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Original Article

The Study of Correlation of Body Mass Index (BMI) & Blood Pressure in Adolescents

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***ABSTRACT*:**
Introduction: Obesity is a situation of excess adipose tissue mass. The most broadly used method to gauge obesity is the body mass index, which is equal to weight/height^2 (in kg/m^2). BMI change during the growth and development of adolescent. It can be a tool for tracking body size throughout the cycle. As BMI increase throughout the range of moderate and severe overweight, so also does the risk increase for cardiovascular complications including hypertension. **Material and Method:** The present study was conducted to study correlation of Body Mass Index (BMI) with blood pressure in Adolescents at Churu district. Study Population consisted of 100 subjects including both male and female between age group of 15-17 yrs. All the subjects were divided in groups A and group B according to BMI. **Results:** The statistical analysis was done using correlation unpaired t-test. There was significant positive correlation between BMI with systolic as well as diastolic blood pressure of male and female in adolescent's age group. Group A Body Mass Index of Male With Systolic Blood Pressure and Diastolic Blood Pressure, the p value are 0.0139 and 0.0280 respectively ($P<0.05$) showing significant positive correlation between body mass index and blood pressures. Group B, Body Mass Index of Female With Systolic Blood Pressure and Diastolic Blood Pressure, the p value are 0.0099 and 0.0025 respectively ($P<0.05$) showing significant positive correlation between body mass index and blood pressures. **Conclusion**: The recognition of elevated BMI in the present study as important factors associated with increased risk of developing elevated BP among adolescents may help target prevention towards high-risk individuals in this age group. This is especially important because of evidence linking adolescent obesity with metabolic abnormalities and risk of cardiovascular disease in adulthood.

Key words: Body Mass Index, Blood Pressure, Overweight, Obese, Hypertension.

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INTRODUCTION:

Obesity is a situation of excess adipose tissue mass. The most generally used method to gauge obesity is the body mass index, which is equal to weight/height^2 (in kg/m^2). BMI changes during the growth and development of adolescent. It can be used as an indicator for tracking body size throughout the cycle. As BMI increases during the range of moderate and severe overweight, so also does the risk increase for cardiovascular complications including hypertension.

The source of adult obesity and its adverse health consequences often begins in childhood. It has been predictable that hypertension accounts for 6% of deaths worldwide.

In industrialized societies, blood pressure increases progressively during the first two decades. In adolescents, changes in blood pressure are associated with growth and maturation.

thus in view of above, this study, "study of correlation of body mass index (BMI) with blood pressure in adolescents." is undertake which will scientifically add to identify at risk population well in advance and will also help to implement necessary action to obtain desired physical fitness in the form of optimum body composition and thereby to prevent/delay future health hazards.

MATERIAL AND METHODS:

This study was conducted in 100 Adolescent 15-17 Yrs. age group at Churu district. All the subjects were divided in groups A and group B according to BMI.

GROUP	MALE	FEMALE
A: BMI ≤ 24.9	39	41
B: BMI ≥ 25	09	11

Students belonging to same socioeconomic strata were selected from school by simple random technique.

Exclusion Criteria:

A. Adolescents above 17 Yrs.
B. Underweight Adolescents.
C. Adolescents having any acute illness.
D. Present or Past History suggestive of cardiovascular, respiratory or any other systemic illness.
E. Family history of hypertension, asthma, diabetes.

Body Mass Index (BMI):

Height: For measurement of Height marking were made on the wall using measuring Tape.

Weight: Weight was recorded using standard weighing scale machine.

Body Mass Index: Body mass index was calculated based on the formula, Blood Pressure: For Recording Blood Pressure here we used instrument are clinical Sphygmomanometer and Stethoscope and record the blood pressure by Auscultatory method.

After giving rest for 10 minutes blood pressure was recorded in sitting position with his back supported, feet on the floor and right arm supported. Right arm was used for consistency and for comparison with standard tables and because of the possibility of coarctation of the aorta, which might lead to false (low) readings in the left arm.

Systemic examination was also done to exclude cardiovascular, renal, and other disease which could affect blood pressure.

Statistical analysis was done by using unpaired t-test.

Table 1: Showing Correlation of Body Mass Index of Male with SBP and DBP in Adolescent Age Group

Male (48)	Blood Pressure	Mean	Standard Deviation	P Value
BMI ≤ 24.9(39)	SBP	124.87	11.6329	0.0139
BMI≥25(9)	SBP	135.11	14.5983	
BMI ≤ 24.9(39)	DBP	77.23	7.6449	0.028
BMI≥25(9)	DBP	83.11	10.0554	

SBP= Systolic Blood Pressure, BP= Diastolic Blood Pressure, P Value< 0.05 is Significant.

