BLOOD PRESSURE PROFILE OF SCHOOL CHILDREN OF GULBARGA CITY

Mujumdar. V.G, Amruta Swati Indupalli, Siddaling Changty, Ayesha Batool, Fatima

1. Assistant Professor, Department of Paediatrics, Khaja Banda Nawaz Institution of Medical Sciences, Roza - B. Gulbarga.
2. Associate Professor, Department of Community Medicine, Khaja Banda Nawaz Institution of Medical Sciences, Roza - B. Gulbarga.
3. Associate Professor, Department of Paediatrics, Khaja Banda Nawaz Institution of Medical Sciences, Roza - B. Gulbarga.
4. Junior Resident, Department of Paediatrics, Khaja Banda Nawaz Institution of Medical Sciences, Roza - B. Gulbarga.
5. Junior Resident, Department of Paediatrics, Khaja Banda Nawaz Institution of Medical Sciences, Roza - B. Gulbarga.

CORRESPONDING ADDRESS:

Dr. Mujumdar. V.G

Plot #34, N. G. O. S

Housing Colony. Jewargi Road

Gulbarga.

E-Mail: drmujumdarvg@gmail.com,

Phone: 0091 9448978170.

ABSTRACT: BACKGROUND: High blood pressure in childhood is a major risk factor for heart disease and stroke in adulthood. There is enough evidence to suggest that the roots of essential hypertension in adults extend into childhood. There is a paucity of literature on the blood pressure measurements amongst children. This study was done to study blood pressure profile of school children in Gulbarga, Karnataka, India. **AIM & OBJECTIVES:** To determine the prevalence of hypertension in children 6–15 years of age and to study the association between selected variables and blood pressure. **MATERIAL & METHODS:** The present study was a school based cross sectional study conducted in 2 Government Primary Schools and 2 Private Secondary Schools of Gulbarga city. For the study 1320 children in the age group 6–15 years were selected. Sample size of 347 was calculated by, using the formula for sample size calculation for single population proportion from a Study where the prevalence of hypertension was 2.42%. The data was collected in a Pre designed pre tested Performa and analyzed using appropriate statistical tests. **RESULTS:** The prevalence of hypertension in the study was found to be 2.42% with 2.4% in females and 2.3% in males. **CONCLUSION:** In the study, hypertension in students was found to be significantly associated with age, height and weight. There was no significant difference in blood pressures of the two sexes, when the values are corrected for maturation status; it was found that body weight and height are the principle determinants of blood pressure. With the onset of puberty spurt in systolic blood pressure was observed in both sexes equally.

KEY WORDS: school children; blood pressure; prevalence

INTRODUCTION: Prevalence of high blood pressure is now commonly observed in children with estimated population prevalence of 1-2% in the developed countries.¹ Hypertension is known to be a major cause of morbidity and mortality in many countries, and the long-term

health risks to children with hypertension may be substantial. However, Idiopathic or essential hypertension, for which no identifiable cause is found, clearly can begin in childhood. If untreated, over time high blood pressure can damage many organs of the body, including the heart, brain, kidneys and eyes.²

Many challenges remain in the study of pediatric hypertension. It is known that children who have high blood pressure tend to be hypertensive as adults. It remains to be definitively determined what level of blood pressure predicts hypertensive end-organ injury. The effects of hypertension can begin during childhood. The high blood pressure itself usually has no signs or symptoms, but may be associated with subtle changes in behavior or school performance. You can have it for years without knowing it. During this time, though High blood pressure can damage your heart, blood vessels, kidneys, and other parts of your body. The causes for increase in blood pressure are attributed to obesity, change in dietary habits, decreased physical activity and increasing stress. Elevated blood pressure, systolic or diastolic at any age, in either sex is a contributor for all forms of cardiovascular diseases. Early child hood identifying and modifying risk factors reduces the incidence and complications in adolescents and adults. Prevalence of hypertension varies across countries and states. It is multifactorial disease, influenced by genetic, racial, geographic, cultural and dietary patterns. There is enough evidence to suggest that the roots of essential hypertension in adults extend into childhood. The American Heart Association recommends that, all the children aged 3 years and older should have yearly blood pressure measurements. There is a paucity of literature on the blood pressure measurements amongst children. This study was done to know the blood pressure profile of school children in Gulbarga, Karnataka, India.

OBJECTIVE: To know the prevalence of hypertension in children 6–15 years
and

To study the association between selected variables and blood pressure.

