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Research Article

LIPID PROFILE IN PREDIABETES, AN EARLY INDICATOR OF CARDIOVASCULAR DISEASES

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ABSTRACT

Introduction: Prediabetes or impaired fasting glycemia or impaired fasting glucose (IFG) refers to a condition in which the fasting blood glucose is elevated above what is considered normal levels but is not high enough to be classified as diabetes mellitus. Nearly 70% of prediabetes subjects can eventually develop diabetes if not managed in early stages. Both IFG and IGT (Impaired glucose tolerance) are associated with increased cardiovascular risk due to impaired Dyslipidaemia.

Aim: To study lipid profile in prediabetic subjects.

Material and Methods: 100 cases and 100 controls were compared for the lipid profile. Duration of study was from June 2017 to June 2018. Subjects were enrolled after applying all inclusion and exclusion criteria. This was a cross sectional case control study.

Results: The prediabetic subjects had significant increase in serum total cholesterol, TG, LDL, VLDL, TG/HDL and LDL/HDL ratio compared to normal healthy subjects while HDL was significantly decreased in prediabetic as compared to normal healthy subjects.

Conclusion: Prediabetic subjects had significantly deranged lipid profile values. Due to dyslipidemia, they are highly prone for cardiovascular and microvascular complications. We recommend that proper screening of prediabetic for dyslipidemia can prevent early cardiovascular and microvascular complications. We also suggest lifestyle changes and pharmacotherapy for prediabetes subjects to prevent the risk of cardiovascular and microvascular disease.

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INTRODUCTION

Diabetes is one of the most prevalent diseases in the world. Diabetes mellitus (DM) is a metabolic disorder characterized by hyperglycemia.^[1] 347 million people worldwide have diabetes.^[2] Prevalence of diabetes and pre-diabetes in India in 2011 was 62.4 and 77.2 million respectively. The weighted prevalence of diabetes (both known and newly diagnosed) was 10.4% in Tamilnadu, 8.4% in Maharashtra, 5.3% in Jharkhand, and 13.6% in Chandigarh. The prevalence of prediabetes (impaired fasting glucose and/or impaired glucose tolerance) were 8.3% in Tamilnadu, 12.8% in Maharashtra, 8.1% in Jharkhand and 14.6% in Chandigarh.^[3] Prediabetes or impaired fasting glycemia or impaired fasting glucose (IFG) refers to a condition in which the fasting blood glucose is elevated above

what is considered normal levels but is not high enough to be classified as diabetes mellitus.^[4]

According to the World Health Organization (WHO), high risk for developing diabetes relates to two distinct states, impaired fasting glucose (IFG) defined as fasting plasma glucose (FPG) of 110-125 mg/dl (in the absence of impaired glucose tolerance -IGT) and IGT defined as post-load plasma glucose of 140-199 mg/dl based on 2-hour oral glucose tolerance test (OGTT) or a combination of both.^[5] The American Diabetes Association (ADA), although applying the same thresholds for IGT, uses a lower cut-off value for IFG (FPG 100-125 mg/dl) and has additionally introduced Glycated hemoglobin (HbA1c) levels of 5.7-6.4% as a new category of high diabetes risk.^[6] Around 5-10% of people with prediabetes become diabetic annually.

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Nearly 70% of prediabetes subjects can eventually develop diabetes if not managed in early stages.^[7] Both IFG and IGT are associated with increased cardiovascular risk.^[8] Dyslipidaemia, frequently occurring in Type2 diabetes mellitus(T2DM) patients, play a critical role in acceleration of macrovascular atherosclerosis and contribute to the excess risk of CVD.^[9]

Therefore, it is important to diagnose lipid abnormalities in prediabetes state itself. Many studies have been done on lipid profile in diabetes and prediabetes subjects in developed countries. But there is very few of such studies in India. Hence, present study is aimed to study lipid profile in prediabetes individuals.

