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LIPID PROFILE CHANGES IN TYPE II DIABETES MELLITUS

R.VENKATESH^{1*}, K. KALAIVANI²

¹Research scholar, Department of Biochemistry, Kongunadu Arts and Science College (autonomous), Coimbatore – 641029.

ABSTRACT

Diabetes mellitus is regarded as a syndrome, a collection of disorders that have hyperglycemia as the hallmark. Non-insulin dependent diabetes mellitus is now epidemic in many countries undergoing modernization and industrialization. In the present research work on type II diabetes mellitus, various biochemical parameters have been analyzed in a systematic manner. Blood and urine samples were collected from Sun and Apollo laboratory in Coimbatore. About thirty diabetic (type II) patients (15 males and 15 females) and thirty normal individuals (17 males and 13 females). Blood and urine samples were collected from the normal and diabetic individuals. The blood was obtained by vein puncture and collected in the centrifuge tubes. The present study is significantly increased levels of lipids like total cholesterol, LDL, VLDL and Triglycerides, whereas HDL cholesterol is lower in diabetic, when compared to normal healthy controls. That diabetes mellitus enhances the deposition of lipids through a multiple derangements in catabolic and anabolic processes, perusing the diabetic patient more susceptible to atherosclerosis.

Keywords:- Diabetes mellitus, polydipsia, polyphagia, HMG CoA reductase, HDL, LDL, VLDL, hyperglycemia, Creatinine and Reactive Oxygen Species.

INTRODUCTION

Diabetes mellitus is regarded as a syndrome, a collection of disorders that have hyperglycemia as the hallmark. Non-insulin dependent diabetes mellitus is now epidemic in many countries undergoing modernization and industrialization. Diabetes is becoming the third killer of mankind, after cancer and cardiovascular diseases, because of its high prevalence, morbidity and mortality ¹.

Diabetes mellitus is a common endocrine disorder characterized by hyperglycemia, metabolic abnormalities and long-term complications afflicting the eyes, kidneys, nerves and blood vessels. India, a developing Asian country with fast industrialization and a modern lifestyle is facing a grave problem in having the largest number of people with diabetes which is estimated to reach 80 million by the year 2030^{2, 3}. It is close to

Correspondence Author



R.VENKATESH

Research scholar, Department of Biochemistry, Kongunadu Arts and Science College (autonomous), Coimbatore – 641029.

Email: biovenki76@gmail.com

becoming the diabetic capital of the world. The literature on Indian studies showed a threefold rise in the diabetic prevalence in rural as well as urban areas⁴.

Diabetes mellitus, or simply diabetes, is a group of metabolic diseases in which a person has high blood sugar, either because the body does not produce enough insulin, or because cells do not respond to the insulin that is produced. This high blood sugar produces the classical symptoms of polyuria (frequent urination), polydipsia (increased thirst) and polyphagia (increased hunger). Diabetes is a chronic condition which occurs either when the pancreas cannot produce insulin or the body is unable to properly use the insulin that the pancreas does produce. Under normal circumstances, insulin is produced by the pancreas in order to regulate the body's metabolism. When food is digested, it is broken down into glucose. The glucose molecules enter the bloodstream, causing a rise in blood sugar levels. Soon thereafter, the pancreas secretes insulin via the pancreatic beta cells. Insulin is responsible for facilitating the transfer of glucose from the bloodstream to the inside of the body's cells. Once glucose enters the cells it can then be used immediately for energy or stored for later use. It is when the insulin pathway becomes disrupted that diabetes develops⁵.

At the same time, the disease and its complications cause a heavy economic burden for diabetic patients themselves, their families and society. A better understanding about the cause of a predisposition of Indians to get T2DM is necessary for future planning of healthcare, policy and delivery in order to ensure that the burdens of disease are addressed⁶. Most of the studies conducted on glucose have mentioned that 90-95% of the diabetic cases were type 2 diabetes mellitus. This adult type of diabetes affects older people who are obese or over weight, or have a family history of diabetes, and have restricted movement or limited exercise. The studies on type 2 diabetes revealed that the patients have problems in lipids concentration and metabolism⁷.

