Original Research Article

Dyslipidemia and diabetics: A relation that's not too sweet

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Abstract

Introduction: In type 2 diabetes mellitus, lipid abnormalities are almost the rule and is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities that are all recognized as major risk factors for coronary artery disease and other macro vascular complications. Present study aimed to assess the lipid profile in type 2 diabetic individuals in comparison with non-diabetic individuals.

Materials and methods: An observational study was conducted at outpatient and Inpatient department in BLDEU'S Shri. B.M. Patil Medical College Hospital and Research Centre. The sample size was 250 of which 125 were type 2 diabetes mellitus patients who were studied as cases and 125 non diabetics were taken as controls and there lipid profile were estimated and the results obtained were statistically computed.

Results: In the present study the results obtained were in cases (type 2 diabetes mellitus) values were as follows – LDL 117.99 ± 49.28, TC 196.77 ± 73.6, TG 186.05 ± 128.32, HDL 38.72 ± 12.5, VLDL 34.06 ± 19.65. These values were much higher as compared to controls ($p<0.05$).

Conclusion: It was observed that in type 2 diabetes mellitus patient's lipid profile is significantly altered as compared to non-diabetic patients and hence regular monitoring of lipid profiles in such patients is warranted.

Key words

Cardiovascular disease, Diabetes, Dyslipidemia, HDL, Triglycerides.

Introduction

Diabetes mellitus is the most prevalent metabolic disease in the world. Diabetes mellitus has been known since antiquity. In India, diabetes is not an epidemic anymore but has turned into a pandemic. The International Diabetes Federation has declared diabetes mellitus as a 'Tsunami'. According to the International journal of Diabetes, India has been labeled as 'The Diabetes Capital' amongst the developing countries.

Around the world about 200 million people have diabetes and is predicted to increase to 300 million by 2020 [1]. The incidence of diabetes mellitus has shown an alarming upward trend among the Indian population. The International Diabetes Federation estimated that the number of diabetic patients in India will be more than doubled from 19 million in 1995 to 40.9 million in 2007. It is projected to increase to 80 million by 2030.

The largest increase of the diabetic population occurs in the most economically productive age group. Currently up to 11% of India's urban population and 3% of rural population above the age of 15 has diabetes mellitus. The most prevalent is type 2 diabetes mellitus, which constitutes 95 percent of diabetic population in the country.

In type 2 diabetes mellitus, lipid abnormalities are almost the rule and is associated with a cluster of interrelated plasma lipid and lipoprotein abnormalities that are all recognized as major risk factors for coronary artery disease and other macro vascular complications. These lipid abnormalities are not only quantitative but also qualitative abnormalities of the lipoproteins which are potentially atherogenic.

Typical findings are elevation of Total cholesterol, Triglycerides, VLDL cholesterol, LDL Cholesterol and Apolipoprotein (Apo B), with lowering of HDL cholesterol. In type 2 diabetes mellitus, due to obesity and insulin resistance, lipolysis and free fatty acid flux from adipocytes are increased, leading to increased VLDL and triglyceride synthesis in hepatocytes. This is responsible for the dyslipidemia found in type 2 diabetes Mellitus. This dyslipidemia may be present at the time of diagnosis of type 2 diabetes mellitus and is a part of metabolic syndrome. Insulin resistance and obesity combine to cause dyslipidemia and are likely to contribute to the risk of coronary artery disease and other macro vascular complications and the determination of serum lipid levels in people with type 2 diabetes mellitus is now considered as a standard of the diabetes care [2].

Realizing the most of diabetics has a high probability of developing coronary artery disease and cerebrovascular diseases due to abnormalities in lipid metabolism. This study intends to show the differences in lipid profile in type 2 diabetic individuals as compared to non-diabetic individuals.

Materials and methods

Present case control study was conducted at department in BLDEU'S Shri. B.M. Patil Medical College Hospital and Research Centre, Bijapur over a period 2 years. The sample size was 250 of which 125 were type 2 diabetes mellitus patients were studied as cases and 125 non diabetics were taken as controls.

Method of collection of data

- By detailed history
- By detailed clinical examination
- By relevant investigations like CBC, Urine for a) Albumin b) Sugar c) Microscopy, FBS, PPBS, HbA1c and fasting Lipid profile.

Inclusion criteria

For cases

Type 2 diabetes patients in the age group of 30-75 years and who are on either:

a) Oral hypoglycemic agents
b) Insulin
c) Both

For controls

Patients without type 2 diabetes mellitus age and sex matched.

