



EVALUATION OF LIPID PARAMETERS IN PATIENTS WITH DIABETES MELLITUS AND ISCHEMIC HEART DISEASE

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ABSTRACT

Diabetes mellitus is a chronic condition that occurs when the body cannot produce sufficient insulin, caused by a genetic predisposition along with environmental factors. The number of people with diabetes mellitus worldwide is increasing and by 2035 this will have risen to 552 million. Patients with type 2 diabetes mellitus have a considerably higher risk of cardiovascular morbidity and mortality, as compared to non-diabetics. And this risk is associated with hypertension, dyslipidemia and obesity in these patients. Thus it is imperative to evaluate the biochemical parameters, most importantly lipids. The objective of the present study was to evaluate the lipid profile in patients with diabetes mellitus and ischemic heart disease and its comparison with healthy controls. One hundred and twenty individuals participated in this study and were categorized on the basis of health (diabetic with ischemic heart and non diabetic) and gender (males and females). Exclusion criteria were subjects with the history of alcoholism, smoking, renal diseases, thyroid disorders and pregnancy. All the individuals were subjected to detailed history, biochemical analysis for fasting blood sugar, total cholesterol, triglycerides, low density lipoprotein (LDLc), high density lipoprotein (HDLc), very low density lipoprotein (VLDLc). Both males and females showed significant increase in total cholesterol, triglycerides, LDLc and VLDLc, as compared to healthy controls. However, both males and females showed low levels of HDLc as compared to healthy controls. The protective function of HDLc may be lost in type 2 diabetics leading to protein modifications, resulting in oxidative stress. Females were found to depict higher levels of total cholesterol, LDLc and TC:HDLc, as compared to males. This study showed that females are prone to diabetic dyslipidemia. This can be reduced by controlling diabetic induced lipid abnormalities in patients through different approaches and also enable us to maintain the health of patients by detecting heart disease at an early stage and its prevention with appropriate medications.

KEYWORDS: Diabetes mellitus, cardiovascular disease, dyslipidemia, cholesterol, triglycerides, high density lipoprotein.

INTRODUCTION

Diabetes mellitus is a group of metabolic disorders characterized by increased blood glucose level due to the defect in insulin secretion, insulin action or both. Insulin deficiency and its resistance affects enzymes and pathways of lipid metabolism (Gibbons 1988) leading to alteration in the lipid parameters both quantitative and qualitative (Bhambhani *et al* 2015). Dyslipidemia is 95% prevalent in diabetic patients (Chattanda and Mgonda 2008) and this ultimately lead to the uncontrollable risk factor for heart diseases which is the major cause of morbidity and mortality in diabetic patients (Krishna *et al* 2005, Leon and Maddox 2015). Diabetes mellitus leads to both macrovascular and microvascular complications such as coronary artery disease, myocardial infarction, hypertension, peripheral vascular disease, retinopathy, end stage renal disease and neuropathy (Chawla *et al* 2016). The latest estimates by the International Diabetes Federation project that 1 in 10 persons worldwide will have diabetes mellitus by 2035.

Dyslipidemia is characterized by a spectrum of quantitative and qualitative changes in lipids and lipoproteins. Cardiovascular diseases represents a major challenge in a developing country like India. Long term hyperglycemia leads to vascular damage through several mechanisms, these include oxidative stress, formation of advanced glycation end products, activation of nuclear factor kappa B and decreased production of nitrogen monoxide. (Angelo *et al* 2011). Cure of heart diseases is difficult but prevention and management of such diseases is imperative. There are many risk factors which can lead to the development of ischemic events. Many studies have found biological mechanisms associated with diabetes mellitus that independently increase the risk of cardiovascular diseases in diabetic patients (Leon and Maddox 2015, Matheus *et al* 2013).

Lipid abnormalities lead to the complex process of vascular injury. Progression and management of the disease can be done by regular monitoring of the lipid

status of the body. Thus it is highly imperative to correlate the various lipid parameters with the progression of the disease. Therefore the present study was planned with the objective to conduct the clinical survey of diabetic and ischemic heart patients and evaluation of lipid parameters.

