Original Article

PREVALENCE OF HYPERTENSION IN GUJARATI SCHOOL GOING CHILDREN AND ADOLESCENTS IN ANAND DISTRICT

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ABSTRACT

Background: Childhood hypertension is now days becoming big problem worldwide. Gujarati school age children are not much studied regarding cardiovascular risk factors like hypertension; especially in the central Gujarat, no such study has been reported so far. Therefore, we conducted this study to assess prevalence of hypertension and relationship of blood pressure with body mass index and body surface area in Gujarati school going children and adolescents in Anand district of Gujarat.

Methodology: A cross-sectional study of 1087 Gujarati school going children and adolescents of 5-18 years was conducted between 2008 and 2010 in Anand district of Gujarat to get a distribution profile of blood pressure, BMI and BSA (body surface area).

Results: The overall prevalence of prehypertension was 10.8% (6.16% for SBP and 5.61% for DBP) and that for hypertension was 9.2% (5.06% for SBP and 5.09% for DBP). In boys, overall prevalence of prehypertension and hypertension were 9.63% (4.82% for SBP and 6.15% for DBP) and 9.8% (6.31% for SBP and 5.65% for DBP) respectively and, that was 9.07% (4.54% for SBP and 4.95% for DBP) and 10.31% (5.77% for SBP and 6.19% for DBP) in girls. The blood pressure was positively correlated with age, height, BMI and BSA.

Conclusion: The high prevalences of prehypertension and hypertension in Gujarati children and adolescents obtained in this study indicate the need for regular evaluation of cardiovascular status in Indian school children.

Keywords: Prevalence, Prehypertension, Hypertension, Gujarati Children and adolescents, BMI, BSA

INTRODUCTION

There is a definite rise in the prevalence of essential hypertension in children and adolescents across the globe.[1,2] Elevated blood pressure at a young age is a predictor of blood pressure elevation later in life.[2]

According to World Health Report 2002,[3] cardiovascular diseases (CVDs) will be the largest cause of death and disability by 2020 in India. In 2020 AD, 2.6 million Indians are predicted to die due to coronary artery disease which constitutes 54.1 % of all CVD deaths.

Nearly half of these deaths are likely to occur in young and middle aged individuals (30-69 years).

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.[7] South Asians have a greater prevalence of coronary risk factors than rest of the world, the coronary artery disease often manifests at an early age which creates unusual pressure on society and the economy.[7] Patients in India are more likely to be younger and present with ST elevation myocardial infarction than those in the registry data from developed countries.[8]

As per our knowledge, especially in the central Gujarat, no such study had been reported yet, especially in the age group of 5-18 years. Therefore, we conducted a study to get the prevalence of hypertension in Gujarati school going children and adolescents of Anand district. We also wanted to get relationship of blood pressure with anthropological parameters like body mass index and body surface area of the children.

MATERIALS AND METHODS

A cross sectional non-interventional study conducted between 2008 and 2010 after the approval of the ethical committee of the institute and obtaining the informed consent from the parents/guardians and the principals of the schools. School going children and adolescents of 5-18 years of all socioeconomic classes were selected from five schools of Anand district of Gujarat. The sample size for this prevalence study was calculated assuming a prevalence of 3% [12] and a population of 27000 (approximate total number of school children in Anand district) with a precision of 1%. Three of these schools were set in rural area while two were urban. The Gujarati ethnicity was determined on the basis that both the parents of the subject had Gujarati as their mother tongue. The subjects with presence or a history of any acute or chronic disease state that would affect the study variables were excluded.