The risk of coronary artery disease is two to four folds, higher in women as compared to men, and following an acute myocardial infarction the risk of death is more than double compared with a non-diabetic population^{8, 9, 10}. Weight reduction is considered to be the primary treatment for obese patients with type 2 diabetes, because of its beneficial effects on glycemic balance, insulin sensitivity and lipoprotein abnormalities¹¹. International researchers observed that antioxidants commonly promoted as being good for our health may speed up early onset of type 2 diabetes by mopping up Reactive Oxygen Species (ROS) that may play a protective role in the early stages of type 2 diabetes by enhancing insulin action¹². The prevalence of obesity everywhere in the world is increasing rapidly. Obesity is the presence of excessive amount of adipose tissue. It is a physiological response to the environment and behavior, in which energy intake exceeds energy output, and the interaction between genotypes and the environment all contribute to development of obesity^{13, 14}.

MATERIALS AND METHODS

In the present research work on type II diabetes mellitus, various biochemical parameters have been analysed in a systematic manner.

Collection of serum and urine sample

Blood and urine samples were collected from Sun and Apollo laboratory in Coimbatore. About thirty diabetic (type II) patients (15 males and 15 females) and thirty normal individuals (17 males and 13 females). Blood and urine samples were collected from the normal and diabetic individuals. The blood was obtained by vein puncture and collected in the centrifuge tubes.

Estimation of Lipid Profiles

Fat absorbed from the diet and lipids synthesized by the liver and adipose tissue must be transported between the various tissues for utilization and storage. Since lipids are insoluble in water, they are transported in plasma as lipoproteins. Lipid profiles such as total cholesterol, HDL, LDL, VLDL and triglycerides were analyzed.

Chemicals

All the chemicals used in the present study were of analytical reagent grade.

STATISTICAL ANALYSIS

Results are Mean \pm SD for 60 samples. Values are expressed as mg / dl. Values that have a different superscript (a,b,c) differ significantly with each other ($P < 0.05$). Data were analysed using the

Table 1. Level of Lipid profile in normal and diabetic patients

Parameter	Normal (Non-diabetic) (n=30)	Diabetic (n=30)	't' Value
Total cholesterol [#]	175.81 \pm 34.74	198.89 \pm 46.16	2.151*
HDL [#]	44.63 \pm 11.43	42.48 \pm 7.59	0.845
LDL [#]	104.31 \pm 29.85	139.43 \pm 34.18	1.132*
VLDL [#]	34.19 \pm 17.95	43.43 \pm 28.81	1.465*
Triglycerides [#]	162.43 \pm 63.42	217.24 \pm 165.97	1.661*

Units:

[#] mg / dl

Values are mean \pm SD; * - Significant at 5% ($t < 0.05$)
ns – not significant

Significantly increased levels of lipids like total cholesterol, LDL, VLDL and Triglycerides, whereas HDL cholesterol is lower in diabetic, when compared to normal healthy controls. The levels of lipids like cholesterol, triglycerides and phospholipids were significantly higher in diabetic subjects than in normal healthy individuals. A variety of derangements in oxidative/reduction metabolic and regulatory mechanisms, due to diabetes mellitus, might be responsible for the observed accumulation of lipids¹⁵.

Hypercholesterolemia, high concentration of low-density lipoprotein cholesterol, hypertriglyceridemia and low high-density lipoprotein are established as independent risk factors for diabetes¹⁶. The pathogenesis is multifactorial, reflecting complex biosynthetic, enzymatic and catabolic derangement in lipoprotein metabolism. Alterations in the fatty acid composition of serum triglycerides, cholesterol

ester and phospholipids were also reported in diabetes condition¹⁷.

