COMPARATIVE ANALYSIS OF ATHEROGENIC INDEX OF PLASMA AND BODY MASS INDEX IN TYPE II DIABETES MELLITUS PATIENTS

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ABSTRACT

Background: Diabetes mellitus is the leading cause of mortality and morbidity world over. Cardiovascular diseases due to diabetes mellitus are related to deranged lipid profile. Hence it is important to check lipid profile in diabetics. And atherogenic index of the plasma is a good indicator to assess lipid profile and it is calculated through the formula of log[TG/HDL-c]. Obese and overweight people are at higher risk for developing diabetes and cardiovascular complications. Hence it is important to check body mass index and atherogenic index of plasma of diabetic patients and if there are cases with deranged lipid profiles they should be treated as early as possible to prevent future complications. **Objectives**: To find out co-relation between body mass index & atherogenic index in type II diabetes mellitus patients. **Study design:** A Case control observational study. **Settings:** Central Clinical Laboratory of MIMER Medical college, Talegoan Dabhade, Pune & Department of biochemistry, Talegoan Dabhade, Pune. **Data Sources& Analysis:** Serum lipid levels & BMI of 66 subjects [33 were cases & 33 were age and sex matched controls] was estimated and analyzed and correlation between them was observed. **Results:** Diabetic patients showed higher values of total cholesterol of 182.54 ± 37.95 mg/dl, TG 145.45±25.24 mg/dl, LDL cholesterol 105.66 ± 26mg/dl, and lower values of HDL cholesterol 43.09 ± 8.85 mg/dl, as compared to controls with total cholesterol levels of 170 ± 36.45 mg/dl, TG levels 66.30 ± 16.96 mg/dl, LDL 99.97 ± 23.82 mg/dl, and HDL 44.33 ± 15.96 mg/dl. Average atherogenic index and BMI values were 0.51 ±0.14, 27.78 ± 2.26 and 0.17 ± 0.15, 23.46 ± 2.77 in cases and controls respectively. **Conclusion:** Diabetics showed higher values of atherogenic index and BMI as compared to normal controls and there was a positive correlation in between BMI and A.I. but it was not significant.

KEYWORD: atherogenic index, BMI, Diabetes Mellitus, Risk of cardiovascular diseases.

INTRODUCTION

India is one of the six countries of the IDF [Indian Diabetes Federation] in South East Asia region. 425 million people have diabetes in the world and 82 million people in the South East Asia Region; by 2045 this will rise to 151 million. There were over 72 million cases of diabetes in India in 2017.[1] As per the WHO Diabetes mellitus is a chronic disease caused by inherited and/or acquired deficiency in production of insulin by the pancreas, or by the ineffectiveness of the insulin produced. There are two principle forms of diabetes: Type I diabetes in which the pancreas fails to produce the insulin which is essential for survival. Type II diabetes which results from the body's inability to respond properly to the action of insulin produced by the pancreas. Type II diabetes is much more common and accounts for around 90% of all diabetes cases worldwide. It is the leading cause of mortality and morbidity world over. Much of this increase will occur in developing countries and will be due to population growth, ageing, unhealthy diets, obesity and sedentary lifestyles.[2]

The dyslipidemia presents a major [probably the most important] link between diabetes and cardiovascular disease. The characteristic lipid changes are not only seen in patients with overt diabetes but also in patients with metabolic syndrome and are therefore believed to reflect insulin resistance rather than hyperglycemia.[3] Diabetic dyslipidemia has been the main focus of discussions regarding the interaction between glucose and lipid metabolism.[4] Excess body weight, a burgeoning problem worldwide, is a major risk factor for cardiovascular disease. Obesity is associated with a pro-inflammatory state marked by chronic elevations of systemic adrenergic activity, dyslipidemia and hyperglycemia.[5] To prevent cardiovascular complications due to deranged lipid profile and high

body mass index it is important to assess lipid profile and BMI of type II DM patients.

