

## Prevalence of Hypertension among Adolescents in a Rural Area of Madurai District: A Cross-Sectional Study

Essakiraja Kanagasabapathy<sup>1</sup>, Muthurajesh Easwaran<sup>2</sup>, Waseemsha Shanavaz Basha<sup>1</sup>

<sup>1</sup>Assistant Professor, <sup>2</sup>Associate Professor, Institute of Community Medicine, Madurai Medical College, Madurai, Tamil Nadu, India

**Correspondence:** : Dr. Essakiraja Kanagasabapathy, Email: [essakiraja2010@gmail.com](mailto:essakiraja2010@gmail.com)

### Abstract:

**Introduction:** Hypertension among adults is an important public health problem nowadays. Uncontrolled hypertension leads to certain complications such as chronic kidney diseases, heart failure, stroke, etc. Early screening of children and adolescents helps to identify those “at risk” of developing hypertension at a future date and also modify risk factors at earlier stage thereby preventing complications. **Objectives:** 1. To estimate the prevalence of hypertension among adolescents aged 10-19 years in Madurai district. 2. To determine the risk factors associated with development of hypertension among the study participants. **Methods:** A cross-sectional study comprising of 420 adolescents in the age group of 10-19 years in Madurai district were included by cluster sampling. Data was collected using a semi-structured questionnaire. Blood Pressure (BP) was measured and diagnosis of hypertension was made based on guidelines of American Association of Pediatrics and Indian Pediatrics. **Results:** The present study revealed a prevalence of elevated BP as 2.1% and hypertension as 10.2%. Educational status ( $p=0.004$ ), screen time ( $p=0.026$ ) and family history ( $p=0.000$ ) were significantly associated with adolescent hypertension. There was a positive correlation between Age and Systolic, Diastolic BP and also between Body Mass Index (BMI) and Systolic BP. **Conclusion:** Based on study findings, around 10.2% of the adolescent population was having hypertension. Non modifiable risk factors like family history of hypertension, age and modifiable risk factors like screen time, BMI were some of the factors associated with hypertension.


**Keywords:** Adolescents, Hypertension, Prevalence, Risk Factors

### Introduction:

Hypertension is a major cause of premature deaths globally with 1 in 4 men and 1 among 5 women are having this condition.<sup>[1]</sup> According to World Health Organization (WHO) in 2021, an estimated 1.28 billion adults in the age group of 30 to 79 years have hypertension globally.<sup>[2]</sup> Number of persons living with hypertension has been doubled to this number since 1990.<sup>[3]</sup> Hypertension is directly linked to more than 8.5 million deaths worldwide approximately 30,000

deaths/day in each year.<sup>[4]</sup> According to Ministry of Health and Family Welfare (MoHFW), hypertension contributes to about 1.6 million deaths annually in India.<sup>[5]</sup> Recently, the global prevalence of hypertension among children and adolescents in a systematic review conducted by Song P et al was 4.32% at 6 years of age, 3.28% at 19 years of age with peak of 7.89% at 14 years of age.<sup>[6]</sup>

According to a systematic review and meta-analysis conducted by Daniel RA et al<sup>[7]</sup>, the pooled prevalence of

Quick Response Code	Access this article online	How to cite this article :
	<b>Website :</b> <a href="http://www.healthlinejournal.org">www.healthlinejournal.org</a>	Kanagasabapathy E, Easwaran M, Basha W. Prevalence of Hypertension among Adolescents in a Rural Area of Madurai District: A Cross-Sectional Study. Healthline. 2026;17(1): 11-19
	<b>DOI :</b> <a href="https://doi.org/10.51957/Healthline_763_2026">10.51957/Healthline_763_2026</a>	

Received : 14-07-2025

Accepted : 22-01-2026

Published : 31-03-2026

hypertension among adolescents in the age group of 10-19 years was 7.6% in 2020. Screening of adolescents during adolescence period helps to identify and also modify risk factors at earlier stage thereby preventing complications at adult stage.<sup>[5]</sup> However, there were fewer studies covering the whole adolescent age group of 10-19 years in India. In order to understand the prevalence of hypertension in the age group of 10-19 years and other associated factors, this study was proposed.

Present study was conducted with the objectives to estimate the prevalence of hypertension among adolescents aged 10-19 years in Madurai district and to determine the risk factors associated with development of hypertension among the study participants.