Exclusion criteria

- Known type 2 diabetics in the age group 30-75 years who are on oral hypolipidemic drugs.
- Known type 2 diabetics in the age group 30-75 years who are suffering from
    a) Chronic liver disease
    b) Hypothyroidism
- Known type 2 diabetics who are on drugs which cause hyperglycemia
    a) Thiazides
    b) Corticosteroids
    c) Oral contraceptives

Blood sampling and preparation of serum

The blood samples were drawn in the fasting state. The venepuncture was done in the cubital fossa. Tourniquet was used but was released just before sampling to avoid artificial increase in the concentration of serum lipids. About 10 ml of blood was drawn using perfectly dry and sterile syringes and the blood was transferred to dried glass vials. Serum was separated within 2 hours of collection to prevent artificial changes in concentration of HDL. The blood was centrifuged at 5000 rpm for 10 minutes. The supernatant clean serum was then pipetted out using dry piston pipettes with disposable tips and stored in dry thin walled vials at 4cc. The samples were analyzed the same day. Care was taken to exclude the hemolysed serum.

Laboratory procedure

Estimation of Blood Glucose

Glucose oxidase (GOD) oxidizes glucose to gluconic acid and hydrogen peroxide in presence of enzyme peroxidase, released hydrogen peroxide is coupled with phenol and 4-Aminoantipyrine (4-AAP) to form coloured quinoneimine dye. Absorbance of colored dye is measured at 505nm and is directly proportional to glucose concentration in the sample.

Estimation of Total Cholesterol (TC)

TC was determined by an enzymatic method. The cholesterol esters are hydrolyzed to free cholesterol by cholesterol esterase. The free cholesterol is then oxidized by Cholesteroloxidasetocholesten-3-one with the simultaneous production of hydrogen peroxide. The hydrogen peroxide produced couples with 4-AAP and phenol, in the presence of peroxidase, to yield a chromogenic with maximum absorbance at 505 nm.

Estimation of Total Triglycerides (TG)

In this direct colorimetric procedure, Serum triglycerides are hydrolyzed to glycerol and free fatty acids by lipoprotein lipase. In the presence of ATP and glycerol kinase (GK), the glycerol is converted to glycerol-3-phosphate, which then is oxidized by glycerol phosphate oxidase (GPO) to yield hydrogen peroxide. The oxidative condensation of ADPS and 4-aminophenazone in the presence of peroxidase (POD) and hydrogen peroxide produces a rose colored dye which is measured at 550 nm. The intensity of the colour formed is directly proportional to the triglycerides concentration in the sample.

Estimation of High-Density Lipoprotein Cholesterol (HDL)

HDL cholesterol 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 and centrifugation.

Estimation of Low-Density Lipoprotein Cholesterol (LDL)

Estimates LDL cholesterol using the Friedewald equation by subtracting the amount of cholesterol associated with other particles, such as HDL and VLDL, assuming a prolonged fasting state. LDL-C = TC- HDL- (TG/5)

Estimation of Very Low-Density Lipoprotein Cholesterol (VLDL)

In the absence of chylomicrons, only three forms of lipoproteins are present in the sera-VLDL,

LDL and HDL. Since VLDL is the primary triglyceride carrying form in the fasting state, its concentration can be approximated by dividing the amount of plasma triglycerides by described by Friedwald formula in 1972**.**

VLDL= TRIGLYCERIDE/5

Results

In the present study, one third of the patients (both cases and controls) ranged from 61-75 years. The mean age was 57 years in cases and 56.6 years in controls. Overall male predominance was seen in both cases and controls (63.2% and 68%). Both groups were comparable with respect to age and gender (p>0.05). Out of 125 diabetic patients, duration of diabetes was <1 year in 47 patients, 1-5 years in 47 patients, 5-10 years in 24 patients and >10 years in 7 patients. Overall high total cholesterol, LDL and triglyceride levels were seen in 19.2%, 61.6% and 52.8% diabetics as compared to 2.4%, 34.4% and 16% non diabetic controls. Low HDL levels were seen in 67.2% diabetic cases as compared to 36.8% controls (**Table - 1**). Overall the values of TC, LDL and TG are increased in type 2 diabetes mellitus patients and HDL values are decreased in the same patients as compared to non-diabetics which is statistically significant with a p value of <0.001 (**Table - 2**).

Table – 1: Study of lipid profile among cases and controls.