MATERIALS AND METHODS: The present study was a school based cross sectional study conducted in 2 Government Primary Schools and 2 Private Secondary Schools of Gulbarga city. For the study 1320 children of in the age group 6–15 years were selected. Sample size of 347 was calculated using the formula for sample size calculation for single population proportion from a Study,³ where the prevalence of hypertension was 2.42%. Any child with a known medical conditions having direct effect on blood pressure was excluded. One child with Mar fan's syndrome having mitral valve prolapse, was excluded.

DEFINITIONS³: The classification of BP percentiles for this study was determined using normative tables generated from the New data, from the 1999–2000 National Health and Nutrition Examination Survey (NHANES) data submitted by National High Blood Pressure Education Program Working Group on Hypertension Education in Children and Adolescents, which take into account the age, gender and height of each child

Hypertension is defined as a average Systolic Blood pressure (SBP) and or Diastolic Blood pressure (DBP), that is >95th percentile for gender, age, and height on three or more occasions.

Pre-hypertension in children is defined as average SBP or DBP levels that are >90th percentile but <95th percentile.

Normal BP is defined as a SBP and DBP that is less than the 90th percentile for sex, age, and height. Revised Blood pressure tables were used to determine the percentiles.

A preformed questionnaire was designed and pre-tested on 44 students (excluded from study) on a school in the nearby and validated during pilot study. This study was done using predesigned questionnaire, by interview techniques, followed by measurements of height and weight, Age was recorded as per school records, Blood pressure was measured by using standardized mercury sphygmomanometer, as per standard guidelines with an appropriately sized cuff on three different occasions. The systolic blood pressure was determined by the onset of the “tapping” Korotkoff-1 sound and the diastolic at its disappearance (Korotkoff-5). Students found to have pre-hypertension (SBP or DBP >90th percentile) or hypertension (SBP or DBP >95th percentile) on first visit were re-examined on at least three different occasions to conclude the presence or absence of hypertension.

The English questionnaire was translated to Kannada. The data was collected and analyzed using appropriate statistical tests. The mean systolic and mean diastolic blood pressures with the standard deviations, for each age, sex, and various percentiles were determined. Similarly mean systolic and mean diastolic blood pressure with standard deviation were determined in different weight and height groups.

The physical instruments used in the study were a weighing machine, portable anthropometric rod and mercury sphygmomanometer with different cuff sizes. Calibration of the instruments was carried out. Different cuff sizes as recommended by the 2004 update of American Academy of Pediatrics on Hypertension⁶ were used.

RESULTS: One thousand three hundred and twenty, apparently normal school children, between 6-15 years of age were studied to define norms of auscultatory blood pressure. Out of 781 were boys and 539 were girls. The mean systolic blood pressure for boys and girls was 104.78 ± 9.24 and 104.55 ± 8.84 respectively and mean diastolic blood pressure was 66.72 ± 6.66 for boys and 66.69 ± 6.15 for girls and 320 (24.24%) children had family history of hypertension.

Table 1 shows the comparative values of mean blood pressure for boys and girls. Systolic BP ranged from 68mmHg to 132mmHg in boys and 90-128mmHg in girls. The mean systolic Blood pressure in the age group of 6 to 15years ranged from 96.12 mmHg to 114.77 mmHg in boys and 95.4 mmHg to 113.29mmHg in girls. A spurt in mean systolic blood pressure was observed between 13-14years and 14-15years of age.

Diastolic BP ranged from 50 to 96mmHg in boys and 50-84mmHg in girls. where as the mean Diastolic Blood Pressure ranged from 62.22 mmHg to 73.59 mmHg and 62.49 mmHg to 72.87mm Hg for 6 to 15 years of age in boys and girls respectively.

Table 2 revealed in boys mean systolic blood pressure with respect to weight ranged from 96.84mm of Hg(10-15 kg group) to 116.81mm Hg(46-50 kg group), where as mean diastolic blood pressure ranged from 63.29mm of Hg to 74.63mm Hg. In girls, mean systolic blood pressure with respect to weight ranged from 97.62mm Hg (10 to 15 kg group) to 117.60mm Hg (46-50 kg group) where as mean diastolic blood pressure ranged from 64.28mm Hg to 76.40mm Hg.

Table 3 Indicates boys with respect to height mean systolic blood pressure ranged from 96.12mm Hg (91 to 100cm group) to 118.28mm Hg (161 to 170cms group) where as mean diastolic blood pressure ranged from 61.86mm of Hg to 76.00mm Hg. In girls with respect to height, mean systolic blood pressure ranged from 96.57mm Hg (91 to 100cms group)

to 120.26 mm Hg (161 to 170 cm group), whereas mean diastolic blood pressure ranged from 62.57 to 77.60 mm Hg.