#### Methods:

A Community based cross-sectional study was conducted among adolescents in Samayanallur area, Madurai District, South India for 1 month from March to April 2023. Apparently healthy adolescents in the age group of 10-19 years were included in this study. Pregnant adolescents, adolescents with known cause of secondary hypertension such as renal parenchymal disease, renal vascular disease, endocrine disorders and those who have taken drugs causing adolescent hypertension (corticosteroids, Non Steroidal Anti Inflammatory Drugs (NSAIDs), immunosuppressants, Oral Contraceptive Pills (OCP), oestrogen, progestins, Serotonin Norepinephrine Reuptake Inhibitors (SNRI)) and those who were not willing to participate were excluded from the study.<sup>[8,9]</sup>

The sample size was calculated using the formula ( $Z_{\alpha}^2 \times p \times q / L^2$ ) \* design effect, Where, Z alpha=1.96 at 95% confidence interval, p=Prevalence, q=100-p, L=Allowable error, design effect=1+(cluster size-1) x rate of homogeneity. Cluster size of 15 was taken for this study as it was possible to see at least 10 study subjects per day in the field thus making 2 days visit for each cluster. Data collection was mostly done in weekdays evenings and on weekends when most of the subjects were available. Rate of homogeneity = 0.02 (proportion of hypertension in general based on systematic review and meta-analysis of cross sectional studies by Roy

Arokiam Daniel et al).<sup>[7]</sup> Therefore, design effect =  $1+(15-1) \times 0.02 = 1+0.28 = 1.28$ , prevalence (p) = 23 (based on a study conducted by Rajiv Narang et al in 2018 in India)<sup>[10]</sup>,  $q=100-p=100-23=77$ , L= Allowable error (allowable error of 20% of prevalence was taken for this study. i.e. 20% of 23 = 4.6), substituting all the above values in the formula, the sample size was calculated as 412 and actual sample size covered was 420.

Cluster sampling was used. With the cluster size of 15, number of clusters needed = sample size / cluster size =  $412 / 15 = 27.5 = 28$  clusters. Therefore, with equal cluster size of 15, sample size to be covered for 28 clusters was calculated as  $28 \times 15 = 420$

Samayanallur Block PHC has 7 panchayat villages. There are total of 68 streets in 7 villages. The adolescent population (10-19 years) of 68 streets varies from a minimum of 20 to a maximum of 95 (Total of 2494 adolescents). Each street was taken as a cluster (68 clusters). Among 68 streets, 28 streets (28 clusters) were selected at random. From these 28 clusters, 15 adolescents were selected in each cluster by starting to collect the data from the first study participant from the house at the midpoint of the street and then by following right hand rule, the subsequent houses were selected till 15 adolescents were obtained in each cluster. If the house was locked during the time of data collection, data was not collected from the particular house. In each household, all adolescents in that house were covered. Similarly, for other clusters too, 15 adolescents per cluster were selected in the same way. By this way, the desired sample size was obtained.

Study Instrument: A predesigned semi-structured questionnaire consisting of basic demographic details such as age, gender, religion, education of adolescent, income of the head of the family, number of members in the family, family history of hypertension, dietary habits and pattern of eating of fruits, vegetables, tea and coffee, physical activity, sleep patterns- hours of sleep per 24 hour and TV, mobile usage details per 24 hours was used. This questionnaire was developed based on Global School Health Survey Questionnaire (which was developed by WHO) and then refined by the authors after

peer review. Blood pressure (in mmHg) was measured using mercury sphygmomanometer as digital devices systematically overestimate Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) compared to auscultation. BP was measured in sitting position with uncrossed legs in right arm at heart level. Three readings were taken with an interval of 2 minutes between each readings and average of last two readings were taken as final record of BP as per recommendations of American Association of Pediatrics and Indian Pediatrics.<sup>[11]</sup> In obese persons appropriate cuff size was used. Height (in cm) was measured using a portable stadiometer. Weight (in kg) was measured using digital weighing machine.<sup>[12]</sup>

Data collection was done in the study area after obtaining permission from The Institute Ethics Committee. Data was collected by house to house visit in the study area. In each selected village, a starting point was selected from the midpoint of the village and using right hand rule, adjacent houses were recruited continuously till 15 households were reached for all 28 clusters. After informed consent from the parents and assent from adolescents and completing the questionnaire, each study subject was explained about the procedure of Blood Pressure measurement using BP apparatus, weight measurement using weighing machine, and height measurement using stadiometer.

