Original Article

Relation of Body Mass Index With Fasting Blood Sugar and Triglycerids Level in Healthy Young Adult Medical Students

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Abstract

Now a day's, high risk habits like smoking, drinking alcohol, stress and sedentary life Prone to develop diabetes mellitus leading to cardiovascular diseases. These are common factors in medical students hence we have taken up this Study. Students of SS Institute of Medical Science and Research Center, Davanagere, Karnataka, were assessed with their consent for anthropometric measures, fasting blood sugar and triglyceride levels. Among 257 students 130 male and female were 127. In 130 male students 11 were underweight with BMI < 19 Kg/m², 94 were of normal that is their BMI was between 19 Kg/m² – 26 Kg/m² and 25 were overweight with BMI of >26 Kg/m². In 127 female students 21 were underweight with BMI less than 19 Kg/m², 82 were of normal weight group of BMI between 19 Kg/m² – 26 Kg/m² and 24 were in overweight group of BMI more than 26 Kg/m². Mean BMI of the three groups in the 130 male students was 22.66±3.36 and that of 127 female is 21.36±3.49. Mean fasting blood sugar level in male is 82.25±9.48 mg/dl and in Female 83.03±10.62 mg/dl. Their mean Triglyceride level was in male 95±39.65 mg/dl and in female 96.08±29.66 mg/dl. Present study shows females and males having overweighted and the fasting blood sugar and triglycerides are more in females than males. From Present study we can say that females are more prone to develop CVD and diabetes mellitus than males even though the risk factors are very high in males.

***Key Words:** Body mass index; Fasting blood sugar; Triglycerides; Diabetes mellitus; cardiovascular diseases.*

Introduction

Body mass index (BMI), which relates weight to height, is the most widely used and simple measure of body size, and is frequently used to estimate the prevalence of obesity within a population[1].

BMI is generally well correlated with body fat percentage and is a good indicator of diseases risk[2]. Obesity is a risk factor for adult coronary heart diseases and is in increasing order among young adults. Obesity is associated with significant morbidity increasing hypertension, type II diabetes mellitus and hyperlipidemia, as well as hyperuricemia and some forms of cancer especially cancer colon, cardiovascular diseases, sleep apnea and articular pathologies[3].

Cardiovascular diseases are the most prevalent causes of death and disability in both developed as well as developing countries. The prevalence of obesity has increased dramatically in Industrialized and developing countries[4]. In India, CVD is projected to be the largest causes of death and disabilities by 2020, with 2.6 million Indians predicted to die due to coronary heart diseases, which constitutes 54.1% of all CVD deaths. Nearly half of these death and middle aged individuals[5]. The importance of serum triglycerides as a risk factor for CVD is controversial[6]. Many epidomological studies have demonstrated a univariate association between triglycerides and cardiovascular risk, particularly in relation to coronary heart diseases[5]. Prevalence of hypertriglyceredemia (HTG) has increased concomitantly with global obesity epidemic[7]. Accumulated evidence suggests that HTG is independently associated with an increased incidence of cardiovascular diseases[7].

An elevated blood glucose level is the defining feature of diabetes, but until now it was unclear whether elevated glucose levels contributed independently to increasing heart disease risk. Higher fasting plasma glucose levels within the normoglycemic range constitute an independent risk, factor for type-II diabetes among young men[8], and such levels may help, along with body mass index and triglyceride levels to identify apparently healthy men at increased risk for diabetes and cancers.

Materials & methods

The total number of 257 healthy (130 male 127 female) medical students in the age group between 18 - 23 years from SS Institute of Medical Science and Research Center, Davanagere, Karnataka, India, were included in this study. Prior to procedure written and informed consent taken. Their height and weight were recorded; body mass index was calculated by using their height (m^2) and weight (Kg). On the basis of BMI all students were divided into three groups i.e. underweight, who's BMI were less than 19 Kg/m^2. Normal whose BMI was between 19-26 Kg/m^2 and overweight whose BMI was more than 26 Kg/m^2. Blood samples were collected by vein puncture after an overnight fast for 12-14 hours. Venous

Table - 1

Relation between body mass index, triglycerides and fasting blood glucose level in males and females according to three BMI groups (Mean ± SD)

