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Original Research Article:

Prevalence of Hypertension and its associated factors among School children in a rural area of Tamil Nadu – a Cross-sectional Study

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Abstract:

Introduction: Hypertension one of the major contributors towards coronary artery disease, stroke has its roots in childhood and screening for hypertensive, children with borderline hypertension and in whom the risk factors for hypertension is present will go a long way in helping these children lead a better life. Secondary prevention is an important strategy in its control. Previous studies have documented that hypertension may begin in adolescence, perhaps even in childhood. The aim of this study is to screen blood pressure among adolescent school students in selected schools of Coimbatore, Tamilnadu. Materials and methodology: A cross sectional survey conducted in selected schools of Coimbatore. 1303 school

children were studied from January 2009 to February 2010 after obtaining consent.An elevated BP reading obtained with an oscillometric device was repeated using auscultation. The Blood pressure values were compared with a standard chart given by the Report of the Fourth US Task Force on Blood Pressure Control in Children, National Heart, Lung, and Blood Institute, Bethesda. Data analysis was performed using the Statistical Package for Social Sciences (SPSS Inc. Chicago, USA) package version 16.00.Results: Out of 1303 children 821 were males and 482 were females. In all age groups males were more when compared to females. Majority were from rural setting. Total prevalence of hypertension in the age group of 10 to 15 years was 14.04%. Prevalence of hypertension among males was found to be 13.89% and prevalence of hypertension among females was found to be 14.29%. Conclusion: Awareness should be done regarding hypertension and its management. Secondary prevention should be initiated at the earliest to prevent complications.

Key words: Hypertension, School Children, Rural, Tamil Nadu, Prevention

INTRODUCTION:

Hypertension (HT) is a major health problem in developed and developing countries and is a major risk factor for cardiovascular and cerebrovascular diseases. Around one billion adult world populationswere found to have HT in the year 2000 and this is expected to increase to 1.56 billion by 2025.(1)The high prevalence of hypertension worldwide has contributed to the present pandemic of cardiovascular disease. During the past century, such disease has changed from a minor cause of death and disability to one of the major contributors to the global burden of disease.(1) The incorporation of blood pressure (BP) measurement into routine pediatric examination has led to the discovery of significant number of children with asymptomatic HT.(2) Since the risk factors for the development of HT start in childhood, pediatricians should be encouraged to include routine BP measurement in children.(3)

Hypertension is defined as elevated blood pressure beyond the 95thpercentile for age and sex.(4) Hypertension is generally considered as an 'iceberg' disease as only half of the population is aware of the problem and among the people who have elevated blood pressure, half of them are not aware of the problem thereby remaining hidden. Besides, only half of the population who are aware of the problem seek medical help and till

now to most of them medical help is not accessible and still remains a costly affair. But now thanks to the electronic media the awareness is now increasing including among the paediatric population.

Systemic HT has an estimated population prevalence of 1–2% in the developed countries(4) and 5–10% in developing countries like India(5), which is increasing in a alarming rate. The increasing stress, sedentary lifestyle changes, food habits, lack of physical activity are further helping the increasing prevalence of hypertension in all age groups.(2)

Comorbidities associated with obesity and overweight are similar in children as in the adult population. Elevated blood pressure, dyslipidemia, and a higher prevalence of factors associated with insulin resistance and type 2 diabetes appear as frequent comorbidities in the overweight and obese pediatric population. In some populations, type 2 diabetes is now the dominant form of diabetes in children and adolescents. Disturbingly, obesity in childhood, particularly in adolescence, is a key predictor for obesity in adulthood.

Moreover, morbidity and mortality in the adult population is increased in individuals who were overweight in adolescence.(6)

The distribution of Blood Pressure differs from population to population and within various ethnic groups. Recognition of various risk factors and correcting them and early detection of elevated blood pressure in the childhood will go a long way in prevention of hypertension and its various ill-effects later in life.

