Section: Physiology

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ASSOCIATION BETWEEN BODY MASS INDEX, BLOOD PRESSURE, BLOOD SUGAR, AND WAIST-HIP RATIO IN YOUNG ADULTS

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Abstract

Background: Obesity is a global epidemic and is on the rise. Obesity is defined as a body mass index (BMI) which is equal to or more than 30kg/m2. It is one of the modifiable risk factors of type 2 diabetes. This study was undertaken to determine the correlation between random blood sugar (RBS), BMI and BP in a healthy young adult Indian population. **Materials and Methods:** This study comprises 92 males and 108 females (200 total) young adults aged between 18 to 30 years. Blood pressure was measured in all subjects using sphygmomanometer instrument in the right arm of the subject after resting period of 10 minutes. BMI, Blood pressure, Waist hip ratio and random blood sugar levels are measured from the subjects. **Result:** The mean BMI was 26.26±3.34 Kg/m2. The mean WHR was 0.91±0.24. Mean RBS was 96.20±18.21 mg/dl. Both diastolic and systolic blood pressures increased significantly with increased BMI status and abnormally elevated WHR than in participants with normal WHR. RBS was also significantly higher in those with elevated WHR than in those with normal WHR. **Conclusion:** Raised BMI and abnormally elevated waist hip ratio are positively correlated with random blood sugar levels and blood pressure in Young adults. Therefore, young population all over world are at risk of developing chronic diseases like hypertension, type 2 diabetes, cancer, stroke and other cardiovascular diseases later in their life. Therefore, BMI and waist hip ratio should be routinely checked and monitored in young population to prevent future development of chronic diseases.

INTRODUCTION

According to the global burden of disease 2019 report of Lancet, one of the highest jumps in risk factor prevalence for hypertension was in the form of increased Body Mass Index (BMI).[1] Body mass index is simple formula to classify obesity in adults. It is defined as person's weight in kilograms divided by height in meter squares. Obesity is one of the major causes for development of chronic diseases like stroke, hypertension, Type 2 diabetes and other cardiovascular disorders.[2] The major cause of obesity is imbalance between calories consumption and calories expenditure. There is increased intake of calorie rich foods and reduced physical activity due to urbanization all over the world.[3] Changes in the lifestyle and food habits, lack of nutritious diet, stress, lack of physical activity could increase the BMI as well as the blood pressure.[4] Increased body weight is a major risk factor for the metabolic syndrome which itself is a risk factor for coronary heart disease (CHD). Many studies have shown that individuals with metabolic syndrome are at high risk for the development of T2 DM.[5-10] Higher BMI in child hood is also associated with an increased risk for CHD later in life.[11] Impaired glucose tolerance is highly prevalent in children and adolescents with severe obesity.[12] Positive correlations between BMI and glucose levels (random and fasting), body lipids levels and blood pressure (BP) have been documented.[13,14]

Although BMI is used at a large scale but it has many shortcomings. BMI does not indicate the body fat distribution and is affected by gender, ethnic differences and age. Hence finding anthropometric measurements which are able to identify body fat and especially central body fat distribution will go a long way in identifying the people who actually have risk factor for cardiometabolic events. In this regard various measurements like Waist circumference (WC), Waist Hip Ratio (WHR), Body Adiposity Index(BAI), a body Shape Index (ABSI), Abdominal Volume Index (AVI) have been developed to give a clearer picture of the same.

The mechanism by which obesity causes insulin resistance is not well understood. Adipocytes secrete

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various hormones like leptin, tissue necrosis factor, free fatty acids, resistin.[15] A positive correlation is thought to exist between random blood glucose and obesity. This study was undertaken to determine the correlation between random blood sugar (RBS), BMI and BP in a healthy young adult Indian population.

MATERIALS AND METHODS

This study comprises 92 males and 108 females (200 total) young adults aged between 18 to 30 years. The design for this study was cross-sectional survey. Ethical approval was taken from ethical committee of institute. BMI, Blood pressure, Waist hip ratio and blood sugar levels are measured from the subjects. Blood pressure was measured in all subjects using sphygmomanometer instrument in the right arm of the subject after resting period of 10 minutes. Then blood pressure classified into normal BP 140/90 mm Hg.

The weight of the subject was measured by using weighing machine in kilograms (kg). The height of the subject was measured in centimeter without the shoes. BMI was calculated by dividing weight in kilogram by square of height in meter (kg/m2). Waist hip ratio is calculated as waist measurement divided by hip measurement (W/H). The Waist circumference was measured as the abdominal girth at the midpoint between the costal margins and the anterior-superior iliac spine. The Hip circumference was measured at the level of the greater trochanters. Patients were classified as normal or abnormal based on the Waist Hip ratio (WHR). WHR>0.95 for males and >0.8 for females were considered to be abnormal. Males with WHR≤0.95 and females with WHR≤0.8 were considered to be normal. Random blood sugar was measured using glucometers. Random capillary blood sugar level of 130mg/dl (7.7mmol/l) was used as cut off. The recorded data was compiled and entered in a spreadsheet computer program (Microsoft Excel 2007) and then exported to data editor page of SPSS version 15 (SPSS Inc., Chicago, Illinois, USA). For all tests, confidence level and level of significance were set at 95% and 5% respectively.

