

## Original Research Article

# Prevalence of hypertension among school children in Kashmir, India

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### ABSTRACT

**Background:** Over the last two decades, there has been increased awareness that hypertension in children may be a part of the spectrum of essential hypertension mainly linked to obesity epidemic. An increasing number of children and adolescents are being diagnosed with hypertension. Objectives of this study was to determine the prevalence of hypertension among apparently healthy school children residing in the valley of Kashmir.

**Methods:** It was a community based cross sectional study was done over a period of one year in School going children aged 11 to 16 years from both urban and rural areas of Kashmir valley.

**Results:** Thus, prevalence of hypertension was 5.1% and prevalence of prehypertension was 9.3%. Out of total 1600 children 1464 (91.5%) had a normal BMI, 72 (4.5%) were overweight and 64 (4%) were obese. In the prehypertensive group 114 (77%) had normal BMI, 18 (12.16%) were overweight and 16 (10.8%) were obese. In the hypertensive group 30 (36.6%) had normal BMI, 26 (31.7%) were overweight and 26 (31.7%) were obese.

**Conclusions:** Our study reveals that hypertension is not uncommon in Kashmiri children. With globalization bringing more lifestyle modifications, children are exposed to multiple risk factors including obesity and family history of hypertension. We need to make people aware of these facts so that blood pressure measurement could be a part of routine health care check-up in children to detect it early and do necessary interventions.

**Keywords:** Hypertension, Obese, Overweight, Prehypertension, Prevalence

### INTRODUCTION

Blood pressure is defined as the amount of pressure exerted by blood on the walls of the arteries as the blood moves through them. It is a continuous variable with two measurements recorded-diastolic and systolic. The highest pressure occurring when blood is propelled through the arterial circulation by the contraction of heart is the systolic blood pressure. When the heart relaxes in between beats the pressure in the arteries falls to its lowest value known as the diastolic blood pressure.<sup>1</sup> The definition of hypertension in children and adolescents is based on the normative distribution of BP in healthy

children. Normal BP is defined as SBP and DBP that is less than the 90th percentile for sex, age, and height. Hypertension is defined as average SBP or DBP that is greater than or equal to the 95th percentile for sex, age, and height on at least three separate occasions. Average SBP or DBP levels that are greater than or equal to the 90th percentile, but less than the 95th percentile, had been designated as “high normal” and are considered to be an indication of heightened risk for developing hypertension. This designation is consistent with the description of “prehypertension” in adults.<sup>2</sup> The term white-coat hypertension defines a clinical condition in which the patient has BP levels that are above the 95th

percentile when measured in a physician's office or clinic, whereas the patient's average BP is below the 90th percentile outside of a clinical setting.<sup>2</sup>

Correct measurement of BP in children requires use of a cuff that is appropriate to the size of the child's upper right arm. By convention, an appropriate cuff size is a cuff with an inflatable bladder width that is at least 40 percent of the arm circumference at a point midway between the olecranon and the acromion.<sup>3</sup> For such a cuff to be optimal for an arm, the cuff bladder length should cover 80–100 percent of the circumference of the arm. Such a requirement demands that the bladder width to-length ratio be at least 1:2.<sup>4,5</sup>

Essential hypertension is the most common form of hypertension in adults, and it is recognized more often in adolescents than in younger children. It is often accompanied by a strong family history. The cause of essential hypertension is likely to be multifactorial. Secondary hypertension in children is most commonly due to renal abnormalities, cardiovascular diseases or endocrinopathies. Renal parenchymal diseases (chronic glomerulonephritis, reflux or obstructive nephropathy, hemolytic-uremic syndrome, polycystic or dysplastic renal diseases), or renovascular hypertension account for approximately 90% of children with secondary hypertension.<sup>6</sup>

Hypertension increases the risk of cardiovascular diseases, including coronary artery disease, congestive heart failure, ischemic and hemorrhagic stroke, renal failure, peripheral arterial disease, blindness.<sup>7</sup>

