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Research Article

Assessment of Lipid Profile in Cases of Diabetes Mellitus Presenting at Fatima Memorial Hospital Lahore

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ABSTRACT

Objective: To study the lipid profile in cases of diabetes mellitus presenting at Fatima Memorial Hospital Lahore
Material and methods: This cross sectional study was conducted at Department of Medicine Fatima Memorial Hospital Lahore from March 2017 to September 2017. Total 40 participants of which 20 were patients admitted with diagnosis of DM and other 20 were age and sex matched healthy controls who fulfilled inclusion criteria. Blood samples were drawn under aseptic precautions from cases of DM and healthy controls. Necessary investigations were carried out and values were tabulated for cases and controls separately for statistical evaluation.
Results: In DM patients compared to controls significant increase in following parameters was observed. FBS, PPBS, HbA1c &Lp(a) levels increased significantly($P<0.001$), HbA1c/HDL, HbA1c/LDL & HbA1c/Chol ratios also increased significantly($P<0.001$). Also the levels of TAG, VLDL &Chol/HDL were significantly increased with $P<0.008$, $P<0.011$ & $P<0.003$ respectively. The levels of HDL were significantly reduced in patients with DM compared to controls with $P<0.002$. There is no significant change observed in Chollesterol, LDL & HbA1c/Lp(a) levels.
Conclusions: There is a statistically significant large effect in FBS, PPBS, HbA1c, TAG, VLDL, HDL &Lp(a) levels of cases compared with controls, where as LDL and Chol levels are not significant. Increased Chol/HDL ratio is well known risk factors of CAD.
HDL, LDL, Chol and TAG levels were well associated with HbA1c, whereas Lp(a) levels are not associated with HbA1c. So our conclusion is that Lp(a) may not be a dependable risk factor for CHD.

Keywords: Diabetes Mellitus; HbA1c; Lipid profile; Lipoprotein (a)

INTRODUCTION

Diabetes mellitus is an ice berg disease. It is a growing public health problem. Diabetes mellitus (DM) refers to a group of common metabolic disorders that share the phenotype of hyperglycemia. Depending on the etiology of the DM, factors contributing to hyperglycemia include reduced insulin secretion, decreased glucose utilization, and increased glucose production. The metabolic dysregulation associated with DM causes secondary pathophysiologic changes in multiple organ systems that impose a tremendous burden on the individual with diabetes and on the health care system. In the United States, DM is the leading cause of end-stage renal disease (ESRD), nontraumatic lower extremity amputations, and adult blindness. It also predisposes to cardiovascular diseases.[1]With an increasing

incidence worldwide, DM will be a leading cause of morbidity and mortality for the foreseeable future.[1] Prevalence of diabetes in adults worldwide was estimated to be 4.0% in 1995 and is expected to rise to 5.4% by the year 2025. The number of adults with diabetes in the world will rise from 135 million in 1995 to 300 million in the year 2025. There will be a 42% increase, from 51 to 72 million, in the developed countries and a 170% increase, from 84 to 228 million, in the developing countries. The countries with the largest number of people with diabetes are, and will be in the year 2025, India, China, and the U.S.[2, 3] In India alone, diabetes is expected to increase from 40.6 million in 2006 to 79.4 million by 2030.[4] Data from the Chennai Urban Rural Epidemiology Study (CURES) suggested an overall prevalence of 15.5% for diabetes and 10.6% for impaired glucose tolerance[5, 6] and in a separate study in Mumbai, the prevalence of insulin resistance was similar in both urban and rural populations at around 42% of the adult population[5, 7], a very high value compared to a prevalence of around 15% reported in European populations such as Austrailia.[5, 8] Most of the long standing macro and micro vascular complications are also more common among Indian diabetics as compared to other races and ethnic groups. Recent studies have shown that the prevalence of coronary heart disease (CHD) in Indian diabetics may be as high as in the migrant population.[4] The emerging epidemic of type 2 diabetes in the pediatric population, especially among minorities whose proportion in population is increasing, presents a serious public health problem. The burden of this epidemic will be felt as these children become adults and develop the long-term complications of diabetes.[9]

