

**Is it necessary to investigate the serum lipid profile among prediabetic Individuals**

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**Citation this Article:** Dr Ayesha Juhi, Dr Rashmi Iyengar, “Is it necessary to investigate the serum lipid profile among prediabetic Individuals”, IJMSIR- December - 2021, Vol – 6, Issue - 6, P. No. 163 – 168.

**Type of Publication:** Original Research Article

**Conflicts of Interest:** Nil

**Abstract**

**Background:** Diabetes mellitus accounts to one of the major non communicable disease across the world. Prediabetes is a prelude to Diabetes mellitus, in which the blood glucose levels are higher than the normal but lower than the threshold of Diabetes mellitus. Prediabetes referred to as impaired glucose tolerance and/or impaired fasting glucose is a preclinical stage of hyperglycaemia where individuals are at increased risk of developing type II diabetes mellitus in the near future. In prediabetics, dyslipidaemia can arise due to the constant increased in blood glucose levels exposing them to substantial risk of developing cardiovascular disease. Hence this study was taken up to estimate the serum lipid profile among prediabetics.

**Material and methods:** This cross-sectional study was conducted on total of 311 individuals (both males and females) in the age group of 30-65 years, with 151 diagnosed as prediabetics and 160 age and sex matched normal healthy individual subjects. HbA1c and Fasting blood glucose levels were used to differentiate the study subjects into prediabetics and normal healthy control subjects. The lipid parameters measured and compared between the two different study subjects were total

cholesterol, LDL cholesterol, HDL cholesterol, VLDL cholesterol and Triglyceride levels. Unpaired t test was done to compare the means of both the study subjects. P value of <0.05 was considered significant.

**Results:** In the present study as per the results obtained the total cholesterol, LDL cholesterol, VLDL cholesterol and Triglyceride levels was significantly higher among prediabetics in comparison to normal healthy control subjects. The HDL cholesterol levels were significantly less among prediabetics then control subjects.

**Conclusion:** Prediabetics have an altered serum lipid profile when compared to the healthy individuals. The above normal blood glucose levels in prediabetics can often lead to dyslipidaemia which can further cause substantial risk of developing cardiovascular disease affecting both macrovascular and microvascular health. It is the early diagnosis of dyslipidaemia along with life style modification is the way forward to modify the prediabetic state to normal glucose tolerance state for a healthier life.

**Keywords:** Prediabetes, HbA1C, Fasting blood glucose (FBS), Serum lipid profile

## Introduction

Prediabetes is a prelude to Diabetes mellitus, in which the blood glucose levels are higher than the normal but lower than the threshold of Diabetes mellitus. By the year 2045, India is estimated of surpassing all the countries across world of having highest number of people with diabetes mellitus of 134 .3 million.<sup>(1)</sup>

It's always been a substantial public health problem to manage the complications arising secondarily due to Type II Diabetes mellitus (T2DM) leads to cardiovascular disease-causing heart disease, stroke, and peripheral vascular disease. The microvascular complications leading to retinopathy, neuropathy and nephropathy.<sup>(2)</sup>

During 2017, mortality due to T2DM in India was the largest contributor among south East Asian region accounted to nearly 1 million deaths attributed to it.<sup>(1)</sup>

Prediabetes referred to as impaired glucose tolerance and/or impaired fasting glucose is a preclinical stage of hyperglycaemia where individuals are at increased risk of developing type 2 diabetes mellitus in the near future.<sup>(3-5)</sup>

To develop a full-blown diabetes mellitus state the progression from a prediabetes state occurs gradually over a period of many years and is characterized by worsening insulin resistance and insulin secretory dysfunction and by gradual increases in fasting plasma glucose concentrations.<sup>(6-8)</sup>

Prediabetes is an increasingly common condition in youth and adults with a most sudden increase in the age group below 30 years of age.<sup>(9-10)</sup>

In 2017, India had 24.0 million populations with prediabetes and further more by 2045 the burden is estimated to be doubled approximately to 41.0 million Indian population with prediabetes.<sup>(1)</sup>

Prediabetes or Impaired fasting glucose (IFG) is defined as fasting plasma glucose of 100 mg/dL (5.6 mmol/L) to 125 mg/dL (6.9 mmol/L). Prediabetes can also be defined as a haemoglobin A1c (HbA1c) of 5.7% –6.4% (39–46 mmol/mol).<sup>11-12</sup>

The increased cardiovascular disease (CVD) risk associated with type 2 diabetes (T2D) is likely due in part to diabetic dyslipidemia characterized by elevated plasma levels of triglycerides, LDL cholesterol and decreased HDL cholesterol levels.<sup>(13-14)</sup>

Since prediabetes is an asymptomatic condition, one has to be extra cautious to determine the various dysregulation occurring at physiological, metabolic and biochemical levels in the body. The constant hyperglycaemic state in prediabetic state can be a threat to the human biological system.

