

Original Article**Study of Lipid Profile in Pre-diabetes in OPD of a Tertiary Level Hospital**Suma Begum¹, Nazmin Haque², Bidhan Chandra Debnath³, Sakhina Khatun⁴**Abstract**

Background: Diabetes mellitus is a metabolic disease, associated with abnormal metabolism of all major nutrients like carbohydrate, protein and lipids. Though diagnostic criteria of DM are persistent hyperglycemia, but are also associated with dyslipidemia, which is a more serious risk factor for increase the chance of development of cardiovascular diseases (CAD). Before the development of classical symptoms and confirmed diagnosis, there may be an uncertain periods of years of impaired glucose regulation, a pre-diabetic state, when persons are not aware of probable associated dyslipidemia. This study was focused to observe the blood lipid status of pre-diabetic subjects.

Methods: It was an observational cross sectional study. Eighty four (84) study subjects were selected randomly from outpatient department of SWMC. Patients came with ailments not related to DM, were not aware of their glycemic status. Their weight, height and WC were measured and plasma glucose, HbA1c and lipid profile results were taken from hospital records with prior informed written consent. On the basis of HbA1c, subjects were divided into two groups, $\leq 5.7\%$, group1 (n=40) and 5.7-6.4% group 2(n=44). Results of Lipid profile, plasma glucose, HbA1c and BMI were analyzed statistically.

Results: BMI, WC, plasma glucose and HbA1c all were significantly increased in pre-diabetes subjects compared to normal persons. TC, LDL-C and TG were significantly elevated but HDL-C level was similar to normal subjects. It may be concluded that pre-diabetes is a dyslipidemic condition and awareness is needed long before established DM to prevent CAD in later life.

Keywords: Impaired glucose tolerance (IGT), impaired fasting glucose (IFG), lipid profile, Type 2 DM, waist circumference (WC), body mass index (BMI), cardiovascular diseases (CAD).

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Introduction

Diabetes is a serious complex condition; non-compliant individuals are in a risk for developing moderate to severe complications. Globally 5% of all deaths caused by DM, and its prevalence is also increasing. Its pathological complications are related with increased mortality and morbidity.¹

The defining diagnostic feature of diabetes is an abnormal glucose metabolism, categorized as 'pre-diabetes' in its early stage.² In pre-diabetics groups of individuals have greater chance of having increased level of low density lipoprotein cholesterol (LDL-c), high triglyceride (TG), low level of high density lipoprotein cholesterol (HDL-c), and therefore they may have more prone to experience cardio vascular disease (CVD). Impaired lipid profile i.e dyslipidemia can also occur in pre-diabetics and it is commonly associated with CVD in type 2 diabetes.³⁻⁴ The other risk factors of pre-diabetic includes high blood pressure, polycystic ovarian syndrome,

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gestational diabetes, being overweight especially those who have excess weight around the waistline, physically inactive, family history of type 2 diabetes and/or heart disease.⁵ Dyslipidemia in IGT patients indicated high risk category for cardiovascular diseases.⁶

Moreover increased dyslipidemia is associated with increased HbA1c.⁷ Reduction in HbA1c is associated with improved insulin sensitivity and better lipid parameters. Increased physical activity helps to improve dyslipidemic condition and there are several mechanisms are responsible for obtaining the effects of physical activity, as it decreases muscle and hepatic insulin resistance and increases glucose removal.⁸ Though, lifestyle modification and increased physical activity is associated with reduced HbA1c and they helps to better lipid and glycemic control. Thus, targeting to reduce the body weight and decrease the lipid parameter is likely to decrease HbA1c not only in diabetic individuals but also have an similar effect in non-diabetic individuals.⁹

One of the common secondary cause of hyperlipidemia is Diabetes mellitus, particularly, if glycaemic control is poor.¹⁰ According to the statement of American diabetic association (ADA), abnormal lipid profiles are when triglyceride level is ≥ 150 mg/dl, total cholesterol level ≥ 200 mg/dl, HDL level is < 40 mg/dl in males and < 50 mg/dl in females, LDL level is ≥ 100 mg/dl. Hence dyslipidemia was defined as the presence of one or more of the above-mentioned abnormalities in serum lipids.¹¹ Due to increased free fatty acid flux secondary to insulin resistance, changing of lipid parameters occur in diabetes.¹²