Instead of looking at classic ratios of HDL/Total Cholesterol, now scientists propose that we instead bring to the spotlight triglycerides. The atherogenic index of the plasma is calculated through the formula of log[TG/HDL-C] where your triglycerides levels are divided by your good cholesterol.[7] Atherogenic index is a good indicator to assess lipid profile in diabetics. Atherogenic index of plasma is a logarithmically transformed ratio of molar concentrations of triglycerides to HDL-cholesterol. The strong correlation of AIP with lipoprotein particle size may explain its high predictive value.[6]

By knowing A.I. levels and BMI [Body Mass Index] in these patients and making the patients change their dietary habits and life-style so as to normalize lipid profile in cases of deranged lipid profile, it is possible to avoid incidence of cardiovascular complications in future.

MATERIALS AND METHOD
A total of 66 subjects were included visiting the outpatient and inpatient department of Medicine of Bhausaheb Sardesai Rural Hospital Talegoan Dabhade during the period of two months after obtaining an approval from Institutional Ethics Committee. Thirty three Type 2 diabetes mellitus patients and thirty three sex and age matched controls were included in this study. Patients with diabetic ketoacidosis, smokers and patients on drugs[lipid lowering] were excluded from study as they can affect lipid profile. A Case control observational study was conducted. After obtaining an informed consent from the participant, five ml of fasting[12-14 hr] venous blood sample under aseptic conditions was obtained for checking serum lipid levels. Serum total cholesterol[14], TG[15], HDL[16], LDL[16] was estimated and atherogenic index of plasma was calculated by using formula log[TG/HDL].[12] BMI i.e

body mass index in patient was calculated from height and weight by using formula BMI = Weight (kg)/Height(m)2. The data was analysed by using Excel.

RESULTS
This study was conducted in 33 cases that is patients with type II diabetes and 33 controls, they were selected according to inclusion and exclusion criteria. The mean lipid levels and BMI values of cases and controls are given in Table no.1. Distribution of lipid levels i.e total cholesterol, TG,LDL,HDL among cases and controls is depicted in Figure1. Average BMI and A.I values are depicted in Figures 2 & 3 respectively. p values calculated from students t test for above criterias are mentioned in Table no. 1 only. p values of TG,BMI & A.I. were less than 0.05 which is statistically significant value that means triglyceride levels, Atherogenic index and body mass index values were significantly increased in cases as compared to controls. p values in case of total cholesterol, LDL,HDL were more than 0.05,that they were not statistically significant which may be due to small sample size.

r values between BMI and A.I. for cases and controls separately are given in Table no.2. There was a positive correlation in between BMI and A.I in both cases and controls found, but it was not significant.

The relation between BMI and A.I. in cases and controls is shown using a scatter diagram in Figures 4 and 5 respectively. As study revealed that there was positive relation of BMI & A.I., increase in BMI caused increase in lipid levels hence increase in Atherogenic index. This suggests that diabetic patient who are overweight or obese were at higher risk of high lipid levels related problems. Study also revealed that in case of 6 controls out of 33, BMI value was above 25kg/m2 and also there were high A.I. values seen. That means non diabetic obese patients have higher risk of cardiovascular diseases as compared to non obese controls.

Table no. 1: showing observations of BMI, A.I. and lipid levels in cases and controls and p values for the same.

	Cases	Controls	p value
Total Cholesterol	182.54±37.95	170±36.45	0.0894#
TG	145.45±25.24	66.30±16.96	0.00*
LDL	105.66±26	99.97±23.82	0.1788#
HDL	43.09±8.85	44.33±15.96	0.3486#
A.I	0.51 ±0.14	0.17±0.15	0.00*
BMI	27.71±2.26	23.46± 2.77	0.00*

*statistically significant value, # not significant

Table no.2: showing r values between BMI and A.I. in cases and controls.