As per ancient saying Prevention is better than cure, early detection of altered serum lipid profile among the prediabetic individuals is necessary before it leads to full blown diabetes mellitus, also exposing the individuals to macrovascular and microvascular complication due to associated dyslipidaemia. Hence this study was taken up with the objective to study the serum lipid profile in prediabetic patients in comparison to normal healthy control subjects. The serum lipid parameters Total cholesterol, (Low density lipoprotein) cholesterol, HDL (High density lipoprotein) cholesterol, VLDL (Very low density lipoprotein) cholesterol and Triglyceride levels were measured along with the Fasting blood glucose levels and HbA1c .

## Material and Methods

The present cross-sectional study was conducted on total of 311 individuals (both males and females) in the age group of 30-65 years, with 151 diagnosed as prediabetics and 160 age and sex matched normal healthy individuals

as control subjects. The study was conducted only after the clearance was obtained from the ethical committee of Apollo medical college, Hyderabad. The patients were selected randomly from the various diabetic camps conducted.

**The inclusion criteria** for Prediabetic status was HbA1c in range of 5.7% - 6.4% and the Fasting blood glucose in the range of 100-125 mg/dl with a normal BMI of 18-25kg/m<sup>2</sup>

The age and sex matched normal healthy individuals with Hb A1c ranging below 5.7% and FBS 70-99 mg/dl were selected as Controls for the study.

**The exclusion criteria:** Individuals having HbA1c more than 6.4%, FBS>125 mg/dl, using oral hypoglycaemic drugs, cardiovascular disease, lipid lowering drugs, kidney disease, anaemia, haemoglobin related disorders, hypertension, cerebrovascular disease, thyroid disorders, Oral contraceptive pills, menstrual irregularities, endocrine disorders, hereditary hypercholesteremia, metabolic disorders.

Written and informed consent was obtained from subjects before the sample collection

**Sample collection for biochemical tests**

The patients were asked to refrain from heavy physical activity for 24 hours and from consumption of alcohol

**Results**

Table 1: Showing the comparison of means of the various parameters between the Controls and Prediabetic subjects.

Parameters	Controls, N=160 Males -77 Females-83	Prediabetics, N=151 Males-79 Females-72	P value
Age (years)	45.88±10.89	44.22 ±5.89	0.0983
Fasting blood glucose level (FBS) mg/dl	83.754±8.856	116.357±4.910	<0.001
HbA1c (Glycosylated Hemoglobin) %	5.153±0.403	6.113±0.581	<0.001
Total cholesterol (mg/dl)	174.08±13.46	205.357±11.002	<0.001
LDL cholesterol (mg/dl)	95.582±7.463	121.158±11.108	<0.001

and caffeinated beverages for 12 hours prior to the measurements. Baseline and anthropometric parameters were recorded before blood collection. 5ml blood was collected by venipuncture technique to estimate FBS, HbA1c levels, Total Cholesterol, LDL, HDL, VLDL and Triglycerides levels.

Glycosylated haemoglobin (HbA1c) was measured using Fully Automated H.P.L.C. using Biorad variant Turbo. Fasting blood glucose was measured using GOD-PAP enzymatic photometric test method. Total cholesterol was measured using Cholesterol Oxidase, Esterase, peroxidase method. HDL by Direct Enzymatic Colorimetric method, LDL by Direct Measure and Triglycerides levels measured using by Enzymatic, End Point.

**Statistics**

It was performed using the licensed SPSS version 24. The parameters obtained were entered using Microsoft excel version 10. The results were expressed as mean ± standard deviation. Normality of the variables was verified by one sample Kolmogorov-Smirnov test. Unpaired students t test was applied to compare the means of the parameters between Prediabetics and control subjects. P value of <0.05 was considered significant.

HDL cholesterol (mg/dl)	48.331±2.018	39.867±1.268	<0.001
VLDL cholesterol(mg/dl)	30.178±8.366	44.331±2.0189	<0.001
Triglycerides(mg/dl)	139.119±5.638	159.456±8.876	<0.001

P value of <0.05 was considered significant.