BMI was calculated by the formula:

BMI = weight in Kg / (height in meters)^2 whereas body surface area (BSA) was calculated by Mosteller formula i.e.[13]

BSA = BSA (m^2) = ([Height (cm) x Weight (kg)] / 3600)^{½}

The resting pulse rate (PR), Systolic blood pressure (SBP) and Diastolic blood pressure (DBP) were measured by Omron T8 automatic Blood Pressure instrument (Accuracy: BP: ± 4mmHg, PR: ± 5) validated by Association for the Advancement of Medical Instrumentation (AAMI) and British Hypertension Society (BHS).[14] A small-sized cuff for small children (arm circumferences of 17 to 22 cm (at the center of brachium) with a small arm circumference and a medium-sized cuff with a bigger arm circumference for bigger children and adolescents (for arm circumferences of 22 to 32 cm (at the center of brachium) were used.[2]

The subjects were given a 10 minutes' rest and no intake of tea, coffee, food, water in last half an hour was allowed. The blood pressure was measured in right arm, in sitting posture with a back rest, with cubital fossae at the level of heart.[2]

Pulse rate and Blood pressure readings of each subject were recorded at the intervals of 1 minute. The average of the three consecutive readings was used for statistical analysis. [5,6]

Statistical analysis was done by computing percentiles of BP, height and weight and Pearson correlation coefficients. Although, the prevalences were not calculated exactly according to the guidelines given in the 4th report of NIH (National Institute of Health, US) on Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents[2]; we considered the 90th - 94th percentiles of BP including subjects with SBP equal or more than120 mm of Hg but less than 94th percentile as prehypertension while a BP at 95th percentile and above was considered as hypertension. Here, for calculating prevalences the height percentiles were not taken into consideration because of smaller size of the data. The method followed for calculating prevalence of hypertension was taken from an article by Saudarssanane et al.[4]

RESULTS

The overall mean systolic blood pressure was 109±11.3 and the mean diastolic blood pressure

was 66±8.7. The values of mean SBP and DBP in boys were 110±11.6 and 66±8.6 respectively and those in girls were 109±10.8 & 66±8.7 in girls. The distribution profile of the blood pressure for each year is shown in the tables 1A and 1B and that in three age groups i.e. 5-9, 10-14 and 15-18 is shown in the figure 1 and figure 2.

Table 1 (A): Age-wise percentiles of blood pressure and mean (SD) of BP, height and weight of Boys

	Age (Years)	BP (mm Hg)	BP Percentiles				Weight (Kg)	Height (cm)
		Mean (SD)	50	75	90	95	(Mean ± SD)	Mean (SD)
SBP	5	99.5 (7.2)	99	104	109	111	14.7 (1.9)	111 (5)
	6	101.5 (7.8)	102	106	111	118	16.4 (2.3)	115 (5)
	7	102.4 (8.0)	103	106	113	114	19 (3)	122 (5)
	8	107.0 (8.7)	106	115	118	123	21.9 (3.6)	126 (6)
	9	107.5 (9.7)	108	111	120	130	23.6 (3.8)	131 (6)
	10	107.4 (7.4)	107	113	119	120	22.6 (3.5)	128 (7)
	11	111.9 (10.4)	112	119	125	134	24.9 (4.1)	133 (8)
	12	112.3 (12.0)	112	121	126	131	31.7 (7.1)	143 (7)
	13	112.1 (12.4)	112	119	129	136	38.3 (10.3)	150 (6)
	14	115.11 (13.17)	113	126	134	140	39.7 (10.2)	153 (9)
	15	110.91 (9.75)	108	121	122	124	42.9 (7.2)	159 (9)
	16	112.89 (10.41)	113	119	126	131	42.5 (8.6)	160 (8)
	17	119.70 (10.7)	123	128	132	136	42.2 (5.1)	160 (8)
	18	120.8 (5.0)	121	124	126	127	46.2 (7.9)	164 (6)
DBP	5	61.9 (8.5)	59	67	69	70	14.7 (1.9)	111 (5)
	6	62.6 (6.3)	60	65	68	70	16.4 (2.3)	115 (5)
	7	61.5 (7.3)	60	64	66	73	19 (3)	122 (5)
	8	64.8 (8.0)	62	65	73	78	21.9 (3.6)	126 (6)
	9	70.0 (8.7)	64	70	73	81	23.6 (3.8)	131 (6)
	10	63.9 (7.8)	70	77	78	80	22.6 (3.5)	128 (7)
	11	67.7 (7.8)	71	78	83	86	24.9 (4.1)	133 (8)
	12	66.5 (9.8)	69	75	80	83	31.7 (7.1)	143 (7)
	13	65.0 (8.3)	67	73	77	78	38.3 (10.3)	150 (6)
	14	66.8 (9.3)	69	76	83	87	39.7 (10.2)	153 (9)
	15	69.4 (7.8)	67	76	79	79	42.9 (7.2)	159 (9)
	16	67.2 (7.2)	64	70	79	84	42.5 (8.6)	160 (8)
	17	68.2 (6.8)	71	75	79	83	42.2 (5.1)	160 (8)
	18	70.0 (9.9)	69	74	75	75	46.2 (7.9)	164 (6)

