



RESEARCH ARTICLE

CORRELATION OF BODY MASS INDEX WITH ARTERIAL BLOOD PRESSURE IN SCHOOL GOING CHILDREN – A CROSSECTIONAL STUDY

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ABSTRACT

The present study was conducted to study the correlation of Body Mass Index with arterial blood pressure in school going children. A cross sectional type of study was carried out among 400 male students between the age group of 8-10 years, selected from Islahul Amal primary school Nanded. Children were grouped as Group I: 8-9 yrs and Group II: 9-10 yrs with 200 students in each group. Height and weight was recorded & Body Mass Index (BMI) was calculated. Blood pressure was recorded as recommended by the fourth report on diagnosis, evaluation and treatment of high blood pressure in children. The statistical analysis was done using Pearson's correlation test. There was significant positive correlation of systolic & diastolic blood pressure with Body Mass Index in both groups. We can conclude that BMI is possible important contributory factor associated with increased risk of developing elevated BP among school going children.

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INTRODUCTION

In India, under nutrition attracted the focus of health workers, as childhood obesity was rarely seen. But over the past few years, childhood obesity is increasingly being observed with the changing lifestyle of families with increased purchasing power, increasing hours of inactivity due to television, videogames and computers, which have replaced outdoor games and other social activities [Bharati DR et al, 2008]. Prevalence of obesity is increasing rapidly in all ages including children all over the world [Hosseini M et al 2010]. The most widely used method to gauge obesity is the body mass index (BMI), which is equal to weight/height² (in kg/m²). BMI changes throughout the growth and development of a child. It can be used as an indicator for tracking body size throughout the life cycle. The origin of adult obesity and its adverse health consequences often begins in childhood [Nanaware NL et al 2011]. Obesity is considered as a gateway disease, which can lead to heterogeneous diseases such as metabolic syndrome, diabetes different gastrointestinal and respiratory disease, and certain type of cancers and hypertension (HTN). Therefore, preventive intervention during early life might reduce the burden of the disease. Several studies have declared that there is a relation between HTN and adiposity. [Hosseini M et al 2010, Nanaware NL et al 2011,]. Most of studies done on "Association of BMI with blood pressure" were conducted in

western population and there is very few studies done in India. In view of this present study is conducted so as to identify at risk population in advance and to implement necessary action to delay /prevent future health hazards.

MATERIALS AND METHODS

The present study was conducted among 400 school going male children of 8-10 years age. Students belonging to same socioeconomic strata were selected from Islahul Amal School Nanded by simple random sampling technique. The study was approved by Ethical committee. The study was conducted after taking permission of school board. All subjects and their parents were explained about the details of study procedures to be undertaken. Informed consent in local language was obtained from parents/guardians of each subject and only the students whom parents will give the written consent was included in the study. Age and dates of birth were verified by school records which were based on birth certificate and the age at the time of examination was calculated. The collection of data, and measurements was done in school. Detail history, detail general and systemic examination was done to exclude the diseases. Anthropometric measurements including weight, height, was taken by standard methods. Body mass index was calculated.

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Height: For measurement of height markings were made on the wall using measuring tape. The child was asked to stand upright, barefoot on the ground with heels, buttocks, upper back, and back of head making firm contact with the wall. The cardboard was pressed firmly onto the subject's head to form a right angle to the wall and the height was recorded in meters.

Weight: All students were weighed in their school uniform or clothes they had worn after removing shoes & after zeroing the scale, using standard weighing machine. The weight was read to the nearest 100 g (0.1 kg).

Body Mass Index (BMI): Body Mass Index was calculated based on the formula-

$$\text{BMI} = \text{Weight in kilogram} / (\text{Height in meter})^2$$

Blood pressure: Before recording the B.P. children was made to rest for 10 minutes. The procedure was explained to children and sufficient time was given to allay anxiety and fears. In sitting position & after keeping instrument at heart level B.P. was recorded using mercury sphygmomanometer as per the recommendation given by the fourth report on the diagnosis, evaluation and treatment of high blood pressure in children [Fourth report 2004] . B.P. was first recorded by palpatory method & then confirmed by auscultatory method.