Table no.1 shows there was no significant difference in the age of the controls and the prediabetic subjects as the p value was 0.0983. Highly significant p value was obtained when the HbA1c of the Prediabetic subjects (6.11%) was compared to healthy control subjects (5.15%). Even when the FBS was compared with the prediabetic subjects (116.35 mg/dl) compared to control subjects (83.75 mg/dl) a highly significant p value was obtained.

The serum total cholesterol was significantly higher among the prediabetic (205.35) subjects when compared to controls (174.08) with p value of <0.001.

When the LDL cholesterol levels was compared among prediabetic subjects (121.15) to controls (95.58) the results showed highly significant p value <0.001.

Similar highly significant p value of <0.001) was obtained with HDL cholesterol levels among prediabetics (39.86) when compared with the controls (48.33)

When VLDL cholesterol was compared among the prediabetics (30.17) and controls (44.33) a highly significant p value of <0.001 was obtained.

Even with the triglyceride levels the alike highly significant p value of <0.001 was obtained when compared between prediabetics (159.45) and control subjects (139.11).

It was found from the results of the study that the total cholesterol levels were significantly higher among prediabetics in comparison to controls. It was observed that the LDL cholesterol levels were significantly higher among prediabetes in relation to controls.

It can also be interpreted from the results that HDL cholesterol levels were significant less when compared to controls. It was also noticed that the VLDL cholesterol and triglycerides levels were significantly higher among the prediabetes in comparison to control subjects.

### Discussion

In the present study as per the results obtained the total cholesterol, LDL cholesterol, VLDL cholesterol and Triglyceride levels was significantly higher among prediabetics in comparison to normal healthy control subjects. The HDL cholesterol levels were significantly less among prediabetics then control subjects.

The results of this study were similar to study finding done by Chakraborty M et al which concluded that pre-diabetics had significantly high total cholesterol and triglyceride levels than normal healthy control subjects. (15)

According to the study conducted by Mohieldein et among young adult Saudis with prediabetics individuals' similar picture of the dyslipidemia was noted. Prediabetics had significant higher levels of total cholesterol, LDL, triglycerides and low levels of HDL in coherence with findings of present study (16)

As per, Knowler et al estimated that 37% of individuals with prediabetes would have diabetes in 4 years without intervention. (17)

Dyslipidemia is a prime cause in the development of atherosclerosis which results in cardiovascular disease (CVD) affecting heart, brain and vascular health leading

to both macrovascular and microvascular complication.<sup>(18)</sup>

The best part about dyslipidemia is it is a modifiable CVD risk factor at the early stages with life style modifications.<sup>(18)</sup>

If individuals with prediabetes apply the lifestyle intervention program, their risk of diabetes developing in 4 years decreases to about 20%.<sup>(17)</sup>

As in overt diabetes mellitus it is a proven fact that the increased cardiovascular disease (CVD) risk associated with type II diabetes is likely due in part to diabetic dyslipidemia characterized by elevated plasma levels of triglycerides, LDL cholesterol and decreased HDL cholesterol levels.<sup>(13-14)</sup>

So, in the present study from the results obtained, it can be interpreted that prediabetics have dyslipidemia which could be mainly due to constant prolonged increase in glucose blood levels. It signifies that prediabetic patients have a significantly greater risk for cardiometabolic disease and death, when compared with normal healthy controls.

As it estimated that India is expected to have approximately 41 million prediabetic population by the year 2045<sup>(1)</sup>. Henceforth, it is high time for early screening of serum lipid profile in prediabetic individual. Every six months screening for serum lipid profile along with healthy life style modifications should be advised to prediabetics.

Regular physical activity, healthy fibre rich with less refined sugar diet along with early screening of dyslipidaemia in prediabetes is a way forward to prevent future morbidity and mortality rising due to existing condition.

Ultimate aim in prediabetics should be to achieve and maintain normal blood glucose level in the blood to

prevent dyslipidaemia and seize its complications in human body.

Conclusion: Prediabetics have an altered serum lipid profile when compared to the healthy individuals. The above normal blood glucose levels in prediabetics can often lead to dyslipidaemia which can further cause substantial risk of developing cardiovascular disease affecting both macrovascular and microvascular health. It is the early diagnosis of dyslipidaemia along with life style modification is the way forward to modify the prediabetic state to normal glucose tolerance state for a healthier life.

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