



CORRELATION OF BLOOD PRESSURE AND BODY MASS INDEX IN CHILDREN BETWEEN 6 –12 YEARS OF AGE

Paediatrics

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ABSTRACT

Introduction: High blood pressure in children is a growing health condition globally. Childhood Obesity has reached its epidemic levels throughout the world. Overweight and obesity are known to cause significant impact on physiological health of adults and Various life-threatening diseases like hypertension and cardiovascular diseases develop at the early age. **Aim:** The aim of the study is to assess the correlation between blood pressure and body mass index in children of age 6-12 years and to find out the prevalence of hypertension. **Material and Methods:** The study was conducted with a total of 801 children of age 6-12 years. Data on demographic variables, anthropometric measurements and family history, physical activity was evaluated for each children and statistical analysis was performed using SSPS version 28 to find out the correlation between blood pressure and Body mass Index in children of age 6-12 years. **Results:** The results of the present study found that there was significant association of blood pressure and body mass index. Increased BMI is associated with gender, waist hip ratio, physical inactivity, poor dietary habits and family history. **Conclusion:** Obesity and overweight are the potential risk factors in developing childhood hypertension which lead to major life-threatening diseases.

KEYWORDS

Childhood Hypertension, Obesity, Prevalence, Body Mass Index.

INTRODUCTION:

Childhood hypertension is more statistical rather than functional in consideration with the fact that cardiovascular events are not the presenting feature. (1) The Fourth report on the Diagnosis, Evaluation and Treatment of High Blood Pressure in Children and Adolescents defines "Paediatric hypertension as average systolic blood pressure and/or diastolic blood pressure that is >95th percentile for gender, age, and height on >3 occasions and prehypertension in children as average SBP or DBP levels that are >90th percentile but ≤ 95th Percentile. As with adolescents BP levels >120/80 mm Hg should be considered prehypertensive. Stage I hypertension is when BP between 95th-99th centile plus 5mm of Hg and Stage II hypertension is when BP more than 99th centile plus 5mm of Hg." (2) BMI has good specificity but has poorer sensitivity. It is the preferred method of expressing body fat percentile from clinical measurements. (3)

Bmi Percentile Based On Weight For Age:(4)

<5th percentile	Under weight
5th – 84th percentile	Normal weight
85th – 94th percentile	Over weight
≥ 95th percentile	Obesity

Obesity in childhood is a leading path for developing hypertension, cardiovascular disease. (5) Hence prevention of excessive body weight in children is necessary to avoid complications associated in adult life. (6) BP varies with age and is related to height and weight of the child. Studies proved that the levels of BP were strongly influenced by sex and growth of an individual. whereas Blood Pressure and Body mass index are correlated to each other showing that obese children have significant high BP than children who are at normal weight. (7) Health education among the target population and awareness among the parents about childhood hypertension and the associated risk factors is the primary approach to prevent hypertension in children and adolescents. The population should be educated about the importance of reducing obesity and increase in physical activity of the child

through school and community based program. (8). Hence, the study is designed to find out the correlation between Blood pressure and Body mass index in children of 6-12 years of age.

MATERIALAND METHODS:

This Cross-sectional study was conducted among the children attending Paediatric outpatient Department of Aarupadai veedu Medical College and Hospital during the period of January 2021 to June 2022 for the Children in the age group between 6 to 12 years attending Paediatric OPD were included. Parents who are not willing to participate in the study and children with serious illness like seizures, nephrotic syndrome, respiratory distress, cardiovascular problems were excluded.

After IEC approval, the written informed consent was taken from the parents and assent from children by explaining the objectives and method of the study. Physical activity of the children including hours of time spending in watching TV and Outdoor games, family history was evaluated by the questionnaire. All children were screened for Anthropometric measurements like Height, Weight Waist circumference, Hip circumference.

Body mass index, Waist to hip ratio, Conicity index was calculated using the formula. Blood pressure of the children was measured in supine position by sphygmomanometer and values were recorded. Appropriate cuff size according to the age group used for recording blood pressure. Sample size was 752 and calculated using the formula $n = 4pq/d^2$.

Statistical Analysis

All the data were collected in proforma and entered in excel sheet. Collected data were analyzed. Continuous variables were represented as Mean & Standard Deviation, and categorical variables as Frequency percentage, and Statistical analysis using Chi square test. SSPS version 28 was used for data analysis. Correlation between the

variables will be analyzed using Pearson correlation Coefficient. P value of <0.05 was accepted as significant.

RESULTS:

Total of 801 children fulfilling the inclusion criteria were included in the study. Among them, 54% were males and 46% were females. Children of age 6-8 years were 37.1%, 8-10 years were 28.1% and 10-12 years were 34.8% respectively

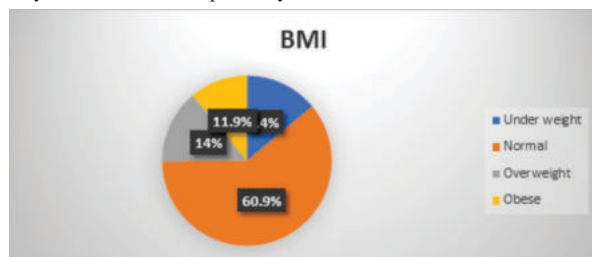


Figure 1: Distribution Of Bmi Among Study Participants

Based on BMI, 11.9% were obese, 14% were overweight, 60.9% were normal, 14% were underweight respectively.

