BLOOD PRESSURE PROFILE OF SCHOOL CHILDREN OF TEA GARDEN WORKERS IN AND AROUND DIBRUGARH TOWN

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ABSTRACT

BACKGROUND

The trends in blood pressure over time in children may be important predictors of subsequent trends in adult hypertension. The Western standards cannot be applied to Indian children, because of difference in factors as ethnic, socio-economic, dietary habits, environmental, etc. between Western and Indian countries. Hence, there is a need to establish the normal blood pressure standards for Indian children and so this study was done to study the blood pressure profile of school going children in the tea tribe community in and around Dibrugarh town.

Aims of this study are

1. To find the blood pressure pattern of school going children of tea garden workers in the age group of 6–12 years.
2. To find the blood pressure pattern in relation to height, body weight and body mass index in the above age group.

MATERIALS AND METHODS

Blood pressure was recorded in the right arm in the sitting position by using a standard Hg sphygmomanometer using appropriate cuff sizes. Three readings were taken at an interval of at least 5 minutes and the average of these three readings was considered as the blood pressure of the individual.

RESULTS

The mean systolic and diastolic blood pressure for both boys and girls shows an increasing trend with the increase in age. The differences in case of both systolic and diastolic blood pressure between the two sexes in all the age groups are found to be statistically insignificant ($p > 0.05$).

Both SBP and DBP are positively correlated with age, height, weight and BMI ($p<0.01$).

CONCLUSION

The high risk children need to be considered for close followups for modification of risk factors by advising lifestyle changes like reduction in intake of salt.

KEYWORDS

Blood Pressure, Hypertension, Tea Garden.

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BACKGROUND

Blood pressure is one of the principal vital signs and it is continuously changing depending on activity, temperature, diet, emotional state, posture, physical state, etc. Maintenance of normal blood pressure in an individual is very important for proper body function.

It is suggested that hypertension has its origin in childhood but goes undetected unless specially looked for during this period. Children with upper percentile of blood pressure levels are more likely to become adult hypertensive. If the trend towards adult hypertension can be recognised in childhood, it may be possible to alter lifestyle and prevent systemic hypertension as well as related complication.[1] Thus, early detection of hypertension and its precipitating or aggravating factor is important if one is to evolve measures so that complication of hypertension can be prevented.[2]

Ideally hypertension or tendency for hypertension should be detected as early in life as possible. According to Nelson, to increase early detection of hypertension, accurate blood pressure measurements should be part of the routine annual physical examination of all children, three years or older.[3] However, it is not possible to record reliable blood pressures by conventional methods in children below 6-7 years of age.[4] Hence, the ideal age would be 6-15 years i.e. school children. This recognition has made the medical workers and authorities in Western countries to include routine blood pressure measurements in school health programs and in

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regular office practice. The incorporation of blood pressure measurement into routine paediatric examination has led to the discovery of significant number of children with asymptomatic hypertension.[5] NIH Task force of USA has even recommended that blood pressure measurements along with weight and height should be recorded in children, at least once a year.[6,7] But even today in many parts of the world including India, this practice has not been implemented due to unknown reasons.

Most of the studies have been done in Western countries on this subject and normal standards for blood pressure have been established for the children of different ages, in both sex, black and white in their countries. No such standards are available for Indian children, although standards for anthropometric measurements have been established by Indian Council for Medical Research. The Western standards cannot be applied to Indian children, because of difference in factors as ethnic, socio-economic, dietary habits, environmental, etc. between Western and Indian countries. Hence, there is a need to establish the normal blood pressure standards for Indian children. The disease burden of hypertension among workers in tea gardens is large, despite the community not being obese.[8] Consumption of high quantity of common salt (NaCl) is considered to be the main factor. This habit of consuming extra salt in food and beverages is present amongst the children in the tea garden community. Therefore, it is expected that prevalence of hypertension and level of blood pressure would be higher among these group of children. Hence, the present study was taken up to determine the normal blood pressure levels in apparently healthy, asymptomatic school children of tea garden workers in the age group of 6-12 years.

MATERIALS AND METHODS

Place of Study

The study was undertaken on apparently healthy school going children of tea garden workers in the age group 6-12 years in and around tea gardens of Dibrugarh town.

Duration of Study

One year.

Type of Study

Community based cross sectional study.

Sample Size

Sample size for the present study was 500.