Cuff with adequate bladder length was used depending on the arm circumference in the age group of 10-19 years.<sup>[8,11]</sup>

**Operational Definitions**

**Adolescent:** According to World Health Organization (WHO) and United Nations (UN), Stages of Adolescence are Early Adolescence - 10-13 years of age; Middle Adolescence - 14-16 years of age and Late Adolescence - 17-19 years of age.<sup>[13]</sup>

**Hypertension In Adolescents:** As per Indian Academy of Paediatrics (IAP), adolescents (10-19 years) are divided into two age groups: 10-13 years and >13 years for the purpose of defining hypertension.<sup>[8,11]</sup> (Table 1)

**Body Mass Index (BMI):** According to WHO<sup>[14]</sup>, based on BMI values and their Standard Deviation (SD) values, boys and girls are classified into 5 categories- Severe thinness- < -3 SD, Thinness- > -3 SD to < -2 SD, Healthy weight- > -2 SD to < +1 SD, Overweight- > +1 SD to < +2 SD, Obese- > +2 SD.

For children aged between 5–19 years, overweight is defined as BMI-for-age greater than 1 standard deviation above the WHO Growth Reference median and obesity is defined as BMI-for-age greater than 2 standard deviations above the WHO Growth Reference median.<sup>[15]</sup>

**Table 1: Category of Hypertension based on percentile for 10-13 years and >13 years**

<b>BP category</b>	<b>10-13 years</b>
Normotensive	SBP/DBP <90th percentile for corresponding age, sex and 50th percentile for height in the table
Elevated BP	SBP/DBP ≥ 90th percentile to <95th percentile (or) 120/80 mmHg to <95th percentile (whichever is lower) for their corresponding age, sex and 50th percentile for height in the table
Stage-1Hypertension	SBP/DBP ≥ 95th percentile to <95th percentile+ 12mmHg (or) 130/80 mm Hg to 139/89 mmHg (whichever is lower) for their corresponding age, sex and 50th percentile for height in the table
Stage-2Hypertension	SBP/DBP ≥ 95th percentile+12 mmHg (or) e”140/90 mmHg (whichever is lower) for their corresponding age, sex and 50th percentile for height in the table
<b>BP category</b>	<b>&gt;13 years</b>
Normotensive	<120/ <80 mmHg
Elevated BP	120/ <80 mmHg to 129/ <80 mmHg
Stage-1 Hypertension	130/80 mmHg to 139/89 mmHg
Stage-2 Hypertension	≥ 140/90 mm Hg

Socio-Economic Status: In this study, Modified B.G.Prasad scale 2023 was used to assess socio-economic status (SES).<sup>[16]</sup>

Sleep Patterns: As per Centre for Disease Control and Prevention, adolescents require 9 - 9.30 hours of sleep every night. Adequate sleep in the age group of 6-12 years is 9-12 hours/24 hours and 13-18 years is 8-10 hours/24 hours.<sup>[17-19]</sup>

Physical Activity: Physical activity is defined as “Any bodily movement produced by skeletal muscles that increase energy expenditure above basal level”.<sup>[20]</sup> WHO recommends physical activity of 60 minutes of physical activity per day throughout a week.<sup>[21,22]</sup>

Screen Time: Screen time can be defined as total time per day spent viewing screens such as TV, mobile, computer, tablet. Adolescent must spend 1 hour of physical activity (play time), time for schoolwork, meals, hobbies, adequate sleep time (8-9 hours uninterrupted sleep at night). If these are displaced due to screen time, it is excessive screentime.<sup>[23]</sup>

Data Entry and Analysis: Data entry was done in Microsoft Excel. The data that was entered was analysed using SPSS software version 26.0. For continuous variables, Mean and Standard deviation was calculated. For categorical variables, Numbers and Percentages were calculated. After calculating the prevalence of high blood pressure, chi square test (and Fisher’s exact test wherever applicable) was applied to find out the association between hypertension and other factors. Pearson’s correlation method was used to find correlation between systolic, diastolic blood pressure and BMI and also between systolic, diastolic blood pressure and age. p value of <0.05 was considered significant in all above associations and correlations.

**Results:**

Table 2 shows that 197 (46.9%) were in the age group of 10-12 years, 233 (55.5%) were boys and 187 (44.5%) were girls. Majority of the study participants 264 (62.9%) were middle school students. Nearly half of the study participants 196 (46.7%) belong to socio economic status(SES) class 4.

