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Original Article

A Comparative Study of Small Dense low Density Lipoprotein levels in the Healthy and Diabetic Adult Individuals

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Abstract
The present study was carried out to identify the differences between small dense LDL levels in apparently healthy individuals and diabetic adults.
Materials and Methods: *The study was conducted in male and female subjects (n =200) aged between 49-60 years who are not on any lipid lowering drugs. The estimation of small dense LDL levels was done by sd LDL methodology.*
Results and Discussion: *In this study we found that there is an increase in small dense LDL levels in diabetic cases than in normal healthy adult individuals.*
Conclusion: *Diabetes is closely associated with small dense LDL, an atherogenic particle. It should be considered as an independent, potential risk factor and as a diagnostic biomarker to be used in conjunction with other biochemical markers for early diagnosis, assessment and follow up of diabetic complications.*
Keywords: *Diabetes, small dense LDL, Biochemical marker, Atherosclerosis.*

Introduction

Diabetes mellitus (DM) is a common disease worldwide. Chronic complications type 2DM (T2DM) which reduces the quality of life of patients which inturn causes heavy burden to the healthcare system, and increases diabetic mortality[1]. Diabetes is fast gaining the status of a potential epidemic in India with more than 62 million diabetic individuals currently diagnosed with the disease. In 2000, India (31.7 million) topped the world with the highest number of people with diabetes mellitus followed by China (20.8 million) with the United States (17.7 million) in second and third place respectively. The prevalence of diabetes is predicted to double globally from 171 million in 2000 to 366 million in 2030 with a maximum increase in India. It is predicted that by 2030 diabetes mellitus may afflict up to 79.4 million individuals in India, while China (42.3 million) and the United States (30.3 million) will also see significant increases in those affected by the disease[2]. Type-2 diabetes

mellitus (T2DM) is a major cardiovascular risk factor, and atherosclerosis is the most common cause of death in diabetic patients. The dyslipidemia of T2DM is characterized by increased small dense LDL particles, hyper triglyceridemia and, decreased HDL-cholesterol[3]. During the past two decades, the importance of the quality of low-density lipoprotein (LDL) particles – in addition to its quantity – has become of increasing interest which influence the choice of the therapeutic regimen in patients with diabetes in the future and has shown in multiple studies to effectively reduce the incidence of cardiovascular events for both primary and secondary prevention in patients with diabetes .This article aims at throwing a light at the qualitative aspects of LDL particles and their importance concerning cardiovascular risk in patients with diabetes[4]

Materials and methods: The present study was conducted in (n=200), their age ranging from 40-60 years. Subjects were taken from Government General Hospital, Guntur. It involves both control and case groups of 100 each. The subjects in the control group were selected by simple random sampling method. Ethical committee clearance was obtained from the institutional ethical clearance committee. Prior to the study, consent was taken from subjects of both control and case group and each subject was informed in detail of the objectives and aim of the research protocol and the method to be used. Inclusion criteria for the study for the control group include individuals free of any known illness and not on any lipid lowering drugs. Individuals who were diagnosed as type II diabetes are taken as case group. The subjects of the study were screened for the presence of diabetes by their fasting blood sugar, post prandial blood sugar and HbA1C levels. Small, dense LDL was measured using Randox laboratories LDL EX" SEIKEN kit. It is based on a two stick enzymatic calorimetric assay.

Experimental protocol

Data thus generated was analyzed and appropriate tables were generated. The data has been used to track the trends in assessing the severity of the complications of diabetes. It is the direct homogenous small dense LDL method and is easily applicable on automated chemistry analyzer and shows acceptable performance to estimate the electrophoretic LDL sub class phenotype.

Statistical Methods

Data were reported as mean and standard deviation (mean+ SD), mean were compared between two groups by unpaired 't'test. A 'p'value of less than 0.05 was considered statistically significant. Descriptive statistical analysis was carried out in the present study. Result on continuous measurements were presented on (Mean± SD). Student 't' test was used to find the significance of study parameters between two groups.

Results

As shown in table 1 the mean fasting blood sugar of healthy individuals was found to be 86.75 which were increased to 143.71 in diabetic individuals. The mean post prandial blood sugar, glycosylated Hemoglobin was found to be more than diabetic individuals and they are 196.40 and 9.90 respectively. The mean sd LDL of diabetic individuals is 70.8 which is very much higher than the healthy individuals. The results were found to be statistically highly significant.

