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Study of blood pressure in overweight and obese school children between 5-15 years of age

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Abstract:

Hypertension is one of the most common diseases worldwide and the prevalence in school children appears to be increasing perhaps as a result of increased prevalence of obesity. Thus the present study was planned to establish an association between BMI with hypertension amongst school children in the age group of 5-15 years. A total of 100 children, who were overweight and obese were included in the study. Anthropometric measurements of weight, height and blood pressure measurements were taken by the standard methodology. The statistical significant correlation observed between BMI and systolic and diastolic blood pressure ($r=0.473$, $p<0.001$); ($r=0.411$, $p<0.001$). It can be inferred that the children with high BMI are more likely to have hypertension.

Key words: Body mass index; Children and adolescents; Hypertension; Overweight and obesity; School children.

Introduction

Obesity is defined as an excessive accumulation of adipose tissue containing stored fat in the form of triglycerides [1,2]. The World Health Organization (WHO) [3,4] describes obesity as one of today's most blatantly visible yet most neglected public health problems. The calculated global prevalence of overweight (including obesity) in children aged 5-17 years is estimated by the International Obesity Task Force (IOTF) to be approximately 10%, but this unequally distributed

with the prevalence ranging from over 30% in America to <2% in Sub-Saharan Africa [5].

According to the WHO, more than 1.2 billion people worldwide are classified as overweight and 250 million are classified as obese. Worldwide, this is equivalent to 7 percent of the adult population [6]. Obesity is recognized as a major health problem in both developed and developing countries. In India, obesity is emerging as an important health problem. The major health consequences associated with overweight and obesity are Type 2 diabetes, Coronary Heart Disease (CHD), hypertension, gall bladder disease, and certain types of cancer, dyslipidemia and insulin resistance [7].

Obesity in adolescents is a major public health problem in developed countries and in some parts of developing countries, too. It is a growing nutritional concern in countries like India, which are witnessing nutritional transition [8]. It, is being realized that with the growing popularity of fast foods, the transition is greatly affecting the food basket of the people. In addition, decreasing physical activity leading to sedentary life style is likely to promote obesity and related health problems. The growing prevalence of hypertension is coupled with increase body weight and many reports have shown an association between blood pressure (BP) and body mass index (BMI) [9,10]. In Bogalusa Heart Study, it was reported that overweight children were 4.5 and 2.4 times likely to have elevated systolic and diastolic blood pressure respectively [10]. Similarly, a study carried on Chinese children and adolescents showed that obese children have 2.9 times higher risk of developing hypertension when compared to their normal weight counterparts [11]. An Indian study conducted amongst adolescent children showed that prevalence of hypertension was about 7.0% and 2.6% amongst urban and rural children. They also found that there was significant increase in prevalence of hypertension with an increased BMI [12]. Obesity in adolescents is not only associated with hypertension and abnormal lipid profile, but also shows clustering of risk factors for cardiovascular disease [13]. Kapil et al. [14] report the prevalence of obesity in school children from the affluent class of Delhi to be only 6–8%, whereas Ramachandran et al. [15] report it to be as high as 16–18% in school children from Chennai and, further, they associate it with lower physical activity. As obesity is an important risk factor for hypertension, we studied adolescent obesity and blood pressure (BP) levels in school children.

Materials and Methods

Study design: A Cross sectional observational study.

Study population consisted of 100 overweight and obese children (60 overweight and 40 obese children) in the age group of 5-15 years of either gender.

The study was approved by Institutional ethical committee of JSS Hospital, Mysore. A pre-tested, structured questionnaire was administered to each subject to elicit information on socio-demographic profile and anthropometric measurements. Anthropometric measurements of weight, height and blood pressure (BP) were recorded utilizing the standard equipments and methodology. Written informed consent was obtained from the parents and oral consent from the children. We prospectively examined 100 children and adolescents aged 5-15 years in two urban schools. A detailed medical and family history was obtained from all subjects, and physical examination was performed. All subjects were otherwise in good health. None of the children suffered from endocrine or syndromal disorders, or were on any medication. Ages of the children were taken from their school record; age at last birthday was recorded per subject. Degree of overweight and obese was derived from body mass index (BMI). Body weight was measured with a digital scale to the nearest 0.1 kg with minimal clothing, and height was measured barefoot in triplicate with a wall-mounted stadiometer. The body mass index — the weight in kilograms divided by the square of the height in meters — was calculated. Children with a body mass index (BMI) >85th percentile of reference data were considered overweight and those with a BMI >95th percentile were considered obese [16]. All equipments were calibrated by biomedical engineering department as per standard operating procedures.

Clinical examination of the subjects was carried out by taking their BP measurements. Before recording the BP, the procedure was fully explained to the children and sufficient time was allowed for recovery from recent activity and apprehension. BP was recorded in sitting position in right arm by auscultatory method using a standard mercury sphygmomanometer with the subject seated and the arm extended over the table at the level of heart. A set of different-sized cuffs was used covering about 2/3 of upper arm and encircling it completely without overlapping [17,18]. BP readings were noted as per the recommendations of American Heart Association [19]. The first and the fifth Korotkoff sounds were for the systolic and diastolic BP levels, respectively.

Three measurements were taken at interval of 5 minutes each and mean of last two readings was taken for systolic blood pressure (SBP) and diastolic blood pressure (DBP). Subjects who were having SBP or DBP above 95% for that age and sex were considered to be hypertensive [20]. The distribution of overweight and obese was according to the BMI.