RESULTS

A total of 200 subjects are examined. Among them 92 are males and 108 females. The mean age of the subjects was 25 years. The mean BMI was 26.26±3.34 Kg/m2. The mean WHR was 0.91±0.24. Among the participants 125 had abnormally high WHR (>0.95 in males and > 0.80 in females). Mean RBS was 96.20±18.21 mg/dl (Table 1). Comparison of these parameters between males and females showed that BMI was significantly higher in females, whereas men had significantly higher WHR as expected. However, while men tended to have WHR within what is normally expected for their sex, women were shown to have abnormally high WHR than expected for their sex (Table 1). Both diastolic and systolic blood pressures increased significantly with increased BMI status and abnormally elevated WHR than in participants with normal WHR. RBS was also significantly higher in those with elevated WHR than in those with normal WHR. (Tables 2 and 3). Bivariate correlation analysis showed that SBP, DBP, RBS and WHR had positive correlation with BMI. They also had a positive correlation with WHR. The variables also showed a positive correlation among themselves except that the blood pressure (systolic and diastolic) was not correlated with RBS.

Table 1: Gender wise distribution of mean values of risk factors

Variables	Male (n=92)	Female (n=108)	P value
Body mass index(BMI)	25.40±3.26	26.88±1.50	0.03*
Waist- Hip Ratio	0.92±7.2	0.90±0.1	0.001*
Random blood sugar	97.1±4.23	95.03±6.80	0.23
Systolic Blood pressure	127.90±12.62	125.09±09.57	0.42
Diastolic blood pressure	87.47±18.55	85.03±8.78	0.09

* indicates statistically significance at p≤0.05
Test applied one-way ANOVA

Table 2: Distribution of mean values risk factors according to BMI groups BMI Groups

Variable	BMI Groups				
	Underweight	Normal weight	Overweight	Obese	P value
Random blood sugar	87.45±14.20	92.10±10.48	99.12±13.48	106.02±04.23	0.002*
Systolic Blood pressure	106.88±12.30	112.90±11.10	123.45±14.36	137.06±15.24	0.001*
Diastolic blood pressure	71.05±11.14	75.31±7.24	77.09±4.34	81.11±22.78	0.003*

* indicates statistically significance at p≤0.05
Test applied one-way ANOVA

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Table 3: Distribution of mean values risk factors according to WHR groups

Variable	Waist-Hip Ratio groups		P value
	Abnormal/Elevated	Normal	
Random blood sugar	110.14±20.15	101.98±18.22	0.001*
Systolic Blood pressure	135.86±24.22	119.34±18.10	0.001*
Diastolic blood pressure	85.95±34.12	73.78±27.34	0.001*

* indicates statistically significance at p≤0.05
Test applied one-way ANOVA

DISCUSSION

Obesity is defined as excessive accumulation of fat in various tissues in the body which causes ill health in the body. Obesity and raised BMI are the major causes for the development of chronic diseases like stroke, hypertension, type 2 diabetes, cancer, musculoskeletal disorders and other cardiovascular diseases later in life.[15] Overweight and obesity are some of the factors implicated in disease conditions including diabetes mellitus, and hypertension. Majority of the notable investigations about them have been carried out among western populations.[16-19] A few have also been done in Asian populations.[20-22]

Our study demonstrated that there is significant correlation between BMI and waist hip ratio for the parameters like random blood sugar and blood pressure. As BMI and Waist hip ratio increases, there is linear increase in blood sugar levels and blood pressure in person. This increase in BMI and waist hip ratio could be due to genetic factors, sedentary life style, lack of physical activity, urbanization, intake of junk foods, increased stress levels. Obese individuals are found to be at increased risk for diabetes, hypertension, renal failure, and other cardiovascular diseases.[23] At the level of kidneys various factors like activation of sympathetic nervous system and Renin Angiotensin System and increase in aldosterone associated with obesity can cause abnormal sodium retention and raised arterial pressure, also renal damage can be caused by compression of kidneys by surrounding fat.[24] Perivascular fat has been proposed to have an important role in vascular events associated with obesity. Vascular tone modulation has been found as one of the actions of adipose tissue surrounding blood vessels.[25] High circulating free fatty acids have been found to activate sympathetic nervous system and hence increase blood pressure.[26] In a meta-analysisof longitudinal studies which were done to track down blood pressure from childhood to adulthood it was found that elevated blood pressure in childhood predicts adult hypertension.[27] Keeping risk factors like obesity in check whose prevention can altogether delay or prevent the onset of hypertension in check is an essential component for good health.

In our study, we demonstrated that mean systolic blood pressure, diastolic pressure, random blood sugar level showed positive correlation with raised BMI and elevated waist hip ratio in both genders. In a study wherein Prevalence and associated risk factors of Hypertension were studied among Urban School Adolescents in Lady Bhore Catchment Area of Bhopal City it was found that the Prevalence of hypertension among adolescents was 15.9%and the prevalence of pre hypertension was 19.8%.[28]

CONCLUSION

Raised BMI and abnormally elevated waist hip ratio are positively correlated with random blood sugar levels and blood pressure in Young adults. Therefore young population all over world are at risk of developing chronic diseases like hypertension, type 2 diabetes, cancer, stroke and other cardiovascular diseases later in their life. Therefore BMI and waist hip ratio should be routinely checked and monitored in young population to prevent future development of chronic diseases. There is need for promotion of a healthy life style, regular exercise, healthy nutrition, stress free life in young population. This study and many more studies are all pointing out to one statement and that is 'prevention is better that cure'. We all need to come together to ensure preventive care by encouraging the younger generation to involve in physical activities like exercise, sports etc, to take a good balanced diet instead of indulging in palatal pleasure by consuming junk.

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