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Study of Serum Lipid Profile Level in Prediabetic Subjects in Indian population

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Abstract: ***Background*: Diabetes mellitus (DM), commonly referred to as diabetes, is a group of metabolic disorders in which there are high blood sugar levels over a prolonged period. Pre-diabetes is the precursor stage before diabetes mellitus in which not all of the symptoms required to diagnose diabetes are present, but blood sugar is abnormally high. This stage is often referred to as the "grey area". Dyslipidemia in diabetes commonly manifests as raised Cholesterol, Triglyceride, low-density lipoprotein cholesterol (LDL-C), VLDL and decreased high-density lipoprotein cholesterol (HDL-C) levels. Our study was aimed to assess and compare the serum Lipid Profile level in pre-diabetic subjects and healthy controls. *Materials and Methods*: The present study is a case control study, conducted on 150 pre-diabetic subjects. Subjects were selected from MOPD of Jawahar Lal Nehru Medical College and Associated Group of Hospitals, Ajmer. Age and sex matched healthy controls (n = 50) were selected from MOPD of Jawahar Lal Nehru Medical College and Associated Group of Hospitals, Ajmer. The present study is approved by Institutional Ethical Committee. *Results*: The mean level of Serum Total cholesterol, triglyceride (TG), very low density lipoprotein (VLDL), low density lipoprotein (LDL) were significantly raised in prediabetic subjects as compared to normal healthy controls, whereas high density lipoprotein (HDL) was significantly lower in prediabetic subjects as compared to normal healthy controls (p<0.0001). *Conclusion*: TC, TG, VLDL & LDL were significantly raised in prediabetic as compared to normal healthy subjects whereas HDL was significantly lower in prediabetics as compared to normal healthy subjects. These prediabetic individuals, because of their dyslipidemia, are at higher risk for developing cardiovascular disease. There is increasing importance of screening individuals for pre- diabetes to prevent morbidity and mortality due to diabetes. Lifestyle modification or pharmacotherapy in such individuals becomes a clinical consideration.***

Key words: Diabetes mellitus (DM), Cardiovascular disease (CVD), Total Cholesterol (TC), Triglyceride (TG), Very Low Density Lipoprotein (VLDL), Low Density Lipoprotein (LDL), High Density Lipoprotein (HDL), Glucose Tolerance Test (GTT), Impaired Fasting Glucose (IFG), Body Mass Index (BMI).

1. Introduction

Diabetes mellitus is considered as giant killer disease of 21st century with its vicious prongs in the South- East Asian countries, specially India, which is rightly said to be the ''Diabetes Capital'' of the world.[1] In Indian population, 61.3 million people had diabetes in 2011, which is expected to reach 101.2 million by 2030 (International Diabetes Federation) now placing India at second position in world diabetic prevalence.[2] Diabetes mellitus (DM), commonly referred to as diabetes, is a group of metabolic disorders in which there are high blood sugar levels over a prolonged period.[3] Pre-diabetes is a component of the metabolic syndrome and is characterized by elevated blood sugar levels that fall below the threshold to diagnose diabetes mellitus. It usually does not cause symptoms but people with pre-diabetes often have obesity (especially abdominal or visceral obesity), dyslipidemia and hypertension.[4] Pre-diabetes is the precursor stage before diabetes mellitus in which not all of the symptoms required to diagnose diabetes are present, but blood sugar is abnormally high. This stage is often referred to as the "grey area".[5] Pre-diabetes typically has no distinct signs or symptoms except the sole sign of high blood sugar.[6]

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. It is considered a pre-diabetic state, associated with insulin resistance and increased risk of cardiovascular pathology, although of lesser risk than impaired glucose tolerance (IGT). IFG sometimes progresses to type 2 diabetes mellitus. Fasting glucose is helpful in identifying pre-diabetes when positive but has a risk of false negatives.[7]

Approximately 11% of people with pre-diabetes who receive no treatment or intervention will develop type 2 diabetes every year.[8] A recent study reported that 77.2 million populations in India fall in pre-diabetic group or the risk group.[2]