Blood pressure (BP) was measured using standard methodology as recommended by The Fourth Report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents [21]. Average systolic or diastolic BP >95th percentile for gender, age and height was considered as hypertension. Pre-hypertension was defined as average systolic BP or diastolic BP that was >90th percentile but <95th percentile. Children with BP levels >120 mmHg systolic and/or 80 mmHg diastolic were also considered pre-hypertensive [21].

Statistical Analysis: Data entered into Microsoft excel and analyzed using SPSS trial version. Descriptive statistics like mean, standard deviation for quantitative data and percentage for qualitative data were used to describe the study variables. Association between categorical data was tested using Pearson's chi square test. For difference amongst the means independent sample t test was used. Statistical significance was interpreted at confidence level of 95% and alpha error cut off at 5%. Pearson correlation coefficient between quantitative variables was calculated and significance tested at p value of 0.05.

Results

The present study was conducted amongst children in the age group of 5-15 years in urban schools. A total of 100 children, who are obese and overweight were included in the study. The distribution of overweight and obese was according to the BMI. BP measurements of 100 subjects from two urban schools were taken. Mean weight, height, systolic and diastolic blood pressure of the children participated in the study is depicted in Table. 1.

The mean ages of the overweight and obese children were 11.22±2.713 and 9.68±2.46 years respectively. The mean weight and height of the children are given in Table.1. The mean systolic and diastolic BP in overweight children was 112.83±15.68 (mean±S.D) and 67.82±9.9. Likewise, the mean systolic and diastolic BP in obese children was 111.38±13.85 (mean±S.D) and 68.18±10.66. The statistical significant correlation was observed between BMI and systolic (r=0.473, p <0.001); and diastolic blood pressure (r=0.411, p <0.001) (Table. 2). It can be inferred that children with high BMI are more likely to have hypertension. The association of sex and BMI with blood pressure is shown in Table: 3.

Table 1: Distribution of study variables among overweight and obese children

Variable	Overweight (mean±SD)	Obese (mean±S.D)	P value
Age (Years)	11.22±2.713	9.68±2.46	0.005
Weight (kgs)	47.70±14.45	47.90±16.35	0.946
Height (Cms)	146.91±15.25	139.79±13.68	0.19
BMI	21.73±2.46	24.19±3.92	
SBP (mm Hg)	112.83±15.68	111.38±13.85	0.635
DBP (mm Hg)	67.82±9.9	68.18±10.66	0.865

Abbreviations: SBP: Systolic blood pressure; DBP: Diastolic blood pressure; BMI: Body mass index; S.D: Standard deviation; Kg- Kilograms; Cms- Centimeters

Table 2: Correlation between BMI of study subjects and their blood pressure

Variable 1	Variable 2	Pearson correlation coefficient (R^2)	P value
BMI	DBP	0.411	<0.001
BMI	SBP	0.473	<0.001

Table 3: Association of sex and BMI with Blood pressure

	Blood pressure		value
	Normal	Hypertension	
Sex			
Male	37 (%)	25 (%)	.086
Female	22 (%)	16 (%)	
Overweight	37 (%)	23 (%)	.5
Obese	22 (%)	18 (%)	

Discussion

Hypertension is the most potent universal contributor to the cardiovascular mortality. An elevated BP, labile or fixed, systolic or diastolic, at any age, in either sex, is a contributor to all forms of cardiovascular diseases [22,23]. BP measurements must be a part of every clinical examination in children [24].

The present study was conducted amongst children in the age group of 5-15 years. In the present study, 7% had pre hypertension, 19% had stage I hypertension, and 6% had stage II hypertension (systolic hypertension). Likewise, 9% had stage II diastolic pre hypertension and 16% diastolic stage I hypertension.

An association was found between BP and anthropometric measurements such as BMI. It was observed that children with more body weight had increased SBP and DBP. The relation of body size to BP has been established in a number of cross-sectional studies [25,26]. In Bogalusa Heart study, it was established that BP is correlated with height and BMI. In our study, the statistical significant correlation was observed between BMI with SBP and DBP (r=0.473, p <0.001).In a study done by Supreet Kaur et al. [27] there was a statistical significant correlation was observed between BMI and systolic and DBP (r=0.440; P<0.001);(r=0.341;P<0.001). The statistical significant correlation was observed between BMI and systolic and diastolic blood pressure. (r=0.473, p <0.001); (r=0.411, p <0.001) in our study.

In the present study, we found an association between BP and anthropometric measurement like BMI in children in the age group of 5-15 years of age. Hence, it would be logical to advise the families with obese children to change their lifestyles with respect to the diet, exercise and the reduced salt intake, to get their children accustomed to the life styles which are favorable for the maintenance of normal blood pressures.

Limitations of the study

While it has been recommended to use the average of the multiple BP measurements which were taken for weeks to months to characterize an individual's BP level, limited manpower and time restricted the authors in this study from doing so. The BP is also influenced by various other factors such as the time of the day and ambience which could not be controlled in this study.

Conclusions

Obesity was a significant predictor of hypertension, based on the BMI. Hence it is logical to advise the families with obese children to change their lifestyles, with respect to the diet, exercise and the reduced salt intake, to get their children accustomed to the lifestyles which are favorable for the maintenance of normal blood pressure [28]. All the pediatricians should measure and monitor the BP. The children in the high risk group should be identified and treated with an individualized approach.

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