



Epidemiological study of blood pressure in school children (5-14 years) in Kadapa

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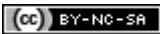
ABSTRACT

Background measurement of blood pressure is not routinely employed in our country in various health checkup programs and studies pertaining to BP of school going children are inadequate and do not have any percentile chart relating BP to height, weight, so as to determine the age related percentile. Hence we want to establish norms for BP in school children. The present study was conducted on 1215 children in the age group of 5-14 year. Various schools of Kadapa city were selected by systemic sample technique. Every child in the class was given a questionnaire designed to obtain information regarding family history of hypertension, Myocardial infarction in the parents. The mean value of systolic and diastolic blood pressure increased with age in both sexes. The prevalence of hypertension was 2.6% in boys and 2.5% in girls. Anthropometric variables like height and weight showed positive correlation with systolic as well as diastolic blood pressure. In school health programmes apart from routine standard medical examination the recording of blood pressure should be compulsory procedure.

Key Words:- Blood pressure, School children, weight, height, socio-economic status.

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INTRODUCTION

Hypertension is a common disease associated with high morbidity and mortality. It is suggested that hypertension has its origin in childhood but gone undetected unless specifically looked for during this period. Children in the upper percentile of B.P. level are more likely to become adult hypertensive. If the trend towards adult hypertension can be recognized in childhood, it may be possible to alter life style and prevent systemic hypertension as well as related complications². Blood pressure measurement in childhood is an important clinical examination. It should be recorded at least once a year. Blood pressure is a continuously distributed variable like height and weight and it is hard to classify children as hypertensive/ normotensive based on any fixed reading or values.

Aim and objective of the study:

1. To establish the normal range of BP in school going children (Age 05-14 years).
2. Relation of BP with variables like sex, weight, height, socio economic status and family history.
3. To find out prevalence of hypertension in school going population.

MATERIALS AND METHODS

The present study was conducted on 1215 children in the age group of 5-14 years from various schools of Kadapa city selected by systemic sampling technique. Out of 120 schools 10 schools were selected by systemic sampling technique. The objectives and importance of the study were explained to the school staff a day prior to the commencement of the survey to get their cooperation. In order to allay the anxiety and fear of children, the nature of the procedure was explained in depth. Every child in the class was given a questionnaire which he was advised to bring the next day after getting it filled in by his/her parent. This questionnaire was designed to

obtain the information regarding family history of hypertension, myocardial infarction in the parents. All the measurements (weight, height, BP) were made by us and the same equipment was used to obtain the accurate measurement and to increase the sensitivity of the results. The weight was taken in kilogram with minimum clothing using beam type of weighing machine, height was measured in centimeters recorded by using fiber glass measuring tape. Socio-economic status assessed by modified BG Prasad classification. Blood pressure was recorded in supine position by single mercury sphygmomanometer with appropriate size cuff.

Inclusion Criteria: 5-14 YEARS Age School Children.

Exclusion Criteria: Children with heart diseases, including congenital malformations were excluded from the study.

Study Period: 31 January, 2016 to 30 January 2017.

RESULTS AND OBSERVATIONS

Blood pressure of 1250 students was recorded and about 35 students could not be followed up during 2nd visit, as the students were absent. So blood pressure of 1215 students were recorded aged between 5-14 years. Among 1215 students 733 were males and 482 were females.

Systolic blood pressure according to age and sex:

The mean systolic blood pressure in males at 5 years was 95.9mm of Hg and at 14 years was 113.9 mm of Hg. In this study it was observed that there was increase in mean systolic blood pressure with increase in age. The mean systolic blood pressure in females at 12 years was 107.9 mm of Hg and at 14 years was 112.7 mm of Hg. From the above readings it was observed that systolic blood pressure did not vary much between 5-12 years of age and there was a gradual increase in mean systolic blood pressure above 12 years of age which can be attributed to hormonal changes that occur in the adolescent period.

