

Original Research Article

Comparison of blood glucose in obese and non-obese students in a medical college

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ABSTRACT

Background: Obesity has a negative effect on health, leading to reduced life expectancy and/or increased health problems. It is one of the underlying causes of non-communicable chronic diseases like type II diabetes, stroke etc. The study was aimed to compare blood glucose levels in obese and non-obese students in a medical college and to show that obese students are more prone to develop type II diabetes.

Methods: A total 20 obese subjects with age and sex matched 20 non-obese subjects were chosen. Their venous blood samples were collected after 12 hours of fasting and analysed for fasting blood sugar (FBS) and haemoglobin A1c (HbA1c).

Result: Results of the study showed that obese students have significant ($p < 0.001$) high blood glucose and HbA1c levels as compared to non-obese students.

Conclusion: The obese students are prone to develop type II diabetes due to changes in body metabolism as a result of change in fat distribution.

Keywords: Obese, Non-obese, Blood glucose, HbA1c

INTRODUCTION

Obesity is a state of excess adipose tissue mass.¹ It is the most prevalent nutritional disorder in prosperous developed countries. It is a medical condition in which excess body fat has accumulated to the extent that it may have a negative effect on health, leading to reduced life expectancy and/or increased health problems.^{2,3} Adipose tissue releases a large number of bioactive mediators which influence insulin resistance and leads to endothelial dysfunction.

Health service use and medical costs associated with obesity and related diseases have risen dramatically and are expected to continue to rise.

The currently recommended cut-offs of body mass index (BMI) and waist circumference (WC) were based on the revised consensus guidelines for India normal BMI: 18.0-22.9 kg/m², overweight: 23.0-24.9 kg/m², obesity: more than 25 kg/m².^{4,5}

The world health organisation (WHO) states that abdominal obesity is defined as a waist-hip ratio above 0.90 for males and above 0.85 for females. Obesity is most commonly caused by a combination of excessive food energy intake, lack of physical activity, and genetic susceptibility, although a few cases are caused primarily by genes, endocrine disorders, medications or psychiatric illness. Obesity increases the likelihood of various diseases, particularly type 2 diabetes mellitus, ischemic heart disease, obstructive sleep apnoea, certain types of cancer, osteoarthritis and depression.^{3,6}

There is a seven times greater risk of diabetes in obese people compared to those of healthy weight.⁴ HbA1c (glycated haemoglobin) is the predominant form of haemoglobin and it reflects the patient's glycaemic status over previous 3 months as compared to sugar which reflects status over 24 hours.⁷ HbA1c predicts the risk for the development of diabetic complications in diabetic patients and may be suggested as diagnostic criteria that detects more diabetes and pre-diabetes cases than fasting glucose or oral glucose tolerance test (OGTT).⁸ Hyperinsulinemia and insulin resistance are pervasive features of obesity, increasing with weight gain and diminishing with weight loss.⁹ Increase in blood glucose is associated with lipid biosynthesis (lipogenesis) and hence, an increase in weight. Since BMI is proportional to weight from its standard formula, it is therefore expected that factors such as blood glucose which influence weight will ultimately affect BMI.¹⁰

The factors contributing to obesity, stress seems to be particularly important as stressful condition leads to irregularity in diet, lack of exercise and addiction, each being considered independent factors leading to obesity.¹¹ Medical education is stressful throughout the course. The amount of material to be absorbed, social isolation, pressure of examination, discrepancies between expectation and reality all can be anticipated to bring psychological stress.¹²

A high caloric diet coupled with a sedentary lifestyle are the major contributing factors in development of the insulin resistance.¹³ Medical students are exposed to various factors, known, unknown for overweight/obesity.¹⁴ Hence, this study was planned to assess levels of blood glucose in obese students.

METHODS

A case control study was conducted at central clinical laboratory, MIMER medical college Talegaon and Dr. Bhausahab Sardesai rural hospital Talegaon Dabhade (Tertiary care). The study is approved by institutional ethical committee, MIMER medical college. Informed consent from all the subjects enrolled in the study was obtained.

The study included cases which were apparently healthy obese (BMI >30 kg/m²) students not suffering from any major illness, and ccontrol which were age and sex matched normal students selected randomly. Individuals with diseases like diabetes mellitus, hypertension and thyroid disorders were excluded.

Fasting venous 5 ml sample was collected from all subjects in fluoride and EDTA bulb for estimation of fasting blood glucose and HbA1c level respectively. All samples were processed in Central Clinical Laboratory of BSRH Talegaon.

Anthropometric measurements, detailed history and biochemical parameters were assessed for all the subjects. Measurements were taken without the subjects wearing shoes or heavy clothing and according to the revised consensus guidelines. BMI was calculated using the formula, weight in kilograms divided by height in meters squared (kg/m²). The WC was measured using non stretchable flexible tape in horizontal position, just above the iliac crest, at the end of normal expiration, in fasting state, with the subject standing erect and looking straight forward and observer sitting in front of the subject. The hip circumference was also measured and the waist:hip ratio was calculated by dividing waist circumference by hip circumference.

Blood glucose was done by GOD-POD method.¹⁵ HbA1c estimation by Immunoturbidometric method.¹⁶

Statistical analysis

The data was collected and arranged in tables using Microsoft excel 2010. The biochemical data was expressed as mean \pm SD. Significance was analysed using student 't' test. Correlations of HbA1c, FBS level with BMI were calculated by Pearson correlation test.

