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Original Article

Pattern of Lipid Profile Abnormality in Subjects with Prediabetes

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Abstract

Introduction: Diabetes is one of the most prevalent diseases in the world. Diabetes mellitus is a metabolic disorder characterized by hyperglycemia. Worldwide, the prevalence is increasing dramatically over decades.

Materials and Methods: It is a cross-sectional case-control study. The sample size: 100 cases and 100 age and sex matched controls meeting inclusion criteria of this study from outpatients and inpatients of K R Hospital, Mysore.

Results: The overall presence of abnormal serum total cholesterol (TC), low-density lipoprotein (LDL), triglycerides (TGs), very LDL (VLDL), TG/high-density lipoprotein (HDL) ratio, and LDL/HDL ratio with statistical significance is tabulated in tables.

Conclusion: TC, LDL, TG, and VLDL were significantly raised in prediabetics as compared to normal healthy subjects whereas HDL was significantly lower in prediabetics as compared to normal healthy subjects.

Key words: Cholesterol, diabetic dyslipidemia, prediabetics

INTRODUCTION

Diabetes is one of the most prevalent diseases in the world. Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia. Worldwide, the prevalence is increasing dramatically over decades. The International Diabetes Federation predicts 592 million diabetes individuals by 2035. India holds second place among countries with the greatest number of individuals with diabetes. There were 69.1 million cases of diabetes in India. Diabetes is seventh leading cause of death as per statistics in 2010. According to ICMR INDIAB study phase[1] showed the prevalence of diabetes in Tamil Nadu was 10, 4%, Jharkhand 5.3% Chandigarh 13.6%, and Maharashtra 8.4%. Except in Chandigarh, the prevalence of prediabetes was higher in urban areas in all age groups.

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Prediabetes or intermediate hyperglycemia is classified as impaired fasting glucose (IFG) = fasting plasma glucose (FPG) = 5.6-6.9 mmol/L, impaired glucose tolerance (IGT) with plasma glucose 7.8 – 11 mmol/L after oral glucose challenge or hemoglobin A_{1c} of 5.7 - 6.4%. Prediabetes individuals are at high risk of developing diabetes, and aggressive management of cardiovascular risk factors such as hypertension and dyslipidemia should be ensured.

The vascular complications of DM can be microvascular (retinopathy, nephropathy, and neuropathy) and macrovascular complications (coronary heart disease, peripheral vascular disease, and cardiovascular disease [CVD]). Macrovascular complications are similar to nondiabetics at a greater frequency.

Dyslipidemia increases macrovascular complications in prediabetes and diabetics. The prevalence of dyslipidemia ranged from 75.7% in urban Maharashtra to 87.2% in urban Chandigarh, and 76.5% in rural Tamil Nadu to 81.1% in rural Chandigarh. The prevalence of coronary artery disease was higher among diabetic subjects compared to normal with Maharashtra having the highest prevalence. Diabetic dyslipidemia commonly includes

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hypertriglyceridemia and reduced high-density lipoprotein (HDL) and increased small density low-density lipoprotein (LDL) particles.

Prediabetics have deranged lipid profile as compared to normal subjects and hence more prone to develop cardiovascular mortality.[1-6]

MATERIALS AND METHODS

- Study design: Cross-sectional case-control study
- Sample size: 100 cases and 100 age and sex matched controls meeting inclusion criteria of this study from outpatients and inpatients of K R Hospital, Mysore
- Duration of study: 6 months from 20th August 2016 to 20th January 2017.

Inclusion Criteria

1. IFG - FPG levels of 100-125 mg/dl
2. IGT - 2 h oral glucose tolerance test (OGTT) values of 140-199 mg/dl.

Exclusion Criteria

1. Age <18 years
2. Patients diagnosed with Type 1? Type 2 diabetes
3. Patients with known thyroid dysfunction
4. Patient already on lipid lowering drugs
5. Pregnancy.

The study was initiated after clearance from the Institutional Ethics Committee. Biochemistry measurements including fasting blood sugar, 2 h OGTT, serum total cholesterol (TC), triglyceride (TG), HDL, and LDL, and very LDL (VLDL) were done. Normal levels of lipids were considered as per National Cholesterol Education Program ATP III classification (Table 1).

Statistical Analysis

Statistical analysis was performed using descriptive statistics and inferential statistics, using Chi-Square test, odd's ratio, Pearson's correlation coefficient, and multiple regression analysis. The software used in this analysis was SPSS version 17.0 and Graph Pad Prism version 5.0. A $P < 0.05$ was considered as a level of significance.

RESULTS

The overall presence of abnormal serum TC, LDL, TGs, VLDL, TG/HDL ratio, and LDL/HDL ratio with statistical significance is given in Table 2.

DISCUSSION

TC

In our study, mean value of TC for cases (190.58 ± 47 mg/dL) was more than controls (105.92 ± 22.2 mg/dL) (Table 2). *P* value was 0.00 ($P < 0.05$), (Table 3) i.e., significant. Similarly, Williams *et al.* studied data from National Health and Nutrition Examination Survey done in 1999-2000. The mean TC of the prediabetic subjects were higher (174.2 mg/dL) than the controls (157.5 mg/dL). They concluded that adolescents with IFG had significantly high TC than adolescents with normal fasting glucose (NFG).[7]

LDL

In our study, mean value of LDL for case (124 ± 32.49 mg/dL) (Table 2) was more than controls (38 ± 13.82 mg/dL). *P* value was 0.00 ($P < 0.05$), (Table 3) i.e., significant.

