

**PREVALENCE OF PREHYPERTENSION AMONG SCHOOL CHILDREN OF RURAL SOUTH KERALA, INDIA**

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**ABSTRACT****BACKGROUND**

Hypertension, a silent killer is a major public health problem. Adult hypertension may start early in life. Literature shows an increasing trend in prevalence of hypertension among children. Early detection of prehypertensives will help in prevention of hypertension by adopting lifestyle modifications. As there is paucity in studies on prevalence of prehypertension among children of rural South Kerala, this study has been planned.

Objectives-1. To study the prevalence of prehypertension among school children of age 9-17 years in Perumkadavila block, Thiruvananthapuram District. 2. To identify the risk factors of prehypertension in the study population.

**MATERIALS AND METHODS**

A cross sectional study was conducted among 1600 school children of age group 9-17 years of Perumkadavila Block, South Kerala, India selected by Multistage sampling during a period of six months from June 2016. Data were collected using Modified WHO Global School-based Student Health Survey Questionnaire, including Anthropometric and BP measurements. Prehypertension was defined as Systolic BP 120-139 mmHg and Diastolic BP 80-89 mmHg. Statistical analysis was done using SPSS package.

**RESULTS**

Out of 1600 study subjects, 49.5% were boys and 50.5% were girls. Prevalence of prehypertension and hypertension was 6.125% (boys - 1.625%, girls - 4.5%) and 4.5% (boys - 1.875 %, girls- 2.625%) respectively. Age ('Z' 3.42, P <0.001), Female gender ('Z' 0.610, P <0.05), Overweight/Obesity ('Z' 158.8, P <0.001), Low Socioeconomic status (Z' 158.8, P <0.001) and Family history of Diabetes, Hypertension or Coronary Artery Disease ('Z' 89.38, P <0.001) were the significant risk factors for prehypertension and hypertension.

**CONCLUSION**

High prevalence of prehypertension and hypertension and associated risk factors among school children of the study area need targeted interventions to reduce consequences. The findings were used in developing awareness programs for prevention of morbidity and mortality due to prehypertension and its complications.

**KEYWORDS**

Prehypertension, Prevalence, Hypertension, Lifestyle Modification.

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**BACKGROUND**

Hypertension, a silent killer, is a major public health problem<sup>1</sup> worldwide and is one of the risk factors for coronary artery disease and cerebrovascular disease. High blood pressure is the leading cause of death and disability worldwide and accounted for 9.4 million deaths and 7% of disability adjusted life years (DALYs) in 2010.<sup>2</sup> Development of adult hypertension may start very early in life causing premature deaths among adults throughout the world.<sup>3</sup>

The prevalence of hypertension among children is 4 to 15% worldwide.<sup>4</sup>

In India, hypertension is the leading risk factor for Noncommunicable Disease and is estimated to be attributable for nearly 10% of all deaths.<sup>5</sup> Literature shows an increasing trend in the prevalence of hypertension among children during recent decades.<sup>6,7</sup>

Many researchers studied the patterns of blood pressure and the determinants in childhood and adolescence.<sup>8,9</sup>

Studies have shown that the level and patterns of blood pressure among children and adolescents may vary from population to population.<sup>10</sup>

Prevalence of childhood hypertension was found to be 5-10% in developing countries and 1-2% in developed countries.<sup>11</sup> The prevalence of childhood hypertension in various Indian studies range from 0.96% to 11.4% respectively.<sup>12</sup>

Most of the risk factors of hypertension are preventable or modifiable if appropriate lifestyle modification is applied. As most of the behaviours begin in early adolescence, it is the appropriate time for appropriate intervention. It will be ideal to find out the prevalence of prehypertension among children so that timely lifestyle modifications will prevent them from becoming hypertensive in adulthood.

No relevant data are available on the prevalence of prehypertension in children of rural South Kerala. In this context, this study had been planned to find out the prevalence

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of prehypertension among school children from rural areas of Perumkadavila block panchayath, in South Kerala.

### Objectives

1. To study the prevalence of prehypertension among school children of age 9-17 years in Perumkadavila block, Thiruvananthapuram District.
2. To identify the risk factors of prehypertension in the study population.

## MATERIALS AND METHODS

### Study Design

Cross sectional study.

### Study Area

Schools from Perumkadavila Block Panchayath located 35 kilometres towards south from Thiruvananthapuram, capital of Kerala. The Perumkadavila Block Panchayath is comprised of five Grama Panchayaths. A total of 45 schools including Government, Private and Aided schools are there in this area.

### Study Population

Among the students from Government, Private and Aided schools of Perumkadavila Block Panchayath, a sample of study subjects of the age group 9-17 years maintaining proportion from them was selected.

### Exclusion Criteria

Those who were not willing to participate in the study.

### Selection of Study Subjects

Multistage Random sampling method was used.

### Sample Size

Prevalence of Prehypertension among children is 20.7% to 24.5% in studies<sup>13</sup> from developing countries.