RESULTS

Table 1 shows mean values of BMI, waist:hip ratio, FBS level and HbA1C. There was a significant result (p<0.05) seen in FBS level and HbA1c in cases.

Bar diagram 1 and 2 shows significant increase in FBS level and HbA1c in obese students respectively.

Table 2 shows positive correlation of BMI with FBS level and HbA1c in obese students (cases) which is significant (p<0.05), however it was not significant in nonobese students (controls).

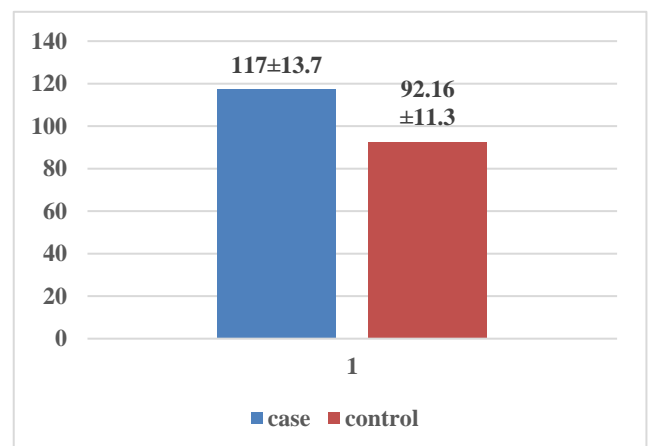


Figure 1: Comparison of FBS in obese and non-obese students.

Table 1: Mean values of BMI, waist:hip ratio, FBS level and HbA1c.

Parameters	Obese students (cases)	Non-obese students (controls)	P value
BMI (kg/m²)	31.68±1.63	20.51±1.17	0.001*
Waist:hip ratio	0.940.15	0.82±0.05	0.001*
FBS level (mg/dL)	117±13.76	92.16±11.39	0.001*
HbA1c (gm/%)	6.03±0.62	4.63±0.61	0.001*

(*significant at p<0.05)

Table 2: Correlation of BMI with FBS level and HbA1c in obese students (cases).

Variables	R value	P value
FBS level (mg/dL)	0.70	0.001*
HbA1c (gm/%)	0.71	0.001*

(*significant at p<0.05).

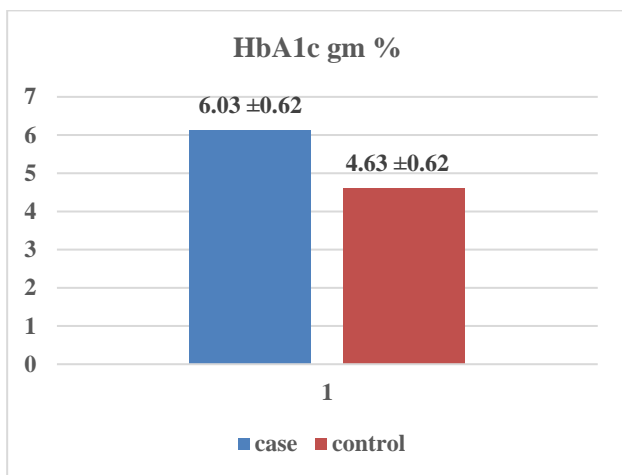


Figure 2: Comparison of HbA1c in obese and non-obese students.

DISCUSSION

Obesity and its related health problems like diabetes are major health problems in India. As diabetes affects individuals in the prime of their lives there is a need to take preventive measures against the cause or risk factors.

The increase in the incidence and prevalence of type 2 diabetes over the past few decades is due to obesity reaching to epidemic proportions.⁴ Obesity is thought to change body's metabolism. These changes cause to release fat molecules from adipose tissue into the blood, which can affect insulin responsive cells leading to reduced insulin sensitivity. Both insulin secretion and insulin resistance develop early in obese persons who progress later on to diabetes.⁴

The study was carried out to compare the fasting blood glucose and HbA1c of obese and non-obese subjects and

to prove that obese subjects are more prone to high blood sugar level and chronic problems like diabetes mellitus. The results of the present study correlated with the earlier studies which observed increased fasting blood glucose levels in obese individuals. Fasting blood glucose levels and HbA1c may be increased due accumulation of lipids leading to insulin resistance. Hence, it is fundamental requisite to monitor BMI and FBS levels.

Sheth et al observed significant linear association of HbA1c in type 2 diabetes mellitus subjects with central and peripheral obesity.¹⁷

Similar to this study Bays et al observed that increase in BMI is generally associated with a significant increase in diabetes mellitus, hypertension and dyslipidaemia.¹⁸

Shah A et al conducted a study on comparison of BMI in diabetic and non-diabetic individuals, it was concluded that BMI is significantly high in diabetic individuals. The cut-off of BMI in non-diabetic was less as compared to diabetic.¹⁹

Abnormal glucose metabolism was observed more frequently in overweight or obese polycystic ovarian disease (PCOD) women.²⁰

In this study on statistical analysis a positive correlation found between BMI and HbA1c which is in agreement with other studies.^{21,22}

CONCLUSION

Blood sugar levels are highly significant in obese students than non-obese. It may lead to diabetes and cardiovascular diseases in obese, hence obesity is positively correlated with blood sugar level. Evaluation of BMI and waist:hip ratio will help the clinician to control and prevent the disease at early stage. A proper balanced diet along with exercise is essential in avoiding chances of being obese and to lead a healthy life. Further programs can be formulated to promote awareness about obesity, its effects and management.

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