Lipid Profile and Lipid Ratios Is Predictor of Cardiovascular Risk in Prediabetics and Diabetics

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Abstract:

Introduction: Dyslipidaemia is very common in diabetes and play an important role in development of atherosclerosis, leading to cardiovascular diseases. It is very beneficial to identify lipid abnormalities in diabetics and prediabetics so that early intervention can reduce the cardiovascular complications. Present study was planned to compare lipid profile and lipid risk ratios of prediabetics with normoglycaemic control and diabetics in central India population.

Material and Method: A total of 320 subjects (103 Prediabetics, 116 Diabetics and 101 Control) were enrolled in this study after taking their written and informed consent. Lipid profile and Lipid ratios of all groups were measured calculated and statistically analysed.

Result: TC, TG, LDLc and atherogenic indices were significantly increased in prediabetics as compared with normoglycemic controls. HDLc significantly decreased in Prediabetics. We also observe that above lipid profile and lipid risk ratios were significantly high in the diabetics in comparison to the control and prediabetic group.

Conclusion: The Prediabetic subjects due to their dyslipidaemia are at high risk for developing cardiovascular disease. Therefore, screening of prediabetic individuals for dyslipidaemia is recommended to arrest the development of cardiovascular complications.

Keywords: Prediabetes, Dyslipidaemia, Atherogenic ratios, Diabetes.

Introduction

The prevalence of Diabetes mellitus is 8.3% worldwide according to the data recorded in 2013 and expected to reach 10.1% by 2035.1 69. [1] million Diabetics are present in India only with 9 to 12 % prevalence of diabetes in many Indian cities. [2] It is a slowly developing condition and it can take many years to progress from prediabetic to diabetic state without interventions. [3]

Diabetes is associated with increase in morbidity and mortality and it is one of the major health problem in the world. [4] Dyslipidaemia are common in diabetes and play an important role in acceleration of atherosclerosis leading to cardiovascular disease. Various studies have shown that cardiovascular disease and atherogenic progression in diabetics have seen in the prediabetic stage. [5] Prediabetes refers to a condition in which fasting blood glucose level is more than normal level but less than to the diabetic level. [6] Studies have reported that prediabetes to be associated with increased risk of atherosclerosis and cardiovascular disease. [7] It is becoming very important step to diagnosing the prediabetic individuals and assesses their lipid profile and prevents them from developing overt diabetes and reduces their further morbidity and mortality. Many studies have shown that lifestyle modification in prediabetic stage can not only delay the development of diabetes but it can also prevent the development of cardiovascular complications. [8] In Diabetic patients leading cause of morbidity and mortality is cardiac disease .It is approxly 70-80% of all death with diabetic complications. [9] It has also been found to be significantly associated with Prediabetes. [10]

The aim of this study was to compare the lipid profile along with lipid ratios of prediabetics with normoglycemic controls and diabetics in central India population.

Material Method

The present cross sectional study was conducted in GMC Bhopal and associated Hamidia hospital Bhopal. The study included 219 age and sex matched subjects over a six month period from Jan 2011 to June 2011. The study subjects were selected after applying some inclusion and exclusion criteria and after obtaining their informed consent. The study had approved by the institutional ethical committee.

Inclusion Criteria: Age 30 to 45 year age

Diabetics with history of the disease for > 1year and not on any farm of treatment or dietary management for the last 1 year are included in the study.

Diabetic criteria as per ADA guideline fasting plasma glucose level greater than or equal to 126mg/dl ,2 hr plasma glucose level greater than or equal to 200mg/dl during an oral glucose tolerance test, HbA1c levels greater than or equal to 6.5% and random plasma glucose of greater than or equal to 200mg/dl.

Prediabetic criteria as per ADA guideline fasting plasma glucose level 100-125mg/dl, impaired glucose tolerance 2 hour glucose level of 140-199mg/dl after a standardized meal and glycosylated hemoglobin HbA1c level of 5.7%-6.4%.

Exclusion Criteria: Known case of renal disease, thyroid disorder, on antidiabetic and lipid lowering drugs, smokers, alcoholics, uncooperative and non-compliant patients were excluded from the study.