Cardiovascular disease (CVD) is the leading cause of death in patients with type 2 diabetes mellitus (T2DM).[9] Dyslipidemia, frequently occurring in T2DM patients, plays a critical role in the acceleration of macrovascular atherosclerosis and contributes to the excess risk of CVD.[10] The dyslipidemia in T2DM is, in general, characterized by elevated triglycerides, reduced high-density lipoprotein (HDL) cholesterol and predominant presence of small dense low density lipoprotein (sdLDL) particles. Apparently

similar abnormalities in serum lipid profiles have also been observed in the pre-diabetic individuals and the abnormalities are attributed to obesity, hyperinsulinemia and glucose intolerance.[11,12] Though pre-diabetes has been associated with an increased risk of CVD events compared to normal, the association is somewhat less than that for overt diabetes.[13,14]

2. Materials and Methods

The present study is a case control study, conducted on 150 pre-diabetic subjects. Pre-diabetic Subjects were selected from MOPD of Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer. Age and sex matched healthy controls (n=50) were selected from MOPD of Jawaharlal Nehru Medical College and Associated Group of Hospitals, Ajmer. The results of pre-diabetic subjects were compared with healthy controls (n=50). The present study is approved by Institutional Ethical Committee.

For control group
Healthy individuals age and sex matched with Fasting serum glucose level <110mg/dl & two hour serum glucose level <140mg/dl.

Inclusion criteria for study group
1) Fasting serum glucose level 110 – 125mg/dl (IFG).
2) Two hour serum glucose level after ingestion 75g of glucose 140 to 199 mg/dl.

Exclusion criteria for study group
1) Fasting serum glucose greater than or equal to 126 mg/dl.
2) Two hour serum glucose level greater than or equal to 200 mg/dl during an oral glucose tolerance test.
3) Patients with classic symptoms of hyperglycemia, random serum glucose greater than or equal to 200 mg/dl.
4) Patients with diabetes mellitus, hypothyroidism, cardiovascular disease, cerebrovascular disease, renal disease, smokers and alcoholics.

Blood samples were collected after an overnight fast (12-14hrs) and after two hour post prandial under aseptic conditions from all the study participants. All samples were centrifuged and analyzed for blood sugar and serum lipid profile. The blood sugar was measured by enzymatic GOD-POD end point method. Total Cholesterol was measured by CHOD-POD Enzymatic colorimetric method, Triglyceride was measured by GOD-POD Enzymatic colorimetric method, HDL-Cholesterol was measured by Precipitated Phoshotungstic acid method and VLDL and LDL calculated by **'Friedewald'** Equation.

Statistical analysis
All data were analyzed by SPSS-13 version. P< 0.01 were considered as significant.

3. Results

The study included 150 pre-diabetic subjects and 50 healthy control subjects. The results are summarized in tables and figures. Among the 150 pre-diabetic subjects, 40 (26.66%) were males and 110 (73.33%) were females. Out of the 50 healthy subjects, 15 (30%) were males and 35 (70%) were females. Table-1, figure-1 shows the Mean±SD of age, weight, height and body mass index of the subjects. The table-2 & figure-2 show the Mean±SD of blood sugar and serum lipid profile. The table-2 & figure-2 show Mean±SD of Fasting Serum Glucose level (116.5±4.61 v/s 98.87±9.8) mg/dl and two hour Post Prandial Serum Glucose level (165.26±16.2 v/s 126.06±15.6) mg/dl in pre-diabetic subjects compared to healthy controls were significantly (P<0.0001) raised. Table-2 & figure-2 shows that the means±SD of serum Total Chol. (236.92±34.4 v/s162.42±29.58), TG (222.45±55.0 v/s113.89±27.78), VLDL (45.07±11.6 v/s 22.7±5.69) & LDL (150.0±37.1 v/s 94.22±24.98) levels were higher in prediabetic subjects as compared to healthy controls and difference was statistically highly significant (P<0.0001).The Mean ± SD of serum HDL level was less in prediabetic subjects (35.29±4.15 v/s 44.9±12.11 mg/dl) than healthy controls and difference was statistically highly significant (P<0.0001). Table-3, Figure-3 shows distribution of Prediabetes among female and male subjects.

