Research Article

Distribution and prevalence of hypertension in school children of Ghaziabad, Uttar Pradesh

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Abstract

Background: Prevalence of hypertension is rapidly increasing among Indians owing to sedentary lifestyle, junk food, and rapid urbanization. **Aims and Objective:** To study the association between anthropometric parameters and blood pressure levels among school children aged 10–14 years in Ghaziabad city and to determine the distribution and prevalence of hypertension in children aged 10–14 years. **Materials and Methods:** A cross-sectional study was done in school children aged 10–14 years in Ghaziabad city, Uttar Pradesh. The blood pressure and anthropometric variables such as age, height, weight, and body mass index were recorded. The results were analyzed by ANOVA with SPSS software, version 17.0, using unpaired *t*-test. **Result:** Results showed that there was an increase in systolic blood pressure (SBP) and diastolic blood pressure (DBP) with the increase in age, height, and weight ($p < 0.05$). Both SBP and DBP were higher ($p < 0.05$) in obese children and children with positive family h/o hypertension than their relative counterparts. **Conclusion:** Body mass index and blood pressure of the children should be checked at regular intervals in order to prevent any future complications.

KEY WORDS: Blood Pressure; School Children; Hypertension; Body Mass Index

Introduction

Blood pressure is defined as the force exerted by the column of blood against any unit area of the vessel wall.[1]

Arterial hypertension is probably established early in life.[2,3] Hypertension has its origin in childhood but goes undetected unless specifically looked for during this period.[4] Hypertension is a major health problem in developed and developing countries associated with high mortality and morbidity affecting approximately one billion individuals worldwide.[5] Hypertension in children is an emerging public health issue attracting the attention of medical professionals worldwide. Hypertension in children exhibits strong correlations with various factors, among which body weight assumes considerable significance.[6–9] Various studies have shown that there is strong tracking of blood pressure from childhood to adulthood.[3,4] There are not much data available on the distribution and prevalence of hypertension in children in Ghaziabad city, Uttar Pradesh, India. Moreover, an early and regular screening of children of parents with hypertension is necessary to prevent any future cardiovascular complications. [10] This is required so that regular exercise training can be started well in advance to lower the blood pressure.[11]

This study was designed: (1) to study the association between anthropometric parameters and blood pressure levels among school children aged 10–14 years in Ghaziabad city; (2) to determine the distribution and prevalence of hypertension in children aged 10–14 years; (3) to study the prevalence of hypertension in obese children; and (4) to study the prevalence of hypertension in children with positive family h/o hypertension.

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Materials And Methods

This population-based cross-sectional study was conducted in Santosh Medical College, Ghaziabad, Uttar Pradesh, India. Ethical approval was taken from the research committee of the institution before starting the study.

One thousand school children of both sexes, in the age group of 10–14 years, were selected for the study. The administrative staffs in the selected school were contacted and explained about the objectives of the study. A letter was sent to every parent explaining the procedure and seeking permission to evaluate the child. All the students were given a questionnaire that they were asked to return after getting it filled with reference to history of hypertension in the family.

Questionnaire:

Name/age/sex	--------
Name of the school/class	--------
Education of parents	Illiterate/primary/middle/high school/ intermediate/graduate/postgraduate
Occupation of parents	Unemployed/unskilled worker/skilled worker/clerical/professional
Monthly income	<1,000/1,000–5,000/5,000–10,000/ 10,000–19,999/>20,000
Socioeconomic status	Lower/upper lower/middle/upper middle/upper class
Family history of	Hypertension/obesity/diabetes/smoking/ alcoholism
Dietary habits	Vegetarian/nonvegetarian
Intake of fast food (noodles, burger, etc.)	Yes/no
Frequency of eating out	Once/twice a week
Lifestyle	Sedentary (watching television, use of computer, etc.)
	Active (playing outdoor games)

Height was measured using a standard stadiometer with the subject standing in erect posture. The readings were taken to the nearest 0.1 cm.

Weight was recorded in kilograms using a calibrated portable weighing machine (Avery) scale, with a capacity of 120 kg and a sensitivity of 0.05 kg. The students were weighed without wearing shoes and with minimal clothes.