Among the study participants, 368 (87.6%) were normotensive persons. Around one-eighth 52 (12.38%) of 420 study participants had High BP. Among those who had High BP levels, 9 participants (17.3%) falls in the stage of elevated BP levels, 32 participants (61.5%) were Stage 1 hypertensive persons and 11 participants (21.2%) had Stage 2 hypertension.

Mean systolic BP of the study participants was 98.65 ± 14.15 mmHg. The mean systolic BP of boys and girls were 97.52 ± 15.00 mmHg and 100.06 ± 12.91 mmHg respectively. The mean systolic BP of boys and girls were compared by unpaired t test, and this was not statistically significant with t value of -1.837 and p value of 0.067.

**Table 2 : Socio-demographic details of the study population (N=420)**

Socio-demographic variables	Frequency (%)
<b>Age Category</b>	
10-12 years	197 (46.9%)
13-15 years	163 (38.8%)
16-19 years	60 (14.3%)
<b>Gender</b>	
Boys	187 (44.5%)
Girls	233 (55.5%)
<b>Religion</b>	
Hindu	391 (93.1%)
Christian	19 (4.5%)
Muslim	10 (2.4%)
<b>Education</b>	
Primary School (Class 1-5)	5 (1.2%)
Middle School (Class 6-8)	264 (62.9%)
High School (Class 9-12)	141 (33.5%)
Intermediate/Diploma	10 (2.4%)
<b>Socioeconomic Status</b>	
Upper middle class (Class II)	43 (10.2%)
Middle class (Class III)	108 (25.7%)
Lower middle class (Class IV)	196 (46.7%)
Lower class (Class V)	73 (17.4%)

**Table 3: Association between Sociodemographic Details and Blood Pressure (N=420)**

Variables	Normotensive (%) [n=368, 87.62%]	Elevated BP (%) [n=9, 2.14%]	Hypertension (%) [n=43, 10.24%]	Total (%)	Fischer's exact test value	p value
<b>Age Category (years)</b>						
10-12	169 (85.7%)	3 (1.5%)	25 (12.8%)	197 (100%)	4.839	0.277
13-15	144 (88.3%)	6 (3.7%)	13 (8%)	163 (100%)		
16-19	55 (91.6%)	0	5 (8.4%)	60 (100%)		
<b>Gender</b>						
Boys	209 (89.7%)	5 (2.1%)	19 (8.2%)	233 (100%)	2.478	0.290
Girls	159 (85.1%)	4 (2.1%)	24 (12.8%)	187 (100%)		
<b>Socio-economic Status</b>						
Class-II	37 (86.05%)	0	6 (13.95%)	43 (100%)	7.327	0.538
Class-III	95 (88%)	3 (2.8%)	10 (9.2%)	108 (100%)		
Class-IV	174 (88.8%)	5 (2.6%)	17(8.6%)	196 (100%)		
Class-V	62 (84.9%)	1 (1.4%)	10 (13.7%)	73 (100%)		
<b>Educational Status</b>						
Primary school	2 (40%)	2 (40%)	1 (20%)	5 (100%)	18.208	0.004
Middle school	232 (87.9%)	2 (0.8%)	30 (11.3%)	264 (100%)		
High school	125 (88.7%)	5 (3.5%)	11 (7.8%)	141 (100%)		
Intermediate/ diploma	9 (90%)	0	1 (10%)	10 (100%)		
<b>Family History of Hypertension</b>						
Present	24 (41.4%)	6 (10.3%)	28 (48.3%)	58 (100%)	132.647	0.000
Absent	344 (95%)	3 (0.8%)	15 (4.2%)	362 (100%)		

Mean diastolic BP of the study participants was  $68.25 \pm 11.63$  mmHg. The mean diastolic BP of boys and girls were  $64.72 \pm 12.15$  mmHg and  $65.90 \pm 10.94$  mmHg respectively. The mean diastolic BP of boys and girls were compared by unpaired T-test, and this was not statistically significant with t value of -1.033 and p value of 0.302.

Table 3 shows that Normotensives (55, 91.6%) were higher in the age group of 16-19 years and lower in the age group of 10-12 years (169, 85.7%). Elevated BP (6, 3.68%) was higher in the age group of 13-15 years whereas hypertension (25, 12.8%) was higher in the age group of 10-12 years. This difference was not statistically significant (p value= 0.277). Among boys, 19 (8.2%) were hypertensives and among girls, 24 (12.8%) were hypertensives. However, this difference was not statistically significant (p value= 0.290). Hypertensives (6, 13.95%) were higher in class-2

category followed by other categories. This difference was not statistically significant (p value = 0.538). Elevated BP (2, 40%) and hypertension (1, 20%) were higher among primary school students. This difference was statistically significant (p value= 0.004). Effect size of Cramer's V value was 0.219 (Large size). Elevated BP (6, 10.3%) and hypertension (28, 48.3%) were higher among those who had family history of hypertension. This difference was statistically significant (p value= 0.000). Effect size by Cramer's V value was 0.562 (Large size).