MATERIAL AND METHODS

This descriptive cross sectional study was conducted at Department of Medicine ----------. This study involved 40 participants of which 20 were patients admitted with diagnosis of DM and other 20 were age and sex matched healthy controls who fulfilled inclusion criteria. Patients suffering from obstructive jaundice, hypothyroidism, hypopituitarism, epileptic patients, psychiatric disorders, nephrotic syndrome were excluded from study. Study was approved by the ethical review committee and written informed consent was taken from every patient. Blood samples were drawn under aseptic precautions from cases of DM and healthy controls and sent to laboratory for lipid profile analysis. Findings were entered on pre-designed proforma along with demographic profile of the patients. All the collected data was entered in SPSS version 20 and analyzed. Mean and SD was calculated for numerical data and frequencies were calculated for categorical data.

Table 1 Comparison of gender distribution

Gender	Control		Cases	
	No	%	No	%
Male	13	65.0	8	40.0
Female	7	35.0	12	60.0
Total	20	100.0	20	100.0

Samples are gender matched with P=0.113

Table 2 Levels of FBS, PPBS, and HbA1c in controls and cases

Sugar parameters	Controls	Cases	Significance
FBS (mg/dl)	86.20±8.28 (70-101)	167.70±59.80 (95-289)	t=6.037;p<0.001**
PPBS (mg/dl)	107.20±19.11 (79-140)	238.30±81.31 (129-381)	t=7.019;p<0.001**
HbA1c	5.41±0.30 (5.0-5.90)	9.44±2.31 (6.4-14.1)	t=7.742;p<0.001**

Table 3: Levels of Lipid parameters in controls and cases

Lipid profile	Controls	Cases	Significance	Effect size
Triglycerides (mg/dl)	128.60±28.25 (66-185)	195.25±102.65 (55-392)	t=2.800;p=0.008**	0.87(L)
Total cholesterol (mg/dl)	169.20±24.57 (123-201)	174.25±42.86 (115-247)	t=0.457;p=0.650	0.14(N)
HDL (mg/dl)	45.05±6.64 (38-61)	37.25±8.03 (22-55)	t=3.348;p=0.002**	1.04(L)
LDL (mg/dl)	100.95±21.22 (57-130)	100.40±34.83 (42-181)	t=0.060;p=0.952	0.02(N)
VLDL (mg/dl)	24.95±5.98 (13-37)	36.60±18.59 (6-78)	t=2.667;p=0.011*	0.83(L)
Lipoprotein (a) (mg/dl)	20.16±6.26 (7-33)	46.20±22.92 (4-91)	t=4.783;p<0.001**	1.52(VL)
HbA1c/ Lp(a)	0.31±0.14 (0.17-0.73)	0.36±0.43 (0.09-1.93)	t=0.47083;p=0.641	0.15(N)
Chol/HDL	3.81±0.68 (2.86-5.00)	4.79±1.21 (3.16-7.24)	t=3.160;p=0.003**	0.98(L)
HbA1c/HDL	0.12±0.02 (0.08-0.15)	0.26±0.07 (0.16-0.40)	t=9.026;p<0.001**	2.67(VL)
HbA1c/LDL	0.06±0.01 (0.04-0.09)	0.10±0.04 (0.04-0.19)	t=5.466;p<0.001**	1.34(VL)
HbA1c/Chol	0.03±0.01 (0.03-0.04)	0.06±0.01 (0.03-0.08)	t=7.640;p<0.001**	2.94(VL)

N: No effect; S: Small effect; M: Moderate effect; L: Large effect; VL: Very large effect

