 \pm 9.1		48.3 \pm 9.2	

TABLE 3: CORRELATION BETWEEN SERUM APOLIPOPROTEIN B WITH OTHER PARAMETERS IN CASES

Correlation between	Pearson's Correlation Coefficient (r)	p-value
Serum Apolipoprotein B and Fasting Blood Sugar	+0.392	Positive correlation
Serum Apolipoprotein B and Total Cholesterol	+0.207	Positive correlation
Serum Apolipoprotein B and Triglycerides	+0.149	Positive correlation
Serum Apolipoprotein B and Non-HDL	+0.193	Positive correlation
Serum Apolipoprotein B and LDL	+0.252	Positive correlation

There is a positive correlation between serum apolipoprotein B, fasting blood sugar and lipid profile (which includes Total Cholesterol, Triglycerides, LDL, and non-HDL). The p value (< 0.05) is significant for the correlation between serum apolipoprotein B and lipid profile.

DISCUSSION

The present study includes 200 subjects of which 100 were Type-2 diabetics and 100 were healthy controls. The main aim of this study was to estimate the values of Serum Apolipoprotein-B, Fasting Blood Sugar, Lipid Profile (includes TC, TG, LDL) and non-HDL cholesterol. In the present study majority 80 p.c of the patients were aged 40-69 years which was similar with the global estimates of diabetes where the majority of diabetic patients in developing countries are between 40 and 60 years.⁷ In the present study, the mean fasting blood sugar levels in healthy controls was 222.8 ± 63.79 mg/dl and in type II diabetics was 100 ± 6.79 mg/dl. The rise in the mean concentrations of fasting blood sugar values in the cases group was statistically significant when compared to control group ($p < 0.05$), these findings were in accordance with the findings of Bodlaj *et al* study.⁸ In the present study, the mean serum triglycerides levels in healthy controls was 162.3 ± 82.14 mg/dl and in type II diabetics was 121.9 ± 24.2 respectively. The rise in the mean concentrations of serum Triglyceride in the cases group was statistically significant when compared to control group ($p < 0.05$). This finding was also in accordance with MI Usitupa *et al* study as they found that the serum total cholesterol levels in diabetic and non-diabetic subjects were similar, but the HDL-C levels were lower and serum triglyceride levels higher in the diabetic

than in non-diabetic subjects.⁹ In the present study, the mean serum LDL-C levels in healthy controls was 125.7 ± 34.24 mg/dl and in type II diabetics was 96.4 ± 32.17 . The rise in the mean concentrations of serum LDL-cholesterol level in the cases group is statistically significant when compared to control group ($p < 0.05$). This was consistent with AM Wagner *et al* study where there is rise in serum LDL-Cholesterol levels.¹⁰ In the present study, the mean serum total cholesterol levels in healthy controls was 200.8 ± 40.43 mg/dl and in type II diabetics was 151.2 ± 31.96 mg. The rise in the mean concentrations of serum total cholesterol in the cases group was statistically significant when compared to control group ($p < 0.05$). The findings were in accordance with Garg *et al* study who found that there was an increase in serum total cholesterol levels in diabetes mellitus.¹¹ In the present study, the mean serum Apolipoprotein B levels in healthy controls was 91.2 ± 9.62 mg/dl and in type II diabetics was 176.8 ± 33.89 . The rise in the mean concentrations of serum Apolipoprotein B in the cases group was statistically significant when compared to control group ($p < 0.05$), this was in accordance with the Lamarche B *et al* study.¹² In the present study, the mean serum non-HDL levels in healthy controls was 164 ± 37.59 mg/dl and in type II diabetics was 120.7 ± 32.52 . The rise in the mean concentrations of serum Apolipoprotein B in the cases group was statistically significant when compared to control group ($p < 0.05$). In the current study, non-HDL-C correlated strongly with apo B and actually there was a higher percentage of patients with high non-HDL-C than with high apolipoprotein B. Non-HDL-C estimates all the cholesterol in LDL-C, IDL-C and VLD-L. NCEP has

recognized non-HDL- C as a secondary target of statin therapy in patients with hypertriglyceridaemia¹³

CONCLUSION

Majority of the patients had elevated non-HDL-C, elevated total cholesterol, elevated triglycerides, elevated LDL-C and elevated Apolipoprotein-B. There was a positive linear correlation between Apolipoprotein-B and total cholesterol, triglycerides, LDL-C, non-HDL- C. The strongest positive correlation was with non-HDL-C. Apo-B can help identify additional dyslipidaemia phenotypes among patients with normal cholesterol and normal LDL-C signifying routine estimation of Apolipoprotein B (Apo-B) in the atherosclerotic risk assessment in Type 2 Diabetes Mellitus.

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Source of Support: None Declared
Conflict of Interest: None Declared