Lipid Profile	**Group**		**Total**	**p- value**
	Cases	**Controls**		
High Total Cholesterol (> 240 mg%)	24	3	27	**<0.01**
	19.2%	2.4%	10.8%	
Low HDL (<40 mg%)	84	46	130	**<0.01**
	67.2%	36.8%	52.0%	
High LDL (> 100 mg%)	77	43	120	**<0.01**
	61.6%	34.4%	48.0%	
High TG (> 150 mg%)	66	20	86	**<0.01**
	52.8%	16.0%	34.4%	

Table – 2: Mean comparison of lipid profile among cases and controls.

Lipid Profile	**Cases**		**Controls**		**p- value**
	Mean	**SD**	**Mean**	**SD**	
LDL	117.99	49.28	100.14	26.22	**<0.01**
TC	196.77	73.6	171.31	37.30	**<0.01**
TG	186.05	128.32	117.08	48.01	**<0.01**
HDL	38.72	12.57	44.48	11.3	**<0.01**

Discussion

In present study, Dyslipidemia was seen in about 75.2% cases of diabetes (n-94) with raised total cholesterol, LDL and triglyceride levels were seen in 19.2%, 61.6% and 52.8% diabetics as compared to 2.4%, 34.4% and 16% non diabetic controls (p<0.01). Low HDL levels were seen in 67.2% diabetic cases as compared to 36.8% controls. (p<0.01)

Many Western epidemiological studies have shown an association between diabetic dyslipidemia, which is characterized by hypertriglyceridemia; low levels of HDL cholesterol; postprandial lipemia and small, dense LDL cholesterol particles and the occurrence of cardiovascular disease [3-5].

In a study by Dixit, et al. [6] over 70% of patients with type 2 diabetes mellitus had one or more types of dyslipidemia. Their results revealed high prevalence of hypercholesterolemia, hypertriglyceridemia and high LDL-C levels in type 2 diabetics. In a similar study by Pandya H, et al. [7], out of 171 DM patients, 36.3% (n = 62) patients were having high serum cholesterol level, while almost similar no. of patients, 35.7% (n = 61) had low serum HDL levels. About 56.1% (n = 96) had high serum triglyceride level, while almost similar number of patients, 57.3% (n = 98) also had serum LDL levels above normal range. About 49.7% (n = 85) also showed high serum VLDL levels. Our results are also in accordance with studies by Sumesh Raj, et al. [8], SV Madhu, et al. [9] and Ozder A, et al. [10].

Oveall mean values of lipid parameters was higher in diabetic cases as compared to controls ($p<0.05$). Simialr findings was also observed in the studies by Aminul Haq, et al. [11], Songa RM, et al. [12] and Zargar AH, et al. [13]. The comparative vales of these studies with present study were shown in **Table - 3**.

Table – 3: Comparison of present study findings with findings of other authors.

Lipid Profile		Aminul Haq, et al. [11]	Songa RM, et al. [12]	Zargar AH, et al. [13]	Present Study
Total Cholesterol	**Cases**	191.61 ± 18.6	189.4 + 33.82	263.02 + 18.01	196.77 ± 73.6
	Controls	182.61 ± 17.6	181.9 + 32.36	215.9 + 33.3	171.3 ± 37.3
Triglycerides	**Cases**	170.15 ± 10.31	225.76 + 139.9	171.9 + 43.46	186.05 ± 128.32
	Controls	159.01 ± 10.11	167.6 + 65.61	169.09 + 26.33	117.08 ± 48.01
LDL	**Cases**	113.12 ± 11	104.02 + 35.04	164.96 + 16.8	117.99 ± 49.28
	Controls	102.69 ± 11.17	102.28 + 35.26	135.32 + 35.9	100.14 ± 26.22
HDL	**Cases**	49.39 ± 6.43	40.86 + 8.45	36.65 + 3.23	38.72 ± 12.5
	Controls	57.69 ± 7.06	46.46 + 9.19	40.47 + 3.4	44.48 ± 11.3

Conclusion

This study laid emphasis on the fact that diabetes mellitus influences lipid metabolism in a significant way. This was evident by the fact that lipid profile was significantly deranged in diabetics. Total Cholesterol, TGs, LDL, VLDL and TC/ HDL levels were found to be significantly higher while HDL levels were significantly lower in diabetics as compared to non-diabetics. Monitoring of lipid profile could have additional benefits of identifying diabetic patients who are at a greater risk of cardiovascular and other macro and microvascular complications. Thus, diabetic patients should be educated about regular monitoring of lipid profile.

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