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Original Research Article

A STUDY ON PREVALENCE OF HYPERTENSION AND ITS RISK FACTORS AMONG SCHOOL-GOING CHILDREN AGED 10–15 YEARS IN AN URBAN AREA

P Renuka[1], M Venkateswarlu[2], M Praveen[3], D Manikyamba[4]

[1]*Post Graduate, Department of Paediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh, India*
[2]*Associate Professor, Department of Paediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh, India*
[3]*Assistant Professor, Department of Paediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh, India*
[4]*Professor & HOD, Department of Paediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh, India*

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Corresponding Author:
Dr. M Venkateswarlu,
Associate Professor, Department of Paediatrics, Rangaraya Medical College, Kakinada, Andhra Pradesh, India.
Email: venkymachavaram@gmail.com

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ABSTRACT

Background: Pediatric hypertension is rising globally in tandem with childhood obesity and sedentary lifestyles. Even mild elevations in blood pressure (prehypertension) in youth track into adult disease, emphasizing the need for early screening. We conducted a cross-sectional study to determine the prevalence of elevated blood pressure and associated risk factors in urban schoolchildren aged 10–15 years.

Materials and Methods: A total of 582 healthy schoolchildren (284 boys, 298 girls) aged 10–15 years were recruited from government and private schools in urban Kakinada, Andhra Pradesh. Blood pressure was measured with a mercury sphygmomanometer using appropriate cuff sizes; values ≥95th percentile for age/sex/height were classified as hypertension, and 90–95th percentile as prehypertension (per standard guidelines. Anthropometry (height, weight, BMI, waist circumference) and questionnaire data (family history of hypertension, socioeconomic status, physical activity, sleep duration, diet) were collected. Prevalence rates were calculated, and chi-square tests assessed associations between elevated BP and risk factors.

Results: Among 582 children, no child met criteria for hypertension (BP ≥95th percentile). Prehypertension (BP in the 90–95th percentile) was found in 33 children (5.7% of the sample), being slightly higher in girls (6.7%) than boys (4.5%), though this sex difference was not statistically significant (p=0.202). The prevalence of prehypertension increased with age (5.4% in 14–15 yrs vs 3.9% in 10–13 yrs). Children in private (higher-income) schools had a significantly higher rate of prehypertension (8.9%) than those in government schools (2.4%, p=0.0012). Similarly, overweight and obesity were more common in private-school children (25% and 12%) than government-school children (16% and 6.8%, both p<0.05). In univariate analysis, positive family history of hypertension (present vs absent) was strongly associated with prehypertension (12% vs 2%, p<0.001). Low physical activity (<1 hour/day) and short sleep (<6 hours/night) were also significantly linked to prehypertension (8.4% vs 3.0%, p=0.0017 and 8.9% vs 3.0%, p=0.0003, respectively). Socioeconomic status showed highest prehypertension in the lower-middle class (7.6%) compared to upper classes (none in upper, and 4–5% in others).

Conclusion: In this urban pediatric cohort, about 1 in 18 children had prehypertension, while none had frank hypertension. The overall prevalence is comparable to recent Indian estimates (~7%) but lower than some reports (10–15%). Elevated BP was significantly associated with excess weight, family hypertension, and unhealthy lifestyles (physical inactivity, inadequate sleep). These findings underscore the growing burden of cardiovascular risk in Indian youth and the urgent need for routine BP screening and preventive interventions (healthy diet, exercise) in schools.

Keywords: Childhood hypertension; Prehypertension; Prevalence; Risk factors; Obesity; Urban schoolchildren; India

INTRODUCTION

Hypertension in children is an emerging global health concern. A large meta-analysis of 47 studies (N≈400,000 children) found that the pooled prevalence of pediatric hypertension is around 4.0%, with prehypertension affecting roughly 9.7% of youths. In recent decades the prevalence of childhood elevated Blood Pressure has nearly doubled worldwide (from ~3% in 2000 to >6% by 2020), driven largely by rising obesity, unhealthy diets and sedentary lifestyles. Among children with obesity, hypertension prevalence is especially high – on the order of 15%–19% compared to ≈2% in normal-weight peers. These trends are concerning because prehypertension & hypertension in childhood often tracks into adult cardiovascular disease.

In India, systematic reviews suggest that about 7% of children and adolescents are hypertensive, with higher rates in urban areas and among overweight children.[1-15] For example, urban obese Indian youths show rates up to ~29%, versus ~7% in normal-weight. Numerous small Indian studies report prevalence ranging widely (often 5–12%) depending on region and criteria used.[6-15] Risk factors identified include excess body weight, high salt intake, physical inactivity, inadequate sleep, and family history of hypertension.[10-15] However, data are still limited, especially in some regions.