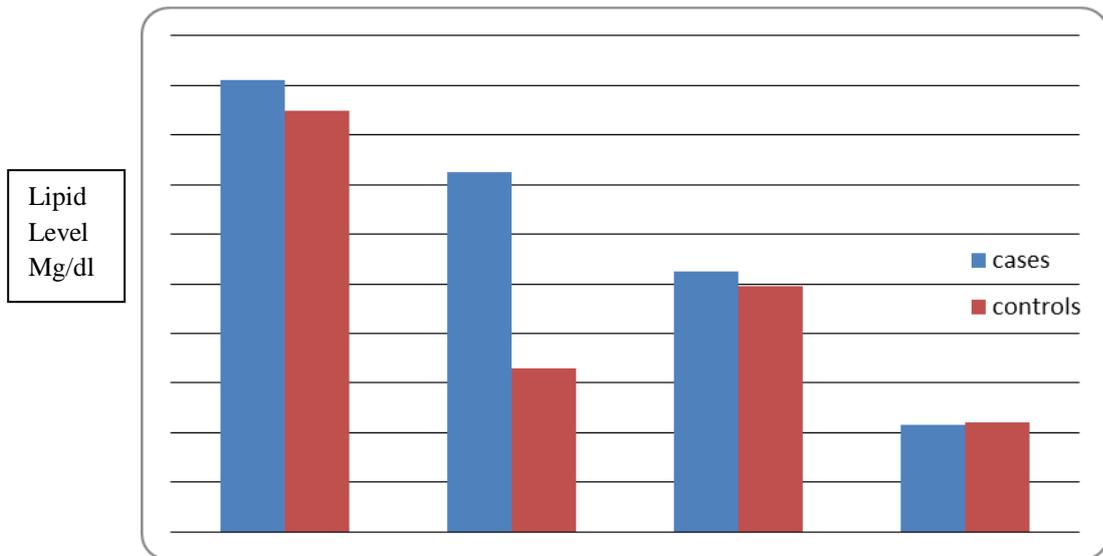|	Cases	Controls
r value	0.7135	0.4062

Lipid
Level
Mg/dl

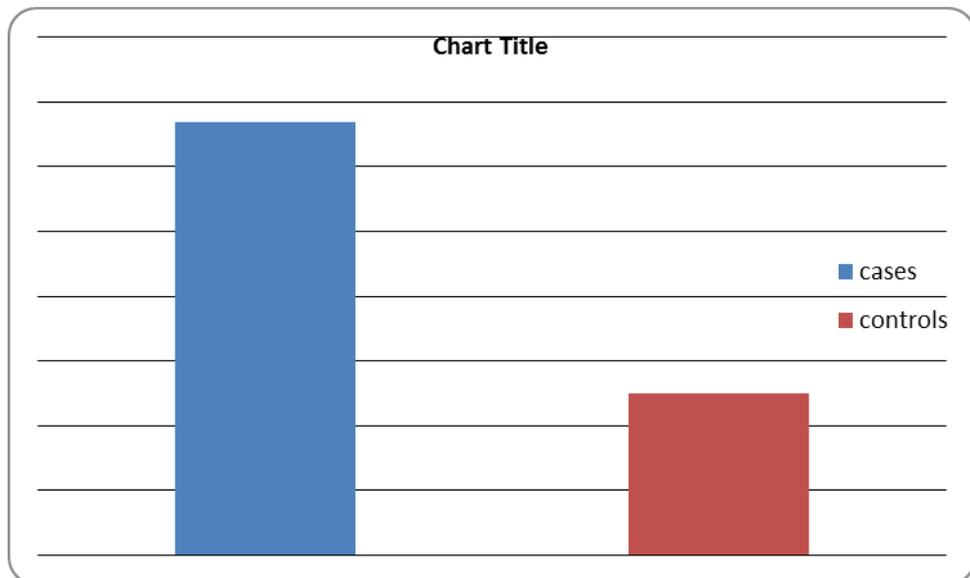**Figure 1: showing distribution of average lipid values in cases and controls.**

Figure 2: showing average BMI values in cases and control.
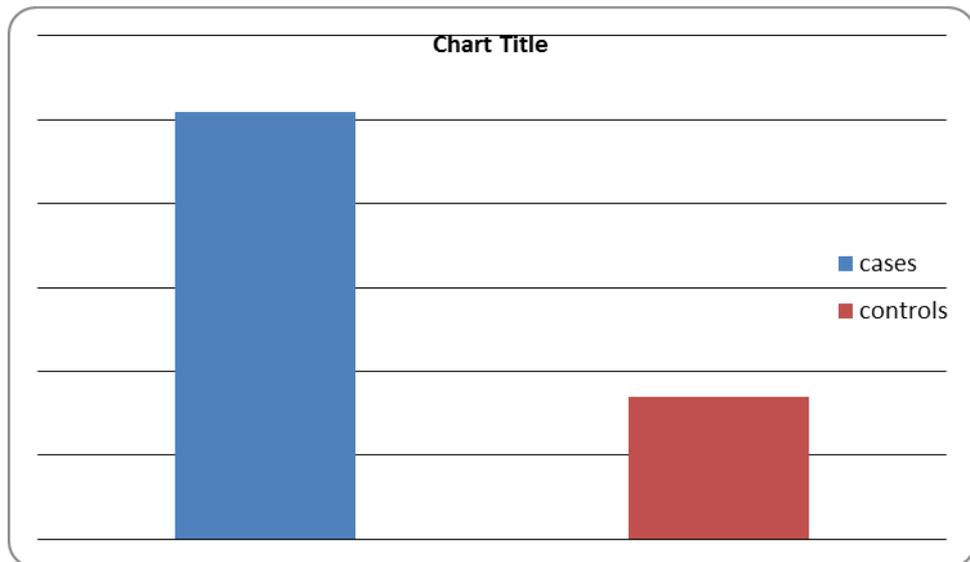