TABLE – I: SBP – MALES

Age (Yrs)	No.	Mean ± SD	PERCENTILES							Range
			5 th	10 th	25 th	50 th	75 th	90 th	95 th	Min-Max
5	83	95.9±4.9	90	90	91	96	99	102	103	90-116
6	76	97.8±6.8	90	90	94	99	100	101	108	68-120
7	85	101.9±7.7	93	93	96	101	108	112	113	90-125
8	80	102.9±9.0	92	93	95	103	108	118	118	95-123
9	68	103.4±8.0	96	97	97	102	109	112	120	92-127
10	71	104.2±8.5	95	95	98	103	110	113	120	94-130
11	65	105.5±8.5	97	97	100	104	110	117	121	97-132
12	62	108.1±7.2	97	97	102	110	114	116	117	94-127
13	90	110.6±6.6	102	103	107	110	115	118	123	98-128
14	53	113.9±4.4	106	106	111	116	116	121	121	106-121

TABLE – II: SBP – FEMALES

Age (Yrs)	No.	Mean \pm SD	PERCENTILES							Range
			5 th	10 th	25 th	50 th	75 th	90 th	95 th	Min-Max
5	48	95.0 \pm 4.5	90	90	90	95	98	101	102	90-105
6	56	98.4 \pm 7.7	90	90	94	98	100	105	110	92-120
7	38	99.7 \pm 7.5	91	91	96	100	103	107	111	90-126
8	53	102.0 \pm 7.2	92	94	97	100	109	111	114	90-118
9	60	103.9 \pm 7.0	94	95	99	103	109	114	120	90-125
10	39	105.3 \pm 8.0	96	97	97	106	111	113	121	96-127
11	51	107.8 \pm 6.8	99	99	100	109	114	118	119	95-119
12	55	107.9 \pm 8.5	98	98	102	108	113	117	124	97-133
13	39	110.0 \pm 5.1	103	103	103	113	113	117	117	95-128
14	43	112.7 \pm 6.7	105	105	109	111	115	124	127	100-128

TABLE – III: DBP – MALES

Age (Yrs)	No.	Mean \pm SD	PERCENTILES							Range
			5 th	10 th	25 th	50 th	75 th	90 th	95 th	Min-Max
5	83	61.7 \pm 5.4	55	57	59	61	64	67	68	50-90
6	76	62.2 \pm 4.2	58	59	60	61	64	65	69	50-86
7	85	62.9 \pm 7.0	60	60	60	60	63	70	80	50-90
8	80	65.0 \pm 7.0	60	60	60	64	65	73	80	50-90
9	68	65.7 \pm 5.9	61	61	62	65	67	72	74	60-90
10	71	67.1 \pm 6.8	60	63	64	65	68	77	79	55-94
11	65	68.1 \pm 5.4	63	63	65	66	71	75	78	61-90
12	62	68.9 \pm 5.3	62	62	66	71	72	72	72	59-92
13	90	70.0 \pm 4.8	64	64	67	69	74	74	77	63-90
14	53	72.7 \pm 4.1	66	66	71	71	76	76	76	66-88

The mean diastolic blood pressure in males at 5 years was found to be 61.7 mm of Hg and at 14 years was 72.7 mm of Hg. It was observed that there was gradual increase in diastolic blood pressure with increasing age. The mean diastolic blood pressure in females at 5 years was 61.9 mm of Hg and at 14 years was 72 mm of Hg. It was observed that as age progresses there was gradual increase in diastolic blood pressure. There was no significant difference between diastolic blood pressure of males and females.

Based on height of individual student 8 groups were made, independent of age and weight with a difference of 10cm between each group. The mean systolic blood pressure for both males and female according to height is shown in table. In males it is observed that there was no much increase in systolic blood pressure between 90-150 cm of height range. There was sharp rise in systolic blood pressure after 150 cm. So this confirms that there is much increase in systolic blood pressure after 12 years of age. In females it was observed that there was gradual increase in systolic blood pressure after 110 cm of height. It was observed from above reading that there was rapid increase in diastolic

blood pressure after 110 cm of height in both males and females.