MATERIALS AND METHODS

The present study was conducted in Department of Biochemistry, Chintpurni Medical College, Pathankot, Punjab, India. A total of 120 subjects were taken for the investigation. Sixty patients (30 males and 30 females) visiting the outpatient clinic in the department having Type 2 diabetes mellitus and ischemic heart were included in the study. These were identified on the basis of polyuria, polydipsia, hypertension, increased thirst, obesity and chest pain. Sixty healthy subjects (30 males and 30 females) with normal fasting blood glucose level with same age were included in the control group. Exclusion criteria were subjects with the history of smoking, alcoholism, renal diseases, thyroid disorders, pregnancy or any other disease. The ethical and research committee of the diagnostic laboratory approved the study protocol and informed consents were obtained from the patients before the collection of the blood samples.

Table 1: Categorization and number of patients with diabetes mellitus and ischemic heart disease under study.

Category	No. of patients	Mean age (years)
Diseased males	30	50 ± 2.5
Healthy males	30	48±2.4
Diseased females	30	49± 3.5
Healthy females	30	48± 2.5

From both the groups under study (healthy and diseased), blood samples were obtained from antecubital vein with all aseptic precautions. The blood was collected in the plain tube for the estimation of serum lipid profile. The serum was used for the estimation of lipid parameters by routine Biochemical Kits using semiautomated analyzer. Standard blood pressure (systolic and diastolic) measurements were done using auscultatory technique by using mercury sphygmomanometer. The fasting blood sugar (FBS) was determined by glucometer, based on the glucose-oxidase method (Hugget and Nixon 1957). Total Cholesterol (TC) was done by the enzymatic CHOD-POD method (Allain *et al* 1974). Triglycerides (TG) were estimated by the enzymatic method (Fossati 1982) in which triglycerides were hydrolyzed by lipase which generates free fatty acids and glycerol. Released glycerol was assayed in reaction catalyzed by glycerol kinase and glycerol phosphate kinase. HDLc was measured by an enzymatic method on the supernatant obtained after selective precipitation of apolipoprotein-B containing lipoproteins with phosphotungstic acid, in the presence of magnesium ions (Burstein *et al* 1970). Serum LDLc was calculated according to the computational

procedures of Friedewald *et al* (1972) [$LDLc = TC - (HDLc + VLDLc)$ (mg/dl)]. Serum VLDL is also a calculated parameter and was calculated using Friedewald formula [$VLDLc = TG/5$ (mg/dl)].

