A Study of Changes in Lipid Profile among Pre-diabetics and Diabetics in Population of Lucknow

MC Srivastava[1], Awadhesh Chandra Nagar[2], Anju Gautam[3], Ruchi Srivastava[4]

ABSTRACT

Introduction: Cardio vascular disease (CVD) is the leading cause of mortality and morbidity in diabetes mellitus (DM) contributing to 65% of all deaths with diabetic complications. Detection of the deranged lipid profile in the pre-diabetic state has been shown to be associated with increased risk of atherosclerosis. This study was planned to compare changes in lipid profiles of patients with pre-diabetes and diabetes in population of Lucknow, India.

Material and Methods: A total of 236 cases (115 Pre-diabetic and 121 Diabetic) who fulfilled the inclusion and exclusion criteria of this study were enrolled. The patients were evaluated for serum fasting blood sugar (FBS), post prandial blood sugar (PPBS), HbA1c, total cholesterol (TC), triglycerides (TGs), in the two groups. The results were statistically analysed using SPSS statistical package version 20.

Results: The mean value of total cholesterol were 179.21±8.12mg/dl in pre-diabetics and 182.31±7.99mg/dl in diabetics, which was statistically not significant (p=0.003). The mean value of triglyceride in pre-diabetics was 134.43±5.21mg/dl and in diabetics 167.87±7.37mg/dl which is statistically significant (p<0.001).

Conclusion: The altered lipid profile in pre-diabetics signifies an increased susceptibility to CVD in the long run. Therefore, screening of pre-diabetics for dyslipidemia is recommended to arrest the development of cardiovascular complications.

Keywords: Dyslipidemia, Pre-diabetes, Total Cholesterol, Triglyceride

INTRODUCTION

The prevalence of diabetes, which is associated with increase in morbidity and mortality, is increasing and it is one of the major healthcare problems in the world.[1] Dyslipidemia occurring in diabetic patients, play an important role in acceleration of macrovascular atherosclerosis and contribute to the risk of cardio vascular disease (CVD). Studies have shown that heart disease and atherogenic progression in diabetic patients have presented in the pre-diabetic phase.[2,3] Pre-diabetes generally refers to an intermediate stage between the clinical entity of type 2 diabetes and normal glucose levels. Pre-diabetes 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] Effects of the disease can be macrovascular, as seen in the cardiovascular system, or microvascular, as seen with retinopathy, nephropathy, and neuropathy. Pre-diabetes also been shown to be associated with increased risk of atherosclerosis.[5,6,7] Lipids play a critical role in pathogenesis of macrovascular complications of diabetes.[8] The derangement of lipid profiles and atherogenic indices start in the pre-diabetic state, much before the development of diabetes mellitus.[9,10] Keeping in view the prevalence and increased risk of cardiovascular disease in diabetes, it is becoming necessary to diagnose pre-diabetic individuals and assess their lipid profile and prevent them from developing overt diabetes. So the present study was conducted to determine and compare the changes in lipid profile among patients with pre-diabetes and diabetes in the population of Lucknow, India.

MATERIAL AND METHODS

This observational study was conducted in the Department of Medicine over a period of six months. The study participants were selected after applying inclusion and exclusion criteria and after obtaining their informed consent. The Ethical Committee of the institution had approved the study. A total number of 236 patients participants were divided into two groups – 115 Pre-diabetes and 121 Diabetes. All the patients were evaluated for serum fasting blood sugar (FBS), post prandial blood sugar (PPBS), HbA1c, total cholesterol (TC), triglycerides (TGs), in the two groups.

Inclusion Criteria: Diabetics with history of the disease for ≥1 year and not on any form of treatment or dietary management for the last 1 year are included in the study so as to get a fair picture of the effect of hyperglycemia on the lipid profile indices.

The diabetic group included the following criteria: fasting plasma glucose level greater than or equal to 126 mg/dL, 2-hour plasma glucose level greater than or equal to 200 mg/dL during an oral glucose tolerance test, HbA1c levels greater than or equal to 6.5% and random plasma glucose of greater than or equal to 200 mg/dL.[4]

[1]Assistant Professor, Department of Medicine, PIMS,Banthara, Lucknow (UP), [2]Medical Officer, SS Hospital, BHU, Varanasi (UP), [3]Associate Professor, Department of Periodontology, Faculty of Dental Sc, IMS, BHU, Varanasi (UP), [4]Associate Professor, Department of Periodontology, Saraswati Dental College, Lucknow (UP), India

Corresponding author: Dr. Ruchi Srivastava, Associate Professor, Department of Periodontology, Saraswati Dental College, Lucknow (UP), India

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The pre-diabetic group included the following criteria: fasting glucose (100–125 mg/dL), impaired glucose tolerance (2-hour glucose level of 140–199 mg/dL after a standardized meal), and glycosylated hemoglobin (HbA1c) level of 5.7%–6.4%.