Sample size for the present study was calculated using the formula  $4 PQ/d^2$ .

Prevalence,  $P = 20$ .

$Q = 100 - P = 80$ .

Effect Size = 10% of  $P = 2$ .

Sample size =  $(4 \times 20 \times 80 = 6400) / 4 = 1600$

The sample size = 1600.

### Study Duration

A period of six months from June 2016.

### Study Tool

Pretested questionnaire based on Modified WHO Global School-based Student Health Survey Questionnaire, including Anthropometric and BP measurements.

Before starting the study, Ethics Committee clearance was obtained from the Institutional Ethics Committee. Informed consent was taken from the children. In the case of children below 12 years of age, informed consent was obtained from the parents and assent from the students.

### Method of Data Collection

The parents, schoolchildren, and responsible school authorities were sensitised about the aim, significance and the timeline for the study.

The school children were interviewed and examined by the investigator. Each participant was comfortably seated. Blood Pressure was measured on the left arm in a sitting position after 5 minutes of rest in a quiet room using reliable sphygmomanometer. Systolic blood pressure (SBP) and diastolic blood pressure (DBP) were recorded.

Prehypertensives were repeated for second BP measurement for confirmation.

Standardised Techniques were used for data on weight and height.

### Study Variables

Dependent variables: Blood pressure recording (SBP in mmHg, DBP in mmHg, hypertension, and prehypertension).

Independent variables: Age (in years as stated by the student), Gender, Father's education (as stated by the student), Mother's education (as stated by the student), Economic status (BPL/APL examining the ration card).

### The questionnaire was used to get information about the following variables also

Hypertensive status of parents, Diabetic status of parents, GDM status of mother, Outdoor activities, Dietary factors, Mode of transportation.

Anthropometric measurements (Height was measured using stadiometer, Weight using weighing machine and BMI was calculated from the height and weight in  $kg/m^2$ ).

The cut-off value for Blood Pressure<sup>14</sup> was taken referring text book of Paediatrics by O.P Ghai and following the NHBPEP Classification<sup>15</sup> of Prehypertension and Hypertension in Children and Adolescents as shown below-

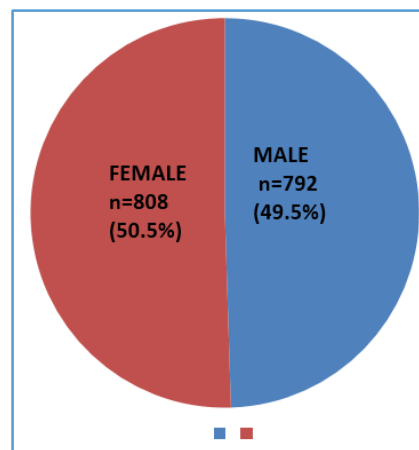
- Normal Blood Pressure is less than 90<sup>th</sup> percentile.
- Prehypertension was defined as average Systolic Blood Pressure (SBP) or Diastolic Blood Pressure (DBP) levels that are greater than or equal to 90<sup>th</sup> percentile but less than 95<sup>th</sup> percentile for gender age and height.
- Hypertension was defined as average SBP or DBP greater than or equal to 95<sup>th</sup> percentile for gender, age and height on at least three separate occasions.

Statistical Analysis was done using SPSS -16 Package.

## RESULTS

The cross sectional study was conducted among 1600 school children from Perumkadavila Block panchayath to find out the prevalence of Prehypertension and the risk factors. It was found that-

- No. of Boys = 792 (49.5%)
- No. of Girls = 808 (50.5%)
- Prevalence of Prehypertension = 98 (6.125%)
- Prevalence of Hypertension = 72 (4.5%)



**Figure 1. Gender wise Distribution of Study Subjects**

Out of the total 1600 study subjects, 792 (49.5%) were male and 808 (50.5%) were female.

Among 792 boys, 26 (3.28%) were prehypertensives and among girls 72 (8.91%) were prehypertensives.

	Systolic BP in mmHg	DBP in mmHg	Height in Centimetres	Weight in Kilograms	BMI in Kg/m <sup>2</sup>	Age in years
MEAN	88.6	52.1	147	42.4	18.9	12.5
SD	11.4	46.1	18.1	17.1	4.41	3.63
5 <sup>th</sup> Percentile	80	50	118	20	13.6	9
10 <sup>th</sup> Percentile	85	50	122	22.2	14.3	10
20 <sup>th</sup> Percentile	90	60	129	26	15.2	11
30 <sup>th</sup> Percentile	95	60	135	30	16	12
40 <sup>th</sup> Percentile	100	60	142	35	17	11
50 <sup>th</sup> Percentile	100	60	149	40	18	14
60 <sup>th</sup> Percentile	105	70	154	46	19.1	15
70 <sup>th</sup> Percentile	110	70	159	51	20.3	16
80 <sup>th</sup> Percentile	110	75	160	57	22.2	16
85 <sup>th</sup> Percentile	115	80	163	60	22.5	17
90 <sup>th</sup> Percentile	120	80	164	65	23.4	17
95 <sup>th</sup> Percentile	120	80	166	70	25.4	17

**Table 1. Blood Pressure and Anthropometric Measures of Participants**

The mean age of the study subjects was 12.5 years, Mean Systolic BP was 88.6 mmHg, Mean Diastolic BP 52.1 mmHg, Mean Height 147 cm, Mean weight 42.4 kg and Mean BMI 18.9 kg/m<sup>2</sup>.(Table 1).

