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Dr. Adrama
Assistant Professor,
Department of Paediatrics,
Kanachur Institute of Medical
Sciences, Mangalore,
Karnataka, India

Relationship between body mass index and blood pressure: A study among school going children

Dr. Adrama

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Abstract

Background: Body Mass Index (BMI) is believed to be an acceptable indicator of the risk of overweight in children and adolescents. Present study was aimed to study relationship between body mass index and blood pressure among school going children.

Keywords: Body mass index, blood pressure, overweight, obese, prehypertension, hypertension

Introduction

Obesity is perhaps the most prevalent form of malnutrition in developing countries, both among adults and children. Studies have demonstrated that obesity is related to elevated systolic blood pressure (SBP) and diastolic blood pressure (DBP) elevation, dyslipidemia, diabetes, etc ^[1, 2].

Body Mass Index (BMI) is believed to be an acceptable indicator of the risk of overweight in children and adolescents ^[3]. Several studies have demonstrated increasing mean BP with increasing age in children ^[4]. Obesity is the main determinant of BP in children and adolescents.

High blood pressure (BP) and obesity among adolescents, in conjunction with many of their health consequences such as dyslipidaemia, abnormal plasma glucose and metabolic disorders, have dramatically increased over the past two decades worldwide due to the rapid socioeconomic, nutritional and epidemiological transitions ^[4]. Blood pressure studies in children provide crucial epidemiological information helpful in the modification of risk factors for coronary heart diseases and other non-communicable diseases later in life ^[5-10]. Present study was aimed to study relationship between body mass index and blood pressure among school going children.

Material and Methods

Present study was cross-sectional observational study, conducted among school-going urban children aged between 6 to 14 years, under Department of Paediatrics, Kanachur institute of Medical Sciences, Mangalore, India. Study duration was of 6 months (July 2018 to December 2018).

300 healthy students aged between 6-14 years were included by random sampling method. Study discussed & consent was obtained from school authorities and their parents. Children having present or past history suggestive of cardiovascular, respiratory or any other systemic illness, family history of HT, asthma, diabetes, or having any physical disability were excluded from the study.

On inclusion, height was measured with a metallic non-stretchable tape measure (fixed to a plane surface wall) as well as weight was measured (in kilograms using standard electronic weighing scale to the nearest decimal fraction of 0.1 kg.). BMI was calculated using the formula: $BMI = \text{Mass (kg)} / \text{Height (m}^2\text{)}$.

Systemic examination was also done to exclude cardiovascular, renal, and other diseases which could affect blood pressure (BP). Standard methodology was employed to measure BP. BP was recorded in sitting position with his/her back supported, uncrossed feet on the floor, and right arm supported with cubital fossa at heart level to avoid parallax error. Standard clinical sphygmomanometer and stethoscope were used to record BP by auscultatory method. Appropriate size cuff bearing a width approximately 40%, and length of at least 80% of arm circumference was used ^[6].

Correspondence

Dr. Adrama
Assistant Professor,
Department of Paediatrics,
Kanachur Institute of Medical
Sciences, Mangalore,
Karnataka, India

Appearance of Korotkoff sounds, K1 was noted as SBP reading and disappearance of sounds K5 was noted as DBP reading. All the recordings were taken on the same time of the day and recorded by the same person with the same instrument to avoid bias. Data was collected and compiled using Microsoft Excel,

analysed using SPSS 23.0 version. Frequency, percentage, means and standard deviations (SD) was calculated for the continuous variables, while ratios and proportions were calculated for the categorical variables.

Results

Table 1: Distribution of all study subjects according to BMI, age & gender

Nutritional status (BMI kg/m ²)	Total
Underweight (< 18.5)	62
Normal (18.5-24.9)	154
Overweight (25.0-29.9)	60
Obese Type 1 (30.0-34.9)	14
Obese Type 2 (35.0-39.9)	6
Obese Type 3 (> 40.0)	4

Table 2: Distribution of subjects according to BMI grade and Blood Pressure recording

Body mass index grade	Normal blood pressure	Prehypertension	Hypertension	Total
BMI < 25	209 (34.83%)	5 (0.83%)	2 (0.33%)	216(36%)
Overweight	50 (8.33%)	7 (1.17%)	3 (0.5%)	60 (10%)
Obese	14 (2.33%)	6 (1%)	4 (0.67%)	24 (4%)
Total	273 (45.5%)	18 (3%)	9 (1.5%)	300 (50%)

Discussion

In study by Vinaykumar S *et al.*,^[11] pre-hypertension and hypertension was seen in 1% (2 out of 195) of normal and 0% (0 out of 30) of overweight and 60.9% (9 out of 14 obese children). P value was statistically significant indicating that there is strong association between BMI and blood pressure.

Jena SK *et al.*,^[12] studied 580 students of age group 6-12 years of both boys and girls. Overweight and obesity were more in boys than girls. There was significantly more BP in overweight and obese participants than healthy weight individuals. There was positive correlation between BMI and BP both systolic and diastolic BP. Prevalence of HTN in boys is more than the girls. Odds ratio suggested that overweight and obesity was associated with HTN. Similar findings were noted in present study.

Mohan B *et al.*,^[13] noted a high prevalence of obesity (2.3% urban and 3.6% rural areas) and hypertension (6.7% urban and 2.6% rural areas) in adolescent population, with a significant increase in the prevalence of hypertension among overweight (15.3% urban and 6.82% rural areas) and obese (43.1% urban and 61.76% rural areas) population.

Stephenson B *et al.*,^[14] studied 1000 children, of age group 13 to 17 years, the incidence of obesity was 3.5%. Girls outnumbered the boys in obesity with 4% compared to 3.5%. The mean Body Mass Index in girls was 21.9 statistically significant compared to boys (21.3). The age wise mean BMI and mean systolic BP along with diastolic BP was also significant. The mean systolic BP of girls (114 mm Hg) was greater than that of boys (113.2) mm Hg (P value 0.025). The mean diastolic BP of girls (72.9 mm Hg) was greater than that of boys (72.2 mm Hg (P value 0.057). A statistically significant positive correlation was seen in both systolic and diastolic BP with BMI of each age group. A positive correlation was also seen in males and females with systolic and diastolic BP with BMI in each age group. Children with obesity and HTN may be accompanied by additional cardiometabolic risk factors such as dyslipidemia and disordered glucose metabolism, which may contribute their effects on BP or may represent comorbid conditions

arising from the same adverse lifestyle behaviors^[15, 16].

Early identification of hypertension and prehypertension translates into early interventions and possibly prevention of later morbidity and mortality. Periodic surveys should be done in schools to identify the “at risk” group of children and adolescents who can develop hypertension in future, so that preventive care can be provided.

Conclusion

Overweight and obese children are at a significantly higher risk for hypertension than are normal weight children. Body mass index is highly associated and linearly related with both systolic and diastolic blood pressures among school going children. Obesity has positive relation with blood pressure and therefore there is an urgent need to change lifestyle pattern as well as physical activity.

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