Correlation between Body Mass Index and Blood Glucose Levels in Jharkhand Population

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ABSTRACT

Introduction: Obesity is the leading factor in the pathogenesis of health disorders such as hypertension and type-2 diabetes mellitus. Since BMI is the associated with obesity, the present study has been carried out to evaluate the association between Fasting Blood Glucose (FBG) level and BMI.

Material and Methods: A prospective study has been carried including 150 subjects between 20-70 years were enrolled in the study, comprising of 103 females and 47 males from PMCH, Dhanbad and RIMS, Ranchi. Statistical calculation was done using SPSS.

Results: The mean BMI was in the overweight range, 25.58 ± 4.77 kg/m2 and was higher in females. FBG, SBP and DBP increased significantly with increasing BMI status (*P*=0.001, *P*=<0.0001 and *P* =<0.0001 respectively). Older people were having higher BP (*P* value = 0.04). There was a significant positive correlation between BMI and fasting blood glucose (r=0.751, *P* <0.0001).

Conclusion: BMI and FBG are positively correlated and subjects are therefore at risk of Obesity and its related conditions.

Keywords: Blood Pressure, Body Mass Index, Obesity, Fasting Blood Sugar, Diabetes

INTRODUCTION

Obesity is the leading public health challenge in India and across world. Indians are highly susceptible to diabetes with modest over weight, central obesity, and decrease in physical activity. As per report by Kelly et al. in 2005[1], the overweight and obese adults were 937 million and 396 million respectively worldwide and the figure has almost doubled in number in comparison to past 20 years.[2] The incidence and prevalence of diabetes and cardiovascular disease in India increasing and is a result of dietary habits and life style. In adults the prevalence of diabetes is 2-3 folds greater in urban than in rural population. National surveys showed that there has been a marked decrease in under nutrition and significant increase in the prevalence of overweight and obesity, more specifically among the urban populations of India.[3-6] Glucose synthesizes fatty acid that constitute body fat content. An increase in blood glucose level will result in increase in BMI causing increased lipid biosynthesis and hence body weight.[7] Insulin which is secreted from beta cells of islets of langerhans from pancrease act through specific cell receptor of insulin sensitive cells which results in enhanced glucose uptake into the cell.[8] Insulin being an anabolic hormone results in energy conservation and thereby signaling the body to produce fat. As BMI increases, insulin resistance also increases which results in increased blood glucose level in body. Since body weight is associated with BMI, it may be expected that BMI should correlate with blood glucose levels. As per result obtained by[9] no significant statistical correlation between the random blood sugar level and Body Mass Index (BMI). In view of above the aim of this study is to evaluate the association between FBG level and BMI in men and women among Jharkhand. The currently recommended cut-offs of include 18.5 - 24.9 kg/m for normal, 25.0 - 29.9 kg/m for overweight and >30 kg/m for obesity. The Health recommended by World Health Organization.

MATERIAL AND METHODS

A prospective study had been carried out at PMCH, Dhanbad and RIMS, Ranchi. Patients attending the medical outpatient department were invited to participate in the study. 150 subjects were enrolled in the study, comprising of 103 females and 47 males.

Inclusion Criteria

Subjects of either gender between 20-70 years and not taking any antidiabetic drugs.

Exclusion Criteria

Patients suffering from diseases like liver disease, renal disease, cardiac disease, respiratory disease or any other acute or chronic diseases as well as patients suffering from AIDS, thyroid disorder, psychiatric illness or on insulin therapy were also excluded. Pregnant women are also not included in the study.

For the collection of blood sample, tourniquet was applied in the arm and blood was taken from antecubital vein of the patient. The collected blood was allowed to clot for 30 minutes. Serum was separated from cells and collected in a separate labeled aliquot vial. FBG measurement was done in morning after 12-hour fast using laboratory kits. A fasting blood sugar level above 126 mg/dl was confirmed as diabetic. Weight was recorded to nearest 0.5 kg and height was recorded to nearest 0.5 cm. Height was measured in standard standing position without shoes by using a tape meter, while keeping shoulders in erect position. Body mass

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index (BMI) was calculated by the formula weight (kg) divided by height squared (meter). Subjects with a BMI of 18- 22.9 kg/m2 were classified as normal weight, 23.0-24.9 Kg/m2 were classified as overweight and those with a BMI greater than or equal to 25 Kg/m2 were defined as obese.

STATISTICAL ANALYSIS

ANNOVA and cross tabulation was used to perform statistical calculation using SPSS. P value less than 0.05 was considered significant. The data were expressed as mean ± SD.

RESULTS

Out of total patients, 68.7% were females and 31.3% males. 67.3% patients were non diabetic and 32.7% patients were diabetic. 73.3% patients were found to have normal BMI (18-22.9 kg/m) and non diabetic, 13.9% patients were underweight and non diabetic. 11 patients (10.9%) were overweight (23-24.9 kg/m) and only 2% patients were obese having BMI >25 kg/m. 73.5% of diabetic patients were overweight and diabetic and 26.5% of the diabetic patients were obese (Table 1 and Figure 1).

21.6% of all subjects were hypertensive, 50.3% had prehypertension and 28.1% had normal

BP. 56.2% of the subjects were healthy, 19% were underweight, 21.2% were overweight and only 3.6% of subjects were obese. It can be observed from Table 2 that fasting blood glucose significantly varied among normotensive, prehypertensive and hypertensive group (p value 0.001). Similarly systolic blood pressure, diastolic blood pressure and BMI has statistical signification variation among the groups (*P* value <0.0001).