Sample Selection

There are 14 numbers of Tea gardens in and around Dibrugarh town. The schools of these tea gardens were selected randomly one by one and the students of the selected schools, who fulfilled the criteria, were included in the study. The process was stopped once the required sample size of 500 children was fulfilled.

Parameters to be studied

a. Blood pressure

Before taking the blood pressure, the students were explained about the procedure and efforts were made to eliminate the factors with may affect the blood pressure such as anxiety, fear, stress, crying, laughing, recent activity etc. Blood pressure was recorded in the right arm in the sitting position by using a standard Hg sphygmomanometer using appropriate cuff sizes.

Three readings were taken at an interval of at least 5 minutes and the average of these three readings was considered as the blood pressure of the individual. The cuff was gradually inflated to about 20 mm Hg above the point at which the radial pulse disappeared; the pressure was then released slowly at a rate of 2-3 mm Hg per second while listening for the first sound (Korotkoff I) using a stethoscope, the diaphragm of which was placed on the brachial artery. Korotkoff's 1st and 5th sounds were considered as systolic and diastolic blood pressures respectively.

Statistical analysis of data was carried out using SPSS Version-16. Data were presented in the forms of percentages, mean±standard deviation and also in the forms of diagrams. Statistical significance was ascertained by using Chi square test and ANOVA wherever applicable.

b. Age (Years)

Age was taken in complete years and was recorded from the school register.

c. Sex

d. Height (cm)

Height was measured using an anthropometer consisting of graduation (0-200) in cm. It was measured without shoes & subject standing against a wall on which a measuring scale was placed. The subject had to stand erect, feet parallel & heels, buttocks & shoulder and occiput touching the vertical rod of the anthropometer, head to be held erect, eyes aligned horizontally & ears vertically without any tilt. The horizontal bar which is at right angles to the vertical rod was placed touching the vertex. Height was measured to the nearest of 0.5 cm.

e. Body weight(Kg)

Weight was recorded without shoes and with light clothes on a bathroom type of weighing machine with a least count of 500 gm. Instrument was standardized prior to the study and also during the study from time to time.

f. Body Mass Index

BMI was calculated using the formula, BMI = Wt. in Kg (Ht. in meter)^2

For children and adolescents between 2 and 20 years old, BMI is interpreted relative to a child's age and sex, because the amount of body fat changes with age and varies by sex.[9]

Percentiles specific to age and sex classify underweight, healthy weight, overweight, and obesity in children.[9] BMI percentiles were calculated using the CDC growth charts 2000.

Percentile Ranking	Weight Status
Less than 5th percentile	Underweight
5th percentile to less than 85th percentile	Healthy weight
85th percentile to less than 95th percentile	Overweight
Equal to or greater than the 95th percentile	Obese

INSTRUMENTS USED

1. Weighing machine.
2. Anthropometer.
3. Sphygmomanometer.
4. Stethoscope.

RESULTS

In the present study, 233 children (46.6%) were boys and 267 (53.4%) were girls. Highest number of boys was found in 8 years age, while in case of girls highest number was found in the 6 years age (Table 1). There is progressive increase in both mean systolic and diastolic blood pressure with age in both the sexes. In boys, increase in mean SBP is more marked in 7-8 years and mean DBP in 10-11 years, whereas in girls mean SBP is marked in 6-7 years and mean DBP increase more in 9-10 years (Table 2, Figure 1).

When cases were distributed according to their height, maximum number of both boys and girls were found to be in the range of 121-130 cm. In males and females, both SBP and DBP increase as the height increases (Table 3, Figure 2).

Both SBP and DBP are positively correlated with height ($p<0.01$) which indicate that with increase in height there is an increase in both SBP and DBP (Table 4).

When cases were distributed according to their weight, maximum number of both boys and girls were found to be in the range of 21-30 kg. In males and females, both SBP and DBP increase as the weight increases (Table 5, Figure 3).

Both SBP and DBP are positively correlated with weight ($p<0.01$) which indicate that with increase in weight there is an increase in both mean SBP and mean DBP in case of both males and females. (Table 4)

The mean SBP of the underweight, overweight and obese children is found to be 98.24±5.71, 101.67±8.45 & 100.33±3.12 mmHg respectively in males. In case of females, it is found to be 99.01±8.51, 99.15±7.36 & 104.46±8.18 mmHg respectively.

Similarly, the mean DBP of the underweight, overweight and obese children is found to be 61.95±6.50, 66.46±10.53 & 61±3.12 mmHg respectively in males. In case of females it is found to be 63.94±8.86, 62.67±4.69 & 65.88±6.77 mmHg respectively (Table 6, Figure 4).