This study was undertaken to find out the prevalence of obesity and hypertension in urban and rural Tamilnadu and compare the same with accumulated data from published reports worldwide. This study is an effort to compare, the prevalence of obesity and hypertension, between urban and rural population of India, as there is lack of data comparing these parameters in this population(5)(7)(8)(9),.

This study emphasized the importance of blood pressure screening in children for early detection of asymptomatic hypertension and to prevent long term

morbidities in adulthood. The objective of the study is to estimate the prevalence of hypertension among the age group of 10 to 15 years and its correlation with anthropometric indices such as height, weight and BMI.

METHODOLOGY:

This cross sectional study is conducted among school children of age group 10 to 15 years in Coimbatore. Using simple random sampling technique, one urban school and one rural school in Coimbatore are enrolled for study. 1303 children were enrolled and data collected from January 2009 to February 2010. After obtaining ethics committee approval from G.Kuppuswamy Naidu Hospital, Coimbatore, Tamil Nadu, children among age group of 10 to 15 years were enrolled. . A verbal consent from the head master/mistress of each selected school was obtained before conducting the health examination. Those suffering from cardiac, renal, endocrine disorder and children on long term medications like steroid hormones, adrenergic antagonists, thyroxine supplementation etc were excluded from the study. Permission was obtained from the school authorities and parents were informed through the school. A complete physical examination including height, weight, BMI, BP, Vitals, Systemic examination was carried out. The school authorities had physical trainers to assist while measuring the height and weight of children which was done by the nursing staff skilled in the anthropometric measurements from G.K.N.M. Hospital, Coimbatore, Dept of Pediatrics. BP and anthropometric measurements were done according to international guidelines. All the instruments were checked for calibration before the survey.The weight of the pupils was measured, when they were wearing light clothing and after removing shoes, sweaters and jackets, with a portable weighing scale and it was calibrated, it's zero error corrected before every measurement. Height was measured with a stadiometer with the pupil standing without shoes and measured to the nearest 1cm. The BMI was calculated with the formula: Weight (kg) / height (m2). Based on the CDC charts the child was classified as overweight (>85th percentile)

and obese (> 95th percentile). The blood pressure was measured on regular school days with normal activities. Sufficient time was given and the procedure was well explained to the students prior to examination. For BP measurement, each child was initially asked to rest for a period of at least 5 min, with their right arm positioned on a table situated at the level of child's heart. After first reading the child was told to remain seated quietly for at least for another 5 min before a second measurement was taken if the first reading was considered abnormal. Blood pressure was recorded in sitting posture in the right arm using a Oscillometric method by using Omron BP Monitor Upper Arm HEM-7203. The cuff bladder was wide enough to cover 2/3 of arm circumference and long enough to encircle the arm completely. All anthropometric and blood pressure measurements were made by a single observer. As discussed in The Fourth Report on the Diagnosis, Evaluation, and Treatment of High Blood Pressure in Children and Adolescents, oscillometric method was used , as the advantages of automatic devices are their ease of use and the minimization of observer bias or digit preference. An elevated BP reading obtained with an oscillometric device was repeated using auscultation. The Blood pressure values were compared with a standard chart given by the Report of the Fourth US Task Force on Blood PressureControl in Children,(5) National Heart, Lung, and Blood Institute, Bethesda and classified as following.

Hypertension is defined as average SBP and/or DBP that is greater than or equal to the 95th percentile for sex, age, and height on three or more occasions. Prehypertension in children is defined as average SBP or DBP levels that are greater than or equal to the 90th percentile, but less than the 95th percentile. As with adults, adolescents with BP levels greater than or equal to 120/80 mmHg should be considered pre hypertensive. The blood pressure percentile values obtained in the study was not used as a standard as the sample size was less that is only 1303. Hence a standard chart given Report of the Fourth US Task Force on Blood Pressure in Children was used to diagnose

hypertension. For standardisation, height, weight and BMI were classified based on CDC charts.

