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Original Research Article

Prevalence of hypertension and obesity in children aged 6-18 years in a city of Central India: a cross-sectional study

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ABSTRACT

Background: Historically, hypertension in children was deemed uncommon and primarily attributable to underlying medical illnesses, such as renal or endocrine abnormalities. However, this phenomenon is evolving, as a growing proportion of youngsters are now being diagnosed with primary (essential) hypertension, a disorder formerly believed to impact mainly adults. Objective was to study prevalence of hypertension and obesity in children aged 6-18 years.
Methods: School-based cross-sectional study was carried out among 1000 school children of age 6-18 years. Height, weight and body mass index were measured and classified as per standard guidelines. Blood pressure was measured and classified as per standard guidelines.
Results: Prevalence of obesity and overweight was 10.6% and 14.6% respectively and combined was 24.8%. Prevalence of obesity decreased as age increased from 6-7 years (12.7%) to 11-12 years (7.5%) and increased to 14.5% at 16-18 years. Prevalence of hypertension was 4.1%. It was 2.5% in 11-12 years and increased to 8.5% in 16-18 years. Prevalence of overweight and obesity was statistically not different in males and females (p=0.6347) and as per school type (p=0.1699). Prevalence of prehypertension and stage-1 hypertension was not much different in the males and females (p=4162).
Conclusions: Prevalence of overweight, obesity, pre-hypertension and stage-1 hypertension was quite high in this study population. The factors like gender and school types were not associated with overweight, obesity, pre-hypertension and stage-1 hypertension.

Keywords: Hypertension, Obesity, Children

INTRODUCTION

Globally, hypertension is one of the leading causes of cardiovascular diseases. Historically, hypertension in this age group was deemed uncommon and primarily attributable to underlying medical illnesses, such as renal or endocrine abnormalities. However, this phenomenon is evolving, as a growing proportion of youngsters are now being diagnosed with primary (essential) hypertension, a disorder formerly believed to impact mainly adults. This transition can be ascribed to numerous variables, particularly the prevalent embrace of detrimental lifestyles marked by inappropriate nutritional selection, lack of physical activities and a significant increase in childhood obesity. Early detection of these cardiovascular risk factors (hypertension and obesity) is an important public health priority as it may possibly prevent the adverse consequences of cardiovascular diseases in adulthood.[1]

Prevalence of hypertension in children have shown an upward trend from a low <1% to a high of 16.2% in different studies. The prevalence of hypertension as per the National Family Health Survey Series Four (NFHS-4) was found to be 18.1% in 2015-2016, while 21% of adolescent females had hypertension compared to 24% of adolescent males of the same age range, as estimated in NFHS-5 (2019-2021).[2,3]

Obesity is a rapidly growing pandemic encompassing many complexities and involves almost every organ of the

body. Obesity must be dealt as an issue that affects the society which encompasses the interactive relationship between environment, biology and behaviour rather than just as a single medical illness. The incidence of overweight and obesity in the pediatric population is on the rise across the world. This is true to all the groups of society irrespective of the income bracket.[4]

Most of the studies done for hypertension in India have been conducted based on National Health and Nutrition Examination Survey (NHANES) guidelines, which show more prevalence of hypertension in children with obesity. These data were based on the 2004 fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents. The American Academy of Pediatrics (AAP) recommended newer guidelines in 2017 for new blood pressure (BP) levels to categorize elevated blood pressure and hypertension. According to the newer guidelines, blood pressure levels were lowered by 2-3 mmHg for children aged less than 12 years based on the percentiles for age, sex, and height.[5]

In Chhattisgarh, the prevalence of hypertension among female of same age group was 8.8% and males 12.8% as per NFHS-4 survey.[3] Previously, childhood obesity and being overweight were initially thought to be a disease in developed countries. Overweight is defined as excess body weight relative to height, whereas obesity refers to surplus body fat. In 1975, the prevalence of obesity and overweight among children and adolescents aged 5-19 was just 4% compared to 18% in 2016. The rise has been observed similarly among girls and boys. Now, more than 124 million children and adolescents (6% of girls and 8% of boys) were obese in 2016. There is a growing global health concern when it comes to overweight and obesity in children, and it poses a significant challenge to the healthcare system in developing countries. Most of the studies state that the prevalence of obesity and overweight is more in developed countries than in developing countries. However, the occurrence is increasing in developing countries in recent years.[6,7]