Both SBP and DBP are positively correlated with BMI ($p<0.01$) which indicate that with increase in BMI there is an increase in both mean SBP and mean DBP in case of both males and females (Table 4).

Age (Years)	Boys	Boys in %	Girls	Girls in %	Total	Total in %
6	41	47.13	46	52.87	87	17.4
7	37	45.68	44	54.32	81	16.2
8	42	54.55	35	45.45	77	15.4
9	39	50.65	38	49.35	77	15.4
10	30	43.48	39	56.52	69	13.8
11	23	41.07	33	58.93	56	11.2
12	21	39.62	32	60.38	53	10.6
Total	**233**	**46.6**	**267**	**53.4**	**500**	**100**

Table 1. Age and Sex Distribution of the Children

Age (years)	Sex	No. of cases	SBP(mmHg)		DBP (mmHg)	
			Mean±sd	Range	Mean±sd	Range
6	M	41	96.91±5.08	86.67-111.33	60.98±4.75	50.67-73.33
	F	46	95.58±5.94	88.00-112.00	61.06±4.88	50.67-70.00
7	M	37	98.99±5.48	87.33-117.33	61.96±6.32	50.67-82.67
	F	44	98.88±7.13	90.67-117.33	62.91±8.36	54.67-89.33
8	M	42	101.94±7.05	90.67-123.33	63.95±7.47	54.67-89.33
	F	35	99.71±7.50	90.67-123.33	62.90±6.84	54.67-89.33
9	M	39	103.44 ±8.44	88.67-123.33	65.83±6.60	54.67-89.33
	F	38	101.58±8.22	90.67-121.33	63.89±6.17	54.67-81.33
10	M	30	104.93±7.19	93.33-125.33	66.11±8.18	57.33-91.33
	F	39	104.63±8.80	71.33-125.33	66.77±5.87	60.67-91.33
11	M	23	105.65±7.43	94.67-127.33	68.06±8.69	56.67-93.33
	F	33	105.60±7.44	96.67-127.33	66.22±6.63	57.33-81.33
12	M	21	106.92±8.98	96.67-131.33	68.83±6.05	60.67-81.33
	F	32	107.90±7.66	96.67-123.33	68.81±4.83	62.67-79.33

Table 2. Systolic and Diastolic Blood Pressure according to Age and Sex

Height in cm.	Boys					Girls				
	No. of cases	SBP		DBP		No. of Cases	SBP		DBP	
		Mean±sd	Range	Mean±sd	Range		Mean±sd	Range	Mean±sd	Range
91-100	4	95.50±2.27	93.33-98.67	56.83 ±3.28	52.67-60.67	3	92.44 ±4.44	88.67-97.33	61.78 ±3.91	57.33-64.67
101-110	30	96.64±5.22	86.67-110.67	59.84 ±3.75	52.67-68.67	37	96.32 ±5.35	88.67-111.33	61.21 ±4.14	52.67-69.33
111-120	71	100.94±7.07	87.33-127.33	64.57 ±7.36	54.67-93.33	87	100.84 ±7.73	88-123.33	63.74 ±7.06	53.33-89.33
121-130	112	104.02±7.83	88.67-131.33	65.60 ±7.28	50.67-91.33	119	102.92 ±8.80	71.33-127.33	65.20 ±6.98	50.67-91.33
131-140	14	104.52±8.41	94.67-122.67	66.86 ±7.53	57.33-81.33	20	107.27 ±8.63	97.33-127.33	68.90 ±5.46	58.67-81.33
141-150	2	106.67±0	106.67	75±6.13	70.67-79.33	1	108	108	65.33	65.33

Table 3. Distribution of Blood Pressure according to Height

	SBP		DBP	
	Correlation Coefficient (r)	p - value	Correlation Coefficient(r)	p - value
Age	0.45	p<0.01	0.35	p<0.01
Height	0.34	p<0.01	0.28	p<0.01
Weight	0.41	p<0.01	0.34	p<0.01
BMI	0.27	p<0.01	0.21	p<0.01