Pre-diabetes is a condition in which the plasma glucose level is above the normal but below the diagnostic threshold of diabetes mellitus. Impaired glucose metabolism includes two

conditions: Impaired fasting glucose (IFG) and Impaired glucose tolerance (IGT). IFG is a condition when fasting plasma glucose levels are above the normal but below the cut off used for diagnosing diabetes mellitus i.e (6.1-6.9 mmol/l) while IGT, a condition when 2 hr postprandial plasma glucose level are higher but still below the cut off used for diagnosing diabetes between i.e. (7.8- 11.0 mmol/l). Pre-diabetes are characterized by either impaired fasting glucose and impaired glucose tolerance or glycated hemoglobin (HbA1c) level between 5.7%-6.4% or both.⁶

Impaired lipid profile can also occur in pre-diabetes.¹³ Annually about 5-10% of pre-diabetic individuals become diabetic where as nearly 70 % of pre-diabetics gradually develop diabetes mellitus if not treated in early stage. Chronic complications (macro and micro vascular complications) may occur in IFG and the risk of CVD is decreased when early detection and treatment of dyslipidemia will started in IFG.¹⁴ Many studies have showed that lifestyle modifications in the pre-diabetic stage can delay the development of type 2 DM and also helps to prevent the development of the disease and CVD risk. This also increases the quality of life and life expectancy and reduces the economic burden on the society.¹⁵⁻¹⁶

It is assumed that there are at least five years hidden history of pre-diabetes before diabetes mellitus is diagnosed clinically and biochemically. To our knowledge limited study is available in Bangladesh about serum lipid profile when patient is not aware of suffering from pre-diabetes. It is well known that diabetes mellitus is a dyslipidemic condition. It is supposed that lipid profile might be abnormal in pre-diabetes state. This study was focused to observe the blood lipid status of pre-diabetic subjects. Early detection of impaired lipid profile in pre-diabetic phase will lower the risk of CVD and its complications.

Materials & Methods

It was an observational cross sectional study. Eighty four study subjects were randomly selected from OPD of Sylhet Women's Medical College, from June 2019 to September 2019. The patients had no previous history of DM or dyslipidemia and came to OPD for some other medical or gynecological diseases. Written consent was taken from all the subjects in previously prepared consent form. Weight and height was measured. BMI was calculated by using the formula of weight (kg) divided by height squared (meter) and used as the WHO criteria for Asian people for the diagnosis of overweight and obesity. Those having a BMI of 17.5-22.9 kg/m² were classified as normal weight, while 23.0-27.9 Kg/m² were classified as overweight and those having a BMI \geq 27 Kg/m² were defined as obese.¹⁶ By using a measuring tape the waist circumference was measured at the level midway between the lowest margin of rib and the iliac crest. According to WHO criteria for Asian people those WC with > 90 cm in male and >80 cm in female were classified as obese.¹⁶ Fasting venous blood was taken after an 8 hour of fast. Under aseptic precautions, 10 ml of fasting venous sample was collected for fasting plasma glucose, fasting lipid profile and HbA1c. They were analyzed on Vitros 250 dry chemistry fully auto analyzer. Fasting plasma glucose level <6.1 mmol/l is considered as normal and 6.1-6.9 is IFG. HbA1c level of \leq 5.7 % is normal and 5.7%-6.4% is considered as prediabetic. Statistical analyses were done by SPSS (version 22) using unpaired 't' test. Statistical significance was considered at p value <0.05.

Results

In our study total 84 cases were included. Among this there were 31 male and 53 were female. On the basis of HbA1c subjects were divided into two groups, \leq 5.7 %, group1 (n=40) and 5.7—6.4% group 2(n=44). Table 1 shows age and sex distribution of study subjects. BMI, WC, plasma glucose and HbA1c, all were significantly increased in pre-diabetes subjects compared to normal persons (Table-2).