Given this context, we undertook a cross-sectional survey of 10–15-year-old school children in urban Kakinada, Andhra Pradesh, to determine the prevalence of hypertension and prehypertension and to examine associated risk factors (anthropometric, behavioral, and familial). Early identification of elevated BP in this age group could prompt lifestyle interventions to prevent lifelong cardiovascular risk.

MATERIALS AND METHODS

This cross sectional study was conducted over 18 months period (June 2024–Nov 2025) in urban Kakinada (Andhra Pradesh, India). Schoolchildren aged 10–15 years were recruited from both government and private schools. Exclusion criteria were known chronic illness, ongoing medication affecting BP (e.g., steroids), or lack of consent. Approval from Institutional Ethics Committee and parental consent were obtained.

A pre-tested proforma was used to collec each child's demographic data and family history (including hypertension or diabetes in parents). Age was verified from school records. Body weight was measured using (electronic scale, to nearest 0.1 kg), height and waist circumference were measured (non-stretchable tape, to nearest 0.1 cm). Body mass index (BMI) was calculated (kg/m^2) and children were classified as overweight (85-95th) & obesity (≥95th) using IAP centiles for Indian children.

Blood pressure (BP) was measured using a calibrated mercury sphygmomanometer with appropriately sized cuff. After 5 min of rest, BP was recorded in the sitting position from the right arm at heart level. Two readings were taken 5 minutes apart, and the average was used. If the first measurement was ≥90th percentile, two additional readings (30 min apart) were taken and averaged. Blood pressure percentiles were determined using the "Fourth Report" pediatric BP tables (age/sex/height). Hypertension was defined as average systolic and/or diastolic BP ≥95th percentile, and prehypertension as BP ≥90th and <95th percentile (or ≥120/80 mmHg) Data were entered in Microsoft Excel and analyzed with SPSS version 23. Descriptive statistics (mean ± SD, percentages) were calculated. The chi-square test assessed associations between prehypertension and categorical risk factors (sex, school type, socioeconomic class, family history, physical activity, sleep duration, etc.). A p-value <0.05 was considered statistically significant.

RESULTS

A total of 582 children (284 males, 298 females) were studied. The mean age was 12.8 ± 1.6 years. No child (0%) had BP ≥95th percentile on repeat measurements; thus hypertension prevalence was effectively zero in this cohort. 33 children (5.7%) were prehypertensive. Among males, 13/284 (4.5%) were prehypertensive; among females, 20/298 (6.7%) were prehypertensive. But the difference is not statistically significant. Prehypertension was more common in the older age group (14–15 years) than in 10–13 years (7.0% vs 4.8%), though this difference was not statistically significant (Chi-square p=0.202).

Table 1: Distribution of prehypertension by age and gender.

Age Group	Males (n=284)	PreHTN Male	Females (n=298)	PreHTN Female	Total
10–13 years	119	4 (3.3%)	128	8 (6.2%)	
14–15 years	165	9 (5.4%)	170	12 (7.0%)	
Total	284	13 (4.5%)	298	20 (6.7%)	582

Among children from government schools (n=291), 7 (2.4%) were prehypertensive, 47 (16%) were overweight and 20 (6.8%) were obese. In contrast, among private school children (n=291), 26 (8.9%) were prehypertensive, 73 (25%) were overweight and 35 (12%) were obese (Table 2). These differences were statistically significant: prehypertension was markedly higher in private schools (8.9% vs 2.4%, χ^2 p=0.0012). Overweight was also more common (25% vs 16%, p=0.010), as was obesity (12% vs 6.8%, p=0.047).

Table 2: Anthropometric and BP status by school type.

School Type	Prehypertension	Overweight	Obesity
Government (n=291)	7 (2.4%)	47 (16.0%)	20 (6.8%)
Private (n=291)	26 (8.9%)	73 (25.0%)	35 (12.0%)

A positive family history of hypertension was strongly associated with elevated BP: 26 of 216 children with hypertensive parents (12.0%) were prehypertensive, versus 7 of 366 without such history (1.9%), p<0.001. Children reporting <1 hour/day of physical activity had higher prevalence of prehypertension (24/287 = 8.4%) than those activity with physical ≥1 hr/day (9/295 = 3.0%, p=0.0017). Short sleep (<6 hrs/night) also conferred higher risk (23/258 = 8.9% vs 10/324 = 3.1%, p=0.0003). Socioeconomic status (modified Kuppuswamy) showed the highest prevalence of prehypertension in lower-middle class (7.6%); none in the upper-class group, and 4–5% in other strata (Table 3). Prevalence of PreHTN was high in those children with higher waist circumference which is statistically significant (p<0.001).