Childhood hypertension is often asymptomatic, leading to underdiagnosis and delayed management. Unlike adults, blood pressure in children varies with age, sex, and height, requiring the use of standardized percentile-based charts for accurate classification. Failure to detect and manage hypertension at an early stage can result in target organ damage, including left ventricular hypertrophy, vascular changes, and renal impairment, even during childhood. Moreover, elevated blood pressure in childhood tends to track into adulthood, significantly increasing the risk of cardiovascular diseases such as coronary artery disease and stroke later in life.[8]

The increasing prevalence of hypertension in children highlights the need for routine blood pressure screening as part of regular pediatric health assessments. Early detection provides an opportunity for timely lifestyle modifications, including promotion of physical activity, healthy dietary practices, and weight management, which can effectively prevent progression to sustained hypertension. Public health strategies focusing on school-based interventions, parental awareness, and community-level programs are essential to curb the rising burden of pediatric hypertension.[9]

Early detection of these cardiovascular risk factors (hypertension and obesity) is an important public health priority as it may possibly prevent the adverse consequences of cardiovascular diseases in adulthood.[10]

However, current data in India regarding the changes in the prevalence of pediatric hypertension and obesity and their association with cardiovascular risk factors are limited, particularly among children and adolescents from Chhattisgarh. Hence, the present study was conducted to assess the association of pediatric hypertension and obesity in school going children aged 6-18 years in Bilaspur city of Chhattisgarh.

METHODS

The present study was a cross-sectional study carried out from December 2024 to October 2025 among school children from age group 6 to 18 years.

Based on the previous study, the prevalence of overweight and obesity combined was taken as 40.8%.[11] Sample size was estimated at 5% level of significance with an allowable error of 5% and a design effect of 2, it came out to be 742. We were able to cover 1000 children.

An updated list of all public schools was used as the sampling frame, and schools were randomly selected to achieve the sample size. All the children belonging to 6-18 years, in all the nearby schools were included in the study. The total number of children in all the nearby schools was 1230. Thus, finally the total number of children studied was 1000.

All school children 6-18 years studying in the schools and present on the day of examination were included in the present study. Those not willing to participate in the study, not belonging to specified age group and children with physical or mental disabilities (pre-diagnosed) were excluded. The study was approved by the Ethical Committee of the Medical College (vide letter no. 376/C.I.M.S./I.E.C./2024 dated: 4-9-2024). Permission was obtained from the District Education Officer (DEO) and authorities of local school. Teaching and administrative staff underwent prior orientation about the study. Before start of study student were aware about the study by their teachers as well as by the investigator. Child assent was obtained as per standard ethical protocol.

Blood pressure in children was defined as follows: normal: BP <90th percentile (compared with age, sex and height percentile in each age group), prehypertension: BP=90th–95th percentile, and hypertension: BP >95th percentile.[12]

Anthropometric measurements weight, height was taken as per standard protocol and guidelines. The socio-demographic data was filled by the parents. School children were sent to home with parental form one day prior to their interview and measurements. Parental form included sociodemographic data. This parental form was attached with consent form.

The age was recorded according to birth date filled in the parental form. It was cross checked from the school records. Record of the educational status of the child was restricted to the class in which the child was studying at the time of examination.

The data obtained was coded and entered into Microsoft Excel Worksheet. Data collected in the study was analysed using statistical package for the social sciences (SPSS) software for windows version 24 (IBM Corp. IBM SPSS Statistics for Windows [computer software], version 24.0. Armonk, New York: IBM Corp.; 2016.). The categorical data was expressed as proportions and comparison was done using chi-square test or Fisher's exact test. The continuous data was expressed as mean±standard deviation (SD). A probability value of less than or equal to 0.05 at 95% confidence interval was considered as statistically significant.

RESULTS

The overall prevalence of obesity and overweight was 10.6% and 14.6% respectively. Total combined prevalence of overweight and obesity was 24.8%. The prevalence of obesity decrease as the age increased from 6-7 years (12.7%) to 11-12 years (7.5%) and then again increased to 14.5% at 16-18 years of age. Similar trend was observed for overweight. This trend was not found to be statistically significant (p=0.2526) (Table 1).

The overall prevalence of hypertension was 4.1%. There were no cases of hypertension in the age group of 6-7 and 8-10. It was 2.5% in the age group of 11-12 years and it increased to 8.5% in the age group of 16-18 years. There were no cases of stage-1 hypertension till 12 years of age. It was 5.6% in the age group of 13-15 years which increased to 8.5% in 16-18 years age group (Table 2).

