

Study of Association between Body mass index and Blood Pressure in private school children aged 5-15 years

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Abstract

Background: Obesity in children and adolescents is gradually becoming a major public health problem in India. In children BMI changes substantially with age, rising steeply with infancy, falling during preschool years, then rising during adolescence, and early adulthood. The prevalence of hypertension in children is 1-3%. In addition to age, gender, height, weight and body mass index are also known to influence blood pressure levels in childhood and adulthood. **Objective :** To Estimate the level of Body mass index, Blood pressure and Association between Body mass index and blood pressure among apparently healthy private school children aged 5-15 years of Tirupati. **Methods :** Cross-sectional study conducted at Tirupati urban area (School based study). **Results:** Out of 900 children included in the study, 580 (64.44%) were males and 320 (35.55%) were females. Majority of the study subjects i.e., 162 (18%) were aged 12 years, followed by 15 years (15.4%) and 14 years (14.8%) age group. Prevalence of obesity is 3.77% (34 out of 900) and overweight is 5.88% (53 out of 900). Prevalence of hypertension is 1.44% (13 out of 900) and pre-hypertension is 1.33% (12 out of 900). Out of 580 (100%) males 1.8% are obese and 1.2% are hypertensive. Out of 320 (100%) females 7.1% are obese and 1.8% are hypertensive. **Conclusion:** In the present study, prevalence of obesity is 3.77% and hypertension is 1.44% among apparently healthy school children aged 5-15 years of Tirupati. Prevalence of obesity is more in females than in males. **Key-words:** BMI, overweight, Obesity, hypertension.

INTRODUCTION

Malnutrition, in every form, presents significant threat to human health. The world today faces a double burden of malnutrition which includes both undernutrition and obesity, especially in developing countries.¹ Obesity in children and adolescents is gradually becoming a major public health problem in India.² In children BMI changes substantially with age, rising steeply with infancy, falling during preschool years, then rising during adolescence, and early adulthood.³

The prevalence of hypertension in children is 1-3%.⁴ Measurement of blood pressure is not routinely employed in our country in various health checkup programmes and studies pertaining to blood pressure of school going Indian children are still inadequate. Elevated blood pressure in children and adolescents may be an early expression of essential hypertension in adulthood.⁵ Few studies have also shown that obese children have an increased systolic and diastolic blood pressure levels.^{6,7} In addition to age, gender, height,

weight and body mass index are also known to influence blood pressure levels in childhood and adulthood.

Blood pressure gradually increases from very low levels at birth and reaches comparable levels to that of an adult by late adolescence. This study underlines the important role of body mass index in influencing the BP levels during childhood and adolescence. In addition to predicting adult BP, childhood BP is also known to predict other factors that are related to cardiovascular risk in later life.⁸

If the trend towards adult hypertension can be recognized in childhood, it may be possible to alter life style and prevent systemic hypertension as well as related complications.⁹ Hence this study is taken up to evaluate the association between body mass index and blood pressure among apparently healthy private school aged children of Tirupati.

Objectives: To Estimate the level of Body mass index, Blood pressure and Association between Body mass index and blood pressure among apparently healthy private school children aged 5-15 years of Tirupati.

MATERIALS AND METHODS

- A. Type of study** - Cross-sectional study.
- B. Study Area** -Tirupati urban area(School based study)
- C. Study period** - from September 2016 to August 2017
- D. Sample number** : It has been observed from the earlier studies that the prevalence of Overweight and obesity was 10% and the prevalence of hypertension was 1-3%. For the present study, sample size of 900 was estimated using the prevalence rate of 10% with 20% acceptable (allowable) error at 90% confidence level.

A) Inclusion criteria:

1. Apparently healthy private school children aged 5-15 years of Tirupati.

B) Exclusion criteria:

1. Children with chronic illness.
2. Children on all long term medications.
3. Children with congenital anomalies.
4. Children diagnosed to be obese and hypertensive secondary to other cause.

Study methods: A list of private schools in the urban area of Tirupati was obtained and from the list of schools three schools were selected using simple random sampling. Permission to undertake the study in such schools was obtained from the school principals.

A pilot study was done in a school to test the questionnaire and to have some acquaintance with the tools to be used in the study. Based on the responses, few modifications were done in the questionnaire. This pilot study was done in the school which was not selected for the study and the data obtained too was not used in the study proper.

Initially questionnaires were issued to the students. After the questionnaire was filled up, students were asked to come to the investigator with their questionnaires in hand and then their weight and height were measured and BP was recorded one by one and were noted in their respective questionnaires with the help of teachers. After collection of data from all the three schools, the questionnaires were used for analysis. For boys and girls anthropometry and BP were recorded by the investigator as per standard protocol.