Table 4 shows that hypertensives (8, 13.3%) were higher among those who sleep 6-8 hours/day than those who sleep 8-10 hours (30, 10.1%) and 10-12 hours/day (5, 7.8%). This difference was not statistically significant. (p value= 0.414). Elevated BP (2, 5%) and hypertension (8, 20%) was higher among those who had used TV, mobile more than 2 hours/day in the last 1

**Table 4: Association between Sleep, Screen time, Physical Activity, Dietary habits and Blood Pressure (N=420)**

Variables	Normotensive (%) [n=368, 87.62%]	Elevated BP (%) [n=9, 2.14%]	Hypertension (%) [n=43, 10.24%]	Total (%)	Fischer's exact test value	p value
<b>Hours of sleep per day in last 1 month (Hours/day)</b>						
6-8	52 (86.7%)	0	8 (13.3%)	60 (100%)	3.687	0.414
8-10	260 (87.8%)	6 (2.1%)	30 (10.1%)	296 (100%)		
10-12	56 (87.5%)	3 (4.7%)	5 (7.8%)	64 (100%)		
<b>Hours of TV, mobile usage per day in last 1 month (Hours/day)</b>						
<2	338 (89%)	7 (1.8%)	35 (9.2%)	380 (100%)	6.653	0.026
>2	30 (75%)	2 (5%)	8 (20%)	40 (100%)		
<b>Hours of physical activity per day in last 1 month (Hours/day)</b>						
<1	299 (88.2%)	8 (2.4%)	32 (9.4%)	339 (100%)	3.299	0.448
1-2	45 (88.2%)	1 (2%)	5 (9.8%)	51 (100%)		
>2	24 (80%)	0	6 (20%)	30 (100%)		
<b>Number of times of fruit and vegetable intake per day in last 1 month (Times/day)</b>						
<2	362 (87.4%)	9 (2.2%)	43 (10.4%)	414 (100%)	0.620	1.000
>2 Times/day	6 (100%)	0	0	6 (100%)		
<b>Number of times of intake of tea, coffee per day in last 1 month (Times/day)</b>						
<2	355 (88.3%)	9 (2.2%)	38 (9.5%)	402 (100%)	5.173	0.079
>2	13 (72.2%)	0	5 (27.8%)	18 (100%)		

month. This difference was statistically significant. (p value= 0.026). Effect size by Cramer's V value was 0.125 (Small size). Hypertension (6, 20%) was higher among those who had physical activity more than 2 hours/day in last 1 month than those who had physical activity in the duration of 1-2 hours/day (5, 9.8%) and less than 1 hour/day (32 (9.4%)). This difference was not statistically significant (p value= 0.448). Elevated BP (9, 2.2%) and hypertension (43, 10.4%) were higher among those who had taken fruits and vegetables less than 2 times/day than those who had taken fruits and vegetables more than 2 times/day in which 6 (100%) of them were normotensives. This difference was not statistically significant (p value= 1.000). Hypertension (5, 27.8%) was higher among those who had intake of tea and coffee more than 2 times/day in the last 1 month than those who had tea, coffee intake less than 2 times/day (38, 9.5%). This difference was not statistically significant (p value=0.079).

Age showed a significant positive correlation with both systolic and diastolic blood pressure. Systolic BP had a moderate positive correlation with age (r= 0.337, p < 0.001), while diastolic BP showed a weaker but significant correlation (r = 0.214, p < 0.001). Body Mass Index (BMI) was also positively correlated with systolic BP (r = 0.222, p < 0.001). However, the correlation between BMI and diastolic BP was weak and not statistically significant (r = 0.054, p = 0.267).