102 healthy age and sex matched controls were included for the study. A total number of 219 patients were divided in to two groups-103 Prediabetes and 116 Diabetes. All the patients were evaluated for serum fasting blood sugar (FBS) post prandial blood sugar (PPBS) HbA1c, Total cholesterol (TC), Triglycerides (TG), LDLc, and HDLc in the 2 groups. Venous blood sample from the patients were collected in standardized EDTA, fluoride and plain vials under aseptic condition for carrying out the measurements of HbA1c, plasma glucose and fasting lipid profile.

Fasting blood sugar, 2- hr postprandial blood glucose were estimated on venous blood sample using Biolab kits were analysed by spectrophotometry.[12] HbA1c were analysed by immunoturbidimetric assay using Biolab kits. [13] Lipid profile were analysed by CST 240 clinical chemistry analyser snibe diagnostics, china, using homogenous assay kit. [14]

The atherogenic ratios were calculated as follows [15]

Castelli s Risk index-I = TC/HDL

TG/HDL

LDL/HDL

Statistical Analysis: LDLc and CVD risk was calculated using appropriate formulae and continuous variables were expressed as mean ± standard deviation (SD).

The comparisons were evaluated by unpaired t test using SPSS statistical package version 20.

Mann-whitney U-test was applied following statistically significant value to identify pairwise differences. P value <0.001 was considered statistically significant.

Result

Table 1: Demographic characteristics of the study population by blood glucose group (mean ± SD)

Variables	Control	Prediabetics	Diabetics
Mean Age	38.344±1.37	30.30±2.56	40.01±1.64
Male/Female	41/60	43/60	40/66

Table 2: Glycaemic indicator in the study group

Variables	Control	Prediabetics	Diabetics	Significance
FBS	84.20±7.69	118.54±2.31	153±15.38	<0.001
PPBS	121.64±5.46	181.12±9.47	281.88±21.73	<0.001
HbA1c	4.58±0.46	5.12±0.67	7.84±0.43	<0.001

Table 3: Multiple comparisons of Glycaemic indicator in the study group

		Mean difference	Standard error	P value
FBS	Diabetic Prediabetic	34.46	2.199	<0.001
	Control	68.8	2.432	<0.001
	Prediabetic Control	34.34	1.136	<0.001
PPBS	Diabetic Prediabetic	100.76	3.352	<0.001
	Control	160.24	3.169	<0.001
	Prediabetic Control	59.48	1.546	<0.001
HbA1c	Diabetic Prediabetic	2.72	0.113	<0.001

	Control	3.26	0.089	<0.001
	Prediabetic Control	0.54	0.115	<0.001

Table 4: Metabolic characteristics of study population by blood glucose group

Parameters	Control	Prediabetics	Diabetics	Significance
TC	147.46±28.25	178.28±22.98	254.14±52.79	<0.001
TG	113.02±30.42	159.51±21.86	194.28±20.42	<0.001
LDL-C	79.94±25.47	109.59±23.98	184.22±50	<0.001
HDL-C	46.48±11.04	34.92±6.43	31.22±2.46	<0.001
TC/HDL-C	3.25±0.88	5.29±1.23	6.39±2.4	<0.001
TG/HDL-C	2.53±0.82	4.76±1.32	4.48±1.49	<0.001
LDL-C/HDL-C	1.80±0.72	3.72±1.02	4.59±2.05	<0.001

Table 5: Multiple Comparisons of Lipid Profile and Atherogenic Indices in the Study Group

Dependent Variables		Mean DIFF	Standard Error	P value
TC	Diabetic Prediabetic	75.86	8.142	<0.001
	Control	106.68	8.467	<0.001
	Prediabetic Control	30.82	5.150	<0.001
TG	Diabetic Prediabetic	34.77	4.230	<0.001
	Control	81.26	5.181	<0.001
	Prediabetic Control	46.49	5.298	<0.001
LDL-C	Diabetic Prediabetic	74.71	7.842	<0.001
	Control	104.28	7.936	<0.001
	Prediabetic Control	29.57	4.947	<0.001
HDL-C	Diabetic Prediabetic	3.70	0.974	<0.001
	Control	15.26	1.600	<0.001
	Prediabetic Control	11.56	1.807	<0.001
TC/HDL-C	Diabetic Prediabetic	1.10	0.381	<0.001
	Control	3.14	0.362	<0.001
	Prediabetic Control	2.04	0.214	<0.001
LDL/HDL	Diabetic Prediabetic	0.87	0.324	<0.001
	Control	2.79	0.307	<0.001
	Prediabetic Control	1.92	0.177	<0.001
G/HDL-C	Diabetic Prediabetic	0.280	0.282	<0.001
	Control	1.95	0.241	<0.001
	Prediabetic Control	2.23	0.220	<0.001