The prevalence of overweight was more in males (15.2%) compared to females (13.2%). Whereas the prevalence of obesity was almost similar in two groups (p=0.6347) (Table 3).

The prevalence of prehypertension and stage-1 hypertension was not much different in the males and females. Only seven males had prehypertension compared to only three males. Only 15 females and 16 males had stage-1 hypertension. These differences were statistically not significant (p=4162) (Table 4).

The prevalence of overweight was 16.2% among students of private schools compared to 12.1% among students of Government schools. The prevalence of obesity was almost similar in two school types (p=0.1699) (Table 5).

There were no cases of stage-1 hypertension in the government schools compared to 31 cases from the private schools. The number of pre-hypertensives were five each from both school types. Because of zero value in one of the cells, we could not apply statistical test in this table (Table 6).

Table 1: Age wise prevalence of overweight and obesity.

Age group (years)	Normal, N (%)	Overweight, N (%)	Obese, N (%)	Total, N (%)
6-7	111 (74)	20 (13.3)	19 (12.7)	150 (15)
8-10	144 (72)	36 (18)	20 (10)	200 (20)
11-12	157 (78.5)	28 (14)	15 (7.5)	200 (20)
13-15	197 (78.8)	30 (12)	23 (9.2)	250 (25)
16-18	143 (71.5)	28 (14)	29 (14.5)	200 (20)
Total	752 (75.2)	142 (14.2)	106 (10.6)	1000 (100)

Table 2: Age wise prevalence of hypertension.

Age group (years)	Normal blood pressure, N (%)	Prehyper-tension, N (%)	Stage 1 hyper-tension, N (%)	Total, N (%)	Hypertension cases, N (%)	Prevalence, N (%)
6-7	150 (100)	0	0	0	0	0
8-10	200 (100)	0	0	0	0	0
11-12	195 (97.5)	5 (2.5)	0	200 (20)	5	2.5
13-15	231 (92.4)	5 (2)	14 (5.6)	250 (25)	19	7.6
16-18	183 (91.5)	0	17 (8.5)	200 (20)	17	8.5
Total	959 (95.9)	10 (1)	31 (3.1)	1000 (100)	41	4.1

Table 3: Gender wise prevalence of overweight and obesity.

Gender	Normal, N (%)	Overweight, N (%)	Obese, N (%)	Total, N (%)
Female	376 (76.4)	65 (13.2)	51 (10.4)	492 (49.2)
Male	376 (74)	77 (15.2)	55 (10.8)	508 (50.8)
Total	752 (75.2)	142 (14.2)	106 (10.6)	1000 (100)

Table 4: Gender wise prevalence of hypertension.

Gender	Normal blood pressure, N (%)	Prehypertension, N (%)	Stage-1 hypertension, N (%)	Total, N (%)
Female	470 (95.5)	7 (1.4)	15 (3.1)	492 (49.2)
Male	489 (96.3)	3 (0.6)	16 (3.1)	508 (50.8)
Total	959 (95.9)	10 (1)	31 (3.1)	1000 (100)

Table 5: School type wise prevalence of overweight and obesity.

School type	Normal, N (%)	Overweight, N (%)	Obese, N (%)	Total, N (%)
Government	380 (76.7)	60 (12.1)	55 (11.1)	495 (49.5)
Private	372 (73.7)	82 (16.2)	51 (10.1)	505 (50.5)
Total	752 (75.2)	142 (14.2)	106 (10.6)	1000 (100)

Table 6: School type wise prevalence of hypertension.

Type of school	Normal blood pressure, N (%)	Prehypertension, N (%)	Stage-1 hypertension, N (%)	Total, N (%)
Government	490 (98.9)	5 (1.1)	0	495 (49.5)
Private	469 (93.9)	5 (0.9)	31 (6.1)	505 (50.5)
Total	959 (95.9)	10 (1)	31 (3.1)	1000 (100)

DISCUSSION

In the present study, the overall prevalence of hypertension among children aged 6–18 years was 4.1%. This prevalence is comparable to several Indian studies conducted in urban and semi-urban settings. Kaur et al from Delhi reported a hypertension prevalence ranging between 3–5% among school children, while Bagudai et al, Odisha, observed a prevalence of 4.2%.[13,14] Similarly Ranjani et al in the ORANGE project conducted in Chennai, documented hypertension prevalence between 4–6% among school-going children.[15] The consistency of findings across geographically diverse regions of India suggests that childhood hypertension is no longer confined to metropolitan cities but is emerging even in smaller urban centers like Bilaspur. This trend may be due to widespread impact of lifestyle changes, including dietary transition, reduced physical activity, and increased screen time.[16]