Variables	Under Weight (BMI<19 Kg/m^2)	Normal Weight (BMI19-26 Kg/m^2)	Over Weight (BMI>26 Kg/m^2)	p-value*
Males	(n=11)	(n=94)	(n=25)	
BMI	17.82 ± 0.40	21.79 ± 1.93	28.08 ± 1.38	P<0.001
FBS (mg/dl)	78.27 ± 8.86	80.93 ± 8.91	89.0 ± 9.02	P<0.001
Triglycerides (mg/dl)	67.45 ± 6.39	88.47 ± 9.57	131. 68 ± 16.13	P<0.001
Females	(n=21)	(n=82)	(n=24)	
BMI	17.24 ± 0.83	20.60 ± 1.40	27.50 ± 1.56	P<0.001
FBS (mg/dl)	78.24 ± 6.57	80.90 ± 10.07	94.71 ± 6.64	P<0.001
Triglycerides (mg/dl)	83.62 ± 6.48	92.15 ± 9.57	120. 42 ± 15.64	P<0.001

Table - 2

Correlation co-efficient between Males & Females

Parameter	Male		Female		Mean Difference	P* Value, Sig
	Mean	SD	Mean	SD		
BMI	22.56	3.36	21.35	3.49	1.21	0.002<P
FBS	82.25	9.48	83.07	10.62	0.82	0.5^{ns}
TAG	95.00	9.15	96.08	9.66	1.08	0.8^{ns}

blood was collected in plain and fluoride bulbs for measurements of serum triglycerides [TAG] and glucose respectively. Plasma glucose was determined by Trinder's method (GoD) and Serum triglycerides were estimated by McGowan et al and Fossati et al on XL 600 auto-analyzer. Statistical analysis was done on Epi-Info-6.

The means of the three groups were compared by ANOVA at the significance level of a=0.05. Correlation co-efficient was determined for the dependent variables of triglycerides and fasting blood sugar (FBS) with BMI (Kg/m^2) as the independent variable.

Results

Among 257 subjects, 49 (19%) had BMI greater than 25 kg/m^2 and were therefore considered overweight. Percentage of overweight was 9.72% and 9.34% in male and female students respectively (P<0.001). Comparison between male and female, the fasting blood sugar was found higher in female overweight group than that of male, whereas triglycerides levels were found higher in male than female in overweight groups. The results are given in Table – 1.

Present study indicated that the mean of BMI in males and females were found to be 22.56 ± 3.36 kg/m^2 and 21.35 ± 3.49 kg/m^2 respectively. The mean FBS in male is 82.25±9.48 mg/dl and that of female is 83.07±10.62 mg/dl. The mean of TAG in male is

95.00±9.15 mg/dl and that of female is 96.08±9.66 mg/dl. This result shows only BMI P value more significance. But not significant difference in FBS and triglycerides. The results are shown in Table –2. Correlation coefficient between body mass index and fasting blood sugar in Male was 0.38 and female 0.52 (P<0.01) more significant. Correlation coefficient between body mass index and triglycerides level in Male was 0.46 and female 0.41 (P<0.01) more significant. The correlation coefficient of BMI & FBA between male and female was less significant. The results are tabulated in Table – 3 & 4.

Table - 3

Correlation co-efficient between BMI & FBS

Groups	Correlation coefficient	P* Value, Sig
Male	0.38	P<0.015
Female	0.52	P<0.015
Combined	0.45	P<0.015

Table - 4.

Correlation co-efficient with BMI & TAG

Groups	Correlation coefficient	P* Value, Sig
Male	0.46	P<0.015
Female	0.41	P<0.015
Combined	0.41	P<0.015

Table - 5

Comparison between different weight categories of male and female with FBS

FBS mg/dl			Mean Difference, Sig**		
Males	Mean	P*Value, Sig	Under Weight (n=11)	Normal Weight (n=94)	Over Weight (n=25)
Under Weight	78.27	P<0.001 HS	-	2.66 HS	10.76 HS
Normal Weight	80.93	P<0.001 HS	-	-	8.07 HS
Over Weight	89.00	P<0.001 HS	-	-	-
Females	Mean	P* Value, Sig	Under Weight (n=21)	Normal Weight (n=82)	Over Weight (n=24)
Under Weight	78.47	P<0.001 HS	-	2.66 HS	16.24 HS
Normal Weight	80.90	P<0.001 HS	-	-	13.81 HS
Over Weight	94.71	P<0.001 HS	-	-	-

