

BLOOD PRESSURE LEVELS AMONG THE STUDENTS OF A SELECTED SCHOOL

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Abstract

In Bangladesh, limited data are available on paediatric hypertension as well as their normal values. This study was done to assess the level of blood pressure in this population group. A total of 1118 students from class I to X of a selected school were measured twice for systolic and diastolic BP within five minutes interval following a standard protocol. The phase V diastolic blood pressure was recorded. The average of two readings was taken. Age was obtained from the school records. The mean age was 10.53 (± 0.09) years and 46.9% of the recruited students were females. The mean (\pm SE) and median of systolic and diastolic blood pressure were 97.89 (± 0.39) and 97.50 mm Hg and 57.58 (± 0.39) and 60.00 mm Hg, respectively. Boys had a significantly higher systolic (99.34 \pm 0.56 mm Hg) and diastolic (62.59 \pm 0.41 mm Hg) blood pressure than the girls (96.78 \pm 0.50 mm Hg systolic BP and 51.54 \pm 0.55 mm Hg diastolic BP; $P < 0.001$). Systolic blood pressure was found to be positively correlated with age, height and weight and diastolic blood pressure was correlated with height and weight. Although this study gave us an insight into the paediatric BP situation in a particular school, a community based study with representative sample is recommended to develop a reference data on paediatric blood pressure for our country.

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Introduction

Blood pressure (BP) measurement is now considered as an important component of the routine paediatric physical examination, although the issue was not given a serious consideration before the mid 1960s.¹ Since then, the relevance of childhood blood pressure measurement to child health care has undergone substantial conceptual change. The original attention of blood pressure in children was towards identification and treatment of secondary hypertension. The inclusion of BP measurement in routine paediatric examination allows detecting asymptomatic hypertension. It broadens the knowledge of hypertension detected in children.²

The long-term natural history of blood pressure is not well understood. The level is considerably lower in children than the adults and increases steadily throughout the first two decades of life. A direct

relation between weight and blood pressure has been documented as early as five years of age and is more prominent in the second decade. Height is independently related to blood pressure at all ages. Sex does not have the same impact on blood pressure in children as in adults.¹

Childhood hypertension is defined as systolic or diastolic blood pressure greater than or equal to 95th percentile for age, height, and sex in the normative blood pressure charts of the update of 1987 Task Force Report. Since these charts are unwieldy, the use of set formulas that estimates 95th percentile of blood pressure value in both boys and girls is recommended:³

Systolic (1-17 years): 100 \pm (Age in years x 2)

Diastolic (1-10 years): 60 \pm (Age in years x 2)

Diastolic (11-17 years): 70 \pm (Age in years)

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Table-1: Mean diastolic Pressure of School Children by Age & Sex

Age in Years	Systolic Blood Pressure									Diastolic Blood Pressure								
	Boys			Girls			Overall			Boys			Girls			Overall		
	n	Geometric mean	SE	n	Geometric mean	SE	N	Geometric mean	SE	n	Geometric mean	SE	n	Geometric mean	SE	N	Geometric mean	SE
5	21	88.74	2.49	14	97.34	2.17	35	92.08	1.84	21	54.92	1.77	14	57.05	3.79	35	55.76	1.84
6	34	90.78	2.02	29	95.62	1.64	63	92.97	1.35	34	55.84	2.08	29	57.68	2.22	63	56.68	1.12
7	45	97.36	1.16	34	101.54	2.07	79	98.94	1.12	45	61.98	1.18	34	65.53	1.46	79	63.48	0.94
8	31	97.26	1.30	30	93.45	2.26	61	95.37	1.30	31	65.15	1.45	30	55.04	2.52	61	59.97	1.54
9	39	91.08	1.81	50	91.83	1.43	89	91.50	1.12	39	57.48	1.47	50	51.25	1.78	89	53.90	1.22
10	37	94.37	1.74	38	90.53	1.82	75	92.40	1.27	37	60.51	1.35	38	46.57	1.69	75	52.99	1.34
11	67	95.26	1.39	63	94.23	1.42	130	94.76	0.99	67	60.51	1.13	63	46.17	1.30	130	53.08	1.05
12	86	99.31	1.30	64	98.90	1.50	150	99.14	0.98	86	62.42	0.97	64	48.52	1.62	150	56.06	1.03
13	70	104.05	1.38	61	97.28	1.60	131	100.84	1.08	70	65.37	1.15	61	46.29	1.51	131	55.67	1.23
14	63	107.65	1.67	45	99.99	1.77	108	104.39	1.27	63	67.22	1.07	45	47.03	1.71	108	57.92	1.32
15	43	109.29	2.11	43	97.80	1.42	86	103.39	1.42	43	67.40	1.22	43	51.01	1.73	86	58.64	1.35
16	22	112.37	3.06	12	99.98	2.23	34	107.83	2.37	22	68.93	2.11	12	51.23	2.85	34	62.07	2.22

A dearth of data on paediatric hypertension as well as the normal values of blood pressure in this age group in our country prompted this study.