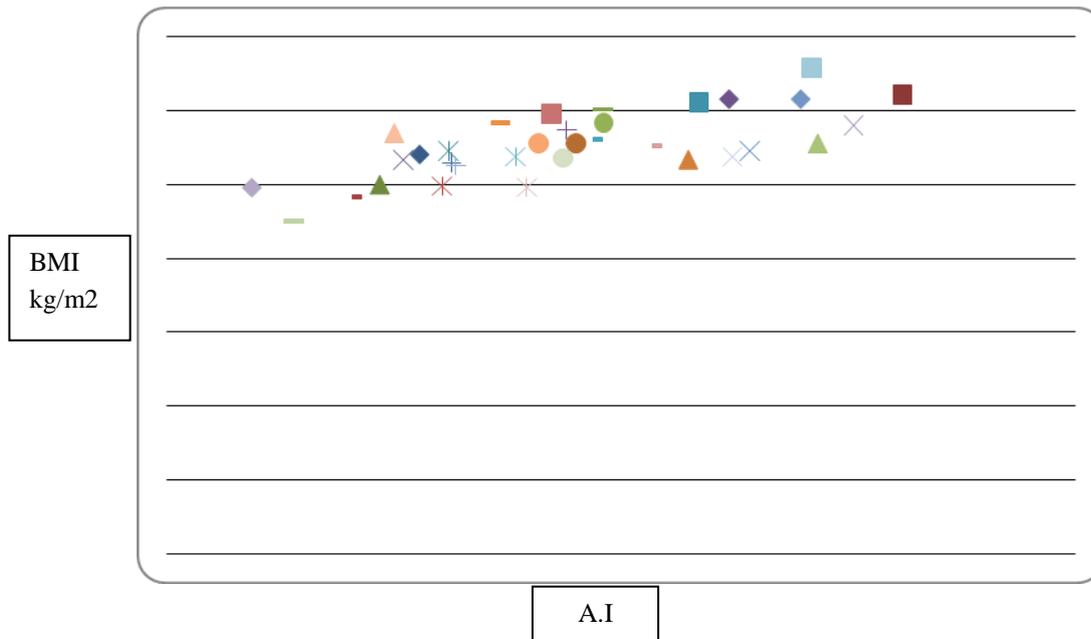**Figure 3: showing average A.I. value in cases and controls.**