The body mass index (BMI: Quetlet index) was calculated as the ratio of weight in kilograms divided by the square of the height in meters [weight (kg)/height (m^2)].[12] Children with BMI more than or equal to 85th percentile of reference data were considered overweight.[13] The reference data used to identify the cutoffs were taken from CDC 2000 data set for BMI.[14]

Blood Pressure

Standard methodology as recommended by the Fourth Report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents was used to measure the blood pressure. Students were allowed to rest for 10 min in a quiet room to reduce the anxiety. Resting blood pressure of all the subjects was measured by auscultatory method with the help of mercury sphygmomanometer (DIAMOND) with the use of appropriate cuff size adapted to arm circumference according to standardized procedural guidelines.[15] First Korotkoff sound indicated systolic blood pressure (SBP) and fifth Korotkoff sound indicated diastolic blood pressure (DBP). Three readings of blood pressure of each child were taken maintaining an interval of 2 min between the readings. The mean of the three readings was reported.

Statistical Analysis

Results were analyzed by ANOVA with SPSS software, version 17.0, using unpaired *t*-test.

Result

The findings of the present study is described in tables 1 to 8.

Table 1: Gender based distribution of anthropometric variables and blood pressure in the study population

Variables	Boys (n = 500) (mean ± SD)	Girls (n = 500) (mean ± SD)
Age (years)	12.00 ± 1.12	12.00 ± 1.4
Height (cm)	143.83 ± 6.75	144.76 ± 5.21
Weight (kg)	41.56 ± 5.49	42.82 ± 5.75
BMI (kg/m2)	19.72 ± 1.21	20.05 ± 1.32
SBP (mm Hg)	110.53 ± 3.39	111.2 ± 4.01
DBP (mm Hg)	75.2 ± 10.96	74.6 ± 3.2

Table 2: Age-wise distribution of blood pressure and hypertension in school children

Age (years)	Boys				Girls				Overall			
	N	Mean SBP (±SD)	Mean DBP (±SD)	HTN, n (%)	No.	Mean SBP (±SD)	Mean DBP (±SD)	HTN, n (%)	*N*	Mean SBP (±SD)	Mean DBP (±SD)	HTN, n (%)
10	121	106.23 ± 5.22	70.43 ± 4.61	9 (7.4)	118	105.79 ± 6.63	70.11 ± 3.43	7 (6.0)	239	106.03 ± 6.61	70.21 ± 3.43	16 (6.7)
11	83	109.31 ± 6.41	73.21 ± 4.47	9 (10.8)	89	108.87 ± 5.79	72.79 ± 4.41	9 (10.11)	172	108.98 ± 5.78	73.02 ± 3.57	18 (10.47)
12	69	112.43 ± 5.47	76.33 ± 3.46	8 (11.5)	73	113.07 ± 6.68	75.94 ± 3.57	10 (13.7)	142	112.87 ± 6.87	76.07 ± 4.41	18 (12.68)
13	126	115.26 ± 6.23	78.39 ± 4.63	11 (8.73)	123	115.43 ± 6.89	78.33 ± 4.03	9 (7.3)	249	115.34 ± 7.42	78.31 ± 3.89	20 (8.03)
14	101	120.33 ± 6.69	79.13 ± 4.41	12 (11.89)	97	115.89 ± 5.88	78.77 ± 4.42	10 (10.3)	198	116.02 ± 6.83	78.99 ± 4.57	32 (16.16)
Total	500	111.17 ± 6.53	75.19 ± 4.23	49 (9.8)	500	111.19 ± 6.13	74.56 ± 4.03	45 (9.0)	1,000	111.13 ± 6.28	74.87 ± 4.05	9.4%

Table 3: Height-wise distribution of blood pressure in school children

Height (m)	Boys			Girls			Overall		
	N	Mean SBP (±SD)	Mean DBP (±SD)	*N*	Mean SBP (±SD)	Mean DBP (±SD)	*N*	Mean SBP (±SD)	Mean DBP (±SD)
<1.35	99	108.43 ± 6.47	70.21 ± 3.37	88	107.23 ± 5.88	69.89 ± 3.41	187	107.89 ± 7.44	69.99 ± 3.23
1.35–1.45	306	114.51 ± 5.53	73.33 ± 3.21	344	114.43 ± 5.47	72.99 ± 4.04	650	114.49 ± 6.33	73.11 ± 3.47
1.45–1.55	68	118.23 ± 6.42	76.43 ± 4.23	53	117.47 ± 6.63	76.21 ± 4.11	121	117.89 ± 6.27	76.29 ± 4.21
>1.55	27	128.47 ± 5.41	85.23 ± 3.43	15	127.51 ± 6.47	85.69 ± 3.99	42	128.49 ± 5.41	85.94 ± 3.17
Total	500			500			1,000		