MATERIAL AND METHODS

This study was done in the Department of Biochemistry, People's College of Medical Science and Research (PCMS & RC) and Centre for Scientific Research and Development (CSRD), People's University Bhopal. This study was a cross-sectional descriptive type of study. 100 cases and 100 controls were involved from OPD of hospital. Duration of study from June 2017 to June 2018. Total subjects were enrolled after applying all inclusion and exclusion criteria and written informed consent was taken. All socio-demographic data of the participants was entered in a self-designed questionnaire.

The Inclusion Criteria

1. Age between 18-60 yrs
2. fasting plasma sugar level 100-125 mg/dl
3. post prandial plasma sugar level (after 2 hours of 75 g oral glucose) 140-199 mg/dl

Exclusion Criteria

1. Age more than 60 yrs and Age less than 18
2. Diagnosed diabetic patients
3. AIDS Patients, Pregnant women.

The study protocol was approved by Institutional ethics committee. All the participants were screened for age, gender, Fasting glucose level, post prandial glucose level, HbA1c, Family history, any medication history. Prediabetic cases were included and excluded with the help of physician, Dept of Medicine, People's College of Medical Science and Research (PCMS & RC). Biochemical parameters including fasting plasma sugar, postprandial plasma sugar (after 2 hours of 75 g oral glucose), fasting lipid profile (serum total cholesterol (TC), low density lipoprotein cholesterol(LDL), triglycerides(TG), high density lipoprotein cholesterol (HDL), very low density lipoprotein cholesterol (VLDL)), were done. Abnormal lipids were defined as per NCEP (National Cholesterol Education Program) ATP III.

Statistical Analysis

The analysis was done with the help of statistical package SPSS latest version 24 and Microsoft Excel 2010. Independent t test were used for comparison. A 'p' value <0.05 was used for level of significance.

RESULT

Mean lipid level including serum TC, LDL, TGs, VLDL, TG/HDL ratio, and LDL/HDL ratio with statistical significance is given in Table 1 and diagram1.

Table 1 Lipid profile values in prediabetes Vs controls

Variables	Prediabetes		Control		t-statistics	P-value	Significant
	Mean	SD	Mean	SD			
Cholesterol	242.96	20.27	171.14	22.51	23.71	0.0000	Highly Significant
TG	169.91	14.43	91.28	16.82	35.48	0.0000	Highly Significant
LDL	171.50	20.13	109.35	18.71	22.61	0.0000	Highly Significant
HDL	31.20	4.38	42.21	5.84	15.09	0.0000	Highly Significant
VLDL	36.15	7.17	19.05	4.82	19.79	0.0000	Highly Significant
TG/HDL	5.57	1.00	2.20	0.49	30.26	0.0000	Highly Significant
LDL/HDL	5.71	1.09	2.62	0.56	25.35	0.0000	Highly Significant

Independent "t" test applied. (p value< 0.05)

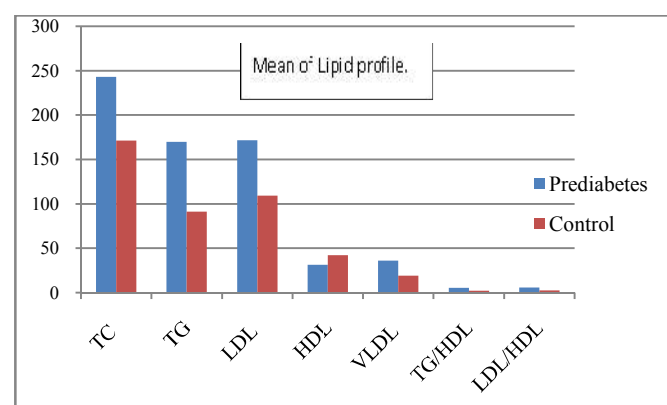


Diagram 1 Lipid profile values in prediabetes Vs Control

DISCUSSION

In our study, mean value of TC for cases (242.96 ± 20.27 mg/dl) was more than controls (171.14 ± 22.51 mg/dl) (Table1). P value was 0.00 ($P < 0.05$), 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 was higher (174.2 mg/dl) than the controls (157.5mg/dl). They concluded that adolescents with IFG had significantly high TC than adolescents with normal fasting glucose (NFG).^[10]