Table 4. Shows Correlation of Age, Height, Weight and BMI with SBP and DBP

Weight in kg.	Boys					Girls				
	No. of Cases	SBP		DBP		No. of Cases	SBP		DBP	
		Mean±sd	Range	Mean±sd	Range		Mean±sd	Range	Mean±sd	Range
11-20	72	97 ±4.57	86.67-111.33	60.59 ±4.67	50.67-73.33	74	97.12 ±6.61	88.67-117.33	61.98 ±6.33	50.67-89.33
21-30	152	104.14 ±7.68	87.33-131.33	66.02 ±7.47	50.67-93.33	177	102.93 ±8.39	71.33-127.33	65.11 ±6.83	50.67-91.33
31-40	9	106.74 ±8.88	93.33-122.67	71.33 ±6.74	62.67-81.33	16	106.83 ±8.45	96.67-127.33	67.83 ±4.71	62.67-81.33

Table 5: Distribution of Blood Pressure according to Body Weight

	Boys					Girls				
	No. of Cases	SBP		DBP		No. of Cases	SBP		DBP	
		Mean±sd	Range	Mean±sd	Range		Mean±sd	Range	Mean±sd	Range
<5th percentile	41	98.24 ±5.71	86.67-117.33	61.95 ±6.50	50.67-82.67	23	99.01 ±8.51	88.67-117.33	63.94 ±8.86	56 - 89.33
5th -85th percentile	170	103.05 ±7.89	87.33-131.33	65.12 ±7.02	52.67-91.33	200	101.50 ±8.45	71.33-125.33	64.32 ±6.59	50.67-91.33
85th-95th percentile	16	101.67 ±8.45	93.33-127.33	66.46 ±10.53	57.33-93.33	11	99.15 ±7.36	88-109.33	62.67 ±4.69	53.33-69.33
≥95th percentile	6	100.33 ±3.12	96.67-105.33	61 ±3.12	56.67-65.33	33	104.46 ±8.18	90.67-127.33	65.88 ±6.77	56 - 81.33