The mean systolic and mean diastolic pressure were found to increase with increasing age, the increase in the mean systolic blood pressure being approximately 1.5 to 2 mm Hg per year. The increase in mean diastolic was approximately 1 mm Hg per year. Both systolic and diastolic blood pressure were found to have significant correlation with weight and height and hence with weight/height ratio in both sexes.

The mean systolic blood pressures and diastolic blood pressures in boys and girls were compared. It was found that the systolic and diastolic blood pressures were slightly higher in boys than in girls. However the difference was not statically significant.

Table 4 reveal the overall prevalence of hypertension in the present study was 2.42% (32). Of these 32 hypertensive children 18 were boys amounting to 2.3% of total number of boys and 14 were girls amounting to 2.4% of total number of girls. The prevalence of hypertension was more in the 9 year old boys where as it was in 14 year old girls. All the 32 children had only mildly elevated blood pressure levels (i.e >95th percentile but <99th percentile).

DISCUSSION: The finding of the present study regarding mean systolic and mean diastolic blood pressure are comparable with findings of the study conducted by N.K. Anand and Lalit Tandon.⁴ Their findings (systolic blood pressure) of 96.3 mm Hg at 6 years and 116.5 mm Hg at 15 years for boys and 95 mm Hg and 116.4 mm Hg at 15 years for girls are close to the findings of the present study. Similarly diastolic blood pressure for both boys and girls in the present study and the study conducted by N. K. Anand Lalit Tandon are comparable.⁴

The systolic spurt observed in the present study between 13-14 years in both sexes has been supported by Agarwal Rajiv, Sharma, AK Shrivastava, Premkumar and CM Pandey who observed similar spurts in systolic blood pressure in both sexes between 12 and 13 years of age.⁵ Raksh Agarwal, SL Mandowara, B Bhandri and Garg OP also observed a spurt in blood pressure between 12 and 13 years.⁶ The steep rise in systolic blood pressure was also observed by Londe between 5 to 6 years in boys, 4 to 5 years in girls and between 14 to 15 years in both sexes.⁷

However, Task Force Committee USA reported only once spurt between 5 and 6 years in both sexes. The gradual increase in the blood pressure along with increase in age can be explained by the fact that, the body mass also increases, which is one of the determinants of blood pressure along with age.⁸

The systolic spurts observed in the present study can be accounted by the onset of puberty in both sexes, which results in increase of body weight and height, as a result of increase in muscular tissue in boys and deposition of adipose tissue in girls which begins around 11 to 12 years and reaches peak levels by 14-15 year of age.

The observations of mean diastolic pressure in the present study resemble those of the study conducted by N K Anand and Lalit Tandon.⁴ In the present studies it range from 61.88 mm Hg at 6 years to 73.9 mm Hg at 15 years in boys where as from 62.09 mm Hg at 6 years to 72.8 mm Hg at 15 years in girls.

In the study conducted by N K Anand and Lalit Tandon it ranged from 64.4 mm Hg at 6 years and 76.9 mm Hg at 15 years in boys and 64.3 mm Hg at 6 years and 76.3 mm Hg at 15 years in girls.⁴ Rakesh Agarwal, SL Mandowara, B Bhandari and Garg OP reported a diastolic blood pressure range of 65 to 77 mm Hg for boys and 67.78 mm Hg for girls in 5-15 years of age group.⁶

All above studies including present study shown approximate increase of diastolic pressure 1 mm Hg per year of age. There is a spurt of diastolic blood pressure in 13-14 years of age group in females in the present studies.

The findings of the present study are in agreement with the statement that height and weight are the strongest determinants of the blood pressure.

It can be seen from the results of the present study, that there were very little differences in the mean systolic blood pressure and mean diastolic blood pressure in all age groups, in between girls and boys.

In the present study the overall prevalence of hypertension as found to be 2.42%, 2.3% of total number of boys and 2.4% of total number of girls. Findings of current study were in the range of the study conducted by Sukumar 2% Londe 2.3% and R Agarwal 2.6%.^{9,7,6}

CONCLUSION: The overall prevalence of hypertension in the present study was 2.42%. Of these 32 children, 18 were boys amounting to 2.3% of total number of boys and 14 were girls amounting to 2.4% of total number of girls. The findings of the present study are in agreement with the statement that the blood pressure, both systolic and diastolic gradually increases with age, although such an increase is not a steady one. It can be seen from the results of the present study that there were very little differences in systolic blood pressure and diastolic blood pressure in all groups in between girls and boys. The findings of the present study are in agreement with the statement that height and weight are the strongest determinants of the blood pressure.