The weight of 1215 students was divided into 9 groups independent of age and height of the children with a difference of 5 kg between each group. The mean systolic blood pressure and diastolic blood pressure was calculated and the same has been displayed in tables. It was observed that as the weight increases there was increase in both systolic and diastolic blood pressure both in males and females. It was observed that both mean systolic and diastolic blood pressure have shown rapid increase from 20 - 45 kg of weight. This weight approximately corresponds with the age group of 9-13 years and this reconfirms the increase of blood pressure observed in the age groups of 9-13 years.

In order to assess the relationship of blood pressure levels with age, height and weight Pearson's correlation coefficient was determined. Highly significant positive correlation was found between the blood pressure levels with age, height and weight. According to this study there is high systolic and diastolic blood pressure values in the children of high socioeconomic status group.

TABLE – IV: DBP – FEMALES

Age (Yrs)	No.	Mean \pm SD	PERCENTILES							Range
			5 th	10 th	25 th	50 th	75 th	90 th	95 th	Min-Max
5	48	61.7 \pm 5.4	56	58	59	62	65	68	68	50-69
6	56	62.2 \pm 4.2	57	59	60	60	64	66	70	55-90
7	38	63.2 \pm 8.6	60	60	60	61	63	64	70	60-95
8	53	63.0 \pm 4.4	60	60	60	60	65	68	71	60-80
9	60	65.3 \pm 6.8	60	60	60	64	65	75	74	58-95
10	39	66.2 \pm 4.5	59	60	64	68	69	70	70	58-80
11	51	68.9 \pm 2.9	63	65	69	69	70	70	72	62-76
12	55	69.0 \pm 6.1	62	62	62	72	72	72	74	60-90
13	39	71.4 \pm 3.3	65	68	70	70	75	75	75	65-95
14	43	72.0 \pm 4.1	68	68	70	70	74	79	80	65-83

TABLE – V: DISTRIBUTION OF BLOOD PRESSURE ACCORDING TO HEIGHT

Ht (cm)	No. of Cases	MALES				FEMALES				
		SBP		DBP		No. of cases	SBP		DBP	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
91-100	24	95.7	4.8	63.4	6.9	21	96	6.4	62.2	3.8
101-110	70	96.9	6.3	61.6	5.6	48	95.7	5.5	60.9	4.0
111-120	197	100.4	7.6	63.6	4.4	119	100.7	8.3	64.0	7.4
121-130	159	103.4	9.1	65.9	7.2	112	104.9	7.6	65.4	5.0
131-140	146	107.4	8.2	68.6	6.1	111	108.2	7.2	68.3	4.7
141-150	89	109.8	7.1	70.4	4.6	54	109.3	7.6	71.1	4.8
151-160	39	114.6	5.9	72.5	5.9	15	109.3	8.0	71.5	3.4
160-170	9	114.0	5.3	71.8	3.5	2	117.0	4.2	73.5	9.2

TABLE – VI: DISTRIBUTION OF BLOOD PRESSURE ACCORDING TO WEIGHT

Ht (cm)	No. of Cases	MALES				FEMALES				
		SBP		DBP		No. of cases	SBP		DBP	
		Mean	SD	Mean	SD		Mean	SD	Mean	SD
10-15	81	96.5	7.1	62.9	6.0	67	97.5	8.2	62.7	6.4
16-20	257	100.9	7.4	63.2	5.1	162	100.2	7.1	63.1	5.7
21-25	159	104.0	9.1	66.0	6.6	55	106.5	7.9	66.3	5.9
26-30	120	108.0	7.8	69.5	5.8	136	107.4	7.4	68.2	4.6
31-35	48	109.9	7.8	75.9	6.0	26	111.5	8.4	72.2	4.2
36-40	40	112.4	6.3	71.4	4.7	24	108.9	6.5	71.2	3.1
41-45	10	116.0	8.5	72.9	9.9	10	113.4	6.1	73.0	5.1
46-50	13	114.5	3.4	71.9	4.0	2	114.0	8.5	76.5	4.9
51-55	5	115.2	4.8	73.8	2.7	No				