RESULTS:

Out of 1303 children 821 (63%) were males and 482 (37%) were females. In all age groups males were more when compared to females as in Table 1. 674 (52%) of them were from rural and 629 (48%) were from urban area. The systolic and diastolic blood pressures were tabulated in table 2 and table 3. Table: 4 show the 50th, 90th, 95th percentiles for systolic and diastolic blood pressures among males. Table: 5 show the 50th, 90th, 95th percentiles for systolic and diastolic blood pressures among females. Among those who are found to have high BP, 132 (10.1%) were in pre hypertension and 183 (14.04%) were in hypertension. Among prehypertensives (132), 57 (43%) were males and 75 (57%) were females. Among hypertensives (183), 114 (62%) were males and 69 (38%) were females. From 10 years of age there is an increase in prevalence of hypertension noted with highest prevalence in 15 years of age both in males and females.

Table 1 Distribution of subjects in different age group

Age	Male	Female	Total
10	131	77	208
11	139	85	224
12	135	81	216
13	141	83	224
14	138	81	219
15	137	75	212
Total	821	482	1303

Table 2 Systolic Blood Pressure Variables in Different Age and Gender Groups.

	Age					
	10	11	12	13	14	15
	Gender	Gender	Gender	Gender	Gender	Gender

SBP	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Count	131	77	139	85	135	81	141	83	138	81	137	75
Minimum	97.00	100.00	98.00	103.00	100.00	105.00	102.00	103.00	105.00	105.00	107.00	110.00
Maximum	124.00	122.00	124.00	122.00	127.00	126.00	130.00	128.00	132.00	134.00	135.00	135.00
Mean	108.59	109.92	110.83	111.41	114.07	118.42	119.23	113.52	117.76	117.43	116.18	121.45
Standard Deviation	7.12	6.61	6.47	5.21	6.53	5.71	6.28	6.39	6.99	7.95	7.64	13.94
Standard Error of Mean	.62	.75	.55	.57	.56	.63	.53	.70	.60	.88	.65	1.61
Percentile 05	98.00	101.00	99.00	104.00	104.00	108.00	108.00	104.00	108.00	106.00	109.00	116.00
Percentile 95	121.00	121.00	122.00	120.00	126.00	125.00	128.00	126.00	130.00	130.00	134.00	134.00

Table 3 – Diastolic Blood Pressure Variables in Different Age and Gender Groups.

		Age											
		10		11		12		13		14		15	
	DBP	Gender		Gender		Gender		Gender		Gender		Gender	
		Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
	Count	131	77	139	85	135	81	141	83	138	81	137	75

	Minimum	65.00	66.00	65.00	67.00	66.00	69.00	68.00	62.00	68.00	70.00	69.00	70.00
	Maximum	83.00	80.00	80.00	81.00	83.00	82.00	83.00	83.00	89.00	88.00	90.00	90.00
	Mean	73.27	72.65	72.18	73.26	72.88	74.27	74.26	71.01	76.53	76.57	74.77	78.23
	Standard Deviation	4.56	3.97	4.00	3.88	4.58	3.68	3.67	4.61	5.66	4.40	7.61	5.36
	Standard Error of Mean	.40	.45	.34	.42	.39	.41	.31	.51	.48	.49	.65	.62
	Percentile 05	66.00	67.00	66.00	68.00	67.00	69.00	68.00	64.00	70.00	72.00	70.00	72.00
	Percentile 95	81.00	80.00	79.00	80.00	82.00	81.00	82.00	81.00	88.00	86.00	88.00	88.00

Blood pressure distribution in the age group of 10 to 15 years in terms of percentiles among males

Table: 4. Distribution of BP in percentiles

Age	**Number (n = 821)**	**Systolic Blood pressure - percentiles**		
		50th	**90th**	**95th**
10	131	108	120	121
11	139	111	120	122
12	135	115	124	126
13	141	120	128	129
14	138	116	128	130
15	137	114	132	134

Age	**Number (n = 821)**	**Diastolic Blood pressure - percentiles**		
		50th	**90th**	**95th**
10	131	74	80	81
11	139	72	78	79
12	135	72	80	82
13	141	74	80	82
14	138	75	87	88
15	137	74	86	88