In the present study, the prevalence of obesity in the present study was 10.6%, which is consistent with findings from other Indian studies. Gupta et al reported obesity prevalence between 8–12% among school children in Delhi, while studies from South India and the ORANGE project reported similar figures.[15-17] The Comprehensive National Nutrition Survey (CNNS 2019–2022) also documented an obesity prevalence of approximately 11% among urban Indian children.[18] These findings indicate that Bilaspur city is experiencing a nutritional transition similar to other urban regions of India. While undernutrition continues to coexist in certain sections of society, overweight and obesity are becoming increasingly prevalent, particularly among children from urban and higher socioeconomic backgrounds. Globally, childhood obesity has reached epidemic proportions. According to the World Health Organization, the prevalence of overweight and obesity among children and adolescents has increased more than fourfold over the past four decades.[19]

The present study revealed a higher prevalence of hypertension among older children (>12 years) compared to younger age groups. This age-wise trend is consistent with findings from Indian studies conducted in Delhi, Pune, and other urban areas by Kaur et al and Devadas et al.[13,20] The increase in prevalence with age may be attributed to pubertal changes, increasing body mass index, hormonal influences, and greater exposure to unhealthy lifestyle behaviors such as reduced physical activity and increased consumption of calorie- dense foods.[21]

In the present study, sex-wise analysis revealed that the prevalence of hypertension was comparable between male and female children, with no statistically significant difference observed. These findings are in agreement with several Indian studies that have reported minimal or no

significant gender difference in pediatric hypertension prevalence after adjusting for BMI. Satapathy et al observed that the association between BMI and blood pressure was strong irrespective of sex, and once obesity was present, both boys and girls exhibited a markedly increased prevalence of hypertension.[22] Similarly, Gundeti et al reported that BMI and urban residence were stronger predictors of hypertension than sex, indicating that lifestyle and environmental factors may override biological sex differences in determining blood pressure levels among adolescents.[23]

In the present study, hypertension was observed exclusively among children studying in private schools, while government school children predominantly exhibited normal blood pressure readings. Overweight and obesity were also marginally higher among private school students. School type in the Indian context often serves as a surrogate marker for socioeconomic status (SES), urban lifestyle, and access to calorie-dense foods, sedentary recreation, and screen exposure. Thus, the observed clustering of hypertension among private school children likely reflects underlying socioeconomic and lifestyle differences rather than school type alone. These findings are consistent with observations by Gundeti et al, who reported a significantly higher prevalence of both obesity and sustained hypertension among urban adolescents and those belonging to higher socioeconomic strata.[23] Their multivariate analysis demonstrated that high socioeconomic status was strongly associated with obesity, which in turn showed a robust association with elevated blood pressure. This highlights the indirect but powerful role of SES in shaping cardiovascular risk profiles during childhood. Similarly, James et al observed a higher burden of hypertension among overweight and obese school children, a pattern more frequently encountered in private school settings.[24] Vasudevan et al using nationally representative data from the CNNS, demonstrated that high blood pressure clustered with multiple cardiometabolic risk factors, including overweight, dyslipidemia, and impaired glucose metabolism.[8] These risk factors were more prevalent among children from higher wealth quintiles and urban backgrounds, underscoring the role of socioeconomic transition in the epidemiology of pediatric hypertension in India. These findings indicate that school type and socioeconomic status influence pediatric hypertension primarily through their impact on lifestyle behaviors and obesity. Children attending private schools or belonging to higher socioeconomic strata may be exposed to obesogenic environments that predispose them to early cardiovascular risk.

These observations underscore the need for school-based and community-level interventions targeting healthy diet, physical activity, and routine blood pressure screening across both private and government schools, with particular emphasis on children from higher socioeconomic backgrounds undergoing rapid lifestyle transitions.

Limitations and strengths

Present study was school based hence, the results cannot be applied to community. It was a cross-sectional study and therefore limited in causality. Only indicative associated risk factors can be known from such kind of study design. However, robust sample size of 1000 school children in one of the strengths of this research.

CONCLUSION

The present study concludes that hypertension is an emerging health problem among children and adolescents, with an overall prevalence of 4.1% among school-going children aged 6–18 years in Bilaspur city. A significant association was observed between obesity and hypertension, establishing obesity as an important modifiable risk factor.

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