Hypertension is a major health problem with high morbidity and mortality affecting both developed and developing nations.<sup>8</sup> While the mortality associated with cardiovascular disease seems to be declining in Western Europe and America, the burden of cardiovascular diseases in developing countries continues to rise and is expected to be a major cause of death in adults from low-income and middle income countries worldwide.<sup>9</sup> Risk factors for hypertension include non-modifiable factors like age, sex, genetic factors, and ethnicity. With age blood pressure rises in both sexes. Genetic factors are important in essential hypertension. Modifiable risk factors for hypertension include obesity, salt intake, physical activity, type of diet, environmental stress, socioeconomic status and other factors.<sup>10</sup> Development of adult hypertension may start very early in life; and children maintain their position in the blood pressure distribution over time.<sup>11</sup>

Blood pressure tracking studies suggest that hypertension in adulthood often has its origin in childhood.<sup>12</sup> Indeed blood pressure in childhood is the best predictor of hypertension in later life.<sup>11,13</sup> Thus, early detection of hypertension and its precipitating or aggravating factors are important if one is to evolve measures so that complications of hypertension can be prevented.

Pediatrics hypertension was historically assumed to be secondary to renal, cardiovascular or endocrine causes. Over the last two decades, there has been increased awareness that hypertension in children may be a part of the spectrum of essential hypertension mainly linked to obesity epidemic. An increasing number of children and adolescents are being diagnosed with hypertension. The evidence from developed countries indicates an increased prevalence of hypertension in children and young adults. With globalization bringing more lifestyle modifications, adolescents are exposed to multiple risk factors including obesity and also family history of hypertension. As the symptoms of childhood hypertension are largely nonspecific, most children with essential hypertension are likely to be asymptomatic.<sup>14</sup> The data on the prevalence of prehypertension and sustained hypertension in school going children in India is scanty.<sup>15-17</sup>

The present study was designed to determine the prevalence of hypertension among apparently healthy school children residing in the valley of Kashmir.

## METHODS

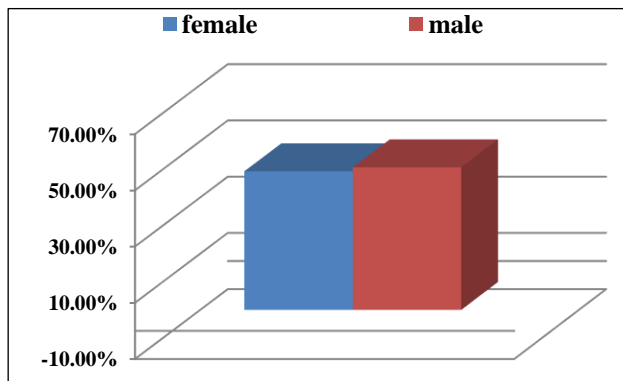
It was a community based cross sectional study for a period of one year (from March 2012 to February 2013). This cross-sectional study was carried out in different schools of Kashmir valley. School children in the age group of 11 to 16 years from both urban and rural areas of Kashmir valley were included in the study. After obtaining informed consent from the parents, all children present on the day of first contact in a particular school were enrolled.

Those on anti-hypertensive medication and known to have chronic heart, renal or hepatic disease, and those on drugs known to raise blood pressure and those who were absent on first day were excluded. Information on age, sex, dietary habits, physical activity, and family history of hypertension and cardiovascular disease was recorded. Weight was recorded using a bathroom scale. Standing height was measured with the shoes removed and the child facing away from the wall, with the heels, buttocks, shoulders and head touching the wall and the child looking ahead and the external auditory meatus and lower margin of the orbit aligned horizontally. BMI was calculated, those with BMI between 85th and 95th percentile was considered overweight. Blood pressure was measured in sitting position by auscultation in right arm using appropriate cuff size covering 2/3 of the upper arm and encircling it completely after a minimum rest of 30 minutes by standardized method using the mercury sphygmomanometer. For each student blood pressure was measured thrice in the same visit with a minimum of 5 minutes rest in between two readings and mean of these readings was taken as systolic blood pressure (SBP) and diastolic blood pressure (DBP). The systolic blood pressure was determined by the onset of the tapping Korotkoff-1 sound and the diastolic at its disappearance (Korotkoff-5). The children were considered hypertensive

if systolic or diastolic blood pressure or both were equal to or more than 95th percentile for height, age and sex. Prehypertension was defined as systolic or diastolic blood pressure or both between 90<sup>th</sup> and 95<sup>th</sup> percentile of height for age and sex, or if the systolic blood pressure was more than 120 mm of Hg or the diastolic blood pressure was more than 80 mm of Hg. Height for age standards was determined using the CDC 2000 growth charts separately for boys and girls. Students found to have hypertension or prehypertension on first visit were contacted to undergo a second set of blood pressure measurements at least three to four weeks later. Three further sets of reading were taken on second contact. SPSS-20 software was used for the analysis of data.