Table 1: NCEP ATP III classification of lipid levels

Risk	LDL-c	HDL-c		TGs	Cholesterol
		Male	Female		
High	≥160	<40	<50	≥200	≥240
Borderline	≥130-169	40-59	50-69	150-199	200-239
Desirable	100-129	>60	>70	<150	<200
Optimal	<100				

LDL-c: Low-density lipoprotein-cholesterol, HDL-c: High-density lipoprotein-cholesterol, TGs: Triglycerides, NCEP: National Cholesterol Education Program

Table 2: LDL/HDL ratio with statistical significance

Parameters	Group	*N*	Mean±SD	SEM
TC	Experimental	50	190.5800±47.05407	6.65445
	Control	50	105.9200±22.24157	3.14543
TGs	Experimental	50	129.1400±36.60490	5.17671
	Control	50	91.5800±19.20256	2.71565
HDL	Experimental	50	27.2800±9.55124	1.35075
	Control	50	39.7200±9.63844	1.36308
LDL	Experimental	50	124.0400±32.49676	4.59574
	Control	50	38.9340±13.82266	1.95482
VLDL	Experimental	50	49.2160±13.90339	1.96624
	Control	50	24.2440±6.98141	0.98732

LDL: Low-density lipoprotein, VLDL: Very low-density lipoprotein, HDL: High-density lipoprotein, TGs: Triglycerides, SD: Standard deviation, SEM: Standard error of mean, TC: Total cholesterol

Table 3: Lipid profile in cases and controls

Parameters	*t*-test for equality of means			
	t	df	Significant (two-tailed)	Mean difference
TC	11.502	98	0.000	84.66000
TGs	6.425	98	0.000	37.56000
HDL	6.483	98	0.000	12.44000
LDL	17.041	98	0.000	85.10600
VLDL	11.350	98	0.000	24.97200

LDL: Low-density lipoprotein, VLDL: Very low-density lipoprotein, HDL: High-density lipoprotein, TGs: Triglycerides, TC: Total cholesterol

Similarly, Rahbar *et al.* reported that prediabetics are at higher risk of having increased level of LDL-cholesterol.[8] Furthermore, Magge *et al.* observed that obese prediabetic adolescents have a significantly more atherogenic lipoprotein profile compared with obese normoglycemic peers.[9]

Similarly, Miyazaki *et al.* observed high LDL levels in prediabetic subjects. Moreover, they stated that the lipid profile in IFG/IGT appears to be very similar to "diabetic dyslipidemia" in T2DM.[10] Shin *et al.* also found a statistically significant difference in LDL between nondiabetes controls ($n = 172$) and prediabetes subjects ($n = 138$) with a mean LDL 134 ± 34.6 mg/dL and150.5 ± 38.0 mg/dL, respectively. They proved that there was a positive correlation between raised blood glucose and LDL.[11]

HDL

In our study, mean value of HDL for case (27.28 ± 9.55 mg/dL) was lower than controls (39.72 ± 9.63 mg/dL) (Table 2). *P* value was 0.000 ($P < 0.05$), i.e., (Table 3) significant. Similarly, Rahbar *et al.* showed that prediabetics are at higher risk of having a low level of HDL-cholesterol. Impaired lipid profile, i.e., dyslipidemia is commonly associated with CVD in Type 2 diabetes and can also occur in prediabetics.[8] Similarly, Miyazaki *et al.* observed low HDL levels in prediabetic subjects than controls.[10] Shin *et al.* also concluded that there is statistical significant difference in mean HDL between nondiabetes controls ($n = 172$) and prediabetes ($n = 138$) subjects with a mean HDL (mg/dl) 54.7 ± 13.3 and 49.9 ± 11.6 mg/dl, respectively. They proved that there is a positive correlation between raised blood glucose and HDL.[11]

TGs

Mean value of TG for case (129 ± 36.6 mg/dL) was higher than controls (91.58 ± 19.20 mg/dL) (Table 2). *P* value was 0.000 ($P < 0.05$), i.e., significant. Similarly, Rahbar *et al.* showed that prediabetics are at higher risk of having high TG.[8] Furthermore, Barzi *et al.*, Gaziano *et al.*, Kansal *et al.,* and Boizel *et al.* observed that TG levels were significantly higher in IFG/IGT compared to NFG/normal glucose tolerance.[12-14] Similarly, Miyazaki *et al.* in their study observed raised TG levels in prediabetic subjects.[10]

VLDL

In our study, mean value of VLDL for case (49.21 ± 13.90 mg/dL) was more than controls (24.34 ± 6.98 mg/dL) (Table 2). *P* value was 0.000 ($P < 0.05$), i.e., (Table 3) significant. Kansal *et al.* showed that VLDL levels were significantly higher in prediabetics.[15-23]

CONCLUSION

TC, LDL, TG, and VLDL were significantly raised in prediabetics as compared to normal healthy subjects whereas HDL was significantly lower in prediabetics as compared to normal healthy subjects. These prediabetics are highly prone for cardiovascular complications. Through this study, we recommend screening of prediabetics for dyslipidemia to prevent early cardiovascular complications.

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