Methodology

This cross-sectional study to measure the blood pressure levels of the school students of Dhaka city was conducted in Government Gono-Bhaban High School, Dhaka. One thousand one hundred and eighteen healthy students from Class I-X who were available and willing to participate were included in the study. To rule out known disease conditions, students were asked a few screening questions before recruitment.

Trained research assistants measured the blood pressure following the standard protocol. Two readings

were taken within a five-minute interval. The phase V diastolic blood pressure was recorded. The average of two readings was taken. Body weight and height were also measured following standard procedures. Age was calculated from school records.

Data were analyzed using the software SPSS PC. Body Mass Index (BMI) and height for age percentile was calculated using the software Epi Info.

Results

A total of 1118 students were included in the study. Students lacking birth records were excluded from the final analysis. Due to limited samples at the age of 4 years and 17-18 years, children in those age groups were excluded. For final analysis, the sample stood at

Table-2: Systolic Blood Pressure of School Children by Age and Sex

Age in years	<50 th , percentile Height for Age									>50 th percentile Height for Age								
	Boys			Girls			Overall			Boys			Girls			Overall		
	N	50 th	90 th	n	50 th	90 th	n	50 th	90 th	N	50 th	90 th	n	50 th	90 th	n	50 th	90 th
5	3	-	-	1	-	-	4	-	-	18	90.00	102.00	13	100.00	108.00	31	95.00	104.50
6	11	82.50	99.00	9	-	-	20	90.00	100.00	23	95.00	111.00	21	100.00	109.00	44	95.00	107.50
7	24	95.00	107.50	11	104.00	110.00	35	97.50	108.50	21	99.00	113.80	23	100.00	115.00	44	100.00	115.00
8	16	96.00	105.50	11	90.00	104.00	27	94.00	103.00	15	99.00	112.50	19	95.00	115.00	34	95.00	113.75
9	27	87.50	105.00	25	90.50	101.40	52	90.00	104.25	12	93.70	113.50	25	95.00	107.00	37	95.00	110.00
10	23	90.00	103.70	22	85.00	108.50	45	87.50	105.00	14	98.25	116.25	16	92.50	110.80	30	96.25	110.00
11	48	91.25	101.85	38	90.00	105.30	86	90.00	105.00	19	110.00	120.00	25	100.00	115.00	44	100.00	118.75
12	54	95.00	108.75	59	100.00	115.00	113	97.50	111.50	32	107.50	121.75	5	-	-	37	107.50	120.50
13	37	105.00	117.50	55	95.00	112.00	92	99.75	115.00	33	107.50	120.00	6	-	-	39	107.50	120.00
14	55	105.00	120.00	45	100.00	114.40	100	101.25	117.50	8	-	-	0	-	-	8	-	-
15	38	107.50	135.25	40	95.00	109.50	78	100.00	121.85	5	-	-	3	-	-	8	-	-
16	20	110.00	139.00	10	102.00	114.50	30	106.25	129.75	2	-	-	1	-	-	3	-	-

Table-3: Diastolic Blood Pressure of School Children by Age and Sex

Age in years	<50 th percentile Height for Age									>50 th percentile Height for Age								
	Boys			Girls			Overall			Boys			Girls			Overall		
	N	50 th	90 th	n	50 th	90 th	n	50 th	90 th	N	50 th	90 th	n	50 th	90 th	n	50 th	90 th
5	3	-	-	1	-	-	4	-	-	18	55.00	70.00	13	65.00	78.00	31	57.50	70.00
6	11	50.00	69.50	9	-	-	20	57.50	70	23	60.00	73.00	21	62.50	74.00	44	60.00	72.50
7	24	60.00	67.50	11	65.00	75.00	35	62.50	71	21	65.00	77.50	23	67.50	75.00	44	67.50	75.00
8	16	67.50	78.25	11	60.00	73.00	27	62.50	75.5	15	67.50	75.50	19	57.00	80.00	34	62.50	77.50
9	27	60.00	68.00	25	57.50	75.00	52	57.50	72.5	12	61.25	77.00	25	45.00	65.00	37	50.00	65.50
10	23	60.00	70.50	22	45.00	69.25	45	55.00	68.5	14	63.75	76.25	16	45.00	60.85	30	52.75	72.25
11	48	60.00	66.60	38	45.00	55.50	86	52.50	65	19	65.00	82.50	25	48.00	69.00	44	59.00	76.25
12	54	60.00	73.70	59	45.00	70.00	113	55.00	71.5	32	66.25	77.50	5	-	-	37	65.00	78.00
13	37	65.00	75.00	55	45.00	65.00	92	53.25	71.75	33	70.00	80.50	6	-	-	39	67.50	77.50
14	55	67.50	77.50	45	45.00	65.00	100	61.25	75	8	-	-	0	-	-	8	-	-
15	38	68.75	77.50	40	50.00	70.00	78	60.00	75	5	-	-	3	-	-	8	-	-
16	20	71.25	82.25	10	50.00	65.00	30	65.00	80	2	-	-	1	-	-	3	-	-

