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Original Article

Prevalence of Hypertension Among Obese Children and Effect of Environmental Factors on Hypertension and Childhood Obesity: A School Based Study

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ABSTRACT

Introduction: Childhood obesity as an important risk factor for cardiovascular and metabolic diseases in the later part of life are more susceptible to develop hypertension and coronary artery diseases. The effect of altered environmental factors may lead to hypertension and childhood obesity.

Aim and objectives: To evaluate the incidence of hypertension among obese children and the effect of environmental factors on hypertension and obesity.

Results: Out of 1000 school going children, 85 were having BMI >85th centile. Among 85, 53 were overweight and 32 being obese. SBP and DBP were significantly higher in obese children when compared to non obese group ($p<0.05$). A positive correlation between age, weight, height, BMI with SBP ($p<0.05$) while a negative correlation between weight, BMI and hours of sleep per day ($p<0.05$).

Conclusion: A higher prevalence of systolic and diastolic hypertension was observed among children with obesity. It is implicated that decreased hours of sleep, milk consumption, physical activity and increased sedentary life style are important risk factors in childhood obesity.

KEY WORDS: Environmental factors-Hypertension-Childhood obesity.

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INTRODUCTION

Obesity is a disorder of energy balance affecting wide range of people belonging to diverse ethnic groups, age and socioeconomic status. Obesity has become an increasingly important medical problem in children and adolescents. Many of the outcomes associated with obesity that was previously thought of as diseases of adults are now affecting children. Outcomes related tochildhood obesity include hypertension, type 2 diabetes mellitus, dyslipidemia, left ventricular hypertrophy, nonalcoholic steatohepatitis, obstructive sleep apnea, and orthopedic problems (such as slipped capital-femoral epiphysis), as well as social and psychological problems [1]. Prevalence of overweight and obesity is increasing in children and adolescents in India as reflected in various studies conducted in various states and regions of India [2-4].

Hypertension is one of the most important, potent and non modifiable universal contributor to majority of non communicable diseases including cardiovascular and cerebrovascular diseases leading to significant morbidity and mortality worldwide and India. Studies on hypertension in childhood have the important

impact on child health with possible control and prevention of high blood pressure before its harmful sequelae can occur. The prevalence of hypertension in children is reported to range from a high of 16.2% to a low of less than l.0% [5,6]. This diverse prevalence of hypertension may vary in different ages with different criteria adopted to define hypertension and differences between racial sub-groups such as geographic, environmental and cultural factors. The causes of childhood obesity and hypertension are manifold that include modifiable factors such as lack of regular exercise, sedentary habits, over consumption of high calorie foods, sleep duration and other various environmental factors. The present study was conducted in apparently healthy school children to look at the incidence of obesity hypertension among obese children and to evaluate the effect of environmental factors on obesity and hypertension.

MATERIAL AND METHODS

Patients: The present cross sectional study was conducted among one thousand apparently normal school children in the age group of 10-15 years. The age of each participant was recorded in completed years and verified from school records belonging to four different schools located in Tirupati, Andhra Pradesh. Schools included in the present study were selected by simple random sampling method. All the necessary details regarding the study were informed to school management, teachers and children. A detailed informed consent was taken from each participant.

Anthropometric measurements such as weight (Kg) and height (m) were measured by standardized techniques. The calculated Body Mass Index (BMI) using weight and height was plotted on CDC 2000 BMI centile charts and the children were categorized into normal (<85th centile), over weight (85th-95th centile) and obese (>95th centile) [7].

Measurement of Blood pressure (BP) was recorded as per the recommendations of 4th US task force report on hypertension [8]. All subjects were advised 5 minutes rest in sitting posture followed by measurement of systolic and diastolic blood pressure on right arm using standard mercury sphygmomanometer. The average of three consecutive readings was taken as the blood pressure of the child. Children were categorized into normal (<90thcentile) prehypertension (90th-95thcentile) and hypertension (> 95thcentile).

The main purpose of the present study i.e., effect of various environmental factors on obesity and hypertension were assessed by using standard questionnaire containing proforma that includes schooling hours per day, hours of physical activity per week, hours of sleep per day, frequency of skipping breakfast per month, hours of television viewing and amount of milk intake per day.