Table 6. Distribution of Blood Pressure according to BMI

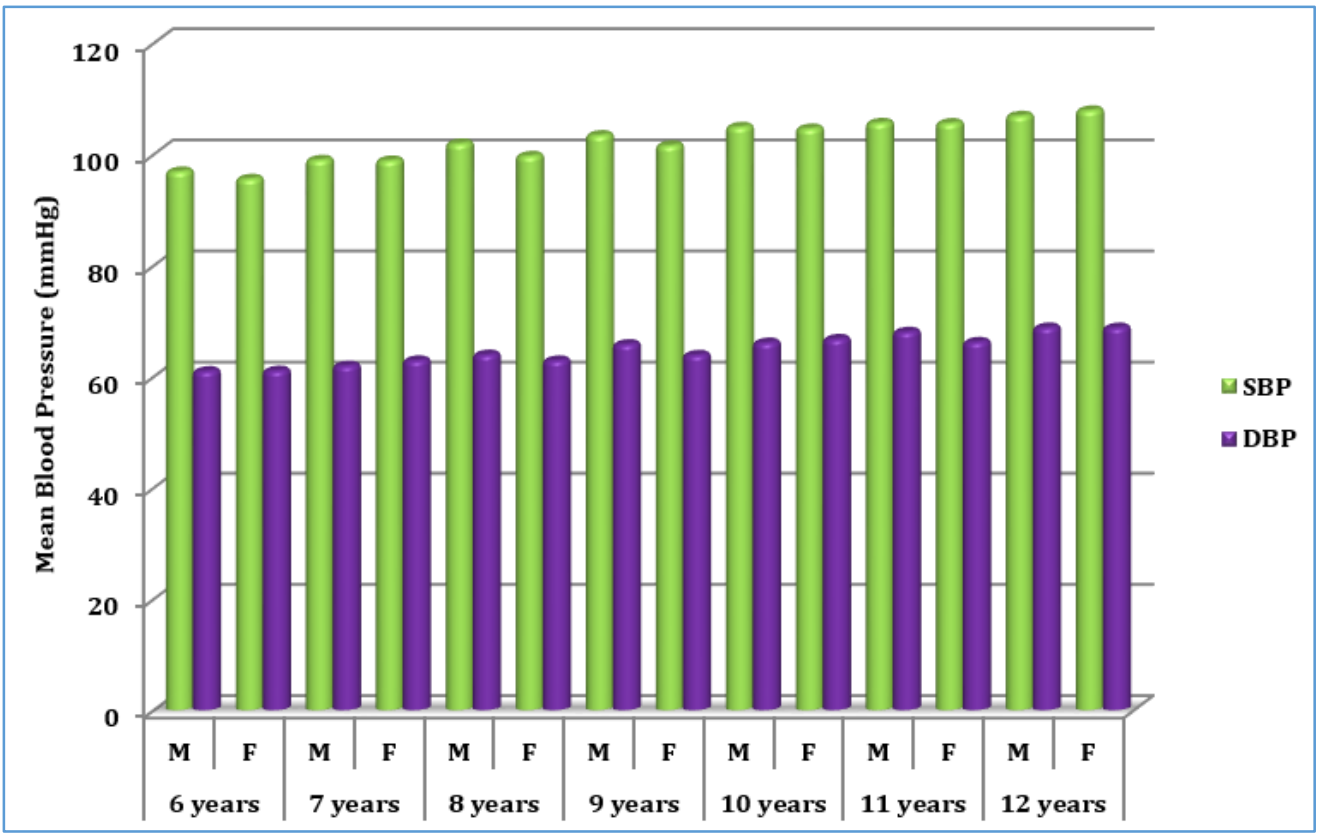

Figure 1. Bar Diagram showing Mean Systolic and Diastolic BP according to Age and Sex.

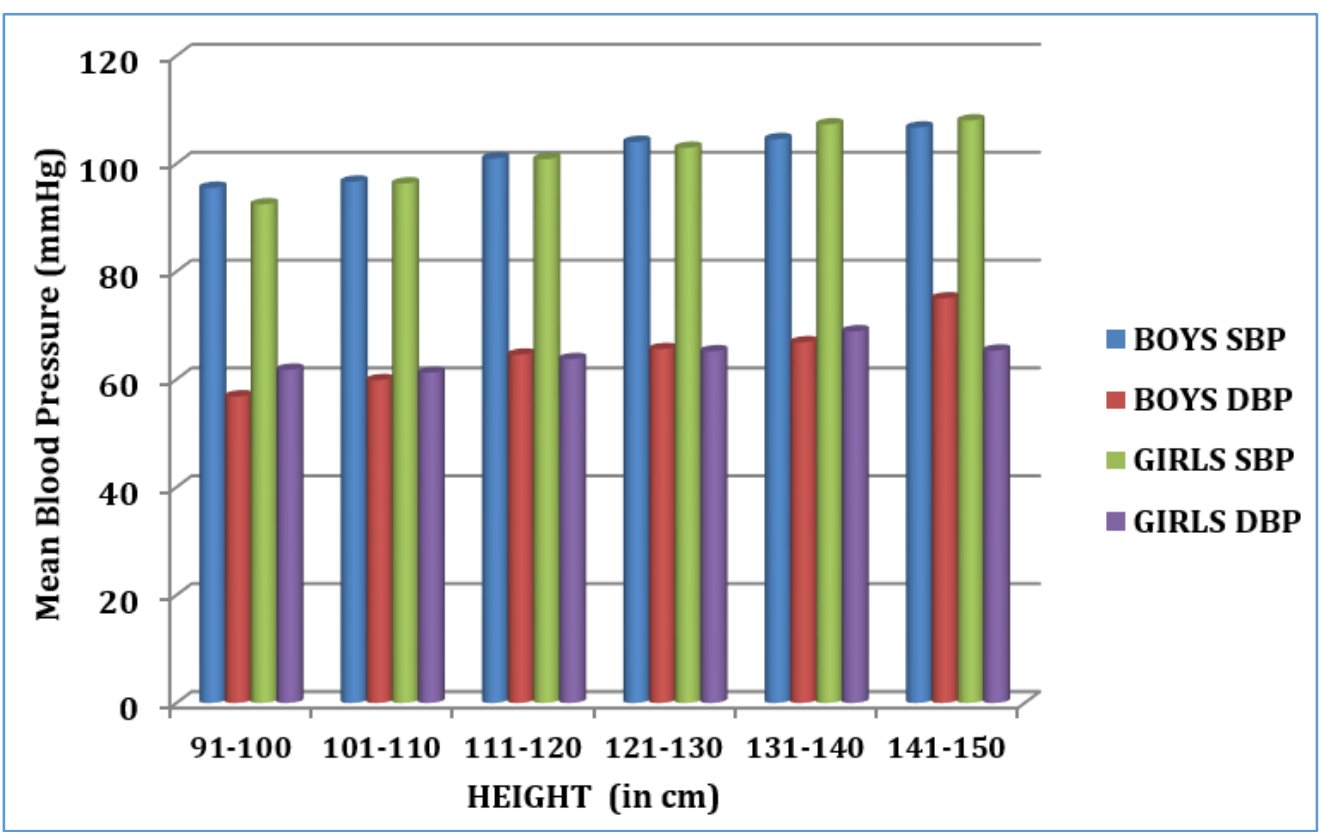

Figure 2. Bar Diagram showing Distribution of Blood Pressure according to Height.