TABLE – VII: CORRELATION BETWEEN ANTHROPOMETRIC VARIABLES AND BLOOD PRESSURE

Variables	SBP	DBP
Age	0.56	0.52
Height	0.53	0.49
Weight	0.52	0.50

Pearson's correlation coefficient (r-value); P<0.001 Highly significant + ve correlation

TABLE – VIII: Distribution of blood pressure according to socioeconomic status

SES	NO.	SBP Mean \pm SD	DBP Mean \pm SD
I	261	107.1 \pm 8.6	68.2 \pm 6.2
II	514	103.1 \pm 8.9	65.7 \pm 6.0
III	337	102.6 \pm 8.7	64.8 \pm 6.2
IV	103	105.5 \pm 9.0	66.8 \pm 7.3

F = 16.6

F = 15.1

P<0.001

P <0.001

TABLE – IX: Distribution of blood pressure according to family history

FH	NO.	SBP Mean \pm SD	DBP Mean \pm SD
+	319	105.6 \pm 9.0	67.5 \pm 7.7
-	896	103.4 \pm 8.9	65.6 \pm 5.9

Z=3.70

Z=4.01

P<0.001 HS

P<0.001 HS

Among 1215 children 319 children had family history of hypertension. The mean systolic blood pressure of these children was 105.6 mm of Hg and the mean diastolic blood pressure was 67.5 mm of Hg. This value was higher than the children who do not have the family history of hypertension. Difference was found to be statistically significant. We have kept values above 95th centile as hypertensive. Our results revealed 2.6% incidence

of hypertension. Out of 31 children found to be hypertensive 19 were males and 12 were females. The prevalence of hypertension (both systolic and diastolic) was 2.6 percent in boys and 2.5 percent in girls. 13 out of 19 male children have family history of hypertension and 6 out of 12 female children have family history of hypertension.

TABLE – X

Age	Cut of point SBP/DBP	With Hypertension	Cut off point SBP/DBP	With Hypertension
5	103/68	1	162/68	No
6	108/69	2	110/70	3
7	113/69	5	111/70	2
8	118/80	2	114/71	3
9	120/74	2	120/74	1
10	120/79	3	121/70	1
11	121/78	1	119/72	No
12	117/72	1	124/74	2
13	123/77	2	117/75	No
14	121/76	No	127/80	No

TABLE – XI: REGRESSION ANALYSIS AND PREDICTION OF BP FOR AGE/HT/WT

Relationship between	Sex	Correlation coefficient (2)	Regression coefficient (b)	Regression equation (Prediction of BP)
Age and SBP	M	0.55	1.75	SBP=87.9+1.75 (Age)
	F	0.57	1.76	SBP=87.3+1.78 (Age)
AGE & DBP	M	0.50	1.19	DBP=55.1+1.19 (Age)
	F	0.54	1.20	DBP=54.8+1.20 (Age)
Ht & SBP	M	0.54	0.34	SBP=61.5+0.34 (Ht)
	F	0.54	1.20	SBP=63.1+0.33 (Ht)
Ht & DBP	M	0.58	0.22	DBP=37.9+0.22 (Ht)
	F	0.49	0.22	DBP=38.4+0.22 (Ht)
Wt & SBP	M	0.53	0.50	SBP=90.0+0.59 (Wt)
	F	0.52	0.62	SBP=89.5+0.62 (Wt)
Wt & DBP	M	0.47	0.40	DBP=56.0+0.40 (Wt)
	F	0.51	0.44	DBP=55.8+0.44 (Age)

* Pearson's corr-coeff

DISCUSSION

In this study an attempt is made to find out normal standards of blood pressure values in children at different ages, to establish the cut off points for hypertension and to find out prevalence of hypertension in pediatric population. Further by our study an attempt is made to relate BP values with height, weight, family history, and socio economic factors.