Result

Table 1 shows total 219 cases were included in the study of which 103 (32.18%) 116 (36.25%) were prediabetics and diabetics. 101 (31.56%) age and sex matched normoglycemic subjects were included as control group. Of the total cases 124(38%) were male and 186 (58%) were females. out of 103 prediabetics 43 (41.74%) were males and 60(58.25%) were females .Among the 116 diabetics 40 (34%) were males and 66 (56%) were females. The mean age of diabetics was found to be 40.01±1.64 and that of prediabetic's 30.30±2.56 years.

Table -2 shows glycaemic indicator FBG, PPBG and HbA1c in the study group. A highly significant difference (P value < 0.001) is seen in the blood glucose indices when compared between the study groups. Table -3 shows comparison of glycaemic indicators in the study population. Summarizes the difference in the means of these parameters and their statistical significance. Comparison of glycaemic indicators shows highly significance

difference (P value < 0.001) when compared between the inter group. Table 4 shows the comparison of lipid profile and atherogenic ratios between the different study groups. We found a highly significant difference (P value < 0.001) between the prediabetics and diabetics. Table 5 shows the difference in the mean of these parameters and their statistical significance. TG, TC, LDL and other lipid ratios were significantly raised in the prediabetics in comparison the control group (P value < 0.001) except HDL. We also observe that above lipid profile and lipid risk ratios were significantly high in the diabetics in comparison to the control and prediabetic group.

Discussion

The mean serum TC, TG and LDL as found in our study in the prediabetic group was 178.28± 22.98mg/dl,159.51±21.86mg/dl and 109.51±23.98 which are significantly higher (P<0.001) than the control group. Kansal et al. in their study found mean TC 184.75±46.02 mg/dl in the prediabetic study group. [16] Miyazaki et al. also observed raised TG levels in prediabetic subjects.17Shin et al

also found LDLc to be significantly higher in prediabetic subjects than non-diabetic controls.[18]

We observed in our study diabetics have a higher TC, TG and LDL than the prediabetics and controls (<0.001). In our study we were found the prediabetic group have significantly lower serum HDL than the control (34.92±6.43 Vs 46.48±11.04mg/dl) .in the same line, mean HDL in diabetic group is significantly lower than the control and prediabetics. Shin et al also found the similar findings. Castelli Risk Index -1(TC/HDLc) is a more sensitive and specific index of cardiovascular risk than the lipid profile and hence it is a marker of atherogenic dyslipidaemia. The value was found to be in prediabetics who are significantly higher than the controls (5.29±1.23 Vs 3.25±0.88). Mahat et al was found >5 in prediabetics .The value to be >5.5 found by Ranjit et al in the CAD positive diabetic dyslipidaemia subjects. [19]

TG/HDLC-It is an indicator of the cardiometabolic profile.TG/HDLC ratios considered a surrogate marker of insulin resistance. Mc Laughlin et al in their study concluded that TG/HDL ratio >3.5 predict insulin resistance. [20] In Our study we found mean value of TG/HDL 4.76±1.32 in prediabetics and 4.48±1.49 in diabetics. Nayak et al in their study found mean value 3.96 in prediabetics. [21] Ozder et al in their study found mean value 7.98±3.8 mg/dl in diabetic group. [22] Atherogenic index (LDLc/HDLc)- In our study we found mean value 3.72±1.02 in prediabetics and 4.59±2.05 in diabetics. Intergoup this value to be highly significant .It was observed in the PROCAM study that subjects with >5 LDL/HDL showed six times higher rate of coronary artery disease. [23] AI >4.1 is considered as a risk factor for the development of CAD.

Conclusion

In our study we found TC, TG ,LDLc were significantly higher in prediabetics as compared with normoglycemic subjects whereas HDL-C was decreased significantly in prediabetics. The higher values of atherogenic ratios as discussed in the study point toward their increased susceptibility for cardiovascular complications. Hence we recommend screening of prediabetics for dyslipidaemia to arrest the development of early cardiovascular complications.

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