RESULTS AND DISCUSSION

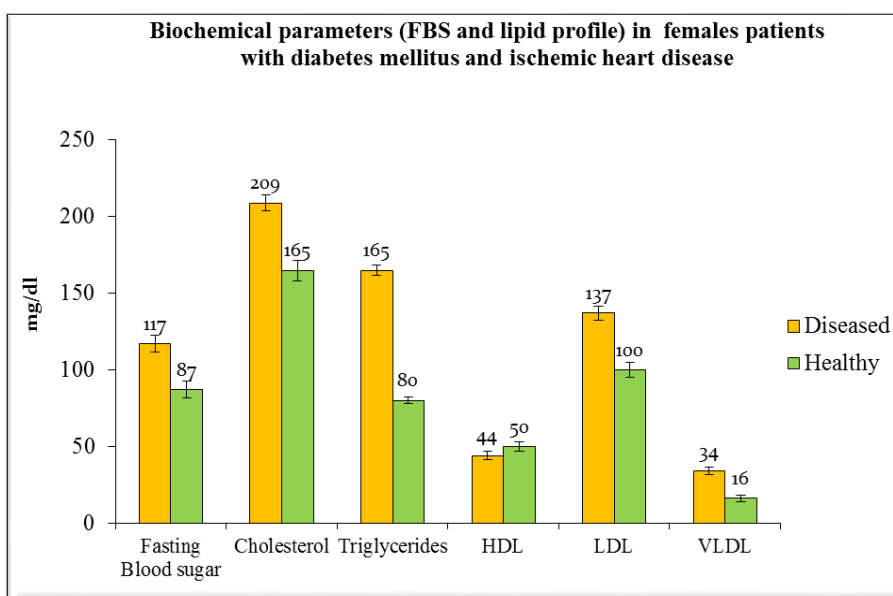
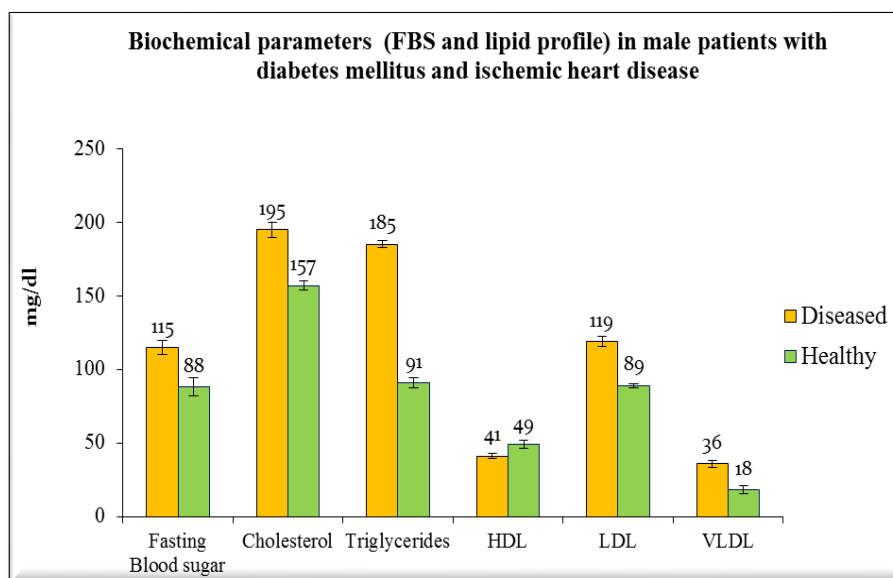
In the present study, fasting blood sugar level was higher in male and female subjects as per the outlined experiment as diabetic patients were taken as sample subjects. Cholesterol was found higher in females as compared to males. It has been seen that total cholesterol level is lower in controls than diabetic patients in both the genders. Onyemelukwe and Stafford (1981) also reported higher values of total cholesterol than normal in persons with type 2 diabetes compared with controls. Similarly triglyceride levels were found to be higher in male and female subjects as compared to their control counterparts. Hypertriglyceridemia is considered the dominant lipid abnormality in insulin resistance and plays a pivotal role in determining the characteristic lipid profile of diabetic dyslipidemia. Elevated triglyceride levels are a result of increased production and decreased clearance of triglyceride rich proteins in fasting and non-fasting states. HDLc was found to be lower in male and female subjects and higher in controls. There were no significant differences in HDLc levels in male and females. High triglyceride levels caused increased transfer of cholesteryl esters from HDL and LDL to VLDL via cholesteryl ester transfer protein, thus forming cholesteryl esters depleted small dense LDL particles. These small dense lipoprotein particles are taken up by arterial wall macrophages, resulting in atherogenesis. HDL acts by enhancing the removal of cholesterol from peripheral tissues and so reduces the body's cholesterol pool. Reduced HDL acts as a powerful predictor for premature coronary heart disease (Sparks and Sparks 1990). Low density lipoprotein cholesterol (LDLc) increased in the male and female patients as compared to controls. Females were found to have higher LDLc than male counterparts. Dixit *et al* (2014) also found the high prevalence of hypercholesteremia, hypertriglyceridemia and high LDL factors in diabetic patients. Both males and females patients were found to have higher VLDLc in their blood serum in comparison to their controls. The characteristic feature of diabetic dyslipidemia is high plasma triglyceride concentration, low HDL and high concentration of small dense low density lipoproteins. Hyperlipidemia is a common complication of diabetes mellitus and it leads to premature atherosclerosis and macrovascular complications. The important impact of dyslipidemia on cardiovascular complications requires undivided attention throughout the course of the disease. Increase in total cholesterol and decrease in HDL lead to increase in TC:HDLc ratio in both the genders. The TC/HDL ratio is a specific and sensitive index of cardiovascular risk. Insulin is involved at all the stages of VLDL production and secretion. Insulin suppresses lipolysis by inhibiting the activity of hormone sensitive lipase, which catalyzes the mobilization of free fatty acids from stored triglycerides. Cook *et al* (2000)

reported gender differences in the dyslipidemia, elevated LDL and reduced HDL concentrations commonly documented in females than in males.