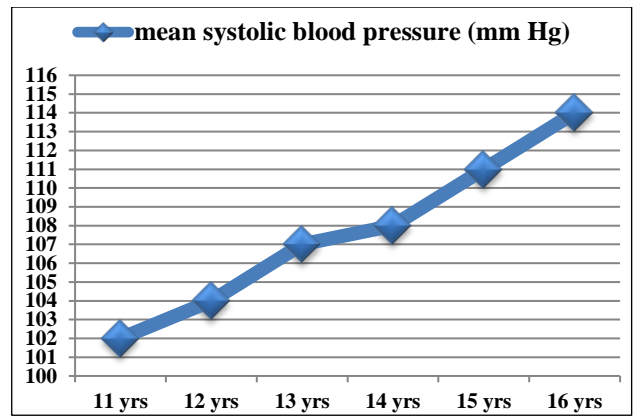
**RESULTS**

After applying exclusion criteria our study included 1600 children in the age group of 11 to 16 years from different schools of Kashmir valley. In this study 789 (49.3%) children were females and 811 (50.7%) were males Figure 1.

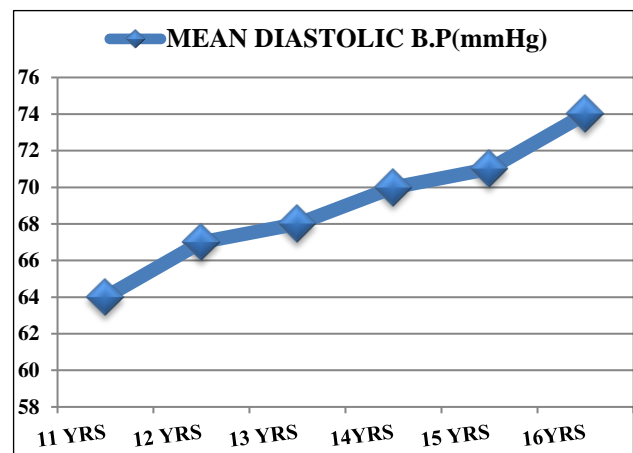


**Figure 1: Bar chart showing frequency distribution of children aged 11-16yrs with respect to gender.**

The mean blood pressure of our study population was 102/64 at 11years of age, 104/67 at 12 years, 107/68 at 13 years, 108/70 at 14years and 114/74 at 16 years. As depicted below in figures 2 and 3, there is increase in both mean systolic as well as diastolic blood pressure as the age increases.



**Figure 2: Line diagram showing relation of age with systolic B.P.**



**Figure 3: Line diagram showing relation of age with diastolic B.P.**

As depicted in the table 1, 85.6% of children had normal blood pressure, among which 49.5% were females and 50.5% were males. 9.3% of children were prehypertensive, among which 50.4% were females and 48.6% were males. 5.1% of children were hypertensive among which 42.7% were females and 57.3% were males. The p value was 0.426 which is not significant.

**Table 1: Frequency distribution of B.P with respect to residence.**

Blood Pressure	Residence				Total (N)	%
	Rural (R)		Urban (U)			
	N	%	N	%		
Normal	687	50.1%	683	49.9%	1370	85.6%
Pre-Hypertension	73	49.3%	75	50.7%	148	9.3%
Hypertension	42	51.2 %	40	48.8 %	82	5.1%
Total	802	50.1%	798	49.9%	1600	100%