It can also be observed that males and females varied significantly in the three groups (*P* value 0.04, Table 2). However, it can be observed that Individuals with higher BP tended to be older (*P* value 0.02). There was a significant positive correlation between BMI and fasting blood glucose (r=0.751, *P* <0.0001)

DISCUSSION

It has been observed that Indians are highly susceptible to diabetes cardiovascular risk even with only modest overweight, central obesity and decrease in physical activity.[6,10] As per World Health Organization (WHO) expert group, Asians have different associations between body mass indexes, the percentage of body fat and the health risk of type 2 diabetes as compared to the other populations. A study by Singh et al[6] demonstrated the prevalence of diabetes to be 8.2% in urban India and 2.4% in rural South India. A study conducted in a diabetic clinic at a university hospital, showed a statistically significant higher BMI diabetic patients compared to non - diabetics.[11] We have got statistically significant differences between BMI groups (underweight, normal, overweight, Obese) and RBS, SBP and DBP. These findings are in accordance with other studies, which showed

	Healthy	Under Weight	Over Weight	Obese	p-value
Non Diabetic	74 (73.3%)	14 (13.9%)	11 (10.9%)	2 (2.0%)	<0.0001
Diabetic	0	0	36 (73.5%)	13 (26.5%)	

Table-1: Diabetes Mellitus in BMI classes.

	Normotensive group	Pre-hypertensive group	Hypertensive group	P -value
Sex	0.26 ± 0.44	0.32 ± 0.47	0.38 ± 0.49	0.04
Age	46.26 ± 11.51	48.44 ± 11.54	51.17 ± 13.27	0.02
Fasting Blood Glucose	108.80 ± 23.46	115.32 ± 27.41	133.14 ± 31.84	0.001
SBP	118.17 ± 22.53	130.03 ± 12.99	156.34 ± 14.66	<0.0001
DBP	71.61 ± 3.78	83.60 ± 4.69	91.10 ± 5.38	<0.0001
BMI	22.49 ± 4.34	24.48 ± 4.04	27.24 ± 4.11	<0.0001

Table-2: Anthropometric parameters in Hypertensive classes

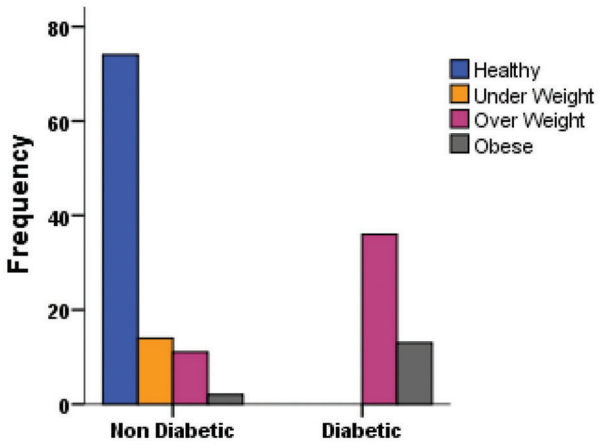

Figure-1: Diabetes status in BMI classes.

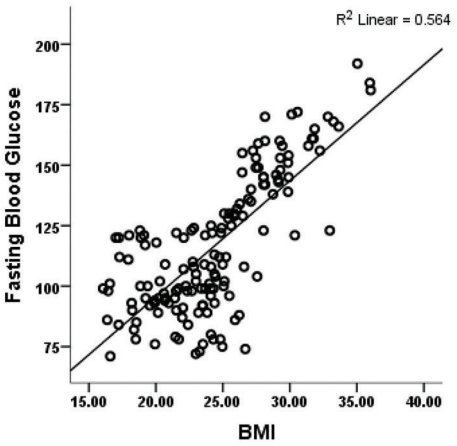

Figure-2: Correlation between FBG and BMI

that overweight and obesity are consistent parameters associated with cardiovascular risk in most populations.[12-14] The mean BMI found in our study was in the overweight range and is higher in females. This is similar to findings of another study in Nigeria.[15] High average BMI has been reported by research workers in many studies in Asia.[16-18] The finding of an average BMI that is in the overweight suggests a possible interplay of genetic factors, sedentary lifestyle and lack of exercise among Indians. Our study revealed that mean SBP, DBP, and RBS level showed a positive correlation with BMI are similar to majority of other findings in western populations[19,20] and several Asian populations.[21,23] Researcher from Nigeria has found a positive correlation of BMI with RBS among males but no significant correlation among females. A study reported by Bakari and his colleagues showed positive correlation of BMI with RBS in females but not significant correlation in males.[15] In most Indians, BMI more than 23 kg/m2 is associated with central obesity and coronary risk. Weight appears to be of fundamental importance in prevention of diabetes and reduction of weight is associated with lower BMI. The limiting factors of the study include (i) Physical activities, and insulin level was not measured among subjects (ii) small sample size.

CONCLUSION

In the present study, we have found a positive correlation between fasting blood glucose level and BMI. Food habits, intensive lifestyle modifications and regular exercise may prevent new-onset of diabetes, especially in patients with high BMI and high glucose level. This may help in prompt treatment or preventive measures to avoid future complications.

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