Mean FBS in the different weight categories of male students underweight was 78.27 mg/dl, normal weight 80.93 mg/dl and overweight 89.00 mg/dl. This result shows high significance p value of <0.001. Mean FBS in the different weight categories of female students underweight was 78.47mg/dl, normal weight 80.90 mg/dl and overweight 94.71 mg/dl. This result shows high significance p value of <0.001. Mean difference significance of fasting blood sugar in male student's underweight group was nil, in the normal weight group it was about 2.66 and in over weight group it was 10.76 and 8.07. Mean difference significance of fasting blood sugar in female student's underweight group was nil, in the normal weight group it was about 2.66 and in over weight group it was 16.24 and 13.81. The results are displayed in Table – 5.

Mean TAG in the different weight categories of male students underweight was 67.45 mg/dl, normal weight 88.47 mg/dl and overweight 131.68 mg/dl. This result shows high significance p value of <0.001. Mean TAG in the different weight categories

of female students underweight was 83.62mg/dl, normal weight 92.15 mg/dl and overweight 220.47 mg/dl. This result shows high significance p value of <0.001. Mean difference significance of triglyceride level in male student's underweight group is nil, in the normal weight group it was about 21.2 and in over weight group it was 64.23 and 43.2. Mean difference significance of triglyceride level in female students underweight group was nil, in the normal weight group it was about 8.53 (NS)* and in over weight group it was 136.85(S)** and 128.3(S). The results are presented in Table – 6.

Discussion

The world health organization (WHO) defines obesity as a condition with excessive fat accumulation in the body, to the extent that and well being are adversely affected [9]. Body weight is the result of a balance between energy taken in and energy expended; it is a condition in which natural energy stored in fat tissue is expended for beyond usual levels to the point of where it impairs health [10]. Body mass index

Table - 6

Comparison of mean difference in weight categories of male and female with TAG

TAG mg/dl			Mean Difference, Sig**		
Males	Mean	P*Value, Sig	Under Weight (n=11)	Normal Weight (n=94)	Over Weight (n=25)
Under Weight	67.45	P<0.001 HS	-	21.2 [ns]	64.23 S
Normal Weight	88.47	P<0.001 HS	-	-	43.2 S
Over Weight	131.68	P<0.001 HS	-	-	-
Females	Mean	P* Value, Sig	Under Weight (n=21)	Normal Weight (n=82)	Over Weight (n=24)
Under Weight	83.62	P<0.001 HS	-	8.53 [ns]	136.8 S
Normal Weight	92.15	P<0.001 HS	-	-	128.3 S
Over Weight	220.47	P<0.001 HS	-	-	-

(BMI) has become widely used tool for identifying overweight and obese individuals. BMI is an index of weight to height (kg/m^2), and while it is not a direct measure of body fat, or lean tissue, it is the most commonly used indicator of health risks associated with overweight (typeII DM and CVD, insulin resistance and underweight (osteoporosis, infertility) [11]. Anthropometric measurements are associated with various health conditions, and BMI is by far the most widely used measurement to reflect general obesity [1].

Abdominal or central adiposity is considered the important determinant of cardiovascular (CVD) and type-II DM. Obesity is an increasing worldwide health problem, especially in developed countries. With changing food habits and increasingly sedentary life styles the prevalence of obesity has increased markedly in Hongkong over recent decades [12]. Obesity, diabetes mellitus and hypertension are common, interrelated medical problem in westernized, industrialized societies. These inter related medical conditions are associated with an increased risk of cardiovascular diseases and are more prevalent in several minority groups, including African–American and Hispanic population [13]. However, the influence of obesity on cardiovascular risk begins before adulthood and overweight during adolescence is associated with an increased risk of coronary heart disease in male and female subjects. Cardiovascular disease is the leading cause of illness and death worldwide [14]. Global burdens of cardiovascular diseases are rapidly increasing, predominantly due to a sharp rise in the incidence and prevalence of the some in the developing countries [15]. South Asians have been observed to have a higher prevalence of cardiovascular disease in all age groups [16]. Many risk factors can help to predict the likelihood of CVD; heredity, male gender, advancing age, cigarette smoking, high blood pressure, diabetes mellitus, obesity, lack of physical activity, dyslipedemia and homocysteine level Diabetes mellitus is one of the classic risk factors for coronary heart diseases (CHD). It is well known; in fact the risk of CHD is 2-6 folds higher in patients

with type II diabetes than in patients without diabetes and those men with diabetes have a worse survival from CHD than do those without diabetes [17]. The prevalence of diabetes mellitus is highest among Indians (3.5%-16%), followed by Chinese and Malaysia [18]. A body of information now available suggest the need for a careful considerations not only of diabetes, but also of other disturbance of glucose metabolism, such as impaired glucose tolerance (IGT), that have emerged as a independent risk factors for cardiovascular diseases mortality.