The subjects selected were as follows:

8-9 years	200 students
9-10 years	200 students
TOTAL	400 students

***NOTE:** The Age group 8-9 years include students of age 8 years to 8 years 11 months & 29 days ,The students of completed 9 years were included in 9-10 year age group.

Statistical analysis: All the data was entered in Microsoft Excel, tabulated and analyzed by Pearson's correlation test using statistical software graph pad prism version 5.0.

RESULTS

Study results are displayed in tables and graph 1 and 2 below

Table 1: Showing Correlation of Body Mass Index with SBP and DBP

BP	r value	p value	Significance
SBP	0.796371	<0.001	HS
DBP	0.894707	<0.001	HS

*HS - Highly significant correlation, r – correlation coefficient. P value –two tailed

From above Table 1 and 2 it is clear that there is significant positive correlation of Body Mass Index with systolic as well as diastolic blood pressure in both age group children.

DISCUSSION

Hypertension is the most common and potent universal contributor to cardiovascular mortality. Elevated blood pressure, labile or fixed, systolic or diastolic, at any age, in either sex is a contributor to all forms of cardiovascular diseases. Studies on Indian schoolchildren have demonstrated that the prevalence of hypertension in overweight children is

significantly higher than that among normal children. Studies on hypertension in childhood have the important advantage that they may help in the control and possibly prevention of high blood pressure before its harmful sequel can occur. The present study assessed association between body mass index and blood pressure in school going children between the age group of 8 to 10 years. This study indicates that SBP and DBP are significantly associated with the increase in amount of BMI.

Previous studies in consistent with our study have reported significant association between BMI and Bp In 2010 M Hosseini *et al* assessed the association between BMI and BP among 7 to 18 yr old Iranian children and adolescents. Their study indicates that elevated BP is more prevalent among overweight healthy children and adolescents. They observed that the mean of SBP, DBP are significantly associated with increase in amount of BMI in all age groups.

In 2011 N. L. Nanaware *et al* concluded that There was significant positive correlation between BMI & both systolic as well as diastolic blood pressure in School Going Children and Adolescents.

In 2011 Kanavi Roopa, *et al* observed that, there was a positive correlation between body mass index systolic blood pressure and diastolic blood pressure.

In 2011 N. K.Mungreiphy *et al* observed that there was significant positive correlation among BMI, age, systolic and diastolic BP.

In 2012 Mohamed Faisal Lutfi observed that, there were significant positive correlation between BMI & both DBP and SBP.

In 2012 Lalit Waghmare *et al* concluded that The BMI has positive correlation with systolic and diastolic blood pressure. Similarly In 2005 Ravisankar P *et al*, In 2007 F Tasfaye *et al* and In 2009 Anjum Humayun *et al* concluded that there was a positive correlation between BMI and Systolic & Diastolic blood Pressure.

Obesity is often defined simply as a condition of abnormal or excessive fat accumulation in adipose tissue, to the extent that health may be impaired. Body Mass Index provides the most useful, albeit crude, population-level measure of obesity. It can be used to estimate the prevalence of obesity within a population and the risks associated with it. Obesity produces an increment in total blood volume and cardiac output that is caused in part by the increased metabolic demand induced by excess body weight. The increase in blood volume in turn increases venous return to the heart, increasing filling pressures in the ventricles and increasing wall tension. This leads to left ventricular hypertrophy and this can decrease the diastolic compliance of the ventricle which can further progress to diastolic dysfunction and as wall tension increases further, can lead to systolic dysfunction. Thus through different mechanisms like increased total blood volume, Increased cardiac output, left ventricular hypertrophy and further diastolic

dysfunction, obesity may predispose to heart failure. [Kanavi RS et al 2011]

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 reabsorption, which causes sodium retention and expansion of extracellular and blood volumes. The increase in sodium reabsorption results in a rightward shift in the renal pressure-natriuresis 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. [Nanaware NL 2011]

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 a number of proposed mechanisms linking obesity with SNS activation including baroreflex dysfunction, hypothalamic-pituitary axis dysfunction, hyperinsulinemia/insulin resistance, hyperleptinemia, and elevated circulating Angiotensin II concentration.[Nanaware NL 2011]

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 [Kevin PD et al 2004].

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