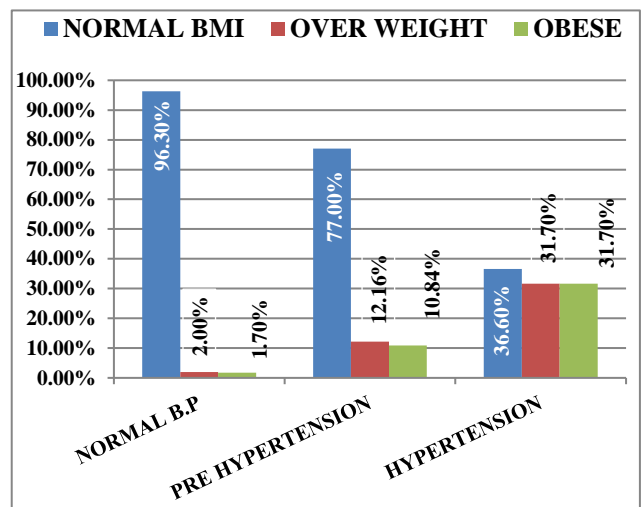
P=0.426.

**Table 2: Frequency distribution of B.P with respect to residence.**

Blood Pressure	Residence				Total (N)	%
	Rural (R)		Urban (U)			
	N	%	N	%		
Normal	687	50.1%	683	49.9%	1370	85.6%
Pre-hypertension	73	49.3%	75	50.7%	148	9.3%
hypertension	42	51.2 %	40	48.8 %	82	5.1%
Total	802	50.1%	798	49.9%	1600	100%

P=0.77

AS depicted above in Table 2, 50.1% of children were from rural areas and 49.9% were from urban areas. Among prehypertensive children 49.3% were rural dwellers and 50.7% were urban dwellers. Among hypertensive children 51.2% were rural dwellers and 48.8% were urban dwellers. The p value of residence distribution was 0.77 which is not significant. As depicted above in figure 4, 91.5 % children had normal BMI, 4.5% were overweight and 4% were obese. In normotensive children 2% were overweight and 1.7% were obese. In prehypertensive group 12.16% were overweight and 10.8% were obese. In hypertensive group 31.7% were overweight and 31.7% were obese. The p value of BMI distribution was 0.000 which is significant. As depicted in the table 3, among prehypertensive group 86.5 % were active while as 13.5% had a sedentary lifestyle. Among hypertensive group 73.2 % were active while as 26.8% were sedentary. Among normotensive 96.6 % were active while as 3.4% were sedentary. The p value was 0.0001 which is significant.



**Figure 4: Bar chart of frequency distribution of B.P of children with respect to BMI.**

**Table 3: Frequency distribution of BP of children with respect to lifestyle.**

Blood Pressure	Lifestyle				Total (N)	%
	Active		Sedentary			
	N	%	N	%		
Normal	1324	96.6%	46	3.4%	1370	85.6%
Pre-hypertension	128	86.5%	20	13.5%	148	9.3%
Hypertension	60	73.2%	22	26.8%	82	5.1%
Total	1512	94.5%	87	5.4%	1600	100%

P=0.0001

**Table 4: Frequency distribution of B.P of children with respect to family history of hypertension.**

Blood Pressure	Family History				Total (N)	%
	No		Yes			
	N	%	N	%		
Normal	1338	97.7%	32	2.3%	1370	85.6%
Pre-hypertension	122	82.4%	26	17.6%	148	9.3%
Hypertension	65	80.2%	17	19.8%	82	5.1%
Total	1525	95.4%	75	4.6%	1600	100%

P=0.0001.

As depicted above in the table 4, 95.4% of children had no family history of hypertension while as 4.6% had family history of hypertension. Among normotensive group 97.7% had no family history of hypertension while 2.3% had family history of hypertension. Among prehypertensive group 82.4 % had no family history of hypertension while 17.6% had family history of hypertension. Among hypertensive group 80.2% had no family history of hypertension while as 19.8% had family history of hypertension.

## DISCUSSION

The purpose of our study was to determine the prevalence of hypertension among school children in Kashmir. In our study we found an increase in both systolic and diastolic blood pressure with age. In most of the cross-sectional studies of blood pressure in various populations of the world, an increase of systolic and diastolic blood pressure with age has been reported. In Indian school children an increase in SBP and DBP has also been reported by various authors like Anand NK and Verma et al.<sup>17,18</sup>

The prevalence of hypertension among school children in our study was 5.1% and prehypertension was 9.3%. There is a lot of variation in the prevalence of hypertension in school going children across India and across the world.