Statistical analysis: Data was expressed as mean ± standard deviation (SD) and frequencies for continuous and categorical variables respectively. Comparison of continuous and categorical variables was analyzed by independent sample *t*-test and Chi-square analysis respectively. Association among various parameters was analyzed using Pearson correlation analysis. A $P \leq 0.05$ was considered significant for this study.

RESULTS

In the present study, the mean age observed as 12.1 ± 1.7 years. Out of 1000 subjects, 85 (8.5%) were above BMI >85thcentile and form the study group. Among 85 children, 59 (69.4%) were boys and 26 (30.6%) were girls. Sub categorization of children with BMI >85thcentile revealed that 53 (62.4%) and 32 (37.6%) were overweight and obese respectively. The mean weight, height, BMI, systolic blood pressure and diastolic blood pressure among boys and girls is shown in table-1.

Prevalence of various stages of hypertension among study group was represented in table-2. Measurement of systolic blood pressure among children with BMI>85thcentile has shown that 13.6% and 22% were having prehypertension and systolic hypertension, while diastolic blood pressure measurement has showed that 18.7% and 33.8% were with prehypertension and diastolic hypertension respectively. Categories of systolic and diastolic hypertension among boys and girls are shown in figure 1a and 1b respectively.

Table 1: Mean weight, height, BMI, SBP and DBP among boys and girls among study group.

Parameter	Boys (n=59)	Girls (n=26)	P-value
Mean weight	57.5 ± 12.0	51 ± 11.9	>0.05
Mean height	151.6 ± 20.9	147.7 ± 13.1	>0.05
Mean BMI	24.1 ± 2.7	23.4 ± 2.7	>0.05
Systolic blood pressure	112.8 ±13.3	115.6 ± 15.3	>0.05
Diastolic blood pressure	75.6 ± 9.7	78 ± 9.6	>0.05

Fig. 1a: Prevalence of systolic hypertension among obese boys and girls.

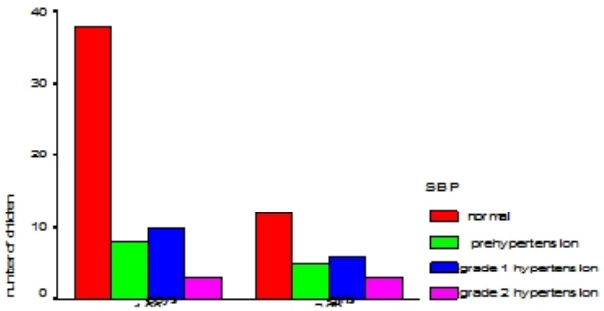

Fig. 1b: Prevalence of diastolic hypertension among obese boys and girls.

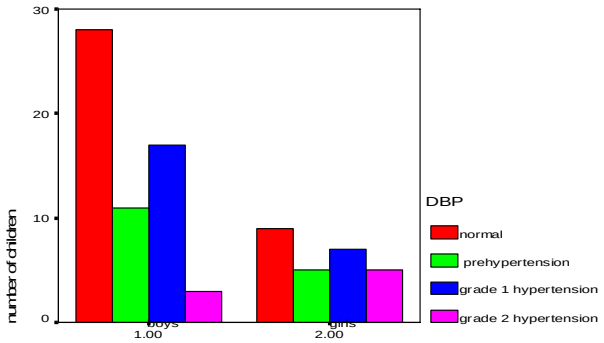

Table 3: Various environmental factors studied among obese children.

Parameter	Mean ± SD	Range
Sedentary life style (hrs/day)	11.5± 1.5	8.0-15.0
Physical activity (hrs/week)	1.3 ± 0.7	0.5-3.0
Schooling (hrs/day)	9 ± 1.3	6.0-11.0
T.V viewing (hrs/day)	1.3± 1	0.0-8.0
Sleep (hrs/day)	8.1 ± 0.9	6.0-10.0
Amount of milk intake (glass of 200ml/day)	0.9 ± 0.8	0.0-5.0

significantly higher in obese children when compared to non obese children (P<0.05). In contrast, average milk intake and hours of physical activity per week have showed to be significantly lower in children with obesity when compared with non obese children (P<0.05). In addition, children with childhood obesity showed significantly higher SBP and DBP when compared to non obese children (P<0.05). Hence, it is inferred that children with higher BMI, leading more sedentary lifestyle with lower consumption of milk and decreased physical activity are more predisposed to childhood obesity and are observed with hypertension.