RESULTS

20 cases of diabetes mellitus that came to OPD were taken as study group and 20 healthy persons matched with age and sex were taken as control group. The age group of patients varied from 17 yrs to 66 yrs with mean age groups of 50.10±12.86 out of which 8 were males and 12 were females. The age group of controls varied from 27 yrs to 56 yrs with mean age groups of 39.50±9.66 out of which 13 were males and 7 were females. (Table 1)The mean FBS values of control is 86.20±8.28 and that of patients is 167.70±59.80. This increase in the FBS values in patients compared to controls shows statistically very large effect (p<0.001). The mean PPBS values of control is 107.20±19.11 and that of patients is 238.30±81.31. This increase in the PPBS values in patients compared to controls shows statistically very large effect (p<0.001). The mean HbA1c values of control is 5.41±0.30 and that of patients is 9.44±2.31. This increase in the HbA1c values in patients compared to controls shows statistically very large effect (p<0.001). (Table 2)The mean total cholesterol values of control is 169.20±24.57 and that of patients is 174.25±42.86. Statistically total cholesterol did not show any significance (p=0.650). The mean HDL values of control is 45.05±6.64 and that of patients is 37.25±8.03. This decrease in the HDL values in patients compared to controls shows statistically a large effect (p=0.002). The mean LDL values of control is 100.95±21.22 and that of patients is 100.40±34.83. Statistically LDL did not show any significance (p=0.952). The mean VLDL values of control is 24.95±5.98 and that of patients is 36.60±18.59. This increase in the VLDL values in patients compared to controls shows statistically a large effect (p=0.011). The mean Lp (a) values of control is 20.16±6.26 and that of patients is 46.20±22.92. This increase in the Lp(a) values in patients compared to controls shows statistically very large effect (p<0.001). The mean HbA1c/Lp(a) values of control is 0.31±0.14 and that of patients is 0.36±0.43. Statistically HbA1c/Lp(a) values did not show any significance (p=0.641). The mean Chol/HDL values of control is 3.81±0.68 and that of patients is 4.79±1.21. This increase in the Chol/HDL values in patients compared to controls shows statistically a large effect (p=0.003). The mean

HbA1c/HDL values of control is 0.12±0.02 and that of patients is 0.26±0.07. This increase in the HbA1c/HDL values in patients compared to controls shows statistically very large effect ($p<0.001$). The mean HbA1c/LDL values of control is 0.06±0.01 and that of patients is 0.10±0.04. This increase in the HbA1c/LDL values in patients compared to controls shows statistically very large effect ($p<0.001$). The mean HbA1c/Cholvalues of control is 0.03±0.01and that of patients is 0.06±0.01. This increase in the HbA1c/Chol values in patients compared to controls shows statistically very large effect ($p<0.001$).

DISCUSSION

The purpose of present study was to study to lipid profile in cases of diabetes mellitus. In our study the mean FBS values of the patients was 167.70±59.80 well above the ADA criteria to diagnose diabetes and the PPBS which was higher than upper limit (238.30±81.31) cut off value of 140 mg/dl where as control group had blood glucose values as 86.20±8.28 and 107.20±19.11 for FBS and PPBS respectively suggestive of normoglycemia. These values correlate well with clinical diagnosis. HbA1c is done to monitor the control of blood glucose in DM. Alteration in blood glucose occurs from day to day average blood glucose level of preceding 2-3 months. Various studies have shown that amount of glucose attached to HbA1c increases with increase duration of DM. HbA1c is used both as an index of mean glycemia and as a measure of risk for the development of diabetes complications. There is a predictable relationship between blood glucose and HbA1c. Understanding this relationship will allow patients with diabetes and their healthcare providers set appropriate day-to-day blood glucose targets based on HbA1c goals.[10]

ADA has recommended a normal reference interval of 4–6% and that a primary goal of therapy is a HbA1c value < 7% and that physicians should reevaluate the treatment regimen in patients with HbA1c concentrations consistently > 8% as it is a good predictor of asymptomatic cardiovascular deseases(CVD). In our study the mean HbA1c values of control is 5.41±0.30 and that of patients is 9.44±2.31. HbA1c levels are significantly raised. This increase in the HbA1c values in patients compared to controls is very significant. Several studies show positive correlation of HbA1c with the duration of DM and a strong predictor of risk for diabetes complications.[11]

Triglycerides are major components of very low-density lipoprotein (VLDL) and chylomicrons. High triglyceride levels in the blood tend to coexist with low levels of HDL ("good") cholesterol, contributing to a condition called diabetic dyslipidemia. The third component of this "dangerous trio" is a tendency for patients with this condition to have the small, dense, undesirable (more atherogenic) type of LDL cholesterol in their blood (even though their LDL cholesterol level may be normal).