RECOMMENDATIONS: Blood pressure recording should be a part of school health program and also of clinical examination of children, attending health care system, to identify and treat hypertension early to prevent the late complications.

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Table 1 Age wise comparison of mean blood pressure between boys and girls.

Age in years	Systolic Blood Pressure		Diastolic Blood Pressure	
	Boys Mean±SD mmHg	Girls Mean±SD mmHg	Boys Mean± SD mmHg	Girls Mean±SD mmHg
6	96.12 ±5.13	94.41±5.31	62.22±4.49	62.49±4.31
7	98.22±6.86	98.67±7.55	62.58±4.14	62.40±5.43
8	102.15±7.43	99.55±7.55	63.35±6.92	62.75±6.89
9	103.62±8.87	102.23±6.92	65.35±7.05	63.71±4.73
10	104.41±7.91	104.65±7.60	66.30±5.81	66.51±6.79
11	105.08±8.23	105.24±7.95	68.02±6.78	66.88±4.42
12	106.24±8.14	107.85±7.05	68.60±5.29	67.28±3.12
13	108.45±7.20	108.22±10.80	69.06±4.86	68.71±5.57
14	111.64±7.18	110.56±6.39	70.89±4.96	71.78±3.37
15	114.77±5.29	113.29±6.67	73.59±4.96	72.87±4.40

Table 2: Showing the distribution of boys and girls according to weight and Blood Pressure.

Weight (Kgs)	Boys					Girls				
	No:	SBP (mmHg)		DBP (mmHg)		No:	SBP (mmHg)		DBP (mmHg)	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
10-15	82	96.84	7.25	63.29	5.99	70	97.62	8.25	64.28	6.34
16-20	266	99.30	7.32	63.58	5.10	169	100.53	7.12	64.90	5.27
21-25	173	104.90	8.10	66.64	6.52	65	105.89	7.96	66.90	5.73
26-30	123	108.32	7.81	69.86	5.77	150	110.28	8.20	70.86	4.61
31-35	53	110.67	7.81	71.20	5.83	37	111.62	11.80	72.21	3.90
36-40	48	113.04	6.11	72.04	4.35	32	114.68	6.23	72.40	3.48
41-45	14	115.57	8.34	74.28	8.37	11	116.90	6.59	76.30	2.19
46-50	22	116.81	6.06	74.63	6.02	5	117.60	5.17	76.40	2.19

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Table 3:- Relationship between blood pressure status sex and height group.

Weight (Kgs)	Boys					Girls				
	No:	SBP (mmHg)		DBP (mmHg)		No:	SBP (mmHg)		DBP (mmHg)	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
91-100	24	96.12	5.04	61.86	6.85	21	96.57	6.93	62.57	3.85
101-110	74	97.08	6.34	62.08	5.56	50	96.90	5.55	63.32	3.99
111-120	207	101.21	7.56	63.70	4.61	126	100.90	8.24	64.28	6.88
121-130	168	104.10	8.08	68.11	7.16	124	104.70	7.76	67.95	5.02
131-140	151	107.84	8.02	69.05	6.07	118	107.00	9.23	70.06	4.67
141-150	93	110.32	7.09	70.70	4.54	74	109.35	8.10	70.47	4.96
151-160	50	114.16	6.98	73.00	5.30	20	113.30	13.14	74.42	3.76
161- 170	14	118.28	7.35	76.00	6.88	06	120.26	4.80	77.60	4.33

Table 4:- Showing prevalence of hypertension as per fourth Report.

Age in years	Boys				Girls			
	Total No of boys	cut off point (95 th percentile) mmHg	Hypertensive		Total No of girls	cut off point (95 th percentile) mmHg	Hypertensive	
			no	%			No	%
06	87	104/68	2	2.29	53	104.8/68	2	3.77
07	79	107/70	2	2.53	59	120/68.8	2	3.38
08	93	114/80	2	2.15	40	110.3/72.9	2	5
09	81	118/80	4	4.94	56	112/72.5	1	1.78
10	73	120/74.8	2	2.73	70	119/80	1	1.43
11	74	120/78.7	1	1.35	45	12/71.6	1	2.22
12	69	121.2/78.4	1	1.45	59	120/74	0	0
13	66	118/73.5	1	1.51	63	123.6/74	1	1.58
14	100	124.1/78	2	2	46	118/76	3	6.52
15	59	122/78	1	1.69	48	127.3/82.6	1	2.08
Total	781		18	2.3	539		14	2.4