**Discussion:**

In present study, the prevalence of elevated BP was 2.14% (n=9) and hypertension was 10.24% (n=43). This is similar to findings of a systematic review conducted by Augusto cesar Ferreria de Moraes in 10-19 years of age which shows prevalence of hypertension to be 11.2%. A study conducted in Texas has shown prevalence of elevated BP among 10-17 years was 16.3%, higher than our study.<sup>[24]</sup> The findings of a cross-sectional study

conducted in Surat by Nirav Buch among 5-18 years of age shows that prevalence of hypertension was 6.48% and another cross-sectional study conducted by Kaushik Nag in Burdwan, West Bengal among 13-18 years had shown that prevalence of hypertension was 5.7% which are lower than our study.<sup>[25,26]</sup>

In present study, girls have higher prevalence of elevated BP and hypertension than boys (14.9% vs 10.3%). This is similar to a cross-sectional study conducted by Pandve H et al<sup>[27]</sup> in 2021 in which girls have higher prevalence of hypertension than boys (14.29% vs 13.89%).

In present study, there was significant positive correlation between BMI and systolic BP with correlation coefficient of + 0.222 and BMI and diastolic BP with correlation coefficient of + 0.054. A cross-sectional study conducted by Kavitha B in Puducherry and a study done by CURES-52 (Chennai Urban Rural Epidemiological Study) in adults shows that body mass index (BMI) was found to be strongly associated with hypertension.<sup>[28,29]</sup>

In this study, there was significant positive correlation between systolic, diastolic blood pressure and age with correlation coefficient values of + 0.337 and + 0.214 respectively in our study. This shows as age increases, systolic BP and diastolic BP increases. In a study in Centre region of Cameroon and in a study done by CURES-52 in adult population, age was found to be strongly associated with hypertension.<sup>[29,30]</sup>

In present study, majority of 87.8 % persons who sleep 8-10 hours/day were normotensives and this difference was not statistically significant. A systematic review conducted by Emanuela de Souza et al<sup>[31]</sup> has shown that short sleep duration of less than 8 hours was associated with high blood pressure in adolescence.

In current study, Elevated BP 5% and hypertension 20% was higher among those who used TV, mobile more than 2 hours/day in last 1 month and this difference was statistically significant. A 5-hour increment per week in hours of sedentary behavior (television/Internet) was

associated with a 17% increased likelihood of high systolic BP which supports our study findings.<sup>[32]</sup>

Cent percent of the participants who had taken fruits and vegetables more than 2 times/day were normotensives in our study. A cross-sectional study conducted by Ragupathy et al<sup>[33]</sup> has shown that consumption of low vegetables/fruits was one of the significant risk factors for hypertension among Indian population. In this study, hypertension was higher among those who had intake of tea and coffee more than 2 times/ day in last 1 month (27.8%). A study conducted by Jacob Schor shows that there was statistically significant positive association between coffee intake and risk of hypertension which supports our study.<sup>[34]</sup>

In present study, elevated BP 10.3% and hypertension 48.3% were higher among those who had family history of hypertension and this difference was statistically significant. A study in Central Jakarta, Indonesia has shown that family history of hypertension was significantly associated with hypertension.<sup>[35]</sup>

#### **Strengths & Limitations of the study:**

This study was done using Global School Health Survey (GSHS) Questionnaire that is of high standard. The study was done in field area at home settings and without use of white coat during data collection, thus in children white coat hypertension and office-based hypertension was avoided which might have given false results and can be generalizable to entire population. The study was done using cluster sampling method, thus covering larger population. The blood pressure measurements were compared with the standard tables recommended by AAP (American Academy of Pediatrics) and IAP and hence higher reliable.

Since this was a cross-sectional study, a causal relationship could not be established between the risk factors with adolescent hypertension, which could be done by a case control study, cohort study or a randomized control trial. Other factors such as substance abuse, academic performance of the students were not included in this study, which might have confounding effects on blood pressure.

**Conclusion:**

The prevalence of elevated BP was 2.14% (n=9) and hypertension was 10.24% (n=43) among adolescents. Age was positively correlated with both systolic BP and diastolic BP. BMI were positively correlated with systolic BP and diastolic BP. Factors like educational status, screen time, and family history of hypertension had a significant association with the prevalence of adolescent hypertension.

**Recommendations:**

The high prevalence of elevated BP and hypertension in adolescent population states an urgent need for periodic screening atleast yearly once regularly in the schools, or through camps in nearby areas. Awareness regarding hypertension and its complications at the school level should be taught to children through teachers in a way acceptable and understandable to them as a measure of primordial prevention and to encourage a healthy lifestyle, integrating with AYUSH for weekly yoga classes to reduce stress.