Methods adopted for statistical analysis: Data analysis was done using MS Excel software, Epi Info 7 version software.

Operational Definition:

- Centre for Disease Control - BMI growth charts developed by National Centre for Health Statistics were used to categorize children using BMI percentiles
- **Obese:** Body mass index (BMI) > 2 standard deviations above the WHO growth standard median.¹⁰

Age and gender wise distribution of study population

Study was undertaken in "Tirupati" city, being a locality of Sri Venkateswara medical college. The present study was carried out among 900 apparently healthy school children aged 5-15 years. The proportion of males is 64.44% (580) and that of females is 35.55% (320).

Prevalence of overweight: Using BMI as criteria and based on CDC growth charts developed by NCHS, prevalence of overweight (BMI for age and sex between 85th and 95th percentile) was evaluated. Out of 900 (100%) study population, 53 (5.8%) apparently healthy school children are overweight.(table 1)

Table No1: Age wise distribution of prevalence of obesity and overweight in the study population

Age (Yrs)	Normal	Overweight	Obesity	Total
5	49(90.7%)	3(5.5%)	2(3.7%)	54(6%)
6	59(90.7%)	4(6.1%)	2(3.07%)	65(7.2%)
7	45(93.7%)	2(4.1%)	1(2.0%)	48(5.3%)
8	42(91.3%)	3(6.5%)	1(2.1%)	46(5.1%)
9	65(87.8%)	5(6.71%)	4(5.4%)	74(8.2%)
10	45(90%)	3(6%)	2(4%)	50(5.5%)
11	41(87.2%)	4(8.5%)	2(4.2%)	47(5.2%)
12	145(89.5%)	10(6.1%)	7(3.7%)	162(18%)
13	74(91.3%)	5(6.1%)	2(2.4%)	81(9%)
14	123(91.7%)	6(4.4%)	5(3.7%)	134(14.8%)
15	125(89.9%)	8(5.7%)	6(4.3%)	139(15.4%)
Total	813(90.3%)	53(5.88%)	34(3.77%)	900(100%)

Prevalence of obesity: Using BMI as criteria and based on CDC growth charts developed by NCHS, prevalence of obesity (BMI for age and sex above 95th percentile) was evaluated. Out of the study population of 900 (100%), 34 (3.77%) apparently healthy school children are obese..(table 2)

Table No 2 : Gender wise distribution of prevalence of obesity and overweight in the study population

Gender	BMI(N(%))			Total
	Normal	Overweight	Obesity	
Male	551(95)	18(3.1)	11(1.8)	580(100)
Female	262(81.8)	35(10.9)	23(7.1)	320(100)
Total	813(90.3)	53(5.88)	34(3.77)	900(100)

Prevalence of hypertension: The National High Blood Pressure Education Program Working Group on High Blood Pressure in Children and Adolescents published the Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents. According to these recommendations prevalence of hypertension (average systolic or diastolic BP is > or = to 95th percentile for age, sex and height) was evaluated. Out

of 900 study population, 13 (1.44) apparently healthy school children are hypertensive.(table 3)

Table No 3: Age wise distribution of prevalence of Hypertension and Pre-hypertension in the study population

Age (Yrs)	Normal	Prehypertension	Hypertension	Total
5	54(100%)	0(0%)	0(0%)	54(100%)
6	65(100%)	0(0%)	0(0%)	65(100%)
7	48(100%)	0(0%)	0(0%)	48(100%)
8	45(97.8%)	0(0%)	1(2.1%)	46(100%)
9	72(97.2%)	1(1.3%)	1(1.3%)	74(100%)
10	49(98%)	0(0%)	1(2%)	50(100%)
11	45(95.7%)	1(2.1%)	1(2.1%)	47(100%)
12	154(95.0%)	4(2.4%)	4(2.4%)	162(100%)
13	78(96.2%)	2(2.4%)	1(1.23%)	81(100%)
14	130(97.0%)	2(1.49%)	2(1.49%)	134(100%)
15	135(97.1%)	2(1.43%)	2(1.43%)	139(100%)
Total	875(97.2%)	12(1.33%)	13(1.44%)	900(100%)

Gender wise prevalence of obesity In the present study out of 580 (100) boys, 1.8 (11) were obese whereas out of 320(100) girls, 7.1 (23) were obese. Girls were found to be more obese than boys and the difference is statistically significant.(table 3)

Table No. 4 : Distribution of Prehypertension and hypertension in overweight and obese

