

Lipid profile in Diabetes Mellitus

Shankarprasad DS^{1,*}, Shivanand Gundalli², Mahantesh B³, SV Kashinakunti⁴, Sunitha P⁵

^{1,4}Professor, ³Postgraduate student, ⁵Associate Professor, Department of Biochemistry,
²Assistant Professor, Department of Pathology, SN Medical College, Bagalkot, Karnataka

***Corresponding Author:**

E-mail: hodbiochemsnmc@yahoo.com.au

ABSTRACT

Diabetes mellitus is the most common metabolic disorder affecting the people all over the world. Diabetes mellitus has been known to be associated with lipid disorders and cardiovascular complications. This study is planned to assess the lipaemic changes in diabetes mellitus patients attending the out-patient department of medicine department in HSK Hospital and Research Centre. Total Cholesterol(TC), Triglycerides(TG), LDL Cholesterol(LDL-C), HDL Cholesterol (HDL-C) levels were studied in serum of diabetes patients. This is a case control study which included 76 patients of diabetes as cases and 50 controls of the same age group and sex. All the samples were taken from subjects who fasted for at least 12 hours before the blood collection. The parameters were determined by manual method using spectrophotometer by liquid chemistry. The Triglycerides, Total cholesterol, LDL Cholesterol were higher in cases as compared to controls in both IDDM and NIDDM. The HDL-C was lower in NIDDM subjects who were on sulfonylurea or biguanides and was not significantly altered in IDDM patients on insulin. There was significant correlation between FBS and TC, TG, LDL-C and HDL-C in NIDDM patients. TC, TG, LDL-C showed significant correlation in IDDM subjects.

Key words: Diabetes mellitus, IDDM, NIDDM, lipid profile.

INTRODUCTION

Diabetes mellitus(DM) is a group of metabolic disease characterized by increase blood glucose level resulting from defects in insulin secretion, insulin action, or both¹. The chronic hyperglycemia of diabetes is associated with long-term damage, dysfunction and disturbance in failure of various organs, especially the eyes, kidneys, nerves, heart and blood vessels². Patients with type-2 diabetes have increased risk of cardiovascular disease associated with atherogenic abnormalities and dyslipidaemia. Coronary artery disease, especially myocardial infarction is the leading cause of morbidity and mortality worldwide³. Hyperglycaemia and atherosclerosis are related in type-2 diabetes⁴.

Persistent hyperglycaemia causes glycosylation of all proteins, especially collagen cross linking and matrix proteins of arterial wall. This eventually causes endothelial cell dysfunction, contributing to atherosclerosis. The prevalence of dyslipidemia in diabetes mellitus is 95%⁵. Early detection and treatment of hyperlipidemia in diabetic patients reduces the risk for cardiovascular and cerebrovascular diseases. Lifestyle changes such as diet and exercise are very important in improving

diabetic dyslipidemia, but often pharmacological therapy is needed⁶. Lipoprotein metabolism⁷.

The rationale of the study was to detect the lipid abnormalities associated with chronic hyperglycemia due to IDDM or NIDDM.

