Original Research Article

Altered activity of lecithin cholesterol ACYL transferase enzyme and high density lipoprotein in type 2 diabetes mellitus

Tahmeen Jameel, Raisa Faheem*, Aiman Mahmood, Afnan Ali Afrooz

Department of Biochemistry, Deccan College of Medical sciences, Hyderabad Telangana, INDIA.
Email: tahmeen.jameel@gmail.com

Abstract

An important enzyme in modulating plasma HDL levels is cholesterol acyl transferase (LCAT) which is responsible for the formation of most of the cholesterol esters (CE) present in human plasma. This enzyme catalyses the transfer of fatty acid from the Sn-2 position of the lecithin to the free hydroxyl group of cholesterol. It utilizes linoleate for the esterification of cholesterol in preference to the other fatty acids. Thus the enrichment of the linoleate content of plasma lecithin which accompanies ingestion of a poly unsaturated fat diet leads to an increase in the proportion of cholesterol linoleate in plasma. The physiological substrate for LCAT is probably nascent HDL. The enzyme activity is dependent on apoA-1 and in inhibited by apoA-2. Thus the maturing HDL particles contain mainly esterified cholesterol which having been rendered non diffusible are trapped in the HDL and then are transferred to the liver to undergo catabolism. Present studies have been carried out on diabetic patients with good glycaemic control and diabetics with poor glycaemic control and compared with normal control group. HDL cholesterol levels in diabetic patients with good and poor glycaemic control were significantly lower than the normal control group. LCAT in diabetic patients with good and poor glycaemic control were significantly lower than the normal control group. However HDL cholesterol level and LCAT activity in diabetic patients with poor glycaemic control was still lower this supports the observation that coronary artery disease (CAD) is 2-4 times higher in diabetes than non diabetes.

Key Words: HDL (High Density Lipoprotein (Lecithin cholesterol Acyl Transferase), CAD (Coronary Artery Disease), NIDDM (Non-Insulin Dependent diabetes Mellitus)

***Address for Correspondence:**
Dr. Raisa Faheem, Department of Biochemistry, Deccan College of Medical sciences, Hyderabad Telangana, INDIA.
Email: tahmeen.jameel@gmail.com

Received Date: 25/08/2017 Revised Date: 29/09/2017 Accepted Date: 26/10/2017
DOI: https://doi.org/10.26611/1002421

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	Accessed Date: 02 November 2017

INTRODUCTION

Accelerated coronary and peripheral vascular atherosclerosis is one of the most serious and chronic complication of long term diabetes. Coronary heart disease is 2-3 times higher in diabetes than in non-diabetes.

Mammilton (1972) has shown that HDL is synthesized in the liver and in its nascent form appears as bi-layered discs on electron microscopy. These nascent particles consist mainly of apoE, apoC, phospholipid and free cholesterol. Subsequently the apoE is largely replaced by apoA-1 and most of the cholesterol becomes esterified as a result of the action of the LCAT enzyme.

Reichi *et al*., (1986) demonstrates that HDL/LCAT complex is able to act as acceptor of cellular free cholesterol which is then esterified by LCAT and transferred to core of the particle to become HDL_2 the cholesterol ester can then be transferred to other lipoproteins of lower density by a lipid transfer protein and reach the liver for excretion.

Glomset (1968) reveals that LCAT is synthesized in liver and circulates in plasma associated with HDL. In disorders that obstruct flow of bile, concentration of un-esterified cholesterol and lecithin in plasma are increased.

How to cite this article: Tahmeen Jameel, Raisa Faheem, Altered activity of lecithin cholesterol ACYL transferase enzyme and high density lipoprotein in type 2 diabetes mellitus. *MedPulse International Journal of Biochemistry.* November 2017; 4(2): 29-31. https://www.medpulse.in/Biochemistry/

Esterification of cholesterol was decreased in many patients with impaired liver function.

Curtiss (1985) has shown that chronic hyperglycaemia in diabetic patient's leads to non-enzymatic glycation of proteins including apoA-1.

Gugliucci (1991) demonstrates that this modification of apoA-1 results ion decrease of LCAT activity.

MATERIALS AND METHODS

Selection of Subjects

The study is conducted in three groups of subjects selected from out patients as well as in patients from the Department of Medicine at Owaisi Hospital and Research Centre and Princess Esra Hospital, Hyderabad.

Group 1

Consists of (10) normal adult males and females between the age group of 30-50 years selected as control group with no history of diabetes mellitus.

Group 2

Consists of (15) subjects of similar age group with good glycaemic control of Diabetes Mellitus.

Group 3

Consists of (15) subjects of similar age group with poor glycaemic control of diabetes mellitus, based on HbA1c result.

RESULTS

Table 1: Total Cholesterol (mg %)

DATA	Group I	Group II	Group III
	Normal Control	DM with Good	DM with Poor
Mean	184.20	231.27	289.00
SD	12.01	26.11	24.95
SE	3.80	6.74	6.44

Table 2: HDL CHOLESTEROL (mg %)

DATA	Group I	Group II	Group III
	Normal Control	DM with Good	DM with Poor
Mean	60.80	44.07	29.60
SD	10.37	6.35	5.24
SE	3.28	1.64	1.35

DISCUSSION

Results of the study indicate derangement of lipoprotein metabolism in patients with NIDDM. There was decrease in HDL cholesterol level and LCAT activity in patients with type 2 diabetes mellitus.

