BIOPHYSICAL PROFILE OF BLOOD PRESSURE IN URBAN HEALTHY SCHOOL CHILDREN- A CROSS SECTIONAL STUDY

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ABSTRACT

BACKGROUND

Hypertension is a chronic non-communicable disease with high morbidity and mortality. Prevailing number of hypertensives diagnosed in society indicate just the tip of iceberg as it was documented that almost 75% hypertension cases and 90% of pre-hypertension cases are undiagnosed. Evidence suggests that pre-hypertension in childhood is precursor of hypertension in adulthood and children maintain their position in the blood pressure distribution over time.[1] Evidence suggests that anthropometric measurements such as weight, height and BMI can be taken as surrogate marker of prevalence hypertension. Hence, measurement of these parameters can help in early detection children at risk of hypertension. Primary hypertension, once considered a rare occurrence in pediatric patients, is seen more often particularly in obese patients. Other factors responsible for increased prevalence of hypertension in children include lifestyle changes such as decreased physical activity, increased intake of high calories, high sodium and low potassium foods, use of caffeinated and alcohol beverages, smoking, mental stress and sleep deprivation.[2]

MATERIALS AND METHODS

It is a cross sectional study. A total of 980 children were taken as sample from various urban schools of Kurnool city. Study was conducted during period of October 2016 to December 2017. The study was conducted after taking consent from the school authorities and parents of the concerned school children. The objectives and importance of the study were explained to the school staff a day prior to the commencement of the study to get their cooperation. The questionnaire comprised of information regarding the history of child, history of any past illness, family history of hypertension, dietary factors, socioeconomic status which may be potentially related to the development of hypertension. Following are the measurements made on the children: 1) Weight**:** Taken in kilograms using a pre-calibrated portable weighing scale. 2) Height**:** With the help of wooden scale the top most point of the vertex is identified, and reading was recorded on the height chart pasted on the wall. 3) Body mass index**:** Quetelets index was calculated for all children. 4) Socioeconomic status: Assessed by using Modified Kuppuswamy's socio economic scale (2009). 5) Blood pressure: Blood pressures were made in the right arm in sitting position by using a standard mercury sphygmomanometer with different sized cuff as per recommendations of the American Heart Association.

RESULTS

There is linear increase in SBP and DBP in both boys and girls with height and this increase was found to be statistically significant with p<0. 001. There is no much differences between systolic and diastolic blood pressures between sexes in most os the age groups except for difference between the SBP and DBP of boy vs girls of 9 years of age group. There is linear increase in both mean SBP and DBP in both boys and girls with weight and this difference is statistically significant with p<0.001.

CONCLUSION

According to the study the means of SBP and DBP in overweight and obese group is significantly higher than the normal weight group. And is statistically significant p<0. 01. Therefore, it may be used as a predictor of high blood pressure. There is a high mean systolic and diastolic blood pressure in the children with high socioeconomic status as compared to that of low socioeconomic status. Our study shows children with family history of hypertension has higher systolic and diastolic blood pressure as compared to those without family history of blood pressure.

KEYWORDS

Hypertension, Height, Weight, BMI, Blood Pressure, Systolic Blood Pressure, Diastolic Blood pressure.

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BACKGROUND

Blood pressure is the lateral pressure exerted on the vessel wall while flowing through it. Cardiac output, Systemic vascular resistance, compliance of vascular system, Competence of aortic valve, isolation of arterial from venous system by arterioles are the chief determinants of arterial blood pressure. Baroreceptor feedback mechanism, chemoreceptor mechanism and central nervous system ischemic mechanism are the rapidly acting pressure control mechanisms. Renin-angiotensin vasoconstrictor mechanism, Stress-relaxation of the vasculature, Shift of fluid through the tissue capillary walls in and out of the circulation to readjust the blood volume as needed. The definition of hypertension in children and adolescents is based on the