MATERIALS

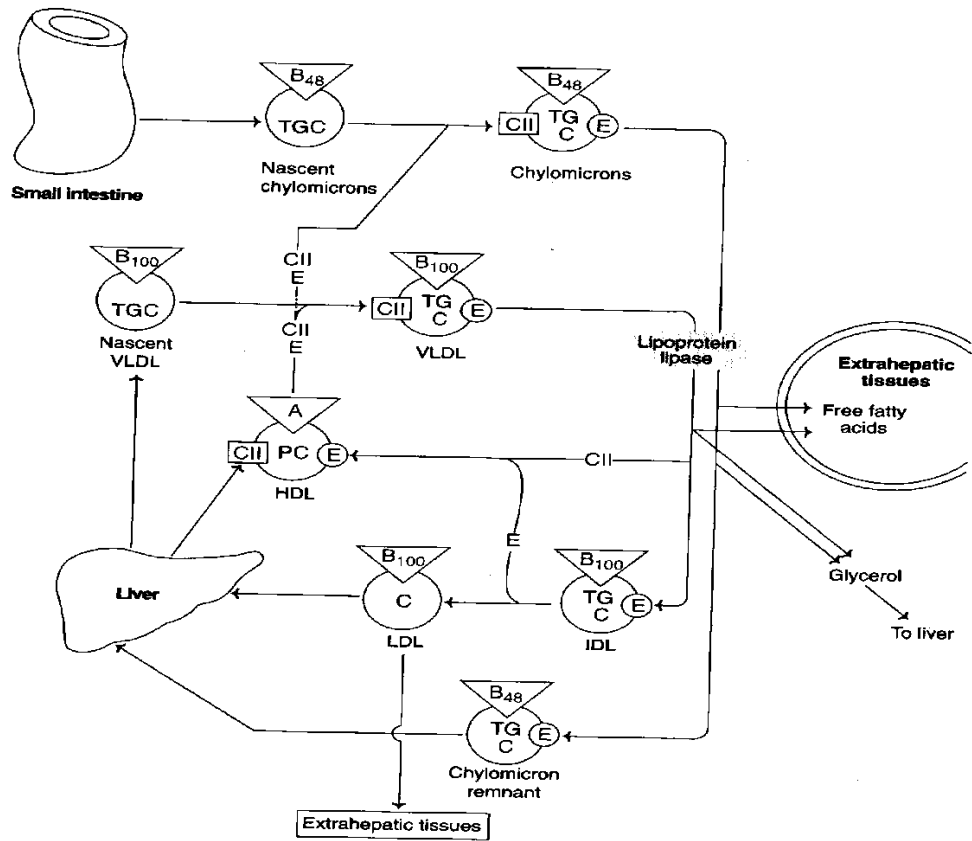
This study was conducted in diabetic clinic, HSK Hospital and Research centre Bagalkot. A total number of 50 control who were healthy non smokers non alcoholics and at the time of study all of them were keeping good health and 76 diabetics who were on treatment were studied. The diabetics were on either sulfonylurea/biguanides or insulin treatment for type I or type II diabetes. In our study, we excluded diabetic subjects who were smokers, alcoholics and who were hypertensives, familial hyperlipidemia patients and patients with complications.

METHODS

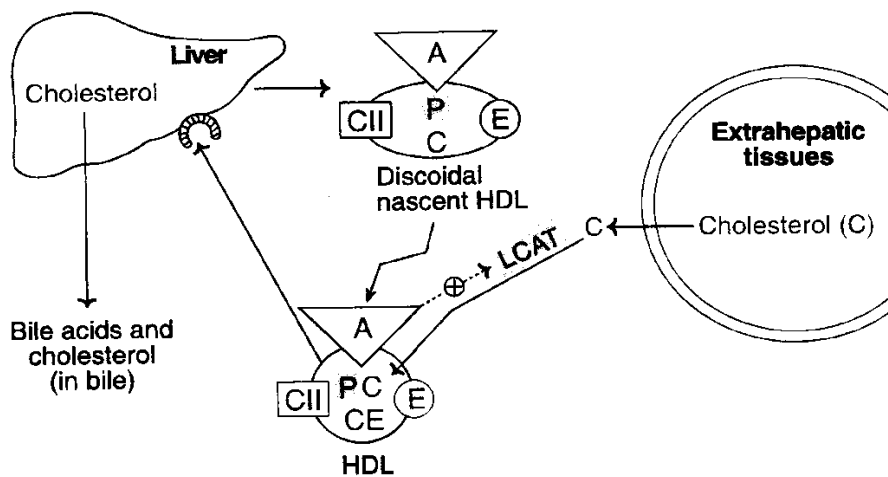
1. Serum glucose estimation by Ortho-Toluidine method⁸.
2. Determination of total cholesterol by Watson method⁹.
3. Determination of serum triglycerides by Acetyl Acetone method¹⁰.
4. Determination of HDL-Cholesterol by Watson method¹¹.
5. Serum LDL-Cholesterol was calculated by Friedwald's Formula¹².