Table 1 (B): Age-wise percentiles of blood pressure and mean (SD) of BP, height and weight of Girls

	Age (Years)	BP (mm Hg)	BP Percentiles				Weight (Kg)	Height (cm)
		Mean (SD)	50	75	90	95	Mean (SD)	Mean (SD)
SBP	5	99.5 (8.5)	98	103	115	118	14.4 (1.5)	107 (4)
	6	101.6 (7.7)	101	105	114	118	16.1 (2.2)	113 (6)
	7	101.7 (7.1)	102	104	113	115	19.2 (2.5)	121 (6)
	8	107.2 (9.3)	106	116	119	122	22.8 (3.3)	126 (6)
	9	112.6 (10.4)	112	119	129	130	22.9 (3.7)	128 (9)
	10	112.1 (9.6)	114	120	124	124	20.9 (2.4)	126 (6)
	11	111.5 (11.1)	112	118	126	133	27.8 (5.6)	139 (7)
	12	113.0 (11.9)	114	119	133	138	32.7 (8.5)	147 (8)
	13	107.4 (11.0)	106	114	123	131	35.8 (8)	148 (9)
	14	113.9 (9.7)	114	121	126	128	37.9 (9.4)	150 (7)
	15	115.7 (11.2)	116	123	134	135	38.1 (7.2)	151 (8)
	16	107.7 (9.5)	108	113	122	126	43.4 (7.8)	155 (5)

	Age (Years)	BP (mm Hg) Mean (SD)	BP Percentiles 50	75	90	95	Weight (Kg) Mean (SD)	Height (cm) Mean (SD)
	17	110.9 (10.5)	110	119	127	131	41.4 (6.5)	152 (5)
	18	113.5 (10.6)	114	117	120	120	44.5 (6.4)	160 (3)
DBP	5	61.9 (8.5)	61	67	71	84	14.4 (1.5)	107 (4)
	6	62.6 (6.3)	62	68	71	73	16.1 (2.2)	113 (6)
	7	61.5 (7.3)	63	67	69	73	19.2 (2.5)	121 (6)
	8	64.8 (8.0)	64	72	76	79	22.8 (3.3)	126 (6)
	9	70.0 (8.7)	71	76	82	82	22.9 (3.7)	128 (9)
	10	63.9 (7.8)	61	69	70	76	20.9 (2.4)	126 (6)
	11	67.7 (7.8)	67	73	78	82	27.8 (5.6)	139 (7)
	12	66.5 (9.8)	66	72	83	85	32.7 (8.5)	147 (8)
	13	65.0 (8.3)	65	70	77	79	35.8 (8)	148 (9)
	14	66.8 (9.3)	66	75	78	82	37.9 (9.4)	150 (7)
	15	69.4 (7.8)	68	76	82	85	38.1 (7.2)	151 (8)
	16	67.2 (7.2)	68	72	78	81	43.4 (7.8)	155 (5)
	17	68.2 (6.8)	68	71	78	82	41.4 (6.5)	152 (5)
	18	70.0 (9.9)	70	74	74	76	44.5 (6.4)	160 (3)