Table 1: Anthropometric Parameters of Healthy Control Subjects V/S Pre-diabetic Subjects

Anthropometric Parameters	Healthy control subjects (n=50) Mean ± SD	Pre-diabetic subjects (n=150) Mean ± SD	P-Value
Age (yr.)	48.51±8.44	49.42±9.01	>0.005
Height (cm)	158.13±0.05	153.23±4.4	<0.001 (HS)
Weight (kg)	51.5±4.9	72.13±4.5	<0.001 (HS)
BMI (kg/m2)	21.98±5.03	29.01±3.01	<0.001 (HS)

Table 2: Biochemical Parameters of Healthy Control Subjects v/s Pre-diabetic Subjects

Biochemical Parameters	Healthy Control Subjects (n=50) Mean ±SD	Pre-diabetic subjects (n=150) Mean ±SD	P-Value
Fasting Serum Glucose (mg/dl)	98.87±9.8	116.5±4.61	<0.0001
2- hour Post Prandial Serum Glucose (mg/dl)	126.06±15.6	165.26±16.2	<0.0001
Total Cholesterol (mg/dl)	162.42±29.58	236.92±34.4	<0.0001
Triglyceride (mg/dl)	113.89±27.78	222.45±55.0	<0.0001
HDL (mg/dl)	44.9±12.11	35.29±4.15	<0.0001
VLDL (mg/dl)	22.7±5.69	45.07±11.6	<0.0001
LDL (mg/dl)	94.22±24.98	150.0±37.1	<0.0001

Table 3: Distribution of Prediabetes among female and male subjects

Female with Prediabetes	Male with Prediabetes	Total
110 (73.33%)	40 (26.66%)	150

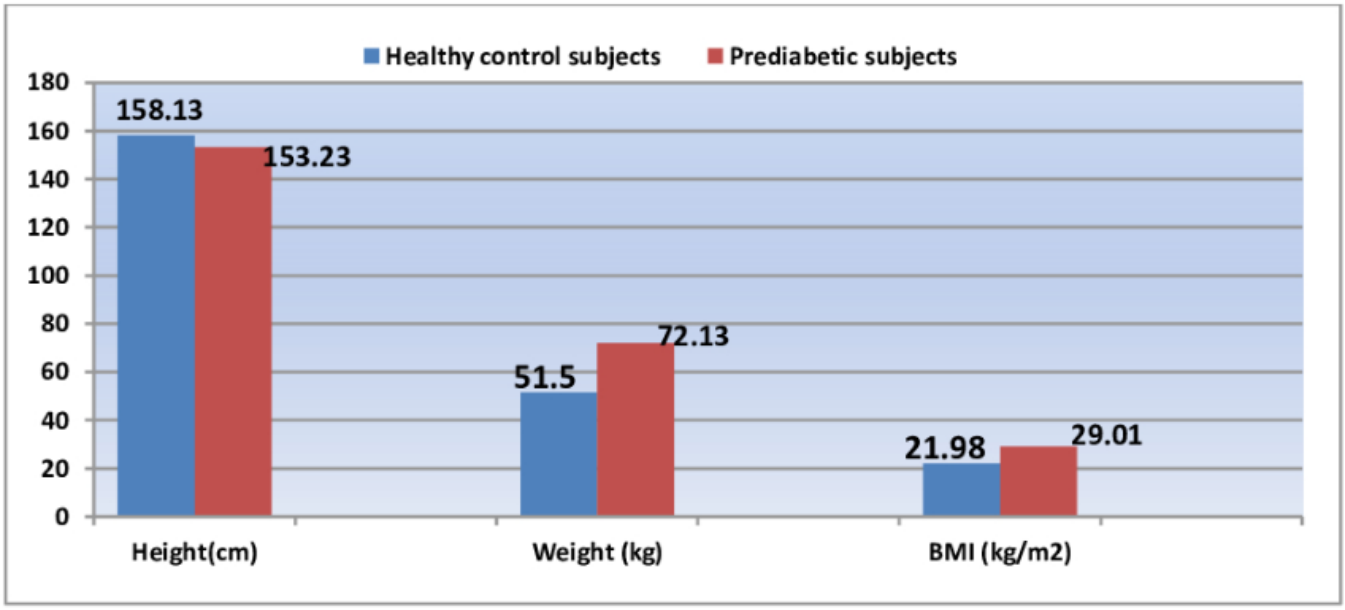

Figure 1: Comparison of Anthropometric Parameters of Healthy Control Subjects V/S Pre-diabetic Subjects