Exclusion Criteria: Patients with history of renal disorders, those on any form of lipid lowering therapy, hypoglycemic drugs, smokers, alcoholics, non-compliant and uncooperative patients were excluded from the study.

Sample Collection: Venous samples from the patients were collected in standardized EDTA, fluoride and plain vials under aseptic conditions for carrying out the measurements of HbA1c, plasma glucose and fasting lipid profile.

STATISTICAL ANALYSIS

All necessary statistical analysis was done including the percentages, means, standard deviations, ranges and p values using SPSS statistical package version 20. A *p* value < 0.05 was considered statistically significant.

RESULTS

Pre-diabetics and diabetics who met the criteria (for pre-diabetes FBS >100 to 125mg/dl and PPBS >140 to 199mg/dl, HbA1c 5.7 to 6.5%, and for diabetes FBS >125mg/dl and PPBS >200mg/dl, HbA1c >6.5%) were included in the study. The results were statistically analysed using SPSS statistical package version 20. Total 236 cases were included in the study of which 115 (48.7%) were pre-diabetic and 121 (51.2%) were diabetic. Of the total cases, 119 (50.4%) were male and 117 (49.5%) were females. Among the 115 pre-diabetics, 56 (48.70%) were males and 59 (51.30%) were females. Out of the 121 diabetics, 63 (52.07%) were males and 58 (47.93%) were females. There was no significant difference in the sex distribution between the pre-diabetes and diabetes groups. The sex distribution of the study population is depicted in Table 1 and Figure 1.

The age distribution of the pre-diabetics and diabetics is shown in Figure 2. There was no significant difference in the age distributions of the pre-diabetics and diabetics in our study.

When the fasting lipid profiles (total cholesterol and triglycerides levels) of the two groups were compared as in Table 2, the following results were found. The fasting total cholesterol and triglyceride levels, were significantly increased in pre-diabetics as compared with the diabetic patients. The mean values of total cholesterol were 179.21±8.12mg/dl in pre-diabetics and 182.31±7.99mg/dl in diabetics. This difference in the mean value of total cholesterol between the two groups was statistically not significant (p=0.003). The mean value of triglyceride in pre-diabetics was 134.43±5.21mg/dl and in diabetics 167.87±7.37mg/dl which is statistically significant (p<0.001). This mean value of triglyceride in the diabetics was found to be significantly higher compared to the pre-diabetics. Thus we concluded that as pre-diabetes progress to diabetes, the fasting triglyceride level rises significantly whereas total cholesterol is not much affected.

| Status	Total no. of patients (%)	No. of Male patients (%)	No. of Female patients (%)
Pre-diabetes	115	56 (48.70%)	59 (51.30%)
Diabetes	121	63 (52.07%)	58 (47.93%)
Table-1: Sex distribution among Pre-diabetes & Diabetes			