Blood pressure distribution in the age group of 10 to 15 years in terms of percentiles among female:

Table: 5. Distribution of BP in percentiles - females

Age	**Number (n = 482)**	**Systolic Blood pressure - percentiles**		
		50th	**90th**	**95th**
10	77	110	120	121
11	82	111	120	121
12	81	112	125	126
13	83	112	125	127
14	81	118	130	132
15	79	122	132	134
Age	**Number (n = 482)**	**Diastolic Blood pressure - percentiles**		
		50th	**90th**	**95th**
10	77	72	78	80
11	82	73	79	80
12	81	74	80	81
13	83	70	80	81

14	81	75	84	86
15	79	76	88	89

DISCUSSION:

Hypertension one of the major contributors towards coronary artery disease, stroke has its roots in childhood and screening for hypertensive, children with borderline hypertension and in whom the risk factors for hypertension is present will go a long way in helping these children lead a better life.

The study was carried on 1303 school children in two schools, Urban - Mani high school, Papanaikenpalayam, Coimbatore, Rural – Government high school, Kurudampalayam, from January 2009 to February 2010. The distribution of blood pressure and the prevalence of hypertension in the age group were analyzed and the significance of risk factors among these children was determined. A pretested questionnaire was given to the students and the data analysis was done using SPSS software version 16.

The prevalence of hypertension in the present study was 14.04%. This prevalence is higher as compared to the mentioned studies. The lowest prevalence of 0.46% was noted by a study done by *Anand NK et al.*(10)

The wide variation in the prevalence of hypertension could be because of different interpretations with regards to the identifying the diastolic pressure with the Korotkoff sounds with some employing K4 and others K5. The blood pressure was also influenced by the size of cuff used as determined by *Clausen et al.*(11)

The prevalence of hypertension among males was 13.89% and females were 14.29% which shows significance of difference in prevalence of hypertension among males and females: P – value being 0.000(Significant). *Sol londe*(12)reported a prevalence of 12.4% in boys and 11.6% in girls. Report on prevalence of hypertension was given by *Chadha et al.*(13)as 11.9% in boys and 11.4% in girls. These two studies reported lower prevalence among males and females compared to the present study.

The present study shows the

distribution of blood pressure among school children of 10 to 15 years of age. The mean systolic blood pressure rose with age and there was peaking as the child reached growth spurt, the rise being more in girls than in boys.

In the present study both SBP and DBP correlated significantly with age. SBP correlated significantly with sex. DBP was not found to have positive sex correlation

Similar observations on rise of BP with age was made by *Sharma BK et al, AnandNK*(10)and *Tandon*L(10), *Handa P et al*(14),*Chadha et al.* (13)and*Switty TA et al.*(15)

In contrast to the observation that age correlates positively with rise in BP, *Savitha MR et al.* in her study on Blood pressure distribution in children concluded that blood pressure does not correlate with both age and sex.

Orchard TJ et al(16).in his study on blood pressure in adolescent population concluded that SBP had a positive correlation with age in boys but not in girls and DBP showed no association with age in both sexes.The study showed systolic blood pressure rose higher in boys than girls and diastolic blood pressures were higher in girls.

Krishnan P et al.(17)in a study of blood pressure among the age group of 3-18 years showed that age and not gender had a positive correlation with blood pressure distribution.

Raj et al.(7)who studied the blood pressure pattern among children of 5 – 16 years concluded that the mean systolic blood pressure of girls demonstrated a higher value than boys the which is consistent with the present study.

In both sexes there was a spurt in SBP at 13 years coinciding with the physiological growth spurt. Similar observation was made by *Anand NK and Tandon L*(10)who in their study determined that rise in BP was directly proportional to increase in age with a spurt in SBP at 12 years of age in both sexes.

The maximum and minimum values of systolic and diastolic blood pressures among males and females in the study were 135 and 90 mmHg respectively and 97 and 65 mmHg

respectively. Among females it was seen that the maximum and minimum systolic blood pressure was being 135 and 90 mmHg respectively and the maximum and minimum diastolic blood pressure being 100 and 62 mmHg respectively.