Table

Parameters	Healthy Individuals Mean ± SD	Diabetic Individuals Mean± SD	t value	p value
FBS (mg/dl)	86.75±6.68	143.7±18.17	53.98	0.0001
PPBS(mg/dl)	129.30 ±5.58	196.40± 14.44	43.34	0.0001
Gly (Hb%)	4.50± 1.21	9.90± 1.38	29.39	0.0001
Sd LDL (mg/dl)	24.76 ±1.43	70.80 ±3.20	131.20	0.0001

Discussion

In the present study, positive and statistically significant correlation between HbA1c and lipid parameters was observed. A highly significant correlation between HbA1c and FBG in our study is similar to various previous studies. It has been well documented that sd LDL has a greater atherogenic potential than that of other LDL sub fractions. Sd LDL proportion is a better marker for prediction of cardiovascular disease. Circulating sd LDL readily undergoes multiple atherogenic modifications in blood plasma, such as desialylation, glycation, and oxidation, that further increase its atherogenicity. Modified sd LDL is a potent inductor of inflammatory processes associated with cardiovascular disease. Homogeneous assays facilitated the LDL sub fraction analysis making possible large clinical studies evaluating the significance of sd LDL in the development of cardiovascular disease. The circulation time of sdLDL is longer and is cleared from the bloodstream through the interaction with the LDL receptor. Lipid trapping and accumulation by foam cells in the arterial wall are the key processes that lead to the development and growth of the atherosclerotic plaque. They induce immune response and inflammation. The increased atherogenicity of sd LDL is linked to the specific biochemical and biophysical properties of these particles. The small size of the particles favors their penetration into the arterial wall. Longer circulation time increases the probability of atherogenic modifications of sd LDL in the blood plasma. Sd LDL-C concentrations were a better marker for assess-ment of coronary heart disease CHD[5]. Small dense LDL particles (sdLDL-C) have been related to risk of coronary events in CHD and IHD cases. Sd LDL particles were more prevalent among CHD patients in an urban Japanese cohort, a biracial American cohort [6,7]. Abnormalities in insulin action are associated with lipid abnormality. Defect in removal of lipid from blood stream after a meal is common in diabetes and also associated with impaired fibrinolysis and increased susceptibility to thrombosis among individuals with increased sd LDL and insulin resistance. Impaired endothelial function and plasminogen activator inhibitor 1 levels were increased among sd LDL phenotype[8]. Both glycosylated LDL and small, dense LDL bind to LDL receptors less avidly than does normal LDL. Diabetic patients, especially those with very poor glycemic control, may have increased LDL that is reduced by treatment of their diabetes. Small dense LDL is considered by many to be one of the hallmarks of diabetic dyslipidemia which was observed in our study. Sd LDL measures the inflammatory marker of cardiovascular disease.[9,10]. The study reveals that HbA1c is not only a reliable glycaemic index but can also be used as an important indicator of dyslipidemia in patients with T2DM. The association between serum lipid profile and glycated hemoglobin (HbA1c) was evaluated. The percentage of HbA1c reflects the glycaemic control of a patient. The complications of diabetes and control trial established HbA1c as the gold standard of glycaemic control. Lowering HbA1c levels has been shown to reduce micro vascular complications of diabetes[11]. Prospective Diabetes Study confirmed that intensive glycemic control delays the onset and retards the progression of micro vascular disease, and possibly CHD, in patients with type 2 diabetes mellitus. Insulin resistance plays a major role in the development of hyperglycemia and dyslipidemia in type 2 diabetes mellitus[12].The lipid changes associated with diabetes mellitus are attributed to increased free fatty acid flux secondary to insulin resistance CVD is the identification and aggressive treatment of high-risk individuals. Several studies have suggested that small dense LDL (sd LDL) is associated with an increased risk of CVD [13,14]. Trials seeking to demonstrate a decrease in cardiovascular disease risk with improved glycaemic control[15]

Conclusion

The association between serum lipid profile and glycated hemoglobin (HbA1c) was evaluated in the present study. HbA1c is an important indicator of dyslipidaemia in patients with T2DM. An overview of the screening recommendations, assessment of risk, and treatment recommendations for lipid disorders are Special consideration for individuals with diabetes and dyslipidemia. Cost-effectiveness data to support therapeutic decision-making in the present study, hypothesizing that early detection and treatment of lipid abnormalities can minimize the risk of atherogenic accident in patients with T2DM.

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Conflict of interest: None declared.

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