Status	Total Cholesterol Mean (mg/dl)	Triglyceride Mean (mg/dl)
Pre-diabetes	179.21±8.12	134.43±5.21
Diabetes	182.31±7.99	167.87±7.37
P Value	0.003 (NS)	0.001 (S)
Table-2: Total cholesterol and triglyceride levels among pre-diabetes and diabetes		
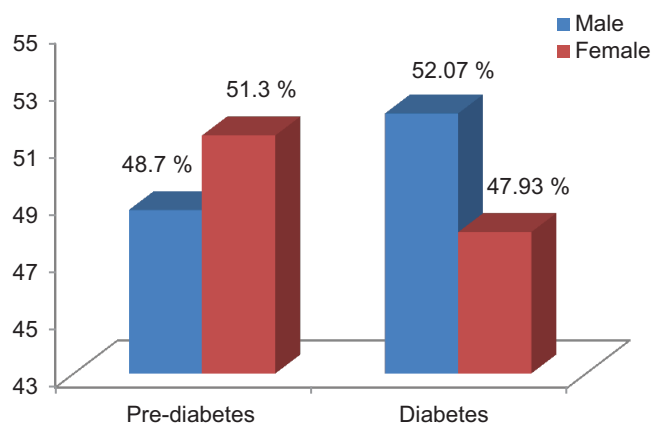
Figure-1: Sex distribution among Pre-diabetes & Diabetes
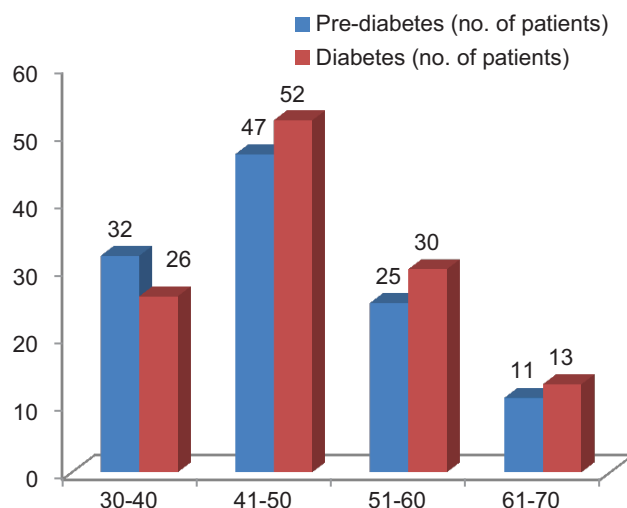
Figure-2: Age distribution among Pre-diabetes & Diabetes

DISCUSSION

The most important cause of Cardio vascular disease (CVD) is atherosclerosis, and dyslipidemia acts as a marker of developing atherosclerosis.[11,12] CVD is the leading cause of mortality and morbidity in diabetes mellitus (DM) contributing to 65% of all deaths with diabetic complications.[13] The exact relationship between pre-diabetes and CVD is still unclear and controversial. The dyslipidemia in Type 2 DM is, in general, characterized

by elevated triglycerides. Results of our study showed that the prevalence of dyslipidemia in pre-diabetic subjects was significantly more than in the control group. The results of our study were in accordance with the study done by Chakraborty M et al.[14] They concluded that pre-diabetics had significantly high total cholesterol and triglyceride than diabetics. In some studies, 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.[15,16,17] Apart from the differences in the plasma peak levels of glucose and/or insulin, difference in lipid profiles has also been proposed as a possible explanation for this. 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. This rise in triglyceride levels can be explained on the basis of increase in insulin resistance as the pre-diabetic progress to diabetic state.[18] Prospective and observational studies showed that diabetes developed approximately in 25-40% of pre-diabetic patients after three to eight years.[19] According to the pathogenesis and natural history of diabetes, it has a prolonged pre-diabetic phase. The results of the present study also showed that aging led to an increase in the prevalence of diabetes, and female patients showed a greater prevalence of than male patients. The mean age of pre-diabetics and diabetics in our study is almost in coherence with the study by Bhatnagar MK et al.[20] Among the cases whose records were reviewed, 51.30% were females in pre-diabetics group. This might be because of the high turnout of females in the OPD as compared with males.

With respect to the lipid profile, the total cholesterol and triglyceride levels were also higher in the pre-diabetics group as compared to the diabetic group. The derangement of lipid profile in the pre-diabetic state is much before the development of established diabetes mellitus. Evidence advocates that pre-diabetic patients have a significantly greater risk for cardiometabolic disease and death, when compared with normal subjects. In this study we took cut off for normal fasting blood sugar <110 mg/dL, because in India, it is commonly used by the biochemists and clinicians. From the above study it could be suggested that the lifestyle modification, dietary restriction and treatment of dyslipidemia should be encouraged at the earliest in pre-diabetic state.

CONCLUSION

Obesity, hypertension and dyslipidemia are important cardiovascular risk factors in pre-diabetic patients. Our results suggest the prevalence of dyslipidemia in pre-diabetic subjects was significantly higher than in the control group. Further studies must be carried out with inclusion of larger sample size, comprehensive assessment of immune status of patients. These pre-diabetic individuals, because of their dyslipidemia are at higher risk for developing cardiovascular disease. Screening program, preventive strategy, risk factor detection and pharmacotherapy are important for pre-diabetic patients to decrease the risk of cardiovascular disease.

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