1041. The mean age was 10.33 (± 0.09) years and 46.4% of the recruited students were females. The geometric mean (\pm SE) and median of systolic and diastolic blood pressure were 97.89 (± 0.39) and 97.50 mm of Hg and 56.58 (± 0.39) and 60.00 mm of Hg, respectively. Boys had a significantly higher systolic (99.34 ± 0.56 mm of Hg) and diastolic (62.59 ± 0.41 mm of Hg) blood pressure than the girls (96.24 ± 0.52 mm of Hg systolic BP and 50.35 ± 0.58 mm of Hg diastolic BP; $p < 0.001$). Systolic blood pressure was found to have quadratic relation with age. The age and sex-wise mean blood pressure is shown in Table-1.

Both systolic and diastolic blood pressure was seen to have a cubic association with height (the correlation coefficient were 0.454 and 0.178, respectively). Systolic blood pressure had a linear ($r = .551$) and diastolic blood pressure had a cubic relation ($r = .204$) with weight. The 50th and 90th percentile of blood pressure by age, sex and 50th percentile of height-for-age are shown in Tables 2 and 3. Due to low number of samples, data has not been shown in some age and sex categories.

Discussion

Although the prevalence of essential hypertension is lower in children and adolescents than in adults, ample evidence supports the concept that the roots of essential hypertension extend back to childhood. During the pre-school years, blood pressure begins to follow a pattern. Children at a given percentile of blood pressure distribution tend to maintain that approximate value relative to their peer group as they grow older, with a tracking correlation of 0.55 for systolic blood pressure

and 0.44 for diastolic blood pressure.⁴ 'Tracking' observed in the blood pressure values from childhood to adulthood shows a potential value of long-term approaches to hypertension control based on the prevention of high blood pressure in children.⁵ The task force recommended that all children 3 years of age or older should have their blood pressure recorded during health maintenance visits and emergent visits. One of the most important developments in the past 5 years has been the publication of new blood pressure tables that are adjusted for height. Although increased blood pressure is clearly associated with obesity and height, the association with weight is believed to be a causal one. The 1996 updated blood pressure tables included blood pressure data from the 1987 second task force report that was reanalyzed to determine blood pressure percentiles based on height to determine age, sex, and height specific systolic and diastolic blood pressure percentiles. These blood pressure tables, adjusted for height and age, alter the blood pressure percentile estimates of boys and girls at all ages but particularly for young children.⁴ BP standards based on gender, age, and height provide a precise classification of BP according to body size.⁶ Development of national database on normative BP levels throughout childhood improves the ability to identify children who have abnormally elevated BP. The current study is a small scale approach to formulate normative BP level in Bangladeshi school children. The age, sex and height-specific 50th and 90th percentile of BP in this study group did not follow any particular pattern. The BP level was lower than the BP shown in standard BP tables. Because of the small sample size

for some age groups BP level could not be analyzed. The mean systolic and diastolic blood pressures were 97.89 and 56.58 mm of Hg respectively. Boys had a significantly higher systolic (99.34 mm of Hg) and diastolic (62.59 mm of Hg) blood pressure than the girls (96.24 mm of Hg systolic BP and 50.35 mm of Hg diastolic BP). The mean systolic blood pressure among the Mexican American Children was 106.0 mm Hg and diastolic blood pressure was 61.7 mm Hg.⁷

South Asian children have a higher body-mass-adjusted blood pressure level than white children in the United States. The mean BMI-adjusted systolic blood pressure levels (\pm SD) were 100 (11) versus 99 (11) mm Hg ($P < 0.001$), and diastolic blood pressure levels (\pm SD) were 63 (10) versus 52 (12) mm Hg ($P < 0.001$) in South Asian versus US children, respectively. The current study findings do not match with these data, probably because it included school children from low socio-economic background.

Conclusion

Both systolic and diastolic blood pressure was found to be related to age, sex, height and weight. Previous studies also supported these findings. A large scale study to develop a national database reflecting the age, sex, height and weight standardized BP of children from all socioeconomic status is recommended. Although the current study lacks external validity, it

could be used as a pilot study for the reference value of childhood BP in our country.

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