**Declaration**

Funding: Nil

Conflict of Interest: Nil

**References:**

1. WHO. WHO Health Topics Hypertension [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 13]. Available from: <https://www.who.int/health-topics/hypertension>
2. WHO. WHO Newsroom Factsheets Detail Hypertension [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 13]. Available from: <https://www.who.int/news-room/fact-sheets/detail/hypertension>
3. WHO. WHO News More than 700 million people with untreated hypertension [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 13]. Available from: <https://www.who.int/news/item/25-08-2021-more-than-700-million-people-with-untreated-hypertension>
4. Zhou B, Carrillo-Larco RM, Danaei G, Finucane JC, Gifford B, Gregg EW, et al. Worldwide trends in hypertension prevalence and progress in treatment and control from 1990 to 2019: a pooled analysis of 1201 population-representative studies with 104 million participants. *Lancet*. 2021 Sep 11;398(10304):957-980.
5. National Health Mission. Hypertension Screening, Diagnosis, Assessment, and Management of Primary Hypertension in Adults in India [Internet]. India: Ministry of Health and Family Welfare; c2021 [cited 2023 Feb 13]. Available from: [https://nhm.gov.in/images/pdf/guidelines/nrh-m-guidelines/stg/Hypertension\\_full.pdf](https://nhm.gov.in/images/pdf/guidelines/nrh-m-guidelines/stg/Hypertension_full.pdf)
6. Song P, Zhang Y, Yu J, Zha M, Zhu Y, Rahimi K, et al. Global prevalence of hypertension in children: a systematic review and meta-analysis. *JAMA Pediatr*. 2019 Dec 1;173(12):1154-63.
7. Daniel RA, Haldar P, Prasad M, Kant S, Krishnan A, Gupta SK, et al. Prevalence of hypertension among adolescents (10-19 years) in India: A systematic review and meta-analysis of cross-sectional studies. *PloS one*. 2020 Oct 6;15(10):e0239929.
8. Themes UFO. Hypertension [Internet]. Obygn Key; 2021 [cited 2023 Feb 13]. Available from: Hypertension | Obygn Key
9. US Pharmacist. US Pharmacist Cardiovascular Drug Induced Hypertension [Internet]. The Association; c2000 - 2025 [cited 2023 Feb 13]. Available from: [https://www.uspharmacist.com/article/drug-induced-hypertension#:~:text=Pharmacists%20should%20maintain%20an%20awareness,products%20\(e.g.%2C%20ginseng](https://www.uspharmacist.com/article/drug-induced-hypertension#:~:text=Pharmacists%20should%20maintain%20an%20awareness,products%20(e.g.%2C%20ginseng).
10. Narang R, Saxena A, Desai A, Ramakrishnan S, Thangjam RS, Kulkarni S, et al. Prevalence and determinants of hypertension in apparently healthy schoolchildren in India: A multi-center study. *Eur J Prev Cardiol*. 2018 Nov;25(16):1775-84.
11. Sinha A, Saha A, Samuels J. American Academy of Pediatrics clinical practice guidelines for screening and management of high blood pressure in children and adolescents: what is new?. *Indian Pediatr*. 2019 Apr;56(4):317-321.
12. WHO. WHO STEPS Surveillance. Part 3: Training and Practical Guides; Guide to Physical Measurements (Step2). 2008 [Internet]. Geneva: The Association; cWHO 2023 [cited 2023 Feb 13]. Available from: <https://www.who.int/docs/default-source/ncds/ncd-surveillance/steps/steps-manual.pdf>
13. Swati Y, Sangeeta Y. Normal Adolescent Development. *Indian J Pract Pediatr*. 2015;17(2):85-89.
14. WHO. WHO Growth reference BMI-for-age (5-19 years) [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 13]. Available from: <https://www.who.int/tools/growth-reference-data-for-5to19-years/indicators/bmi-for-age>
15. WHO. WHO Health Topics [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 13]. Available from: <https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight>
16. Mahantshetti S, Singh J, Dhandapani S. Updated Modified BG Prasad Classification for October 2023. *NJCM*. 2024;1(15):89-90.
17. CDC. CDC Sleep [Internet]. USA: Centers for Disease Control and Prevention; 2022 [cited 2022 Nov 21]. Available from: [https://www.cdc.gov/sleep/about/index.html#cdc\\_behavioral\\_basics\\_quick-getting-enough-sleep](https://www.cdc.gov/sleep/about/index.html#cdc_behavioral_basics_quick-getting-enough-sleep)
18. Paruthi S, Brooks LJ, D'Ambrosio C, Hall WA, Kotagal S, Lloyd RM, et al. Recommended amount of sleep for pediatric populations: a consensus statement of the American Academy of Sleep Medicine. *J Clin Sleep Med*. 2016;12(6):785-786.