Vivek V et al, in their study in school going children in Anand district of Gujrat found a prevalence of prehypertension of 10.8 %.<sup>19</sup> Prevalence of hypertension was found to be 9.2 %. The prevalence of prehypertension is almost similar to our study while that of hypertension is much higher. Sharma A et al, in their study in nearby Shimla found a similar prevalence of 5.9% but prevalence of prehypertension was higher (12.3%) compared to our study.<sup>20</sup> Across the world there have been different studies conducted in recent years to find out the prevalence of hypertension in school children and adolescents. Irgil E et al, in their study found a prevalence of hypertension of 7.2%. Rampal L et al, in Malaysia found an overall prevalence of prehypertension of 11.1% and hypertension 11.6% respectively which is higher than our study.<sup>21,22</sup> Naim N et al, in their study in Turkey found that hypertension was prevalent among 4.4% of the students. Chioloroa A et al, found a prevalence of only 2.2 %.<sup>23,24</sup>

We found hypertension higher in males (5.8 % in males and 4.31 % in females). There was also difference in the prevalence of prehypertension (8.8% in males and 9.63 % in females). Overall there was no significant gender variation when both prehypertension and hypertension were taken together. Anand NK et al, in Amritsar found no significant difference between the SBP as well as DBP of the two sexes in most age groups. Rampal L et al, in

Malasiya in their study found among males, the prevalence of pre-hypertension and hypertension was 16.2% and 12.9% respectively.<sup>17,22</sup> The prevalence of pre-hypertension and hypertension in the females was 5.8% and 10.2% respectively. Anjana et al<sup>25</sup> in their study found no significant difference in hypertension between males and females.

There was no significant difference in the prevalence of prehypertension and hypertension in rural (5.12 %) and urban (4.88%) students. Contrary to our study Sharma A et al<sup>20</sup> found a prevalence of 7.1 % in urban and 4.3 % in rural students. Jafar TH et al, in Pakistan found higher rates in rural children.<sup>26</sup>

In our study 91.5 % had normal BMI, 4.5 % were overweight and 4 % were obese. Among prehypertensive group 12.2% were overweight and 10.8% were obese. Among hypertensive group 36.6 % had normal BMI, 31.7% were overweight and 31.7% were obese. These results show a strong relationship between hypertension and increase in BMI. N et al, also found high BMI a significant risk factor for hypertension.<sup>23</sup> Sundar JS et al, found overwhelming evidence in their study that the prevalence of hypertension was high among obese individuals.<sup>27</sup>

In our study only 3.4 % had a sedentary behavior in the normotensive group. In the prehypertensive 13.5 % had a sedentary behavior while in the hypertensive group 26.8 % had a sedentary lifestyle. These results show that blood pressure increases with the increase in number of hours spent in sedentary activities. Sundar JS et al, in their study could not find the any significant association between physical activity and hypertension.<sup>27</sup>

In our study only 2.3 % of normotensive children had a positive family history of hypertension. In contrast family history of hypertension was present in 17.6 % in prehypertensive group and 19.8 % in hypertensive group. These results show that family history is a significant risk factor for the development of hypertension in children and adolescents. Sharma A et al, in their study found a positive family history in 8.6 % of hypertensive children.<sup>20</sup> In contrast Sundar JS et al, found a high prevalence of hypertension (41.86%) among children of hypertensive parents (either father or mother or both).<sup>27</sup> Anand NK et al, in their study observed that 5.9 % of hypertensive children had a positive family history.<sup>17</sup> Rampal L et al, found a positive family history in 12 % hypertensive children.<sup>22</sup>

## CONCLUSION

The above study reveals that hypertension is not uncommon in Kashmiri children. With globalization bringing more lifestyle modifications, children are exposed to multiple risk factors including obesity and family history of hypertension. Authors need to make

people aware of these facts so that blood pressure measurement could be a part of routine health care checkup in children to detect it early and do necessary interventions.

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