Table 2: Comparison of biochemical parameters in patients with diabetes mellitus and ischemic heart disease.

Biochemical parameters	Male Subjects	Male Controls	Female Subjects	Female Controls
Fasting blood sugar (FBS) (mg/dl)	115±4.75	88±6.0	117±5.3	87±5.6
Total Cholesterol (TC) (mg/dl)	195±5.2	157±3.3	209±5.3	165±6.7
Triglycerides (TG) (mg/dl)	185±2.6	91±3.5	165±3.6	80±2.3
High density Lipoprotein (HDLc) (mg/dl)	41±1.7	49±2.7	44±1.8	50±3.2
Low Density Lipoprotein (LDLc) (mg/dl)	119±3.7	89±1.48	137±4.5	100±4.8
Very Low Density Lipoprotein (VLDL)(mg/dl)	36±2.4	18±2.7	34±1.5	16±1.3
TC:HDLc	4.7±0.15	3±0.36	4.8±1.6	3.2±0.37

Data are represented as mean ± S.D.

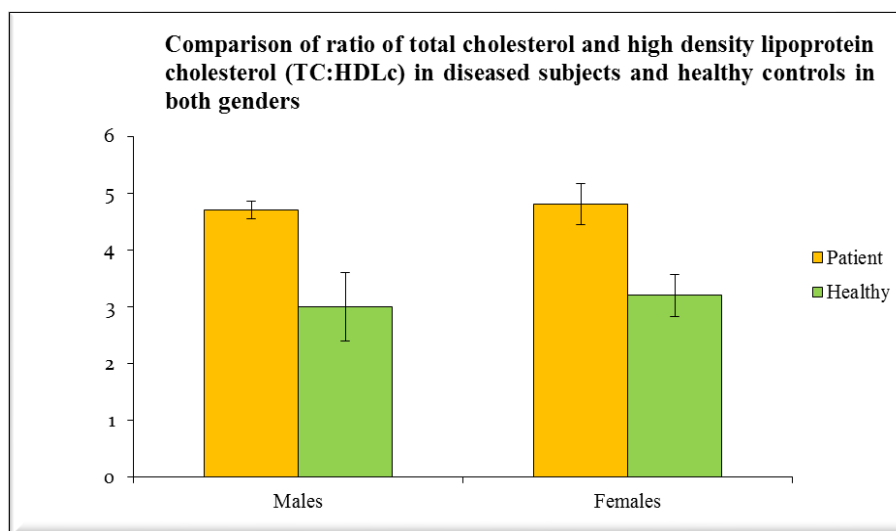


The relationship between diabetes mellitus and serum lipid profile have been shown to be an important predictor for metabolic disturbances including dyslipidemia, hypertension, cardiovascular diseases and hyperinsulinemia (Goldberg 2001). Earlier studies also

indicated a strong clustering risk factor for coronary artery disease in diabetic patients (Elinasri and Ahmed 2008). Interrelationship between carbohydrates and lipid metabolism leads to the disorder in the lipid metabolism because of the disorder in the carbohydrate metabolism

(Chatterjee and Shinde 2006). Insulin deficiency reduces the activity of hepatic lipase and several steps in the production of biologically active lipoprotein lipase (Mooradian 2009, Smith and Lall 2008). Abbate and Brunzell (1990) also reported that the increase in triglycerides in poorly controlled patients is related to the decrease of activities of adipose tissue and muscle

lipoprotein lipase activity. Dyslipidemia management in people with diabetes mellitus starts with the evaluation that aims to identify secondary causes that contribute to abnormal lipid profile (Hachem and Mooradian 2006). Stamouli *et al* (2014) also found the combination of elevated triglycerides and reduced HDL as most prevalent lipid abnormality in the population of Greece.



CONCLUSION

This study concluded that dyslipidemia exists in type II diabetes population with higher total cholesterol in diabetic females than diabetic males. All the diabetic patients must be started on primary prevention by encouraging healthy lifestyles diets so as to reduce the risk of cardiovascular diseases. Study of lipid profile is a prerequisite to evaluate the risk of progression of ischemic heart disease in diabetic patients. Heart disease is one of the chief causes of deaths in India, as well as in other countries. But it is potentially preventable and reversible. Attentive monitoring of lipid profile could be helpful in the management of the disease.

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