19. Sukumaran TU. Indian Pediatr. 2011;48:843-844 [Internet]. [cited 2023 Feb 13]. Available from: <https://www.indianpediatrics.net/nov2011/nov-843-844.htm>
20. The Government of the Hong Kong Special Administrative Region. Change4Health - Classification of Physical Activity and Level of Intensity [Internet]. Hong Kong: Department of Health; c2022 [cited 2022 Nov 21]. Available from: [https://www.change4health.gov.hk/en/physical\\_activity/facts/classification/index.html](https://www.change4health.gov.hk/en/physical_activity/facts/classification/index.html)
21. WHO. WHO Physical activity [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 12]. Available from: <https://www.who.int/news-room/fact-sheets/detail/physical-activity>
22. WHO. WHO Noncommunicable Disease Surveillance, Monitoring and Reporting Global School based Health Survey Questionnaire [Internet]. Geneva: The Association; c2023 [cited 2023 Feb 12]. Available from: <https://www.who.int/teams/noncommunicable-diseases/surveillance/systems-tools/global-school-based-student-health-survey/questionnaire>
23. Gupta P, Shah D, Bedi N, et al. Indian Academy of Pediatrics guidelines on screen time and digital wellness in infants, children and adolescents. Indian Pediatr. 2022;59:235-244.
24. Bell CS, Samuel JP, Samuels JA. Prevalence of Hypertension in Children. Hypertension. 2019 Jan;73(1):148-152.
25. Buch N, Goyal JP, Kumar N, Parmar I, Shah VB, Charan J. Prevalence of hypertension in school going children of Surat city, Western India. J Cardiovasc Dis Res. 2011 Oct;2(4):228-32.
26. Nag K, Patra M, Paul A, Saha I, Bhattacharyya K, Dasgupta S, et al. An epidemiological study on prevalence of hypertension and its risk factors among school boys of Burdwan municipal area. Int J Community Med Public Health. 2017 Oct 25;4(11):4213-8.
27. Pandve H. Prevalence of Hypertension and its associated factors among School children in a rural area of Tamil Nadu – a Cross-sectional Study. Int J Med Sci Clin Res Rev. 2021;4(01):6-18. Available from: <https://ijmscrr.in/index.php/ijmscrr/article/view/128>
28. Kavitha B, Bhuvaneswari K, Vinoth P. Prevalence of sustained hypertension among adolescent school children in Puducherry. Indian J Basic Appl Med Res. 2016 Sep;5(4):649-655.
29. Mohan V, Deepa M, Farooq S, Datta M, Deepa R. Prevalence, awareness and control of hypertension in Chennai—The Chennai Urban Rural Epidemiology Study (CURES-52). J Assoc Physicians India. 2007 May;55:326-32.
30. Chelo D, Mah EM, Chiabi EN, Chiabi A, Koki Ndombo PO, Kingue S, et al. Prevalence and factors associated with hypertension in primary school children, in the centre region of Cameroon. Transl Pediatr. 2019 Dec;8(5):391-397.
31. Dos Santos EDGS, De Souza OF. Association of Sleep Duration and Blood Pressure in Adolescents: A Multicenter Study. Am J Hypertens. 2020 Jan;33(1):77-83.
32. Dasgupta K, O’Loughlin J, Chen S, Karp I, Paradis G, Tremblay J, et al. Emergence of sex differences in prevalence of high systolic blood pressure: analysis of a longitudinal adolescent cohort. Circulation. 2006 Dec 12;114(24):2663-70. Erratum in: Circulation. 2007 Aug 28;116(9):e319.
33. Anchala R, Kannuri NK, Pant H, Khan H, Franco OH, Di Angelantonio E, et al. Hypertension in India: a systematic review and meta-analysis of prevalence, awareness, and control of hypertension. J Hypertens. 2014 Jun;32(6):1170-7.
34. Schor J. Coffee and Hypertension [Internet]. Natural Medical Journal; 2017 May 3. Available from: <https://www.naturalmedicinejournal.com/journal/coffee-and-hypertension>
35. Pardede SO, Yunilasari, Setyanto DB. Prevalence and Factors that Influence Hypertension in Adolescents in Central Jakarta. Am J Clin Med Res. 2017 Jul 7;5(4):43-8.