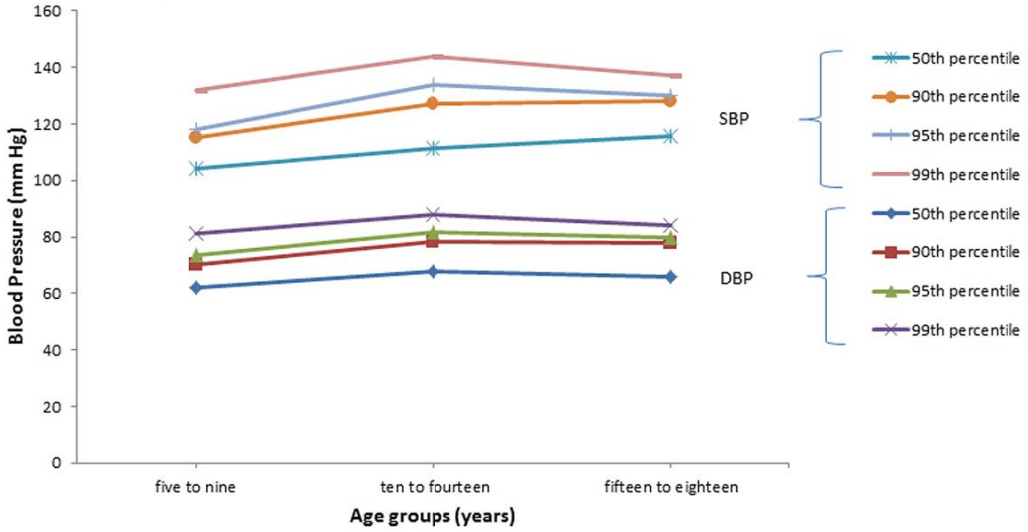

Figure 1: Age group specific centiles of SBP & DBP in Boys.

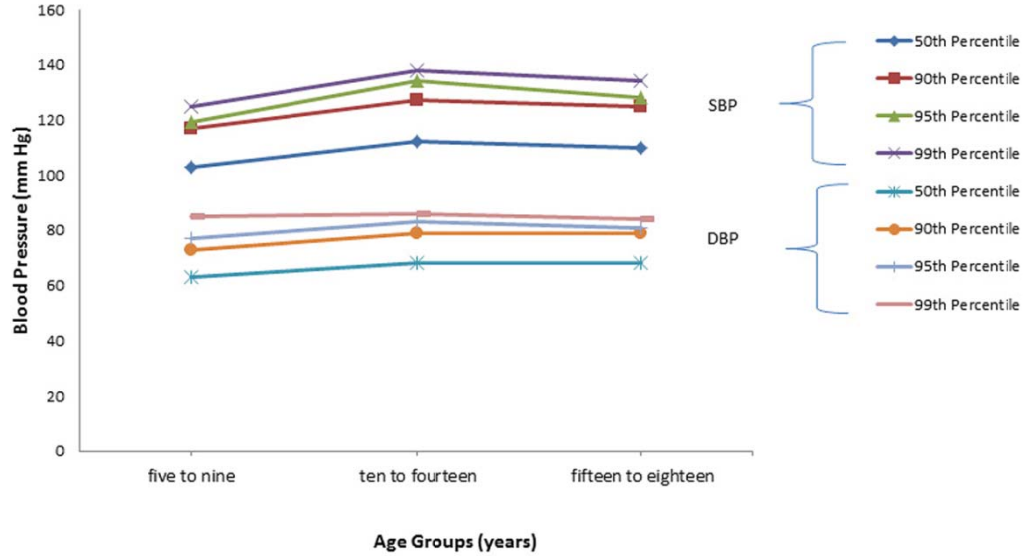

Figure 2: Age group specific centiles of SBP & DBP in girls

The overall prevalence of prehypertension and hypertension are shown in table 2 along with individual gender. The prevalences of prehypertension and hypertension in the predetermined age groups are shown in table 3.

The blood pressure was positively correlated with BMI (body mass index) and body surface area (Table 4).