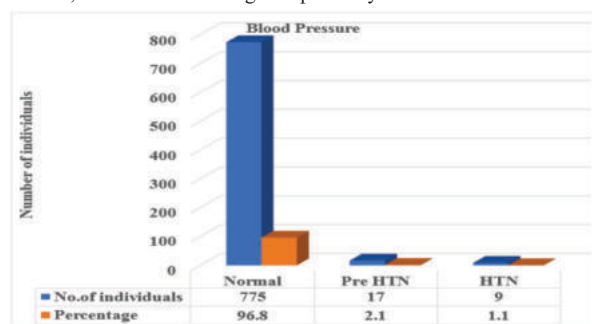


Figure 2 : Distribution Of Blood Pressure Among Study Participants

Among those children, 96.8 % were normal, 2.1% were pre-hypertensive and 1.1 % were hypertensive respectively.

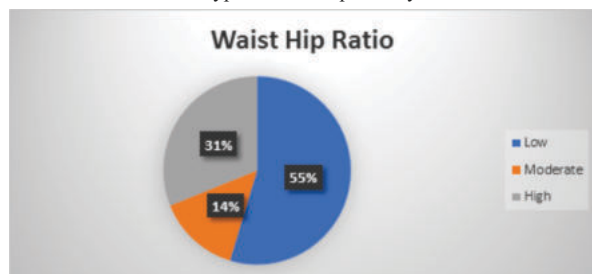


Figure 3: Percentage Of Waist Hip Ratio

In WHR, 55% were found with low WHR, 14% were moderate, 31% were high WHR. In this study, the mean values of BMI was found to be 16.24 kg/m²; Waist Hip Ratio was found to be 0.88 cm; Systolic blood pressure was 101 mm Hg; Diastolic blood pressure was 65.21 mm Hg; Conicity Index was 1.13 m and Age was 9.3 years.

Table 1: Association Between Body Mass Index And Blood Pressure

		BMI				Total	chi-square value	P value
		Under weight	Normal	Overweight	Obese			
BP centile	Normal	111	483	108	73	775	75.949	<0.001*
	Pre HTN	0	2	3	12	17		
	HTN	1	3	1	4	9		
Total		112	488	112	89	801		

In our study, the findings shows a significant association of positive correlation between Blood Pressure (BP) and BMI with $p < 0.001^*$. Out of 488 children with normal weight, 3 of them found hypertensive and 2 were prehypertensive. Among 89 obese children, 4 of them found hypertensive and 12 were prehypertensive whereas in 112 overweight children, 1 found hypertensive and 3 were prehypertensive.

Table 2: Association Between Childhood Hypertension And Parental Hypertension

		BP PERCENTILE						Total		Chi-square	P value
		Normal		Pre HTN		HTN					
		N	%	N	%	N	%	N	%		
FATHER HTN	No	727	93.8 %	0	0.0 %	0	0.0%	727	90.8 %	264.002	<0.001*
	Yes	48	6.2%	17	100.0%	9	100.0 %	74	9.2 %		
MOTHER HTN	No	753	97.2 %	0	0.0 %	0	0.0%	753	94.0 %	421.559	<0.001*
	Yes	22	2.8%	17	100.0%	9	100.0 %	48	6.0 %		

There was a significant association noted between between childhood hypertension and parental hypertension with $p < 0.001^*$. Hence the study shows parental hypertension is a risk factor for childhood hypertension. Dietary habits also stands as a major risk factor for increase in BMI.

Table 3: Correlation Between Bmi And Waist Hip Ratio

Correlations			
		BMI	WAIST HIP RATIO
BMI	Pearson Correlation	1	.342**
	Sig. (2-tailed)		<.001

There was a significant correlation between BMI and Waist Hip Ratio with p value less than 0.001

DISCUSSION:

The present study is aimed to assess the correlation of blood pressure and body mass index in children 6-12 years of age and To find out the magnitude of childhood hypertension. This study also identify the children who are developing complications due to risk factors of high blood pressure. A medical history with physical examination including anthropometric measurements are done to assess the children who are hypertensive, obese and at risk of developing complications. They are also evaluated by using questionnaire for Physical activity like watching TV, playing outdoor games, dietary habits, parental history(9)

According to the study of Wright et al, the rise of BMI was noted with the rise in age but in our study age do not have association with Body mass index. The impact of gender on the association with BMI is controversial and there was a significant association noted between BMI and gender (10)