Association of demographic parameters, blood pressure and environmental factors among obese children has showed the following results. A significant positive correlation was observed between age, weight, height, BMI and systolic blood pressure alone (p<0.05) concluding that children with increased BMI are more susceptible to elevated systolic blood pressure. However, hours of sleep per day had a significant negative correlation (p<0.05) with weight and BMI. Height had a significant positive correlation with the amount of milk intake per day (p<0.05) suggesting the negative impact of hours of sleep per day on increased weight and positive impact of milk consumption with growing height.

Table 2: Prevalence of various stages of hypertension among study group.

Parameter	Normal	Pre hypertension	Stage 1 HTN	Stage 2 HTN
Systolic blood pressure				
Boys	38(64.4%)	8(13.6%)	10(17%)	3(5%)
Girls	12(46.1%)	5(19.3%)	6(23.1%)	3(11.5%)
Diastolic blood pressure				
Boys	28(47.5%)	11(18.7%)	17(28.8%)	3(5%)
Girls	9(34.7%)	5(19.2%)	7(26.9%)	5(19.2%)

The important objective of the present study was evaluation of effect of environmental factors on childhood obesity and hypertension. The mean values of the environmental factors among study group included were shown in table-3. The effect of environmental factors among study group was compared with 85 non obese, age & sex matched children. It was observed that mean weight, BMI and sedentary hours per day were

Parameter	Obese children (Mean±SD)	Nonobese children (Mean±SD)	P-value
Weight (Kg)	55.5 ± 12.3	45 ± 10	<0.001*
Height	150 ± 18.9	154 ± 10.9	0.08
BMI	23.9 ± 2.7	18.6 ± 2.4	<0.001*
Milk intake (glass of 200ml/day)	0.9 ± 0.8	1.5 ± 0.9	<0.001*
Sedentary hours/day	12.8 ± 11.9	10 ± 2.4	0.048*
Hours of TV viewing	1.3 ± 1.1	1.2 ± 0.6	0.51
Sleep hours/day	8.1 ± 0.9	7.9 ± 0.8	0.16
Physical activity (hours/wk)	1.7 ± 2.3	2.3 ± 0.7	<0.001*
SBP (mm Hg)	113 ± 13	107 ± 8	<0.001*
DBP(mm Hg)	76 ± 9	72 ± 6	0.003*
Skipping breakfast/month	1.3 ± 4	0.56 ± 1.5	0.1

Table 4: Comparison of effect of environmental factors among obese children and nonobese controls.

DISCUSSION

Childhood obesity is an important non communicable disease that is epidemic globally. It is estimated that 17.6 million children under five years of age are overweight worldwide. In the United States, the prevalence and severity of overweight status is clearly increasing among children. In national surveys from the 1960s to the 1990s, the prevalence of overweight in children grew from 5% to 11% [9]. This increase in the severity of obesity has also translated into an increase in the prevalence of outcomes such as type 2 diabetes mellitus, hypertension and cardiovascular diseases [2]. In our study, we found a prevalence of 8.5% with childhood obesity in comparison to international figures [9].

The association between obesity and hypertension in children has been reported in numerous studies among a variety of ethnic and racial groups. All studies signifying elevated blood pressures with higher prevalence of hypertension in obese compared with lean children [2,10]. In our study, there was a high prevalence of systolic hypertension (22%) and diastolic hypertension (33.8%) among obese children. There was a significant positive correlation of systolic blood pressure in obese children with age, weight, height, BMI as shown in previous studies [11-14].

There was a significant negative correlation of number of hours of sleep with BMI. Short sleep duration has been shown to be a risk factor for obesity in children. It is proposed that modulation of hormones such as decreased leptin and ghrelin can increase hunger, appetite, and influence weight gain [15-16]. The duration of sleep in this study was self reportage. Obese children are less physically active, had more sedentary hours per day and consume less milk per day. The blood pressure records were significantly less among controls compared to obese children. Dairy calcium promotes weight loss was substantiated in this study in comparison to non obese children.

CONCLUSION

Based on the results of the present study, it concludes a higher prevalence of obesity among apparently healthy school children that is been unnoticed. Prevalence of systolic and diastolic hypertension was higher among obese children. It is implicated that decreased hours of sleep, milk consumption, physical activity and increased sedentary life style are important risk factors in childhood obesity.

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