Prevalence of hypertension in children reported in various Indian studies ranged from 0.4% to 11.9%. In this study cut off value for hypertension was placed above 95th percentile. Most of other studies have considered similar criteria^{2,4,5}. We found the prevalence of hypertension among children between 5-14 years to be 2.6%. There was no significant difference between the prevalence of hypertension in the two sexes. The prevalence of BP increases in our present study was 2.6% as compared to significantly higher prevalence in a study done by Chandha SL et al. from Delhi who noted a prevalence of 11.9% in their population of school children in the age range of 5-14 years. In our study 26.2% of children had positive family history of hypertension.

Age and its relation to blood pressure: The findings of the present study revealed that rise in BP was directly proportional to increase in age in both sexes.

Height and its relation to blood pressure was studied and it was observed that there is sharp rise in systolic blood pressure above 150 cm of height in males and in females a sharp rise in SBP after 110 cm of height which can be attributed to hormonal changes that occur in the adolescent period¹. There was also slow increase in diastolic blood pressure of both males and females in relation to height. Except V.K. Agarwal³ all other

studies^{1,2,4} showed systolic, diastolic blood pressure positive correlation with height.

Weight and its relation to blood pressure: In the present study we found that both systolic and diastolic blood pressure increased with weight. In order to assess the relationship of blood pressure levels with weight, Pearson's correlation coefficient was determined which was highly significant.

Distribution of blood pressure according to socio economic status: According to this study both mean systolic and diastolic blood pressure had higher values in the I grade of SES which can be attributed to increase in weight in this group of children. Based on the mean systolic and diastolic blood pressure readings obtained in our study correlation coefficient and regression coefficient was calculated and the prediction equation for systolic blood pressure and diastolic blood pressure for particular age, height and weight was obtained which has been depicted in table 11. This equation is helpful in predicting the blood pressure based on child's, age, height and weight for peripheral health workers.

CONCLUSION

Distribution pattern of blood pressure was studied in a sample of 1215 school children (733 males and 482 females) in the age group of 5-14 years in Kadapa city. The mean value of systolic and diastolic blood pressure increased with age in both sexes. The cut-off points for high blood pressure were based on values above 95th percentile. The prevalence of hypertension was 2.6% in boys and 2.5% in girls. (An insignificant difference). Anthropometric variables like height and weight showed positive correlation with systolic as well as diastolic blood pressure. Among the hypertensive children many (61.2%) had family history of hypertension.

REFERENCES

1. Anand N.K, Lalit Tandon, 1996 "Prevalence of Hypertension in school going children". Indian J. Pediatrics ; 33; 377-381.
2. Chandha S.L, Tandon R, Shekhawat S, Gopinath N. 1999 "An Epidemiological study of Blood pressure in school children (5-14 year) in Delhi". Indian Heart Journal, 51; 178-182.
3. Agarwal V.K, Rajiv Sharan, Srivastava A.K, Prem Kumar Pandey C.M. 1983 "Blood Pressure Profile in Children of age 3-15 years" Indian Pediatrics, 20; 921-925.
4. Sachdev Y. 1984 "Normal blood pressure and hypertension in Indian children". Indian Pediatrics, 21 ; 41-48.
5. Preter Rudd, ward Hagar R; Hypertension Newyork Lippincott — Raven. 1997 ; 2732 pp
6. Reid C, Chantler C, Systemic hypertension, London : Churchill : Livingstone, 2002: 1966 pp.
7. John B West. "Intracardiac and Arterial pressures and the cardiac output ; cardiac catheterization ; Baltimore ; Williams & Wilkins, 1985: 1 170 pp.
8. Chatterjee C.C. Text book of Human Physiology Vol-1 11th edition 296-313 May 1992 : 300 pp.
9. Arthur J. Moss MD. 1978 "Indirect methods of blood pressure measurement" *Pediatr Clin North Am* Vol-25 No.1 : 3-13.
10. Park M.K Hypertension Singapore : Mosby-Year book, Inc., 1996. 540 pp.
11. Blood pressure, 1988 Archives of disease of childhood 63, 347-49.
12. Alan R. Sinaiko 1989 "Prevalence of significant hypertension in Junior High School Children". *Journal of Pediatrics* Vol-14 No-4: 664-69.