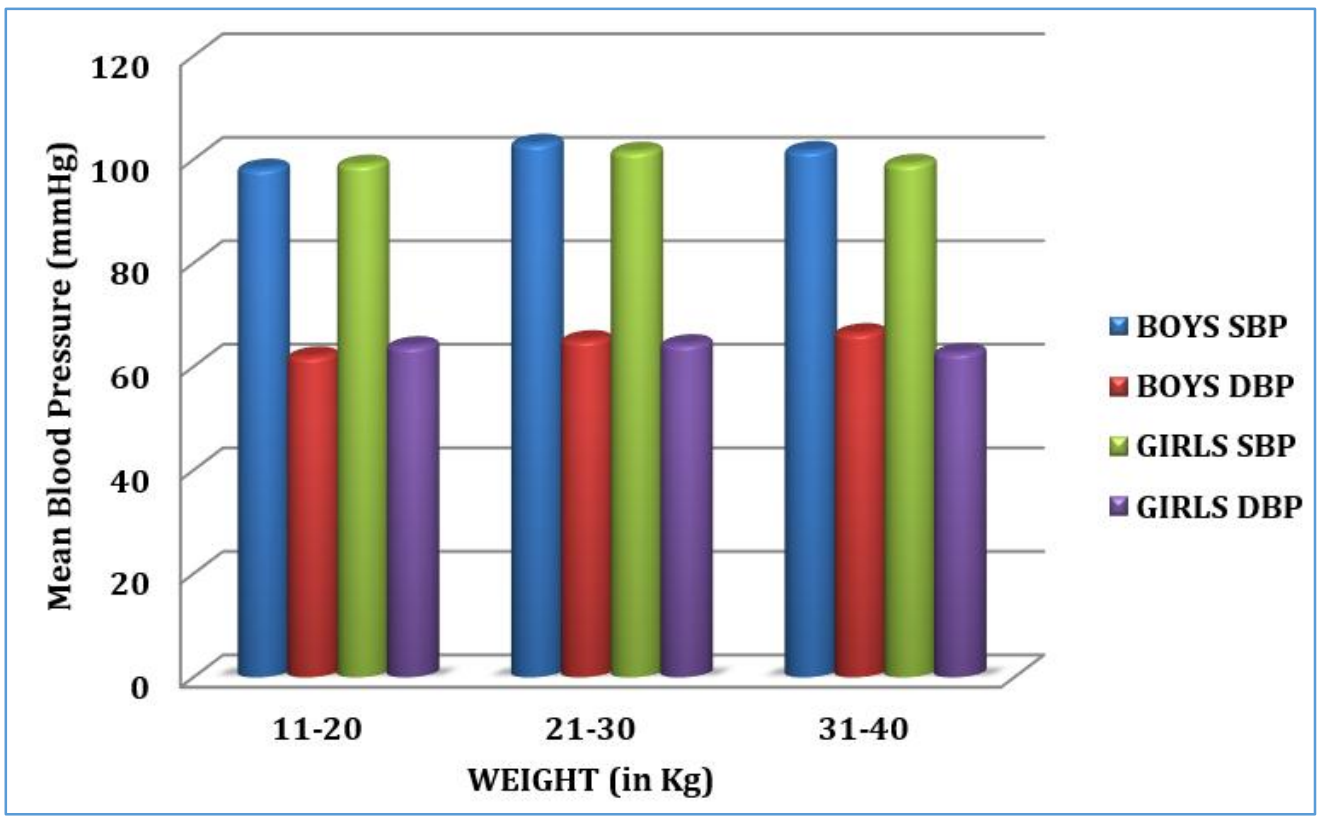

Figure 3. Bar Diagram showing Distribution of Blood Pressure according to Body Weight.