Table-1: Age and sex distribution of study subjects

Parameters	HbA1c \leq 5.7% N=40	HbA1c (5.7%-6.4%) N=44
Age (yrs)	35.15	42.9
Sex		
Male	15	16
Female	25	28

Table-II: Anthropometric and pre diabetic measurements

Parameters	HbA1c \leq 5.7% N=40	HbA1c (5.7%-6.4%) N=44	p-value*
BMI	23.5	26.7	<0.001
WC	80.9	89.4	0.02
FBS	5.2	6.8	<0.001
HbA1c	5.0	5.9	<0.001

Unpaired 't' test done, level of significance was p<0.05

Table-III: Lipid profile in pre-diabetes

Parameters	HbA1c \leq 5.7% N=40	HbA1c (5.7%-6.4%) N=44	p-value*
TC	160.0 \pm 50.7	212.0 \pm 46.7	<0.001
TG	142.5 \pm 75.1	207.3 \pm 132.2	0.006
LDL-C	94.8 \pm 32.1	131.6 \pm 36.8	<0.001
HDL-C	38.2 \pm 13.2	38.1 \pm 9.5	0.06

Low density lipoprotein cholesterol (LDL-C), total cholesterol, (TC) and triglyceride (TG) were significantly elevated in pre-diabetes subjects compared to normal persons but there was no significant difference of high density lipoprotein cholesterol (HDL-C) level between two groups. (Table -3)

Discussion

In our study we enrolled 84 individuals having no history of diabetes mellitus or dislipidemia. We divided the subjects into 2 groups based on the HbA1c, group1 (n=40) having HbA1c \leq 5.7% and group 2(n=44) having HbA1c 5.7-6.4%. We measured the blood lipid status, BMI, WC, plasma glucose and HbA1c of subjects in both groups. We found statistically significant difference in BMI, WC, HbA1c and FBS in pre-diabetes subjects compared to normal persons. Bosi et al¹⁷ also found the association between BMI and pre-diabetes. Some other researchers also found the positive relationship between BMI and pre-diabetes.¹⁸⁻²⁰ In our study we showed that total cholesterol, triglycerides and LDL-C were statistically higher in group 2 as compared to group1. In this study there was no significant difference of HDL-C between two groups. Our findings were consistent with Chakraborty et al²¹ in their study they found FBS, HbA1C, TC, TG, LDL-C were significantly increased in pre-diabetics as compared with controls. HDL-C was significantly decreased in pre-diabetics. Biradar et al¹⁴ also showed the significant difference in FBS, HbA1C, TC and LDL in IGT groups when compared to the controls, but TG and VLDL did not show significant difference in IGT subjects than controls. HDL was significantly decreased in IGT than the controls. Our result was consistent with Singh et al¹³ in their study on pre-diabetes revealed that there was significant increase TC, TG, LDL and VLDL as compared to normal controls. And significant decrease in HDL in pre-diabetics compared to normal controls, but we did not found any significant difference of HDL between two groups, in our study we did not do VLDL. A study done by Kumar et al⁴ on pre-diabetics showed TC, TG, LDL were significantly increase than the normal controls and HDL was significantly decreased in pre-diabetics compared to controls. Chakarova et al²² found similar

results. Kansal et al¹⁵ also found increased levels of TC, TG, LDL-C, VLDL-C in pre-diabetic subjects as compared to controls except for HDL-C, which was significantly decreased. This dyslipidemic pattern in pre-diabetic is very much similar to findings of previous studies.²³⁻²⁶

Conclusion

Pre-diabetic person are dyslipidemic and obesity prone, though they are asymptomatic and unaware of impaired glucose regulation. BMI, WC, plasma glucose and HbA1c all were significantly increased in pre-diabetes subjects compared to normal persons. TC, LDL-C and TG were significantly elevated but HDL-C level was similar to normal subjects. These pre-diabetic subjects are at higher risk of developing cardiovascular disease because of their dyslipidemia. Pre-diabetes is a dyslipidemic condition and awareness is needed long before established DM to prevent CAD in later life. We recommend proper screening for pre-diabetic and their associated dislipidemia to reduce the cardiovascular risk. Pre-diabetic individuals should be followed up with advice of active life style to improve their cardiovascular health.

Conflict of Interest: The authors declare no conflict of interest.

Author Contribution: Conceptual work: Bidhan Chandra Debnath; Data collection: Suma Begum, Nazmin Haque and Sakhina Khatun; Manuscript writing: Suma Begum; Editing of final manuscript: Bidhan Chandra Debnath

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