Classification	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
Normal (SBP & DBP <90th percentile)	736	46	694	43.375	1430	89.375
Prehypertension (SBP or DBP ≥90th percentile but <95th percentile)	26	1.625	72	4.5	98	6.125
Hypertension (SBP &/or DBP ≥95th percentile)	30	1.875	42	2.625	72	4.5
<b>Total</b>	<b>792</b>	<b>49.5</b>	<b>808</b>	<b>50.5</b>	<b>1600</b>	<b>100</b>

**Table 2. Prevalence of Prehypertension and Hypertension among Study Subjects**

SBP- Systolic Blood Pressure; DBP – Diastolic Blood Pressure.

A total of 1600 subjects were studied of which 792 (49.5%) were male and 808 (50.5%) were female.

Prevalence of Prehypertension was 98 (6.125 %) with 26 male (1.625%) and 72 female (4.5%) prehypertensives.

Prevalence of Hypertension was 72 (4.5%) including 30 male (1.875%) and 42 (2.625%) female hypertensives.

Category	Component of Category	Prehypertensive Group		'z'	Significance
		Number	Percentage		
Age	< 12	12	12.2	3.42	P <0.001
	≥ 12	86	87.8		
Gender	Male	26	26.5	0.610	P > 0.05
	Female	72	73.5		
BMI	≥ 23	75	76.5	158.8	P < 0.001
	< 23	23	23.5		
Family history of HT, DM CAD	Present	74	75.5	89.38	P < 0.001
	Absent	24	24.5		
Socioeconomic status	High	23	23.5	158.8	P < 0.001
	Low	75	76.5		

**Table 3. Characteristics of Prehypertensive Group According to Different Variables**

BMI-Body Mass Index, HT- Hypertension, DM – Diabetes Mellitus, CAD- Coronary Artery Disease

With regard to gender, 26.5% of prehypertensives were male and 73.5% of prehypertensives were female and the difference was statistically significant (P <0.05).

Age, female gender, BMI and family history of Diabetes, Hypertension or Coronary Artery disease were showing

statistically significant (P<0.001) association with prehypertension in the present study.

Low Socioeconomic status was seen as a significant risk factor for prehypertension in this study.

**DISCUSSION**

In the present study, the prevalence of prehypertension among 1600 school children was 6.125%, prevalence of hypertension was 4.5%. The prevalence of systolic hypertension (SBP>140) was 7.84% and diastolic hypertension (DBP >90) 2.15% in a study conducted by A. K. Singh et al.<sup>15</sup> A study conducted among children from rural areas by Mohan et al showed a prevalence of 2.56%.<sup>16</sup> Patil and Garg reported in their study<sup>17</sup> that prevalence of hypertension among children aged 6-16 years was 3%.

Gender wise, the present study showed a higher prevalence of prehypertension and hypertension among females than males. Prevalence of prehypertension was 6.125% with 26 males (1.625%) and 72 females (4.5%). The 72 (4.5%) hypertensive children included 30 boys (1.875%) and 42 (2.625%) girls.

But several studies reported higher prevalence of blood pressure among males than females during adolescence and early adulthood.<sup>18,19</sup>

In the present study, prehypertension and hypertension showed significant association with high Body Mass Index. Previous studies also showed that blood pressure increased significantly as Body Mass Index (BMI) increased.<sup>20-22</sup> A study conducted among youth showed that there is 14% increased chance for prehypertension or hypertension for a unit increase in BMI. A study by Berenson et al<sup>23</sup> showed high BMI as one of the strongest risk factors of hypertension.

Low Socioeconomic status was seen as a significant risk factor for prehypertension in this study. Recent studies<sup>24</sup> from India reported that belonging to low socioeconomic group and being illiterate are independent risk factors for cardiovascular diseases.

Family history of Diabetes, Hypertension or Coronary Artery Disease were showing statistically significant association with prehypertension in the present study. Some other studies also show similar finding.<sup>25</sup>

Low physical activity did not evolve as significant risk factor in this study.

**CONCLUSION**

High prevalence of prehypertension and associated risk factors among school children of rural areas need targeted interventions to reduce cardiovascular risk. It is beneficial if every health facility makes attempts for routine recording of blood pressure of school children so that prehypertensives may be detected early and subjected to lifestyle modifications to prevent morbidity and mortality due to hypertension and prehypertension. Health education programs may be given importance from the Departments of Health Services and Department of Education for evolving a generation free of risk factors for Noncommunicable diseases.

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