The combination of high triglycerides, low HDL and central obesity are the hallmarks of the metabolic syndrome, which occurs in 80 percent of people with diabetes. The frightening significance of this combination of risk factors is the marked incidence in these people of premature death from heart disease.[88]

Association between elevated total cholesterol and Insulin resistance was also statistically significant in study conducted by Meniket al.[12]

In a study by H. Surekha Rani et.al., an attempt has been made to evaluate the risk factors for coronary heart disease in DM patients. It is observed that fasting and post prandial blood glucose, TC, VLDL, LDLs, TAGs were high and the levels of HDLs were low compared to controls.[13]

Similarly in our study we found that increased levels of TAG and VLDL and decreased HDL levels. But there is no significance observed with serum levels of LDL and total cholesterol.

Lp (a) is a lipoprotein subclass. Lp(a) consists of an LDL-like particle and the specific apolipoprotein(a) [apo(a)], The physiological function of Lp(a)/apo(a) is still unknown. Lipoprotein's structure is similar to plasminogen

and tPA (tissue plasminogen activator) and it competes with plasminogen for its binding site, leading to reduced fibrinolysis. Also because Lp(a) stimulates secretion of PAI-1, it leads to thrombogenesis. In addition, because of LDL cholesterol content, Lp-a contributes to atherosclerosis.[14-16]

Fijino A et al., have found increased levels of Lp(a) levels in both the types of diabetes and also stronger association of Lp(a)levels in DM with complications.[17]

Similarly in our study we found the increased levels if Lp(a) (46.20±22.92) in cases compared to the controls (20.16±6.26) predicting the possibilities of diabetic complications.

Normal referance levels of Lp(a) should be < 30mg/dl. Studies have shown that high Lp(a) in blood is a risk factor for coronary heart deseases (CHD), cerebrovascular disease (CVD), atherosclerosis,thrombosis, and stroke.[18]

The mean values of Chol/HDL ratio are significantly (p=0.003) higher in diabetics (3.81±0.68) than non-diabetics(4.79±1.21) which is in accordance with the work of Sosenko et al, SubhankarChowdury et al and Boraskar et al. Increased Chol/HDL ratio increases the risk of coronary artery disease.

Study of Elizabeth et al. observed that LDL and HDL cholesterol were significantly associated with HbA1c. HDL cholesterol was inversely associated with HbA1c where as LDL cholesterol was positively associated with HbA1c in individuals with diagnosed diabetes.[19]

In our study there is no significant change in the LDL and total cholesterol levels between cases and controls. However there is a significant difference in the HbA1c/LDL ($p<0.001$) & HbA1c/Chol ($p<0.001$) ratios between cases and controls.

The mean HbA1c/LDL values of control is 0.06±0.01and that of patients is 0.10±0.04 & the mean HbA1c/Chol values of control is 0.03±0.01and that of patients is 0.06±0.01. This suggests that HbA1c/LDL & HbA1c/Chol parameters may be better indicators in determining the risk factors for CHD than the individual parameters of LDL and total cholesterol.

Similarly we also observed a significant difference in HDL/HbA1c ratio ($p<0.001$). The mean HbA1c/HDL values of control is 0.12±0.02 and that of patients is 0.26±0.07. These results indicated the inverse relation between HDL and the HbA1c levels.

CONCLUSION

In our study we tried to throw light on lipid metabolic changes in DM. There is a disturbance in lipid metabolism which inturn is reflected on lipoprotein metabolism. Also we tried to derive a relation between various lipoprotein factors and HbA1c. There is a statistically significant large effect in FBS, PPBS, HbA1c, TAG, VLDL, HDL levels of cases compared with controls, where as LDL and Chol levels are not significant. Even though LDL cholesterol levels may be normal in our study, the small, dense, undesirable type of LDL cholesterol in blood which is more atherogenic should be considered.

Increased Chol/HDL ratio in our study is well known risk factors of coronary artery disease as shown by several previous studies.

Lipoprotein (HDL, LDL, Chol and TAG) levels are well known risk factors for the complications of DM like CHD. Their levels were well associated with HbA1c. Other important risk factors evaluated in this study, Lp(a), showed a rise in the serum levels in DM patients but its levels are not associated with HbA1c levels which is a standard risk factor for the CHD. So our conclusion is that Lp(a) may not be a dependable risk factor for CHD. However further studies with large sample size is required to evaluate the association between the Lp(a) and other lipoprotein factors with HbA1c to assess the risk for development of CHD in DM.

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