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## Original Article

# Apolipoprotein levels in type 2 diabetes mellitus patients



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## ABSTRACT

**Background and objectives:** Diabetes mellitus is regarded as a defective regulation of carbohydrates, lipid and protein metabolism. The worldwide prevalence of diabetes especially that of type 2 diabetes mellitus is increasing, as has the information and awareness about the disease among people. Lipids play a key role in the development of atherosclerosis and its clinical manifestation. This study intends to measure the apolipoprotein levels in type 2 diabetes mellitus patients and to correlate it with levels of LDL-C, total cholesterol and HDL, as well as with levels of glycated haemoglobin.

**Methods:** Total 114 patients who met inclusion criteria and exclusion criteria were subjected to detailed clinical examination and investigations. Depending upon data obtained, results were evaluated, tabulated and the various lipid parameters were correlated.

**Results:** In this study, the levels of fasting and post-prandial blood glucose (161.61 and 223.61 mg/dl respectively), glycated haemoglobin (8.72%), serum cholesterol (177 mg/dl), LDL-C (109 mg/dl), Apo B (84.5 mg/dl) and Apo A-I (103.5 mg/dl) were significantly higher in diabetics compared to healthy population. There was a positive correlation between HDL-C and Apo A-I in diabetic individuals according to our study.

**Conclusion:** Apolipoprotein measurements present some methodological advantages when compared with LDL-C quantification. Apolipoproteins estimation can be included in the dyslipidaemia work-up of diabetics. But larger studies are still needed to confirm the practical superiority of apolipoprotein over traditional dyslipidaemia markers.

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## 1. Introduction

The worldwide prevalence of diabetes, especially that of type 2 diabetes mellitus, is increasing. In South Asia, total number of diabetic cases in 2013 was 72.1 million, out of

which 65.1 million were in India.<sup>1</sup> Epidemiologic studies have shown that diabetes mellitus amplifies the risk of developing dyslipidaemia during life time. Dyslipidaemia is a main risk factor for macro- and micro-vascular complications in patients with diabetes mellitus.<sup>2</sup> Many studies have documented superiority of serum concentration of Apo B as

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biochemical atherogenic marker than both LDL-C and non-HDL-C.<sup>3</sup> The studies done worldwide like AMORIS,<sup>4</sup> QUEBEC<sup>5</sup> have demonstrated superiority of apolipoproteins in determining development of cardiovascular disease.

The concentration of Apo B is a dependable marker of all potentially atherogenic particles because all these lipoprotein particles (VLDL, IDL and LDL including small dense LDL) contain only one molecule of Apo B-100 and various amounts of cholesterol. Apolipoprotein measurements present more or less methodological benefits when compared with LDL-C quantification. In many laboratories, LDL is still measured by Friedewald equation. This equation presents several restrictions as LDL estimate cannot be extended to sample with triglyceride levels greater than 400 mg/dl and in patients with dysbetalipoproteinemia. Apolipoproteins may be measured directly in plasma through precise and detailed internationally uniform methods, by using a common reference material, which does not regularly exist for measurements of HDL-C and LDL-C. From this point of view, this study was undertaken to study the relationship of apolipoproteins with the LDL, HDL cholesterol levels and to establish whether Apo B/Apo A-I ratio can be used as a marker for prediction of dyslipidaemia in type 2 diabetic patients.

## 2. Materials and methods

The study was carried out in type 2 diabetes mellitus patients presenting to Sir Ganga Ram Hospital. The study included a total of 114 subjects, out of which 62 were type 2 diabetic cases (fasting plasma glucose >126 mg/dl) and 52 were healthy non-diabetic controls (fasting plasma <126 glucose mg/dl). Age- and sex-matched controls were selected for assessment. Informed consent and ethical committee clearance were taken for the study. Exclusion criteria included patients with diabetes-related complications, liver or thyroid disorder, patients on lipid lowering agents and pregnant females.

Fully automated chemical analysers (Beckman Coulter DXC-800) were used for determination of various biochemical parameters like fasting blood sugar, HbA1c, total cholesterol, HDL cholesterol, LDL cholesterol, Apo B and Apo A-I after 10-12 h fasting.

Statistical analysis was performed by the SPSS program for Windows, version 17.0. Data was checked for normality before statistical analysis. Normally distributed continuous variables were compared using the unpaired t test, whereas the Mann-Whitney U test was used for those variables that were

not normally distributed. Categorical variables were analysed using either the chi-square test or Fisher's exact test. For all statistical tests, a p value less than 0.05 was taken to indicate a significant difference.

## 3. Results

In the study, 52 subjects were included in control group, out of which 27 were males (51.9%) and numbers of females were 25 (48.1%). Similarly, in cases group, total numbers of subjects were 62, out of which 34 were males (54.8%) and 28 were females (45.2%).

Mean age of control group was  $52 \pm 9.39$  years whereas that of cases group was  $51.63 \pm 6.57$  years. Mean duration of diagnosis of diabetes mellitus was 6.58 years in cases group. Both case and control groups were matched for haematological and biochemical parameters. Mean glycated haemoglobin in cases group was  $8.72 \pm 2.54\%$  whereas in control group, it was  $5.25 \pm 0.47\%$ .

The diabetic patients showed significant changes in the lipid profile. The levels of serum cholesterol, LDL, Apo B and Apo A-I were significantly higher in the diabetic group than controlled (Table 1, Fig. 1). There was no statistically significant correlation between LDL and Apo B (Table 2, Fig. 2), Apo B and HbA1c (Table 3, Fig. 3), whereas HDL and Apo A-I (Table 4, Fig. 4), Apo B and total cholesterol showed statistically significant positive correlation (Table 5, Fig. 5).

## 4. Discussion

Diabetes mellitus is characterised by defective regulation of carbohydrates, lipid and protein metabolism.<sup>6</sup> The characteristic pattern of lipid abnormalities in patients with diabetes mellitus consists of moderate elevation in triglycerides, low HDL and an increase in small dense LDL particles.<sup>7</sup> This lipoprotein pattern is present even before the onset of diabetes and is strongly associated with insulin resistance.<sup>8</sup> The small dense LDL particles are more intrinsically atherogenic because of their enhanced susceptibility to oxidative modification and are less readily cleared from the circulation.<sup>9</sup>

The current study was in discordance with most of other studies which showed lower levels of high density lipoprotein in diabetic patients. The study done by Bodhe et al. in Indians showed that HDL cholesterol levels varied with glycaemic control.<sup>10</sup> As in our study, all patients with diabetes (controlled

**Table 1 – Lipid parameters.**

	Controls		Cases		p value
	Median	IQR	Median	IQR	
Cholesterol	137.5	116.25–161.75	177	141–197.75	<0.001
HDL	37.5	32.0–41.0	37.5	30.75–44.50	0.565
LDL	77.5	57.25–97	109	85.75–135.25	<0.001
LDL/HDL	2.24	1.49–2.77	2.93	2.13–3.61	<0.001
Apo A-I	96.5	86.5–110.5	103.5	89.0–120	0.041
Apo B	78	57–88.75	84.5	65–109.25	0.006
Apo B/Apo A-I	0.82	0.63–1.04	0.92	0.64–1.27	0.240

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