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normative distribution of BP in healthy children. Normal Blood pressure is defined as SBP and DBP that are <90th percentile for gender, age, and height. Hypertension is defined as average SBP or DBP that is >=95th percentile for gender, age and height on at least 3 separate occasions. Prehypertension is average SBP or DBP levels that are >=90th percentile but <95th percentile has been designated as high normal and were considered to be an indication of heightened risk for developing hypertension. Hypertension is classified into Essential or primary hypertension and secondary hypertension. Common causes are Renal such as congenital anomalies like polycystic kidney, obstructive uropathy, Hemolytic-uremic syndrome. Cardiovascular causes such as coarctation of aorta, PDA, Complete heart block etc., Endocrine causes are Hyperthyroidism, Excessive catecholamine levels, Pheochromocytoma, Neuroblastoma, Adrenal dysfunction etc., Drugs like Sympathomimetic drugs, Amphetamine levels, Steroids, Oral contraceptives etc. Neurogenic like Increased intracranial pressure, Poliomyelitis, Guillain-Barre syndrome etc., There are various methods used to measure Blood pressure. Direct method: In this method, the artery is exposed and cannula of which one tapering end is inserted directly into the lumen of the vessel and the other end is connected to U shaped mercury manometer that shows actual blood pressure in mm of Hg. But the main disadvantage is, it is an invasive procedure. Various indirect methods by using sphygmomanometer-Palpatory method, Auscultatory method, Oscillatory method. Other indirect methods such as Flush method, Oscillometric method, Doppler technique. There are many variations in recording blood pressure. Known factors are recent physical activity, Emotional state, Position of subject and arm, Room temperature and season. Unknown factors such as relating to instrument- Inaccurate sphygmomanometer, Cuff width and length. Observer related errors such as mental concentration and reaction time, Hearing activity, Confusion of auditory and visual cues, interpretation of sounds, rates of inflation and reading of moving column.

Aims and Objectives-

1) To determine the correlation of blood pressure with age, gender, anthropometric measurements.

Inclusion Criteria-

Apparently healthy school children aged 5 to 15 years were included from the pre-selected schools.

Exclusion Criteria-

Children suffering from various systemic diseases like Anemia, cardiac or renal or any other systemic disorder are excluded from the study.

MATERIALS AND METHODS

It is a cross sectional study. A total of 980 children were taken as sample from various urban schools of Kurnool city. Study was conducted during period of October 2016 to December 2017. The study was conducted after taking consent from the school authorities and parents of the concerned school children. The objectives and importance of the study were explained to the school staff a day prior to the commencement of the study to get their cooperation. The questionnaire comprised of information regarding the history of child, history of any past illness, family history of hypertension, dietary factors, socioeconomic status which may be potentially related to the development of hypertension. Following are the measurements made on the children: 1) Weight: Taken in kilograms using a pre-calibrated portable weighing scale. 2) Height: With the help of wooden scale the top most point of the vertex is identified, and reading was recorded on the height chart pasted on the wall. 3) Body mass index: Quetelets index was calculated for all children. 4) Socioeconomic status: Assessed by using Modified Kuppuswamy's socio economic scale (2009). 5) Blood pressure: Blood pressures were made in the right arm in sitting position by using a standard mercury sphygmomanometer with different sized cuff as per recommendations of the American heart association.

RESULTS

Age	Sex (Male)	Female	Total
5	37	22	59
6	31	33	64
7	65	48	113
8	30	30	60
9	26	14	40
10	27	28	55
11	77	74	151
12	63	58	121
13	52	51	103
14	50	55	105
15	91	47	138
TOTAL	**549**	**460**	**1009`**

Table 1. Showing Total no. of Children in the Study were 1009 of which 54% are Boys and 46% are Girls. Sex Distribution in each Age Group as follows