Mean value of TG for case (169.91 ± 14.13 mg/dl) was higher than controls (91.28 ± 16.82 mg/dl) (Table 1). 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.^[11] 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.^[12-15] Similarly, Miyazaki *et al.* in their study observed raised TG levels in prediabetic subjects.^[16]

In our study, mean value of LDL for case (171.50 ± 20.13 mg/dl) was more than controls (109.35 ± 18.31 mg/dl). P value was 0.00 ($P < 0.05$), (Table 1) i.e., significant. Similarly, Rahbar *et al.* reported that prediabetes are at higher risk of having increased level of LDL-cholesterol.^[11] Furthermore, Magge *et al.* observed that obese prediabetic adolescents have a significantly more atherogenic lipoprotein profile compared with obese normoglycemic peers.^[17] 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.^[16] Shin *et al.* also observed that a statistically significant difference in LDL between nondiabetic controls ($n = 172$) and prediabetes subjects ($n = 138$) with a mean LDL 134 ± 34.6 mg/dl and 150.5 ± 38.0 mg/dl, respectively. They proved that there was a positive correlation between raised blood glucose and LDL.^[18]

In our study, mean value of HDL for cases (31.20 ± 4.38 mg/dl) was lower than controls (42.21 ± 5.4 mg/dl) (Table 1). P value was 0.000 ($P < 0.05$), i.e. 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.^[11] Similarly, Miyazaki *et al.* observed low HDL levels in prediabetic subjects than controls.^[16] Shin *et al.* also concluded that there was statistically significant difference in mean HDL between non diabetic 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 levels.^[18]

In our study, mean value of VLDL for case (36.16 ± 7.17 mg/dl) was more than controls (19.05 ± 4.82 mg/dl) (Table 1). P value was 0.000 ($P < 0.05$), i.e. significant. Kansal *et al.* Balgi *et al* showed that VLDL levels were significantly higher in prediabetics.^[14, 19]

In our study, Tryacylglycerol to high density lipoprotein cholesterol concentration (TG/HDL) ratio was higher in prediabetes subject (5.75 ± 1.00) than healthy controls (2.00 ± 0.49). Miyazaki *et al* observed that IGT/IFG subjects had higher TG/HDL ratio than controls (4.0 ± 2.5 for cases and 2.7 ± 1.9 for controls).^[16] Barzi *et al*, Gaziano *et al* and Boizel *et al*, Kumar M *et al* also reported higher TG/HDL ratio in IFG/IGT subjects compared to NFG/NGT subjects.^[12,13,15,20]

This cut-off had high sensitivity (79%) and specificity (85%) in their study population and concluded that a plasma TG/HDL cholesterol concentration ratio might provide a simple means of identifying insulin resistance. In our study, LDL/HDL ratio was significantly higher in prediabetes case (5.71 ± 1.9) as compared with Healthy controls (2.62 ± 0.56). Similarly, Kumar M *et al* observed significantly high LDL/HDL ratio in prediabetes subjects than controls.^[20] However, Miyazaki *et al* showed no statistical difference in LDL/HDL ratio between case group and control group.^[21]

CONCLUSION

Our findings show that prediabetic subjects had significantly increased serum total cholesterol, TG, LDL, VLDL, TG/HDL and LDL/HDL ratio compared to normal healthy subjects. Whereas HDL was significantly decreased in prediabetic as compared to normal healthy subjects. These prediabetic subjects, because of their dyslipidemia are highly prone for cardiovascular and microvascular complications.

We recommend proper and early screening of prediabetics for dyslipidemia to prevent cardiovascular and microvascular complications. We also suggest some lifestyle changes and

pharmacotherapy for prediabetic subjects to prevent the risk of cardiovascular and microvascular disease.

Abbreviations: TC-total cholesterol, TG- triglycerides, HDL- high density lipoprotein cholesterol. LDL-low density lipoprotein cholesterol. VLDL- very low density lipoprotein cholesterol, DM- Diabetes Mellitus, CVD-cardiovascular diseases

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