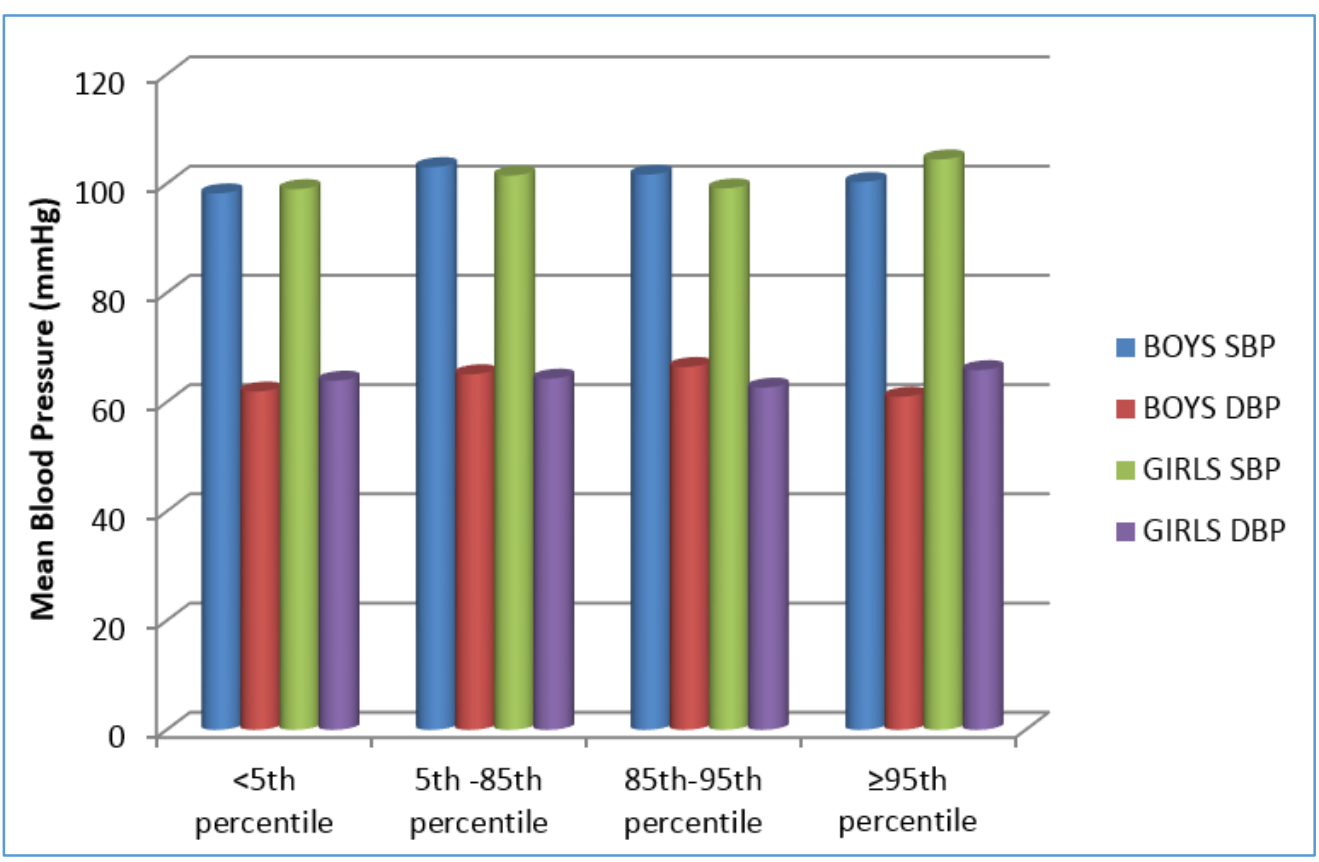

Figure 4. Bar Diagram showing Distribution of Blood Pressure according to BMI

DISCUSSION

Blood Pressure and Age

The mean systolic and diastolic blood pressure for both boys and girls shows an increasing trend with the increase in age.

Laroia D. et al[10] also noted a gradual increase in mean systolic and mean diastolic blood pressure of boys and girls with age. Gupta A.K., Ahmed A.J.[11] also observed a gradual increase in mean systolic blood pressure and mean diastolic blood pressure of both boys and girls with age in their study. Sharma B.K. et al[12] noted that both systolic and diastolic pressure revealed a rising trend with age in boys and girls. However, the rise was steeper during adolescence compared with the rise during ages 7-10 years. The average annual increase in mean systolic pressure from 7-16 years was 1-3 mmHg. N.K. Anand and Lalit Tandon[2] also found that blood pressure increased with increases in age with a spurt in systolic blood pressure at the age of 12 years in both sex. A. S. Bose, P. Marimuthu and A. K. Chakraborty.[13] also found in their study that both SBP and DBP showed a rising trend with increasing age. Anjana et al[14] showed that the mean values of systolic blood pressure and diastolic blood pressure increase with age in both sexes. Arun Kr De and Sukanta Chatterjee.[15] in their study found that mean SBP increased from 98.2 mmHg in boys and 96.62 mmHg in girls at 5 years of age to 118 in boys and 120.86 mmHg in girls at 15 years of age. Like MSP, MDP also had a higher start in boys than girls did at 5 years of age, but at year 15 girls overtook the boys. Maximum rise of MDP in boys and girls was at 12-13 and 13-14 years respectively.