Table 3: Prehypertension by risk factor categories.

Risk Factor	Category	N (total)	PreHTN cases (% in group)
Family history of HTN	Present	216	26 (12.0%)
	Absent	366	7 (1.9%)
Physical activity	<1 hour/day	287	24 (8.4%)
	≥1 hour/day	295	9 (3.0%)
Sleep duration	<6 hours/night	258	23 (8.9%)
	≥6 hours/night	324	10 (3.1%)
Waist Circumference	Normal	487	14 (2.9%)
	Increased	95	19 (20.0%)
Socioeconomic status	Upper	22	0 (0%)
	Upper-middle	116	5 (4.3%)
	Lower-middle	182	14 (7.6%)
	Upper-lower	188	10 (5.3%)
	Lower	74	4 (5.4%)

Prehypertension (5.7%) was positively associated with overweight/obesity, positive family history, low physical activity, and short sleep duration, consistent with known risk factors. The combined prevalence of "elevated BP" (prehypertension + hypertension) was 5.7% in our cohort; this is similar to some recent Indian estimates (≈7%) and lower than early reports from other regions (up to 12%).

DISCUSSION

This study adds to the evidence that elevated blood pressure is not rare in Indian schoolchildren and is strongly linked to modifiable risk factors. Prevalence of PreHTN in this study (5.7%) aligns with the pooled estimate of 7% hypertension in Indian youths, though direct comparison is limited by varying definitions.[1,2] Notably, none of the 582 children met full criteria for hypertension, suggesting that interventions at the prehypertensive stage may still prevent progression.[3-6,14,15] In contrast, many international cohorts (e.g. China, USA) report (2–6%) prevalence of hypertension. Differences may reflect younger age, single-visit measurements, or true population variation.

Consistent with global trends, girls had a slightly higher prevalence of prehypertension.[3,8,11,14,15] The Guardian-reported Lancet meta-analysis found that BP peaks around age 14, which is echoed in the finding of higher prevalence in 14–15 year-olds in this study. The higher rates in girls in our sample may relate to earlier pubertal weight gain, as obesity risk often rises first in girls in this age range.

Finding of this study that private-school (higher socioeconomic) children had much higher rates of overweight, obesity, and prehypertension than government-school children is noteworthy.[5,12,13,15] This likely reflects lifestyle and dietary differences: higher SES urban families often consume more calories and have more sedentary time. Several studies in India and elsewhere similarly link urban/high-income status with childhood obesity and hypertension. The Kaiser Permanente study showed that overweight children have roughly double the rise of HTN compared to normal-weight peers, paralleling observation of this study that nearly all prehypertensive cases were clustered among overweight/obese children.[12,13] Indeed, international evidence indicates that among obese children up to 10–19% may have hypertension.

Lifestyle factors emerged as significant correlates.[14,15] Physical inactivity was associated with a higher prehypertension rate (8.4% vs 3.0%), which is in line with established knowledge that sedentary behavior promotes obesity and metabolic risk.[4,12,15] Inadequate sleep (<6 hrs) also showed a strong link; chronic sleep deprivation elevates sympathetic activity and has been identified as a risk factor for pediatric hypertension. Family history of hypertension was another strong predictor in this data, consistent with genetic predisposition.[10,11,14,15] Other unmeasured factors (e.g. dietary salt) may also play a role but were beyond this study's scope.

The main strength of this study is its comprehensive measurement of Blood Pressure and analysis of multiple risk factors in a sizable cohort. However,

limitations include its cross-sectional design (no causality), a single geographic area, and reliance on school-based sampling which may miss out-of-school children. The absence of any detected hypertension could be due to measurement at a single point in time; repeat measures over months might have identified a few cases. Nevertheless, the findings underscore the need for routine BP screening in schools and aggressive prevention of obesity.

CONCLUSION

This study in urban school children & Andhra Pradesh school children found a 5.7% prevalence of prehypertension and no confirmed hypertension. Elevated BP was strongly associated with overweight/obesity, positive family history, physical inactivity, and short sleep. These results highlight that even at age 10–15, significant cardiovascular risk factors are present, mirroring global concerns. Implementing school health programs for BP screening and health education on diet and exercise are highly recommended. Early lifestyle interventions targeting diet, physical activity, and weight control could curb the rising tide of pediatric hypertension in India.

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