Age in Years	BOYS			Girls		
	No. of Boys	SBP	DBP	No. of Girls	SBP	DBP
		Mean ± SD	Mean ± SD		Mean ± SD	Mean ± SD
5	37	88. 3 ± 7. 2	57. 6 ± 8. 1	22	85. 0 ± 6. 6	56. 4 ± 7. 1
6	31	91. 2 ± 7. 4	59. 3 ± 9. 7	33	90. 5 ± 9. 1	60. 5 ± 7. 5
7	65	93. 3 ± 7. 9	64. 6 ± 6. 2	48	93. 7 ± 7. 8	64. 8 ± 6. 5
8	30	94. 5 ± 6. 4	63. 3 ± 4. 3	30	96. 1 ± 8. 4	65. 2 ± 5. 1
9	26	98. 5 ± 7. 4	64. 3 ± 7. 1	14	92. 6 ± 6. 0	60. 6 ± 5. 6
10	27	94. 1 ± 5. 5	63. 5 ± 5. 9	28	94. 8 ± 5. 2	62. 5 ± 5. 3
11	77	98. 7 ± 11. 2	63. 8 ± 8. 2	74	97. 8 ± 8. 0	62. 9 ± 6. 0
12	63	97. 7 ± 7. 5	62. 8 ± 6. 5	58	101. 3 ± 12. 1	64. 8 ± 7. 2
13	52	100. 3 ± 7. 2	62. 9 ± 6. 2	51	101. 8 ± 9. 6	65. 1 ± 8. 3
14	50	104. 9 ± 9. 3	65. 8 ± 6. 1	55	106. 5 ± 12. 0	67. 7 ± 8. 3
15	91	110. 0 ± 9. 9	69. 9 ± 7. 2	47	104. 3 ± 11. 1	66. 3 ± 9. 3

Table 2. Showing Comparison of mean of Systolic and Diastolic Blood Pressure in different Age Groups

There is no much differences between systolic and diastolic blood pressures between sexes in most of the age groups except for difference between the SBP and DBP of boy vs girls of 9 years of age group.

Height in CMS	Boys			Girls		
	Number	SBP	DBP	Number	SBP	DBP
100-109	21	89. 7 ± 10. 9	57. 1 ± 11. 3	27	86. 9 ± 7. 5	58. 0 ± 8. 8
110-119	73	91. 1 ± 6. 5	61. 4 ± 6. 0	66	91. 7 ± 8. 6	62. 6 ± 6. 1
120-129	86	93. 2 ± 7. 1	62. 6 ± 7. 5	53	93. 5 ± 7. 2	63. 2 ± 6. 5
130-139	85	95. 6 ± 6. 9	62. 0 ± 6. 7	58	95. 8 ± 7. 04	63. 2 ± 6. 1
140-149	98	98. 9 ± 8. 3	63. 7 ± 6. 9	97	98. 6 ± 7. 4	63. 2 ± 6. 6
150-159	83	104. 3 ± 9. 2	66. 3 ± 6. 3	128	104. 6 ± 11. 6	66. 5 ± 8. 5
160-169	74	108. 8 ± 9. 7	68. 7 ± 7. 1	29	108. 4 ± 11. 8	68. 2 ± 7. 4
>170	29	112. 6 ± 9. 6	71. 5 ± 7. 0	2	125 ± 7. 1	79. 0 ± 1. 4

Table 2. Showing Distribution of Blood Pressure According to Height

There is linear increase in SBP and DBP in both boys and girls with height and this increase was found to be statistically significant with p<0. 001.

Weight in KGs	Boys			Girls		
	Number	SBP	DBP	Number	SBP	DBP
10-19	68	89. 9 ± 7. 2	60. 7 ± 6. 9	72	88. 9 ± 8. 1	60. 4 ± 7. 2
20-29	172	93. 6 ± 6. 8	61. 7 ± 7. 3	98	94. 0 ± 7. 4	62. 8 ± 6. 5
30-39	140	97. 9 ± 7. 6	63. 2 ± 6. 8	131	97. 1 ± 7. 1	62. 9 ± 6. 1
40-49	101	106. 6 ± 7. 3	67. 5 ± 6. 2	110	105. 1 ± 11	66. 0 ± 8. 1
50-59	57	112. 2 ± 10. 9	70. 6 ± 7. 4	42	108. 1 ± 10. 9	70. 2 ± 8. 1
>60	11	115. 5 ± 9. 1	73. 8 ± 4. 5	7	117. 7 ± 10. 7	74. 6 ± 4. 0

Table 3. Showing Distribution of Blood Pressure According to Weight

There is linear increase in both mean SBP and DBP in both boys and girls with weight and this difference is statistically significant with p<0. 001.