HDL Cholesterol levels in normal control are 60.80 ± 10.37. In diabetic patients with good glycemic control it is decreased (44.07 ± 6.35). It is further decreased in diabetic patients with poor control the levels being 29.60 ± 5.24 ($P<0.01$ (TableIII). Lecithin cholesterol acyl transferase activity in normal control is 45.57 ± 4.28

In diabetic patients with good glycaemic control, it is decreased 29.88 ± 4.68

It is further decreased in diabetic patients with poor glycaemic control, the levels being 21.31 ± 3.68

Miller *et al*., (1977) has shown that HDL cholesterol concentrations are strongly independently related to coronary heart disease, low HDL cholesterol levels are important predictor of coronary artery disease.

Brown (1994) has shown that low levels of HDL may be associated with coronary artery disease risk even when serum cholesterol and LDL levels are normal.

Lusitupa *et al*., (1986) has shown that lowered HDL levels were reported in diabetes. An inverse relationship has been described between plasma insulin and HDL levels.

Nikhila *et al*., (1969) showed that HDL concentration particularly HDL 2 have been reported to be lower in NIDDM but normal in IDDM.

Dunn (1988) showed that lowered HDL cholesterol levels in NIDDM have been reported to increase on diabetic treatment but still is lower than normal.

Luoma *et al*., (1985) demonstrated that the decrease in LCAT may be due to alteration in hepatic microsomal activity. An altered hepato cellular structure and decreased microsomal enzyme activity was observed in NIDDM enhancement of hepatic microsomal function improves both cholesterol distribution and glycaemic control in diabetes thus the risk of coronary artery disease in diabetes as evaluated by HDL and blood glucose levels seems to be related to activity of lever microsomal enzyme system.

The present study also supports the observation by other workers that in NIDDM, HDL cholesterol levels are lowered. There is also associated lowering of LCAT activity which may further be related to derangement in lipoprotein metabolism in diabetes thus these patients are more prone to develop CAD. However HDL cholesterol levels and LCAT activity in diabetic patients with poor control was still lower supporting the observation that CAD is 2-4 times higher in diabetes than in non diabetes.

REFERENCES

1. Allain CA, Poon LS, Chan CS, Richmond W, Fu PC (1974) Enzymatic determination of total serum cholesterol Clinical Chemistry 20 470-5
2. Curtis LK and Witztum JL (1985) Plasma apolipoproteins A1, A11, B, C1 and E are glycosylated in hyperglycaemic diabetic subjects. Diabetes 34 452-461.
3. Glomset (1968). Transport of cholesterol from peripheral tissue to liver Journal of Lipid Research 9 155.
4. International Journal of Basic and Applied Medical Sciences ISSN: 2277-2103 (Online)
5. An Online International Journal Available at hpp://www.cibtech.org/jms.htm 2013 Vol.3 (3) September-December, pp.100-109/Tahmeen and Syed

6. Glomset (1968). Transport of cholesterol from peripheral tissue to liver Journal of Lipid Research 9 155-67.
7. Glomset (1969). Cholesterol esterification in the sera of all three species, but at higher concentrations they promoted the hydmly. Journal of Lipid Research 9 155-67.
8. Gugliucci A and Stah AJ (1991). In vitro glycation of human apolipoprotein A1 reduces its efficacy in lecithin cholesterol acyl transferase activation. Clinica Chimica Acta 204 37-42.
9. Lopes – Veralia MF, stone P, Elnis and Colweh JA (1977). Cholesterol determination in high-density lipoproteins separated by three different methods. Clinical Chemistry 23 882-884.
10. Luma V et al., (1985). Acta Medica Scandinavica 217 473-479.
11. Miller NE, Thelle DS, Forde OH and Jos ODM (1977). The Tromso heart stury. High density lipoprotein and coronary heart disease; a prospective case control study. Lancet (8019) 965-968.
12. Nikikila EA (1969). Control of plasma and liver trigkyceride kinetis carbohydrate metblosim and insulin. Advance in Lipid Research 7 63-134.
13. Nikikila EA and Hormila P (1978). Serum lipids and lipoprotein in insulin treated diabetes: demonstration of increased high density lipoprotein concentration. Diabetes 27 1078-86.
14. Reichi D and Miller NE (1986). The anatomy and physiology of reverse cholesterol transport. Clinical Science 70 221-231.
15. Richmond W (1973). Preparation and properties of a cholesterol oxidase from Nocardia sp. And its application to the enzymatic assay of total cholesterol in serum. Clinical Chemistry; 19(12) 1350-1356.
16. Sperry, W.M.andWebb.M(1950).Journal of Biological Chemistry 187-97
17. Varley H (1969). Text Book of Clinical Bio-Chemistry 4th Edition. Arnold Heinemann Publishers (India) Pvt. Ltd.
18. Zlatkis Am Azk-B and Boyle GJ (1953). A new method for the direct determination of serum cholesterol. Journal of Lab clinical Medicine 41 486-492.

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