These tests were done by manual methods using stat fax 3300 spectrophotometer by liquid chemistry.

Access this article online	
Quick Response Code:	Website: www.innovativepublication.com
	DOI: 10.5958/2394-6792.2015.00030.7



Summary of metabolism of lipoproteins (Apoproteins-A, B₄₈, B₁₀₀, CII and E; TG-Triacylglycerol; C-Cholesterol; P-Phospholipid; VLDL-Very low density lipoprotein; IDL-Intermediate density lipoprotein; LDL-Low density lipoprotein; HDL-High density lipoprotein).



Metabolism of high density lipoproteins (P-Phospholipid; C-Cholesterol; CE-Cholesteryl ester; A, CII, E-Apoproteins; LCAT-Lecithin cholesterol acyltransferase).

RESULTS

Table 1: Showing Comparison of FBG, TC, TG, HDL-c, LDL-c Between Insulin Treated Diabetic subjects (IDDM and Control Subjects)

Groups	FB Glucose Mg/dl	TC mg/dl	TG mg/dl	HDL-c Mg/dl	LDL-c Mg/dl
Control	92.2±11.0	173.0±31.6	122.5±28.7	56.9±17.9	93.3±36.3
IDDM Subjects	229.8±46.2	222.2±23.3	197.9±49.7	58.4±14.6	124.2±25.0
p-value	<.001	<.001	<.001	>.05	>.01
Statistical Significance	H. S	H.S	H.S	N. S	S. S

Table 2: Showing Comparison of FBG, TC, TG, HDL-c, LDL-c Between Diabetic (NIDDM) and Control Subjects.

Groups	FB Glucose Mg/dl	TC mg/dl	TG mg/dl	HDL-c Mg/dl	LDL-c Mg/dl
Control	92.2±11.0	173.0±31.6	122.5±28.7	56.9±17.9	93.3±36.3
IDDM Subjects	206.2±37.9	229.9±30.5	226.4±59.7	39.5±15.4	145.2±32.5
p-value	<.001	<.001	<.001	<.001	<.001
Statistical Significance	H. S	H.S	H.S	N. S	S. S

Table 3: Showing Comparison of FBG, TC, TG, HDL-c, LDL-c between control and Sulfonylurea Treated Diabetic subjects and also with Biguanide Treated Diabetics

Groups	FB Glucose Mg/dl	TC mg/dl	TG mg/dl	HDL-c Mg/dl	LDL-c Mg/dl
Control	92.2±11.0	173.0±31.6	122.5±28.7	56.9±17.9	93.3±36.3
IDDM Subjects	211.7±41.7	226.0±30.3	220.2±64.4	37.9±17.2	146.0±28.2
p-value	<.001	<.001	<.001	<.001	<.001
Statistical Significance	H. S	H.S	H.S	H. S	H. S
Control	92.2±11.0	173.0±31.6	122.5±28.7	56.9±17.9	93.3±36.3
IDDM Subjects	191.7±27.1	223.6±27.1	246.2±50.5	41.2±10.7	143.2±39.2
p-value	<.001	<.001	<.001	<.001	<.001
Statistical Significance	H. S	H.S	H.S	H.S	H.S

1. The values are expressed as their mean ± S.D
2. H.S — highly significant, S. S-Statistically significant, N. S- not significant.

Table No 1: Shows the comparison between the estimated levels of FBG, Tc, Tg HDL-c in healthy controls and in IDDM subjects. It is evident from the table that there are increased levels of FBG, TC, TG, HDL-c and LDL-c in IDDM subjects as compared to controls. The "p" value is highly significant for FBG, TC and TG, statistically significant for LDL-c and not significant for HDL-c.