Chadha et al.(13)in his study on pattern of distribution of blood pressure in children showed the values of blood pressure in the age group 10 – 14 years, the values for SBP and DBP ranged from 72 mmHg to 160 mmHg and from 46 mmHg to 120 mmHg respectively. The blood pressure values in the present were found to be higher.

CONCLUSION AND RECOMMENDATION:

The prevalence of hypertension is higher among female children than males. Higher prevalence also noted in rural children. Adolescent health programmes should be targeted for secondary prevention of hypertension.

REFERENCES:

1. Kaerney PM, Whelton M, Reynolds SK, Muntner P, Whelton PK, He J. Global burden of hypertension: Analysis of worldwide data. Lancet. 2005;365:217–23.[PubMed].
2. Bartosh SM, Aronson AJ. Childhood hypertension: An update on aetiology, diagnosis and treatment. PediatrClin North Am. 1999;46:235–52. [PubMed].
3. Sanchez RG, Labarathe DR, Forthofer RN, Fernandez-Cruz A. National standards of blood pressure for children and adolescents in Spain: International comparisons. Int J Epidemiol. 1992;21:478–87. [PubMed].
4. Munter P, He J, Cutler JA, Wildman RP, Whelton BK. Trends in blood pressure among children and adolescents. JAMA. 2004;291:2107–13. [PubMed].
5. National High Blood Pressure Education Program Working Group. The Fourth report on the diagnosis, evaluation and treatment of high blood pressure in children and adolescents.Pediatrics. 2004;114:555–76.
6. Deckelbaum RJ, Williams CL. (2001.) "Childhood obesity: the health issue", Obes Res., 9(Suppl 4), pp. 239S-243S.
7. Raj M, Sundaram KR, Paul M, Sudhakar A, Kumar RK. (2010) "Body mass index trend and its association with blood pressure distribution in children.", J Hum Hypertens, 24(10), pp. 652-658.
8. Avinash Sharma, Neelam Grover, Shayam Kaushik, Rajiv Bhardwaj and Naveen Sankhyan. (2010) "Prevalence of Hypertension Among School children in Shimla.", Indian Pediatr, 47(10), pp. 873-876.
9. I. Peytremann-Bridevaux, D. Faeh, B. Santos-EggimannD. Faehc, d, B. Santos-Eggimanna. (2007) "Prevalence of overweight and

obesity in rural and urban settings of 10 European countries.", Preventive Medicine, 44(5), pp. 442–446.
10. Anand NK, Tandon L. Prevalence of hypertension in school going children. Indian Pediatr 1996; 33: 377-81.
11. Clausen LR, Olsen JA, Mortensen PE, Nielson PE. Influence of cuff size on blood pressure among school children. Blood Press 1999; 8(3): 172-6.
12. Sol Londe. Blood pressure standards for normal children. Clin Pediatr 1968; 7(7): 400-403.
13. Chadha SL, Vasan RS, Sarma PS, Shekhawat S, Tandon R, Gopinath N. Age and height specific reference limits of blood pressure of Indian children. Natl Med J India 1999; 12(4): 150-6.
14. Handa P, Wolf HK. Blood pressure: distribution in students of junior and senior high schools in Saint John, NB. Can Med Assoc J 1985; 132: 29-32.
15. Switty TA, Shaheen BH, Habashneh MS, Kelani Z, Hazza IA. Blood pressure among school children in Jordan. Saud J Kid Dis Transpln 1996; 7(3): 283-90.
16. Orchard TJ, Hedley AJ, Mitchell JRA. The distribution and associations of blood pressure in an adolescent population. J Epidemiol Comm Health 1982; 36: 35-42.
17. Krishnan P, Kumar P, Desai N, Thennarusu K. Blood pressure reference tables for children and adolescents of Karnataka. Indian Pediatr 2006; 43: 491-501.