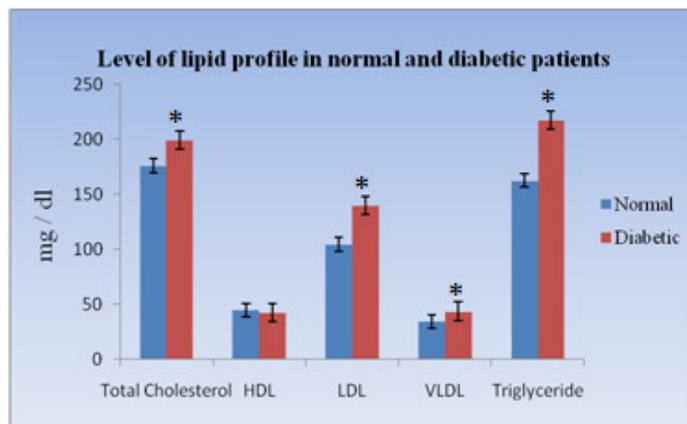
RESULTS

The tables 1 indicate the results of lipid profile in normal and diabetic patients.

Studies by¹⁸ have shown that diabetes mellitus enhances the deposition of lipids through a multiple derangements in catabolic and anabolic processes, perusing the diabetic patient more susceptible to atherosclerosis.

Patients with diabetes can have many complications including elevated levels of VLDL-C, LDL-C and Triacylglycerols; and low levels of HDL-C. These patients have a preponderance of abnormalities in the composition of smaller, denser particles, which increase atherogenicity even if the absolute concentration of LDL-C is not significantly increased¹⁹.

Diabetes is also known to be associated with an increase in the synthesis of cholesterol, which may be due to the increased activity of HMG CoA reductase, whereas HDL cholesterol levels were significantly lower compared to normal healthy individuals. Hypertriglyceridemia is a common finding in patients with diabetes mellitus and is responsible for vascular complications²⁰.



DISCUSSION

Diabetes is characterized by hyperglycemia together with biochemical aberrations of glucose and lipid metabolism. The objectives of managing diabetes mellitus are to optimize the control of blood glucose, diminish the adverse effects of oxidative stress, and normalize instabilities in lipid metabolism.

Also elevated serum lipid level is associated with a higher risk of coronary heart disease for patients with diabetes. Hyperlipidaemia does not only increase the risk of ischemic heart disease in diabetic patients, but also, may impair glycaemia control, accelerate the progression of renal insufficiency, and increase mortality. The nature of the relationships suggests a probable inflexibility of the enzymes to utilize their nutrient-based molecules in diabetics. In the foregoing, these differences with the various percentage variances in enzyme activities showed multi-factorial and complex regulations beyond one common determinant.

In the same note, it is worthy to indicate a cluster of physiological functions such as insulin secretion and action, glucose homeostasis, lipid metabolism and hormones that take on characteristic values in any one individual and tend to co vary between individual. The increase in triglyceride may be due to insulin deficiency which results faulty glucose utilization causes hyperglycemia and mobilization of fatty acids from adipose tissue. In diabetes blood glucose is not utilized by tissue resulting in hyperglycemia. The fatty acid from adipose tissue is mobilized for energy purpose and excess fatty acids

are accumulated in the liver, which are converted to triglyceride.

In most cases of diabetes mellitus are able to raise the urea and creatinine are mainly identified as risk markers of kidney disturbances in our sample are characterised by: high urea, creatinine, uric acid, and total protein. We also noted in our patients with low serum levels of HDL cholesterol consequent change in the composition of the fractions related to their content of Triglycerides is increased and their cholesterol content, which in contrast decreases. This can be explained by reduction in the lipase lipoprotein causing a reduction in the breakdown of triglycerides, and subsequently a decrease in HDL particle formation.

CONCLUSION

The results of the present study indicated significant aberrations in the carbohydrate, protein and lipid metabolisms. Reduction in the level of antioxidant defence status to counteract the diabetes associated oxidative was also well evident. The diabetic patients had a higher prevalence of high serum cholesterol, high triacylglycerol and high LDL cholesterol than the controls, indicating that diabetic patients were more prone to cardiovascular diseases. Type 2 diabetic patients in addition to glycemic control hence early diagnosis can be accomplished through relatively inexpensive blood testing.

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