Elevated fasting serum glucose level and a diagnosis of diabetes are independent risk factors for several major cancers and the risk tends to increase with an increased level of fasting serum glucose [19]. Lowering blood sugar levels could reduce the coronary heart diseases in both diabetes and non diabetics, according to researchers at the Johns Hopkins Bloomberg School of public health and other institution [20].

Men with serum triglyceride levels of at least 150 mg/dl and fasting plasma glucose level of 91 to 99 mg/dl had a hazard ratio of 8.23 for DM compared with men with a combined triglyceride level of less than 150 mg/dl and fasting glucose levels of less than 86 mg/dl. The impaired blood glucose levels are on their way to develop diabetes, which is important risk factor for CVD [21], in coronary artery disease in Indians (CADI) study reports the prevalence of diabetes to be 3-6 times higher among south Asians than Europeans, Americans and other Asians. Across Canada, the prevalence of childhood overweight and obesity is rising with the overall prevalence reported to be 26%.

All though, the association between Body Mass Index and increased risk of diabetes was significant in the populations studied, this association was stronger in women than in men. Among middle aged Swedish [22] women even very slightly elevated S-TG resulted in a considerably enhanced risk of developing diabetes. TG was significantly associated with risk of type II diabetes mellitus, with more pronounced effect in women than in men. Despite the strong association between excess weight and developing diabetes only a few studies have reported estimates of the risk of diabetes attributable to overweight and obesity [23].

In the United States [10], about one third of the population was overweight and another third was obese. The prevalence of adult overweight (BMI range 25-29, 9) and obesity is increasing regardless of age socioeconomic or ethnicity differences. As the prevalence of obesity is increasing worldwide, data from epidemiological studies in grebe demonstrate that a considerable proportion of the population is overweight or obese.

Prevalence of obesity in western populations varies greatly, but a weighed estimate suggests prevalence between 15% and 20%. There is a lot of data on the prevalence rates of obesity in the general population in Bahrain and other Arabian Peninsula States Faisal [24], where the prevalence rate among adults is highest in the world. Prevalence of trend of overweight and obesity has been increasing among adults Arab, probably due to the effects of modernization, affluence, increased food consumption and the concomitant changed to sedentary life styles [24].

The Framingham [25] study followed a cohort of individuals for 26 years and showed that each I-SD increment in relative weight was associated with a 15% increase in the risk of cardiovascular events in men and 22% increase in women.

The present study shows higher valves of FBS level in overweight group as well obesity but it is normal range comparatively in normal and underweight subjects. The TAG level is higher in overweight and obesity. The FBS and TAG levels were higher in female than male subjects. This result shows females

were more prone to develop DM which leads to CVD.

In this study the prevalence of overweight and obesity was 9.72% and 1.5% in male and that in female 9.3% and 1.16% of about 257 students, was higher than that reported in European countries[14] where the prevalence overweight and obesity were 8% and 1% respectively, and among the medical students of Greece University [14] the prevalence of obesity was 43%. It was lower than that reported in some Arab gulf countries [14]. For example, among Kuwait [10] college students overweight and obesity were prevalent as 38.5% and 11% respectively. Tunisia's adult population, not unlike the expressions of those in industrialized countries, is a currently taking an increase in chronic non communicable diseases, especially CVD [26].

Conclusion

Our study shows more underweight and overweight in female than male and the fasting blood sugar and triglycerides were found more in female than male. From Present study we can say that females are more prone to develop CVD and diabetes mellitus than males. Thus, this study focuses on obesity as a risk factor for impaired FBS and TAG in adult population. Hence, requires implementation of local and national level programmes to prevent obesity and cardiovascular diseases.

Acknowledgement

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