Table 4: Weight-wise distribution of blood pressure in school children

Weight (kg)	Boys			Girls			Overall		
	N	Mean SBP (±SD)	Mean DBP (±SD)	*N*	Mean SBP (±SD)	Mean DBP (±SD)	*N*	Mean SBP (±SD)	Mean DBP (±SD)
<30	209	105.43 ± 6.61	70.11 ± 3.43	25	105.79 ± 6.44	69.88 ± 3.41	460	105.23 ± 7.33	69.97 ± 3.13
30–40	191	114.27 ± 5.97	73.23 ± 3.47	169	114.13 ± 7.32	72.89 ± 4.47	360	114.16 ± 7.41	73.03 ± 3.47
40–50	89	118.13 ± 6.43	78.41 ± 4.02	74	117.89 ± 7.11	77.98 ± 4.02	163	117.98 ± 6.98	78.07 ± 4.03
>50	11	127.21 ± 6.41	84.21 ± 4.13	6	126.89 ± 6.47	83.94 ± 3.86	17	127.04 ± 6.84	84.11 ± 4.11
Total	500			500			1,000		

Table 5: Distribution of hypertension in children with positive family h/o HTN

Sex	Total no. of subjects	No. with positive family h/o HTN	No. of hypertensive children with positive family h/o HTN
Boys	500	39 (7.8%)	12
Girls	500	33 (6.6%)	13
Total	1,000	72 (7.2%)	25

Table 6: Statistical Analysis of distribution of hypertension in children with positive family h/o HTN

Family h/o HTN	*N*	No. of hypertensive students	Percentage	*P*	Significance
Positive	72	25	34.72	<0.005	Highly significant
Negative	928	62	6.9		
Total	1,000	87	8.7		

Table 7: Distribution of obesity and hypertension in study population

Sex	Total no. of subjects	No. with positive family h/o HTN	No. of hypertensive children with positive family h/o HTN
Boys	500	35 (7.0%)	19
Girls	500	24 (4.8%)	12
Total	1,000	59 (5.9%)	31

Table 8: Statisitcal analysis of distribution of obesity and hypertension in study population

	N	No. of students with HTN	Percentage	*P*	Significance
Obese	59	31	52.5	<0.005	Highly significant
Nonobese	941	63	6.7		
Total	1,000	94	9.4		

Discussion

Very few studies have been done to know the prevalence and risk factors associated with hypertension in school children. Sedentary lifestyle, junk food, obesity, stress, and family history of hypertension are the important risk factors for hypertension.

Age and Blood Pressure

Results of this study show that there was statistically significant increase in mean blood pressure with age. The mean systolic blood pressure (MSBP) of the boys was 106.23 ± 5.22 mm Hg and that of the girls was 105.79 ± 6.63 mm Hg at the age of 10 years; at the age of 14 years, the MSBP was 120.33 ± 6.69 mm Hg in boys and 115.89 ± 5.88 mm Hg in girls. Thus, MSBP showed an increase of 14.54 mm Hg in boys and 10.1 mm Hg and in girls with age, which was statistically significant ($p < 0.05$). There was no statistically significant difference between the MSBP levels in the boys and girls ($p > 0.05$) at the age of 10 years; however, there was a statistically highly significant difference between the MSBP levels in the boys and girls ($p < 0.05$) at the age of 14 years.

Similarly, mean diastolic blood pressure (MDBP) increased from 70.43 ± 4.61 mm Hg at the age of 10 years in boys to 79.13 ± 4.41 mm Hg in boys at the age of 14 years; in girls, the MDBP was 70.11 ± 3.43 mm Hg at the age of 10 years in girls and 78.77 ± 4.42 mm Hg in girls at the age of 14 years. Increase in MDBP was 8.7 mm Hg in boys and 8.66 mm Hg in girls from the age of 10 to 14 years, which was statistically significant ($p < 0.05$). There was no statistically significant difference between the MDBP levels in the boys and girls ($p > 0.05$) at the age of 10 and 14 years.