Table 2: Prevalence of hypertension and prehypertension (n=1087)

	Pre-hypertension			Hypertension		
	Systolic	Diastolic	Total	Systolic	Diastolic	Total
Boys (n=602	4.82%	6.15%	9.53%	6.31%	5.65%	9.80%
Girls (n=485)	4.54%	4.95%	9.07%	5.77%	6.19%	10.13%
Total (n=1087)	6.16%	5.61%	10.8%	5.06%	5.89%	9.2%

Table 3: Prevalence in the predetermined three age groups

Age	Prehypertension (%)						Hypertension (%)					
	Boys			Girls			Boys			Girls		
	SBP	DBP	Total	SBP	DBP	Total	SBP	DBP	Total	SBP	DBP	Total
5-9 years	3.77	6.13	9.91	4.93	7.04	11.27	6.6	5.66	8.96	7.04	5.63	9.86
10-14 years	4.55	9.42	13.31	5.74	5.74	11	5.84	4.5	9.09	5.26	5.74	9.57
15-18 years	6.1	7.32	13.25	5.97	5.97	5.978	4.88	4.88	8.54	4.48	4.97	9.7

Table 4: Pearson correlation coefficients

	Age	Height	Weight	BSA by Mosteller Formula	BMI
SBP	.340**	.342**	.392**	.388**	.368**
DBP	.267**	..256**	.309**	.307**	.295**
PP	.164**	.180**	.193**	.200**	.176**
MBP	.323**	.317**	.374**	.370**	.355**
PR	-.281**	-.277**	-.203**	-.238**	-.110**

** Correlations are significant at p 0.01 (2 tailed)

DISCUSSION

Overall, there was no significant difference in blood pressure of boys and that of girls in the study sample but, as expected,[15] resting pulse rate was significantly higher in girls than that in boys.

The SBP values were found significantly higher in the boys of 15-18 years age group (p=.0015) while PP (pulse pressure) was high in the boys of 5-9 (p<.005) and 15-18 years (p<.001) than the girls of these age groups.

In the age group of 5-9 years, DBP was significantly higher in girls (p=.011), while boys had significantly higher DBP in 10-14 years age group (P=.013). DBP showed no difference between boys and girls of the age group of 15-18 years.

The overall prevalence of prehypertension was 10.8% (6.16% for SBP and 5.61% for DBP) and that for hypertension was 9.2% (5.06% for SBP and 5.89% for DBP). In Comparison to our study, Thakor et al in 1998 in Surat city[11], found much less overall prevalence of hypertension (2.3%) amongst school children. The overall prevalence of hypertension (systolic, diastolic or both) in this study was found higher than that reported by Anand et al[5] and Anjana et al[6] but it was almost equal to that found by Moura et al[16] in the city of Maceió in Brazil (9.41%).

In boys, overall prevalence of prehypertension was 9.53% (4.82% for SBP and 6.15% for DBP) that was 9.07% (4.54% for SBP and 4.95% for DBP) in girls. Moreover, hypertension was more prevalent in girls than boys in all the predetermined age-groups (Table 4) which is in contrast to the findings of Chadha et al[9] in 1999 where the prevalence of hypertension was a little more in boys than the girls.

In this study, the prevalence of Hypertension in boys was 9.8% (6.31% for SBP and 5.65% for DBP) and that in girls was found to be 10.31% (5.77% for SBP and 6.19% for DBP) which however, is a little less than that found by Chadha et al (11.9% in boys and 11.4% in girls).[9]

The blood pressure was positively correlated with age, height, BMI and BSA (body surface area) while, it was negatively correlated with resting pulse rate (Table 5). The correlations were stronger with SBP than DBP than PP. Similarly correlations of SBP, DBP, PP, MBP and

PR with BSA were found to be stronger than those with BMI. All the above mentioned correlations in this study were stronger than those found by Sharma BK et al in 1991.[10]

CONCLUSION

By this study, the prevalences of prehypertension and hypertension in the Gujarati school children could be determined and a distribution profile of blood pressure for this population could be prepared. As the prevalences of hypertension were on the higher side of the established ranges of blood pressure; in the developing countries like India, we recommend that blood pressure measurement should be included as a regular feature of the school health check-up.[18] A positive significant correlation of BP with BMI has been reported in almost all the available literature pertinent to this study signifying BMI as a strong correlate of blood pressure.

LIMITATIONS

This was a cross sectional study mainly intended to get prevalences of high blood pressure in children and adolescents so; to obtain a more precise idea about trends of blood pressure some longitudinal studies may be required. Further similar studies can be done with a larger sample size in this region to create more accurate reference ranges of blood pressure for children and adolescents.

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