In our study, children with normal weight are more in number when compared to overweight and obese. Based on BMI, 60.9% were normal, 11.9% were obese, 14% were overweight, 14% were underweight respectively. The study by Kowal proved that children of age 3-18 in Krakow city are observed to have increased incidence in overweight and obesity when Mazur noted that children of aged 13-15 years are in less percentage of obese and overweight. (11)

However it is found that Body mass index (BMI) is significantly associated with systolic blood pressure (SBP) and diastolic blood pressure (DBP) Showing positive correlation in our study. A study by Hernandez and a study done in Harvard school found that BMI and BP are always positively correlated. (12)

The prevalence of childhood hypertension was found to be 1.1% and prehypertension was 2.1% respectively in our study whereas Brady TM et al found that the prevalence of hypertension in children is 6% and increases who are at risk of obese. Primary hypertension in children is associated with risk factors like hyperlipidaemia, insulin resistance, end organ damage, left ventricular hypertrophy and carotid intima-media thickness. (13)

Decreased physical activity by spending few hours in playing outdoors and more time in watching TV showed positive association with Body mass index in children in this study. As per the information by Wijnhoven TM et al., the major influencing factors for overweight and obesity were found to be watching TV, playing computer games for longer duration or spending more time in smartphone. (14)

On the basis of our study, it is observed that obesity is an independent risk factor for developing hypertension and measurement of BMI is

highly recommended in health care settings. The use of BMI should be made mandatory to predict and screen hypertension. successful weight management, Healthy eating habits and performing more physical activity plays a significant role in preventing obesity and controlling BMI

CONCLUSION :

The present study documented a significant association of positive correlation of blood pressure and body mass index in children between 6 – 12 years of age. This suggest that obesity is strong risk factor for developing hypertension and helps to identify the children who are at risk of developing complications due to increased blood pressure by early age. Healthy diet and regular physical activity will prevent obesity and its harmful comorbidities. Regular screenings should be done in children to prevent the risk of life threatening disease. Hence it is necessary to conduct biannual body weight and blood pressure measurements in children which protect them from the cause of hypertensive disorders.

REFERENCES:

1. Daniel B, Kleigman, Behrman, Nelson textbook of Paediatrics 18th edition:Saunders. Philadelphia: 2017, pg1988-1995.
2. National High Blood Pressure Education Program Working Group. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. *Pediatrics*. 2004;114:555-76.
3. Centers for Disease Control and Prevention. Overweight and obesity; childhood overweight and obesity, consequences. [Last accessed on 2009].
4. Robert M. Kliegman, Nelson T.B. of 18th edition Nutrition : Saunders. Philadelphia: 2017; Vol I Page No: 234.
5. Flynn JT, Kaelber DC, Baker-Smith CM, Blowey D, Carroll AE, Daniels SR, de Ferranti SD, Dionne JM, Falkner B, Flinn SK, Gidding SS. Clinical practice guideline for screening and management of high blood pressure in children and adolescents. *Pediatrics*. 2017;140(3):e20171904
6. Smith JD, Fu E, Kobayashi MA. Prevention and Management of Childhood Obesity and Its Psychological and Health Comorbidities. *Annu Rev Clin Psychol*. 2020; 16:351-378
7. Wang W, Lee ET, Fabsitz RR, Devereux R, Best L, Welty TK, Howard BV. A longitudinal study of hypertension risk factors and their relation to cardiovascular disease: the Strong Heart Study. *Hypertension*. 2006; 47:403–409.
8. He Q, Ding ZY, Fong DY, Karlberg J. Blood pressure is associated with body mass index in both normal and obese children. *Hypertension*. 2000;36(2):165-70.
9. Woo J, Ho SC, Sham A, Leung SSF, Lam TH, Janus ED. Dietary habit of smokers in a Chinese population. *Int J Food Sci Nutr*. 2001; 52:477–484.
10. Wright SM, Aronne LJ. Causes of obesity. *Abdom Imaging*. 2012;37(5):730-2.
11. Kowal M, Woronowicz A, Kryst Ł, Sobiecki J, Pilecki MW. Sex differences in prevalence of overweight and obesity, and in extent of overweight index, in children and adolescents (3–18 years) from Kraków, Poland in 1983, 2000 and 2010. *Public Health Nutr*. 2020; 17, 7492.
12. Gelber RP, Gaziano JM, Manson JE, Buring JE, Sesso HD. A prospective study of body mass index and the risk of developing hypertension in men. *Am J Hypertens*. 2007;20(4):370-7.
13. Brady TM, Neu AM, Miller ER 3rd, Appel LJ, Siberry GK, Solomon BS. Real-time electronic medical record alerts increase high blood pressure recognition in children. *Clin Pediatr (Phila)*. 2015 ;54(7):667-75.
14. Wijnhoven TM, van Raaij JM, Spinelli A, Rito AI, Hovengen R, Kunesova et al. WHO European Childhood Obesity Surveillance Initiative 2008: Weight, height and body mass index in 6–9-year-old children. *Pediatr. Obes*. 2014; 14:806–810