The gradual increase in mean systolic and diastolic blood pressures in both boys and girls with age as seen in the present study agree with the findings of Laroia D. et al,[10] Gupta A.K, Ahmed A.J,[11] Sharma B.K. et al,[12] N.K. Anand and Lalit Tandon,[2] A. S. Bose, P. Marimuthu and A. K. Chakraborty,[13] Anjana et al.[14] Also positive correlations of both SBP and DBP with increase in age are consistent with findings reported by several studies in children mentioned above.

Blood Pressure and Sex

Agarwal R. et al[16] studied 1692 apparently healthy school children between 5 and 15 years and noted that no significant difference between two sexes in both systolic and diastolic blood pressure. Sachdev Y.[17] studied 3,911 normal healthy asymptomatic Indian children over a period of 5 years, but he did not find any significant correlation between blood pressure values and sex. Laroia D.et al[10] had studied a total of 2073 school children between the age group of 5-14 years and found that there was no significant variation of blood pressure with sex. Sharma B.K.et al[12] had observed BP among 2453 school children aged between 7 and 16 years, they noted that there was no difference in the systolic and diastolic pressure of boys compared with girls at corresponding age. Anjana et al[14] observed no significant difference in blood pressure in 6-14 years of the two sexes at all age groups except for systolic blood pressure at age group 7+. Arun Kr De and Sukanta Chatterjee.[16] observed that the values of SBP and DBP were slightly lower among girls than boys, but the differences were not found statistically significant in most of the age groups except for the difference between the SBP at age 7.

So, our present study of no significant difference in mean SBP and mean DBP in boys and girls correlates well with the findings reported by many authors as mentioned above.

Blood pressure and height, weight and BMI:

Victor 0., Ansa.[18] found positive correlations of blood pressure with anthropometric parameters (weight, height and BMI) in most age groups. Some of the correlations were statistically significant illustrating the relationship between blood pressure and body mass. Ribeiro f. et al[19] reported that systolic and diastolic blood pressures were significantly ($p<0.05$) and positively related to BMI. Israeli Eran et al[20] found a statistically significant increase in the mean SBP and DBP with age and BMI. Amar taksande et al[5] in their study of 2643 school children found a significant correlation of SBP and DBP with the weight, and body mass index (BMI). Bayat M et al[21] found in their study that there was a positive correlation among height, weight, BMI, age and the blood pressure values; and as BMI and age increased, so did the blood pressure value. Manu raj et al[22] in their study of 20,263 students found a significant correlation for both systolic and diastolic pressures with height and weight. F Akor et al[23] in their study of 650 students found that weight had a positive correlation with blood pressure. There was; however, low albeit a significant ($p=0.001$) correlation between blood pressure and height of the subjects. Fujita Y et al[24] in their study found that a positive correlation between weight and blood pressure was the strongest among the three body size indices (height, weight, and body mass index), but the association between height and blood pressure was also significant. Arun kr De et al[16] in their study found that increment in height and weight had a significant positive relationship with SBP and DBP. Anisa M Durrani et al[25] in their study of 701 school children, found that both SBP and DBP of both sexes had a positive correlation with height and weight.

Regarding the effects of height, weight and body mass index on blood pressure, most of the studies in children have shown a strong positive correlation. In our study, the systolic blood pressure and the diastolic blood pressure had positive correlation with height, weight and body mass index in both the sexes, which tallies with the findings observed by other authors.

CONCLUSION

In this study, a humble endeavour has been made to study the blood pressure profile and its relation to height and weight in the 6-12 years age group in the schools of tea gardens in and around Dibrugarh town. Blood pressure recording and anthropometric measurements should be a part of school health programmes and also for children attending the health care system, to prevent epidemic and the complication of hypertension. Schools should be encouraged to play a role in modification of lifestyle changes among the school children.

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