Table No 2: Shows the comparison between the estimated levels of FBG, Tc, Tg, HDL-c in healthy controls and in NIDDM subjects on oral hypoglycemics. It is evident from the table that there are increased levels of FBG, TC, TG and LDL-c, but decreased levels of HDL-c in NIDDM subjects as compared to controls. The "P" value is highly significant statistically for all the parameters.

Table No 3: Shows the drug wise comparison between the estimated levels of FBG, TC, TG, HDL-

c in healthy controls and in NIDDM subjects treated with sulfonylurea and biguanides separately. It is evident from the table that there are increased levels of FBG, TC, TG and LDL-C, but decreased levels of HDL-C in both sulfonylurea and biguanide treated NIDDM subjects as compared to controls. The "p" value is highly significant statistically for all the parameters.

DISCUSSION

FASTING BLOOD GLUCOSE

The FBG levels in all the diabetics were highly significant ($p < 0.001$) as compared to their respective controls^{13,14}.

TOTAL CHOLESTEROL

Our study in IDDM and NIDDM are in accordance with earlier studies of John D Bagdade²¹⁵ and James M Falko¹³. Diabetic state appears to be

associated with increased synthesis of cholesterol. It has been hypothesized that hyperphagia of diabetes induces increased activity of HMG-CoA reductase of the intestine resulting in increased synthesis of cholesterol leading to raised levels in plasma. Dietary cholesterol also adds up to total cholesterol by increased absorption¹⁶.

TRIGLYCERIDES

In our study the TG levels in IDDM as well as NIDDM on insulin as well as sulfonylurea or biguanide treated diabetics are raised and statistically highly significant. The hypertriglyceridemia may be due to higher rates of production of triglyceride rich VLDL by the liver¹⁷ and to decreased removal of TG by peripheral tissues—primarily adipose tissue and muscle. Insulin deficiency leads to high TG production and subsequent high packaging in VLDL. Several studies using radioactive substrates to trace the metabolism of plasma VLDL are consistent with their simultaneous overproduction and reduced clearance as the common etiologic mechanism for hypertriglyceridemia in poorly controlled IDDM¹⁸. Furthermore, the structural composition of the VLDL itself may change with increase in protein components such as apolipoprotein C-III that inhibits the lipase enzyme and the uptake of VLDL remnants by the liver¹⁹.

In NIDDM when TG are elevated above 200 mg/dl higher production rates of triglyceride and VLDL particles have been the most commonly identified metabolic abnormalities²⁰. Many hypertriglyceridemic NIDDM patients also appear to have defect in the clearance of triglyceride with lipoproteins.

HIGH DENSITY LIPOPROTEIN

The mean levels of HDL-C in our study in IDDM on insulin therapy are not statistically significant as compared to match controls which is in accordance with the study of Kennedy and associates but not in variance with that reported by Nikkila et al²¹.

Celvert et al have reported low HDL-C in patients on sulfonylurea our study shows low HDL-C in both sulfonylurea and biguanide treated diabetics²². Lower HDL-C in diabetes may be due to reduced Lipoprotein Lipase activity. The activity of cholesterol ester transfer protein is increased in IDDM¹⁸. Hepatic TG lipase (HTGL) which lines the sinusoids of the liver which break TG added HDL is increased in the diabetic an inversely correlated with HDL

LOW DENSITY LIPOPROTEINS

Our study confirmed the stud. of Sosenko et al who have reported increase levels of LDL-C in IDDM²³. The mean LDL-c levels in total NIDDM subjects on sulfonylurea and patients on biguanides

are increased ($p < 0.001$) as compared to the matched controls. LDL production rates are reported to be elevated in IDDM but return to normal after insulin infusion²⁰. It may be due to increased synthesis of VLDL or impaired removal of VLDL remnant. Impaired receptor mediated clearance of LDL has also been postulated²¹. In NIDDM there is alteration in the LDL lipid composition, and the LDL is enriched with triglycerides. LDL in patients with hypertriglyceridemia show decreased receptor binding to cultured skin fibroblasts, which may be the mechanism of increase in LDL-C in NIDDM²².