Table 2: Showing Correlation of Body Mass Index of Female with SBP and DBP in Adolescent Age Group:-

Female (48)	Blood Pressure	Mean	Standard Deviation	P Value
BMI ≤ 24.9(41)	SBP	117.46	10.2471	0.0099
BMI≥25(11)	SBP	126.18	12.2132	
BMI ≤ 24.9(41)	DBP	78.19	8.0722	0.0025
BMI≥25(11)	DBP	86.36	8.6634	

SBP= Systolic Blood Pressure, BP= Diastolic Blood Pressure Value< 0.05 is Significant.

Berkey CS ET al[5] (1998) confirmed that greater BMI in adolescence is associated with raised BP. Jonathan Sorof[6] (2002) concluded that obesity has become an increasingly important medical problem in children and adolescents. Obese children are at approximately a 3-fold higher risk for hypertension than non-obese children. In addition, the risk of hypertension in children increases across the entire range of body mass index (BMI) values.

Aneesa M. Al -Sendi ET al[7] in 2003 showed that weight and height in boys and weight only in girls were significantly associated with systolic BP independent of age or percentage fat. BMI and percentage body fat were significantly and positively associated with the risk of having high BP in the boys and girls.

Schiel R et al[8] (2006) after investigating the associations and interactions between height, weight, body-mass index and blood pressure values in overweight / obese and normal weight children and adolescents found that overweight and obese children had significantly higher blood pressure values both systolic as well as diastolic than control subjects. Manu Raj et al[9] in 2007 determined the relationship of obesity with blood pressure. Systolic or diastolic incident hypertension was found in 17.34% of overweight children versus 10.1% of the remaining students.

Survey by Neamatollah Ataei et al[10] (2009) identified a high prevalence of overweight that was associated with elevated SBP among preschool-aged children in Iran and concluded that the effect of higher BMI on mean SBP is present in childhood and can be used as a predictor of high SBP even in children as young as 1–6 years.

Obesity: Cause of Hypertension: One of the causes of hypertension is abnormal sodium and fluid balance. In obesity hypertension, abnormal kidney function initially is due to increased tubular sodium re-absorption, which causes sodium

retention and expansion of extracellular and blood volumes. The increase in sodium re-absorption results in a rightward shift in the renal pressure-natriures is relation and BP elevation. Thus the obese individual requires higher levels of BP to maintain sodium and fluid homeostasis. There are several potential mechanisms that could mediate the sodium retention and hypertension associated with obesity, including sympathetic nervous system activation, renin-angiotensin-aldosterone system activation, and compression of the kidney.

a. Sympathetic Nervous System Activation

The sympathetic nervous system (SNS) plays a critical role in the regulation of cardiovascular homeostasis. SNS activation plays an important role in the pathophysiology of obesity hypertension in humans. There are number of proposed mechanisms linking obesity with SNS activation including baroreflex dysfunction, hypothalamic-pituitary axis dysfunction, hyperinsulinaemia/insulin resistance, hyperleptinaemia, and elevated circulating Angiotensin II concentrations.

b. Renin-Angiotensin-Aldosterone System (RAAS) Activation

Several components of Renin-Angiotensin-Aldosterone System are elevated in obese human despite sodium retention. In addition, plasma renin activity declines with weight loss and is correlated with the reduction in BP. Adipose tissue expresses many components of RAAS, and this local system has been implicated in obesity hypertension.

c. Compression of the Kidney

Intra-abdominal pressure is directly related to the degree of abdominal adiposity, and, thus, elevated intra-abdominal fat could act to compress the kidney, increase sodium and water retention, and elevate BP. In addition, the ectopic deposition of fat within the rigid renal capsule could also elevate intra-renal pressure, result in sodium and water retention, and increase BP.[11] Both non-pharmacologic and pharmacologic approaches are useful in managing children with elevated blood pressure. Treatment modalities used in obese children and adolescents can be categorized into combination of: caloric restriction, anorectic drugs, increased physical activity, and therapeutic starvation, surgery, and habit pattern changes based on social learning therapy. Certainly drugs, starvation, and surgery are unacceptable treatment strategy for most children.

Socio-Cultural Issues and Adolescent Obesity in India:

There is a general misconception in parents in India and other developing countries that an obese child is a healthy child. In an effort to keep child "healthy" he/she is fed in excess. High burden of school work and academic competitiveness have led to decreased participation in sports and any other form of physical activity. "Fast foods" fads oversee balanced nutrition. Lastly, Adolescents spend more time in front of television and computers at the expense of sports and physical activity.

Prevention of Obesity Hypertension

As indicated earlier, weight gain is almost invariably associated with an increase in BP. Thus prevention of weight gain should be a primary therapeutic target for reducing the problem of hypertension. Regular physical activity and reduced dietary fat intake reduce weight gain in normal weight subjects and weight regain after weight loss in obese individuals. This could be achieved by relatively small lifestyle changes such as adding 15 min of walking each day and reducing portion sizes by a few bites per meal. If successful, lifestyle modification such as the one proposed may have important implications for the prevention of obesity-associated hypertension.

Conclusion:

We conclude that Prevalence of Pre-hypertension among overweight/obese recommended an early clinical detection of pre-hypertension and intervention together with life style modification particularly weight management.

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