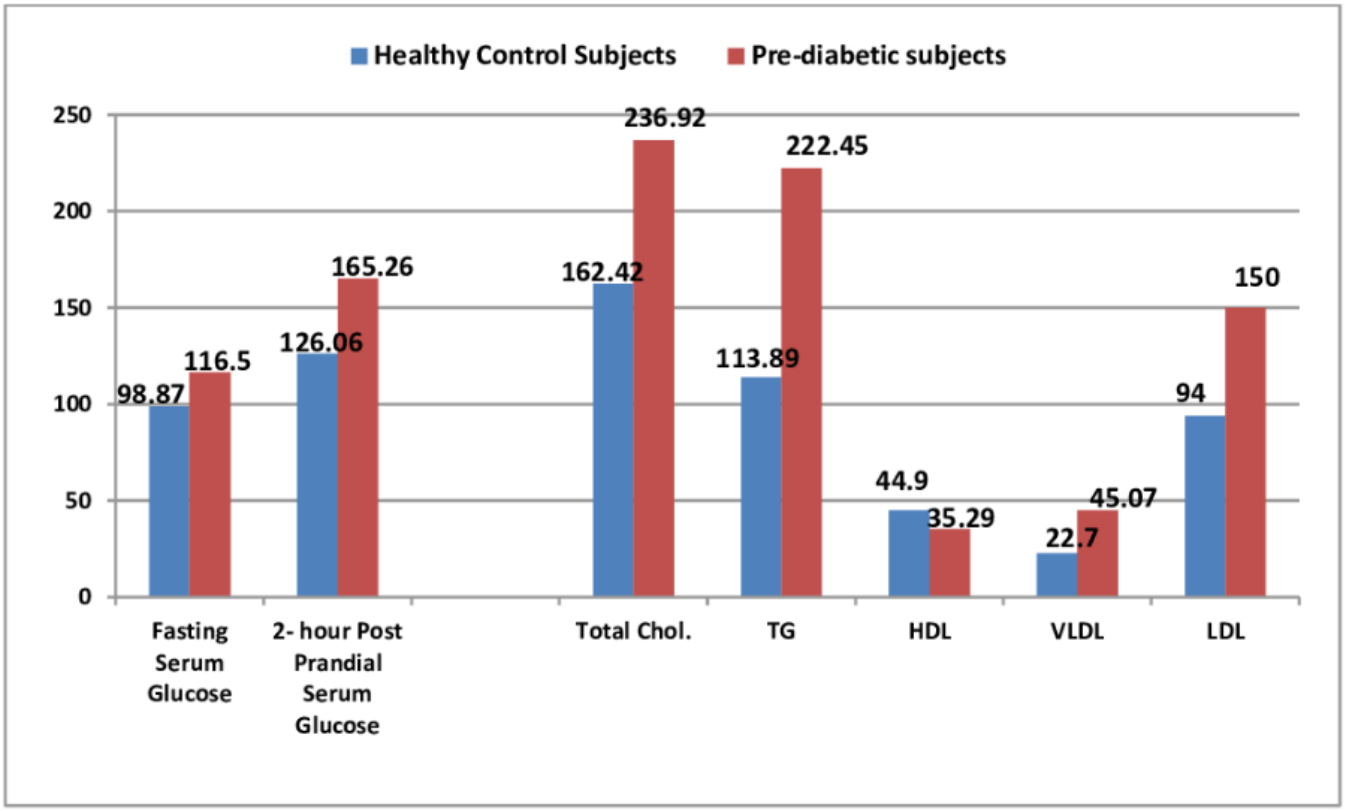

Figure 2: Comparison of Biochemical Parameters of Healthy Control Subjects V/S Pre-diabetic Subjects