DISCUSSION

Age limit of children in this study was 5-15 years. The findings of the present study revealed that blood pressure increased linearly with age in both sexes.[3] In our present study, spurt in SBP and DBP was found in both girls and boys between 13-15 years. Similar observations have been made in the studies done in the past. Greater increase in systolic and diastolic pressure in boys at 9 years of age and girls at 8 years of age cannot be explained. In our present study spurt in SBP and DBP was found in both girls and boys between 13-15 years which can be attributed to hormonal changes that occurs in adolescent period. In our present study, it was observed that as the height increases mean SBP and mean DBP also increases proportionately and the increase is statistically significant P<0. 001. Except V. K. Agarwal et al,[4] all other studies showed positive correlation of height with blood pressure. In our present study it was observed that there was a spurt in blood pressure for children reaching height beyond 150 cms in both boys and girls. Steep increase in blood pressure among girls and boys beyond 170 cms of height can be attributed to low number in their group. In the present study, we found that systolic and diastolic blood pressure increased linearly with weight, and this increase was statistically significant (P<0. 001). This is the finding consistent with that seen in other studies. BMI is used as an indicator of overall adiposity. In order to exclude age as a confounding factor BMI was plotted on percentile charts and he children were categorised in to four groups to correlate the percentiles with blood pressure. BMI between 85th - 95th percentile was taken as overweight and

more than 95th percentile is taken as obesity. Both SBP and DBP were significantly higher in overweight and obese group when compared to children with normal BMI. This indicates that BMI percentile can be used as predictor of high blood pressure. Similar observations were noted in studies done by Wang et al,[5] Ribeiro et al[6] He Q et al,[7] Sacheil et al.[8] Among the overweight and obese groups both systolic and diastolic blood were higher in boys who were obese compared to overweight but similar correlation could not be seen in girls and this may be attributed to low number in obese group (>95th percentile) of girls. In our study it was observed that the mean systolic and diastolic blood pressure increased linearly with increase in socioeconomic status. It indicates that children belonging to higher socioeconomic status have higher blood pressure as a result of having higher mean weight which was noted in our study. Evidence exists that hypertension tends to aggregate in families and the cause can be genetic, environmental or both. In our study, 6.24% of children had positive family of hypertension. The result of the study shows that compared to children of normotensive parents, subjects coming from families with hypertension tended to have higher levels of blood pressure in both sexes and is statistically significant (P<0. 001), which had been observed by Mungar et al,[9] Chadha et al,[10] Londe et al.[11] In this study cut off value for prehypertension was taken as =/>90^{th} – 94^{th} centile and that for hypertension was taken as greater than and equal to 95th percentile as per recommendations of fourth task force report on high blood pressure in children. Most of other studies have considered above 95th percentile as their criteria. However, Gupta et al and Anand NK, Tandon L had considered means ± 2SD for estimation of hypertension and prevalence of hypertension was found to be 1.39% and 0.46% respectively. In the present study we found the prevalence of high blood pressure is 13.1% of which 6.44% were prehypertensive and 6.64% were hypertensive. Among the pre-hypertensives prevalence among boys was lesser than that of girls, and among the hypertensives the prevalence among boys was almost equal to the prevalence among girls. The prevalence of hypertension in our study (6.64%) was as less as compared to significantly higher prevalence in a study done by Chadha SL et al from Delhi who noted a prevalence of 11.9% in their population of school children in age range of 5-14 years. These differences could be possibly be attributed to varying climatic, genetic, socioeconomic and dietary factors. Prevalence of hypertension in children in various Indian studies ranged from 0.4% to 11.9%. This diversity in prevalence of hypertension is due to varying age groups taken for the study and different criteria adopted for defining hypertension and basic difference among various racial subgroups, geographic, dietary and cultural factors.

CONCLUSION

According to the study, the means of SBP and DBP in overweight and obese group is significantly higher than the normal weight group. And is statistically significant p<0.01. Therefore, it may be used as a predictor of high blood pressure. There is a high mean systolic and diastolic blood pressure in the children with high socioeconomic status as compared to that of low socioeconomic status. Our study shows children with family history of hypertension has higher systolic and diastolic blood pressure as compared to those without family history of blood pressure.

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