	Overweight	Obese	Total
Normal	41(77.3%)	21(61.7%)	62(71.26%)
Prehypertension	9(16.9%)	3(8.8%)	12(13.7%)
Hypertension	3(5.6%)	10(29.4%)	13(14.94%)
Total	53(100%)	34(100%)	87(100%)

Table No 5 : Sex wise distribution of prevalence of non-obese and obese in the study population

Sex	BMI		Total
	Non Obese	Obese	
Male	569(98.1%)	11(1.89%)	580(100%)
Female	297(92.8%)	23(7.1%)	320(100%)
Total	866(96.2%)	34(3.7%)	900(100%)

Pvalue-0.0001 Chisquare = 14.46

Gender wise prevalence of hypertension In the present study out of 580 (100) boys, 1.2 (7) are hypertensive and among 320 (100) girls, 1.8 (6) are hypertensive. The percentage of hypertensive girls are slightly higher than boys but the difference is statistically insignificant. Statistically insignificant difference between boys and girls with respect to prevalence of hypertension. When the mean height and mean weight in different age groups were compared, it was found that boys are slightly taller and heavier than girls. .(table 4)

Age group wise prevalence of hypertension among obese children Out of 34 (100) obese children, 64.71 (22) belonged to 11-15 years age group whereas only 35.29 (12) belonged to 5-10 years age group. Out of 22 (100) obese children of 11-15 years age group, 27.2 (6) are hypertensive. Out of 12 (100) obese children of 5-10 years age group, 16.5 (2) are hypertensive..(table 5)

DISCUSSION

Prevalence of overweight : Studies conducted in different parts of India on school children have come out with prevalence ranging from 5.43 in Chakroborty et al⁷- 2011 to 22 in Sharma et al⁹ – 2007. The prevalence of overweight in the present study (5.8) correlates with the study done by Deokeet al⁸(5.84) which was conducted among 565 school children aged 5-17 years.

Prevalence of obesity : Studies conducted in different parts of India on school children have come out with prevalence ranging from 0.35 (Deoke et al⁸ – 2012) to 6 (Sharma et al⁹ – 2007) . The prevalence of obesity in the present study (3.77) correlates with the study done by Premnath M et al¹¹(3.4) which was conducted among 43,152 school children aged 5-16 years at Mysore .

Prevalence of hypertension: Studies have come out with prevalence of hypertension ranging from 0.41 (Gupta A.K and Ahmad A.J¹²) to 1.8 (Aggarwal VK et al¹³). The prevalence of hypertension in the present study 13(1.44) correlates with the study done by Verma M⁵et al (1.1) which was conducted among 2560 apparently healthy school children aged 5-15 years. Children and adolescents with upper percentiles of blood pressures are “at risk” of developing hypertension at a future date in adulthood.

Gender wise prevalence of obesity: Study done by Sonya Jagadesan et al¹⁶(IOTF criteria) showed higher prevalence of obesity among girls than boys. Also studies done by Mudu²¹ in three major Indian cities reported higher prevalence of obesity among girls than boys. Contrarily a few studies have come out with lower prevalence of obesity among girls when compared to boys (Kapilet al¹⁷ and Shiji K Jacob et al¹⁸)

Gender wise prevalence of hypertension: These findings are in favour of the argument that body weight and height are the strongest determinants of blood pressure and not the gender Verma M¹⁵ et al.

Age group wise prevalence of hypertension among obese children: Similar findings were reported by one other study conducted by ChadaSL¹⁹ which showed 34 of 11-15 years age group obese children are obese which is higher than 13.1 of 5-10 years of obese children are hypertensive. These findings strongly favour the argument that anthropometric variables like height, weight and body mass index show positive correlation with systolic as well as diastolic blood pressure. Hence, obese children of 11-15 years age group who were taller and heavier showed higher prevalence of hypertension than those of 5-10 years age group

Prevalence of obesity among hypertensive children: The present study shows that among hypertensive children 76.9 are obese. Similar findings were reported in many other studies. Percentage of asymptomatic hypertensive children found to be obese. Close relevance was found in the study conducted by Gupta AK et al¹² which showed 62.5 of asymptomatic hypertensive children were obese.

CONCLUSION: In the present study, prevalence of obesity is 3.77 and hypertension is 1.44 among apparently healthy school children aged 5-15 years of Tirupati. Prevalence of obesity is more in females than in males and the observation is statistically significant. Prevalence of hypertension is slightly higher in females but the observation is statistically insignificant. Anthropometric variables like height, weight and body mass index showed positive correlation with systolic as well as diastolic blood pressure. Obese children are at a higher risk of "childhood onset of adult diseases". Thus, timely recognition and intervention will result in decreased adulthood morbidity and mortality.

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