Thus, an increase in both MSBP and MDBP was seen with the age, more in boys than in girls. Our results are similar to that of the studies carried out by Londe, Laroia et al., and Sharma et al.[16–24]

Height and Blood Pressure

MSBP was positively correlated with height in both the sexes. MSBP increased from 108.43 ± 6.47 mm Hg with height < 1.35 m to 128.47 ± 5.41 mm Hg with height > 1.55 m in boys ($p < 0.05$). Similarly, in girls, it increased to 127.51 +/- 6.47 mm Hg with height > 1.55 m from 107.23 ± 5.88 mm Hg with height <1.35 m, which was statistically significant ($p < 0.05$). However, there was no statistically significant difference between the MSBP levels in the boys and girls ($p > 0.05$) at different height groups.

MDBP increased from 70.21 ± 3.37 mm Hg with height < 1.35 m to 85.23 ± 3.43 mm Hg with height > 1.55 m in boys ($p < 0.05$). Similarly, in girls, it increased to 85.69 ± 6.47 mm Hg with height > 1.55 m from 69.89 ± 3.41 mm Hg with height < 1.35 m, which was statistically significant ($p < 0.05$). However, there was no statistically significant difference between the MSBP levels in the boys and girls ($p > 0.05$) at different height groups.

Similar findings were shown by Sharma et al.[18] and Gerber and Stern.[25] Contrary to our results, Agarwal et al.[26] showed that there was no significant correlation of height with MSBP and MDBP

Weight and Blood Pressure

MSBP was positively correlated with weight in both the sexes. MSBP increased from 105.43 ± 6.61 mm Hg with weight <30 kg to 127.21 ± 6.41 mm Hg with weight > 50 kg in boys ($p < 0.0001$). Similarly, in girls, it increased to 126.89 ± 6.47 mm Hg with weight > 50 kg from 105.79 ± 6.44 mm Hg with weight < 30 kg, which was statistically significant ($p < 0.0001$). However, there was no statistically significant difference between the MSBP levels in the boys and girls ($p > 0.0001$) in different weight groups.

MDBP increased from 70.11 ± 3.37 mm Hg with weight < 30 kg to 84.21 ± 4.13 mm Hg with weight > 50 kg in boys ($p < 0.05$). Similarly, in girls, it increased to 83.94 ± 3.86 mm Hg with weight > 50 kg from 69.88 ± 3.41 mm Hg with weight < 1.35 kg, which was statistically significant ($p < 0.05$). However, there was no statistically significant difference between the MSBP levels in the boys and girls ($p > 0.05$) in different weight groups. Various authors such as Munoz et al.[27] and Sorof et al.[28] have shown similar results.

An increase in weight adds volume to an increase in peripheral resistance, accentuating left ventricular work that adversely affects cardiac function.[29]

Prevalence of Hypertension

On the basis of blood pressure reading, 5th to 95th percentiles were computed for each age and sex group, for both SBP and DBP). Hypertension was defined as average SBP and/or DBP of >95th percentile for age and sex.[10]

Ninety-four (9.4%) of 1,000 students were found to be hypertensive. Of them, 49 (9.8%) were boys and 45 (9.0%) were girls. Chadha et al.[20] showed similar results.

Family History and Hypertension

Seventy-two children have shown a positive family h/o hypertension. Of them, 39 (7.8%) were boys and 33 (6.6%) were girls. Thus, the prevalence of hypertension was much higher (34.72%) among children with a family h/o hypertension in contrast to that of children with no family h/o hypertension (6.9%), and it was statistically significant ($p < 0.05$).

Obesity and Hypertension

Our study showed that obese children (BMI > 95th percentile) displayed significantly higher SBP and DBP when compared with lean children (BMI < 85th percentile) ($p < 0.05$).

Conclusion

Children are the future of our nation. Children with bad habits (i.e., increased consumption of junk food and sedentary lifestyle) make them vulnerable to develop obesity and hypertension with its complications. As there is also increase in SBP and DBP with increase in age, height, and weight in both the sexes, early screening of blood pressure is necessary, especially, in obese children and those with positive family h/o hypertension. This will help in starting lifestyle modification at an early age to prevent any future complications.

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