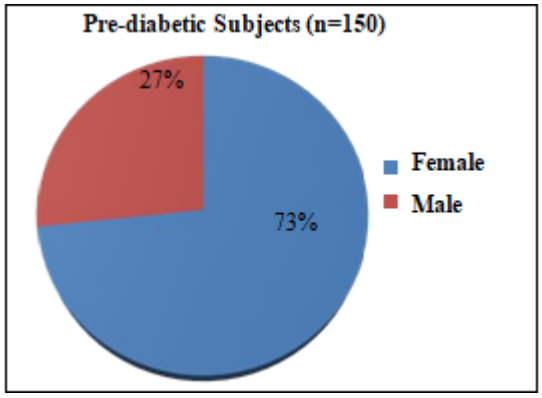

Figure 3: Distribution of Prediabetes among female and male subjects

4. Discussion

Diabetes is a group of metabolic disease characterized by hyperglycemia and metabolic changes which could be the result of insufficiency or defect in insulin secretion, insulin action or both.[15,16] The risk factor for pre- diabetes and diabetes are stress and depression, [17,18] chronic underlying disease and inflammation,[19,20] obesity, low physical activity, sedentary lifestyle and environmental factors.[21,22] Pre-diabetes is a condition in which the blood glucose level is above normal but below the diagnostic threshold for diabetes mellitus.[23]

In the present study, the BMI were more in pre-diabetic subjects than controls and difference was statistically significant ($p<0.001$). Our findings are in concordance with A. Nwafor et al. (2015) which also showed that BMI was increased significantly in individuals with high blood glucose level.[24]

In the present study we have observed that the level of fasting serum glucose level was elevated in pre-diabetic subjects as compared to the healthy control subjects. It is in concordance with Taif K Hamdan et al. (2011) which also states that mean value of fasting serum glucose level was significantly ($P<0.0001$) higher in pre- diabetic subjects compared to healthy control subjects.[25]

Mean level of two hour post prandial serum glucose level was significantly higher in pre-diabetic subjects than healthy control subjects. Our study are in agreement with Mitra J.K et al (2017) who also found a statistically significant increase in two hour post prandial serum glucose level in prediabetics.[26]

In the present study we have observed that the level of serum Total Chol., TG, VLDL & LDL were higher in pre-diabetic subjects as compared to the healthy control subjects.The Mean ± SD of serum HDL level was less in prediabetic subjects than healthy controls. It is in concordance with Vandana Balgiet al. (2017) which also states that the serum Total Chol., TG, VLDL & LDL levels were higher in pre-diabetic subjects and serum HDL level was less in prediabetic subjects than healthy controls.[27]

Consequently; the treatment of confounding risk factors of obesity, hypertension, and hyperlipidemia assumes major importance and must be coordinated with good glycemic control for reduction in total mortality in type 2 diabetes mellitus [28,29,30,31]. IGT is characterized by an increase in postprandial glucose levels, which is considered the initial metabolic abnormality in type 2 diabetes mellitus. It is one of a series of risk factors for Cardio Vascular Disease (hypertension, high triglyceride levels, low high-density lipoprotein-cholesterol and central obesity), known as the metabolic syndrome. The different factors making up this syndrome are intimately related. An impaired lipid profile can contribute to insulin resistance, as IGT may play a pathogenic role on other cardiovascular risk factors.

5. Conclusion

The observation of this study has revealed that TC, TG, VLDL & LDL were significantly raised in prediabetic as compared to normal healthy subjects whereas HDL was significantly lower in prediabetics as compared to normal healthy subjects. Therefore prediabetic subjects are highly prone for cardiovascular complications. Our study also shows increased prevalence of prediabetes in female as compared to male. There is increasing importance of screening individuals for pre-diabeties to prevent progression of these individual to Diabetes Mellitus and its associated morbidity and mortality. Therefore, proper screening of prediabetes and associated dyslipidaemia is necessary, as life style modification and pharmacotherapy can control these conditions and thereby reduce cardiovascular risk.

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