CONCLUSION

This showed that every patient had at least one type of dyslipidemia. Overall diabetes mellitus is closely associated with dyslipidemia in both IDDM and NIDDM. It is mandatory to treat this dyslipidemia to prevent adverse lipemic status and long term complications to ensure a healthy and happy life inspite of diabetic dyslipidemia.

REFERENCES:

1. American Diabetes Association. Diagnosis and classification of diabetes Mellitus. *Diabetes Care*.2005;28(1):537-42.
2. Shera, A.S., F. Jawad and A. Maqsood, A. Prevalence of diabetes in Pakistan. *Diabetes Res. Clin. Pract.*2007;76(2):219-22.
3. Roberto, T., A.R. Dodesini, Lepore G. Lipid and Renal disease. *J. Am. Soc. Nephrol.*2006;17: S145-7.
4. Devrajani, B.R., S.Z. Shah, A.A. Soomro and T.Devrajani, . Type 2 diabetes mellitus: A risk factor for Helicobacter pylori infection: A hospital based case-control study. *Int. J. Diabetes Dev. Ctries.* 2010;30(1):22-6.
5. Chattanda SP, Y.M. Mgonda. Diabetic dyslipidemia among diabetic patients attending specialized clinics in Dar es Salaam. *Tanzania Med. J.*2008;23(1):08-11.
6. Arjola Z, Klodiana S, Gentian V et al (2014). Lipid profile in diabetes mellitus type 2 patients in Albania and the correlation with BMI, HTN and hepatosteatosis. *J Family Med community health*;1(4):1018.
7. Satyanarayana U, Chakrapani U. *Biochemistry*.2013;(4):319-20.
8. *Clinical chemistry by Carl A. Burtis and Edward A. Ashwood*;(4):965-66.
9. D. Watson, *Clinica Chimica Acta*.1960;5:637-47.
10. Lowell B. Foster and Ralph T. Dunn, *Clinical Chemistry*. Vol 19, (No.3) 1973, 338-340.
11. Francogillo et al. *Clinical Chemistry* 1981;27:375-79.
12. Rafi MD. *Textbook of biochemistry for medical students*.2014;(2):360.
13. James M. Falko et al, *Am J Med*.Oct.1987;83:641-47.
14. Bhalla Kapi, Shukla R, Gupta VP et al. Glycosylated proteins and serum lipid profile in complicated and uncomplicated NIDDM patients. *Indian J. Clin Biochem.*1995;10(2):57-61.
15. John D Bagdade et al. "Diabetic Lipemia" *NEMJ*.1966;276(8):427-33.
16. Christopher D. Saudek and Nancy L. Young. Cholesterol metabolism in diabetes mellitus. *Diabetes*.Nov1981;30S(2):76-81.

17. Nikkila and Kekki. Plasma triglyceride transport kinetics in diabetes mellitus. *Metabolism*.1973;22:1-22.
18. Nikkila et al. *Diabetes*.1977;26:11-24.
19. Brown and Baginsky. *BiochemBiophys Acta*.1972;46:325-82.
20. Howard BV. lipoprotein metabolism in diabetes mellitus. *J Lipid Res*.1987;28:613-28.
21. Esko, A Nikkilaetal. Serum lipids and lipoproteins in insulin treated diabetes. Nov-1978;27:1078-86.
22. Calvert GD, Graham JJ, Mannik T, Wise PH, Yeates RA. Effects of therapy on Plasma high density lipoprotein cholesterol concentration in diabetes mellitus. *Lance*.1978;2:66-8.
23. Sosenko et al. *NEngl J Med*.1980;302: 650-54.