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13. Jeninifer M.H. Loggie 1969 "Hypertension in Children and adolescents, causes and diagnostic studies" The Journal of Pediatrics Vol-74; No. 3, 331-55.
14. Task force on Blood Pressure control in children Report on Second task force on blood pressure control in children Pediatrics 1987 Vol 79: 1 -25.
15. Alexander S. Nadas, Donald C, Fyler Text book of Pediatrics . Cardiology 3rd Ed.pp No. 520 — 535.
16. Udani P.M. 1998 Text book of Pediatrics Vol-2 1' edition 1952-65.
17. Ganong William F. "Dynamics of blood and lymphflow" US ; lange Medical book 1989 pp 868
18. Antonie W. Voor S et al. 1978 "Epidemiology of essential hypertension in youth". Implication for clinical practice — Pediatr Clin North Am, Vol-25 No. 1 : 15-25.
19. Matti Uhari et al. 1991 "Pulse sounds and measurement of diastolic blood pressure in children". The lancet, Vol 338 : 159-61.
20. Rosner B. 1988 "Blood Pressure nomograms for children and adolescent by height, Sex and age in the United States". The Journal of Pediatrics, Vol-123 No. 6 Jan; 871-86.
21. Robert M. Kliegman ; Daniel Bernstein ; Cardiovascular system Philadelphia, Saunders 1996 : 2086 pp.
22. Rance C. Petal. 1974 "Persistent Systemic Hypertension in infants and children". Pediatr Clin North Am, Vol 21 No. 4 : 801-24.
23. Celia J. Rodd. 1993 "Endocrine causes of hypertension in children". Pediatr Clin North Am, Vol-10 No. 1 :149-164.
24. Albert P. Rocini MD. 1984 "Childhood Hypertension Etiology, Diagnosis and Treatment. Pediatr Clin North Am., Vol. 31 No. 6 : 1259-73.
25. Linda. B. Hiner. 1993 "Renovascular hypertension in children". Pediatr Clin North Am, Vol-40 No. 1: 123-39.
26. Munger R.G., Rineas RJ, Gomez-Mauro. 1988 "Persistent elevation of blood pressure among children with a family history of hypertension". J Hypertens, 6: 647-653.
27. Antonic W. Voors et at. 1978 "Epidemiology of essential hypertension in youth. Implication for clinical practice". Pediatr Clin North Am, Vol-25 No-1 :15-25.
28. Rosner B. 1988 "Blood Pressure monograms for children and adolescents by height, sex and age in the united states". The Journal of Pediatrics Vol-123 No. 6 : 871-86.
29. Laroid D, Sharma N, Diwedi V, Mathur PS. 1989 "Profile of blood pressure in normal school children". Indian pediatrics, 26 : 531-536.
30. Aggarwal R, Mandowara SL, Bhandari B, Garg OP. 1982 "Prevalence of hypertension in apparently healthy school children". Indian Pediatrics. 19 : 779-784.
31. Londe S. 1968 "Blood pressure standards for children as determined under office conditions". Clin Pediatrics, 7 : 400 --403.
32. Londe S, Bourgoigne Ji, Robson AM. 1971 "Hypertension in apparently normal children". J Pediatrics, 78 : 569 - 577.
33. Chahar CK, Shekhawat V, Miglani N, Gupta BD. 1982 "A study of blood pressure in school children at Bikaner". Indian J Pediatrics, 49:791-794.
34. Gupta AK. 1991 "Influence of family history of morbid cardiovascular events on blood pressure levels of school children. Indian Pediatrics, 28:131-139.