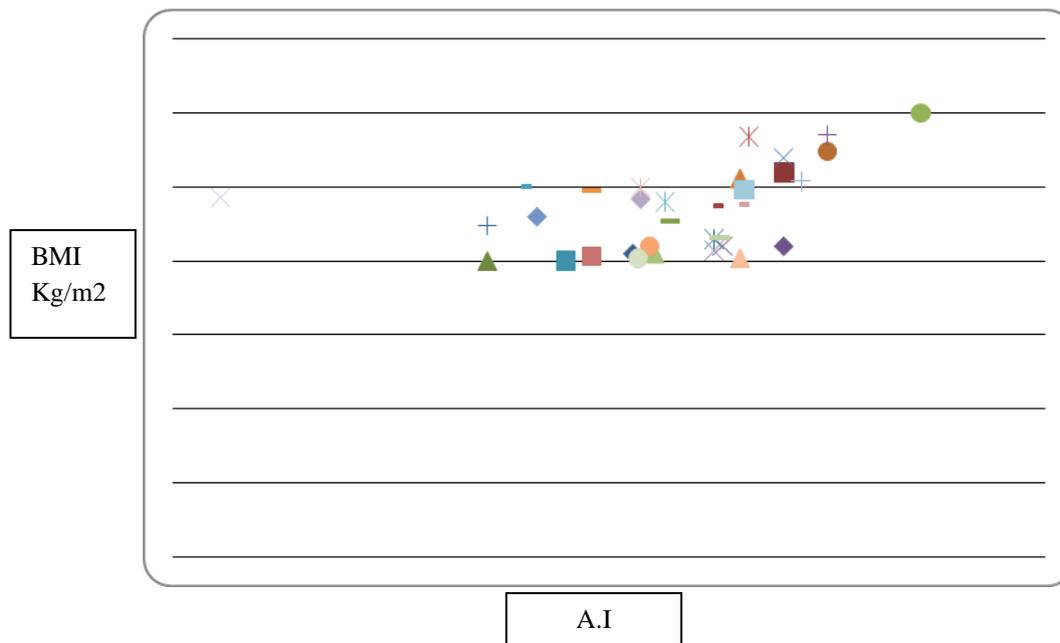**Figure 4: showing relation of BMI and A.I in cases.**

Figure 5: showing relation between BMI and A.I in controls.

DISCUSSION

The incidence of diabetes mellitus (DM) continues to rise and has quickly become one of the most prevalent and costly chronic diseases worldwide. A close link exists between DM and cardiovascular disease (CVD), which is the most prevalent cause of morbidity and mortality in diabetic patients. Cardiovascular (CV) risk factors such as obesity, hypertension and dyslipidemia are common in patients with DM, placing them at increased risk for cardiac events.[8] According to study conducted by Vinik et al., 2013 a three-fold increase in the incidence of CVD in DM patients has been reported and CVD has become the major risk factor for DM-associated morbidity and mortality.[9]

Ortega *et al*,in an article entitled "Obesity and Cardiovascular Disease", discuss the complex relationship between obesity and cardiovascular disease.[10] Association of visceral fat obesity, insulin resistance may aggravate the atherogenic lipoprotein profile. Hence obesity and dyslipidemia due to diabetes are two main factors causing cardiovascular diseases and both of these factors can be modified only if immediate actions are taken to reduce weight and change of sedentary lifestyle. Atherogenic index is an important indicator of lipid profile in diabetics. Same is proved in a study conducted by Dobiásová M.et. al.[6] It mentioned that the Atherogenic index of plasma is a logarithmically

transformed ratio of molar concentrations of triglycerides to HDL-cholesterol. The strong correlation of AIP with lipoprotein particle size may explain its high predictive value.

The present study confirms the presence of more atherogenic lipid profile in type 2 diabetes mellitus patients and non diabetic obese & overweight patients. In diabetics it may be Insulin deficiency which causes higher metabolization of free fatty acid and can cause disorder in lipid metabolism. There is increase in triacylglycerol level may be due to the accumulation of triacylglycerol, could as a result of increased lipogenesis, decreased clearance or reduced fatty acid oxidation. Insulin resistance causes more catabolism of HDL particles and formation of LDL particles. Hence increase in LDL and decrease in HDL levels in type 2 diabetes. This study revealed the same that as compared to non-diabetic control group, type 2 diabetes mellitus patients showed high triglycerides,LDL,total cholesterol and low HDL-c levels . In our study we found that there was significant rise in BMI, A.I and T.G values in cases, LDL and total cholesterol values were also increased but that were not significant. Same results were obtained in a study conducted by Wamique et.al.[11]

CONCLUSION
We conclude here that the lipid profile and BMI are two important factors in assessing risk of cardiovascular diseaes. As results of our project clearly suggests that there is direct relation of Body mass index and Atherogenic index which is a lipid profile indicator. Patients with Type II diabetes mellitus and non diabetic patients who are obese or overweight are at higher risk of developing high lipid related cardiovascular complications, hence strict monitoring of BMI and A.l. is important in these patients.

By making the patients change their dietary habits and life-style so as to normalize lipid profile in cases of deranged lipid profile and to maintain normal weight, it is possible to avoid incidence of cardiovascular complications in future.

ACKNOWLEDGEMENT

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