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Prevalence of Prehypertension among School Students in Puducherry.

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ABSTRACT

Hypertension in childhood is now recognized to be a common and serious problem with a prevalence of 2% to 5%. Early detection of children at risk for hypertension, proper evaluation and appropriate management are important to prevent the serious, long-term complications associated with the condition. The present study was undertaken in this direction, to assess the prevalence of prehypertension and among school students [11 -17 years] in Puducherry. To show any possible correlation between high normal BP and increasing BMI. A total of 1100 school students consented to participate in this study, their BP reading were recorded after a demographic questionnaire to assess their socioeconomic status & BMI. Out of a total of 1100 students, there were 31 [4.97%] boys & 14 [3.09 %] girls. boys and girls both systolic and diastolic blood pressure increases with weight and it is found to be statistically significant

Keywords: Pre-hypertension, School Students, Blood Pressure, BMI

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INTRODUCTION

Hypertension is a major killer disease in the world. Hypertension in childhood is now recognized to be common and serious problem with a prevalence of 2% to 5% [1]. Hypertension is an independent predictor of cardiovascular disease and cerebrovascular events affecting nearly a quarter of the adult population worldwide. Hypertension is an important clinical problem in children's, and the approach to its management differs from that in adults in several major respects. As the symptoms of childhood hypertension are largely non-specific, most children with essential hypertension are likely to be asymptomatic [2]. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure [JNC7] defines hypertension as blood pressure >140/90 mmHg. Persons with blood pressure above optimal levels, but not clinical hypertension [systolic blood pressure of 120-139 mm Hg or diastolic blood pressure of 80-89 mm Hg], are defined as having "prehypertension". Subjects with pre-hypertension have a greater risk of developing hypertension later and risk of major cardiovascular events independent of other cardiovascular risk factors. Cardiovascular diseases contribute to atleast one third of deaths in India every year. Although hypertension has been well studied, there is dearth of data on the prevalence and risk factors for prehypertension in India.

With India emerging as an economically developed nation, the need of the hour is to focus research and data collection on urban as well as rural population. Studies targeting prehypertension would provide an estimate of the future magnitude of the problem and assist in developing strategies for control of hypertension and CVD [3]. With growing urbanization, socio developmental and life style changes from traditional to modern have lead to physical inactivity. Rising affluence has also modified the dietary pattern characterized by increased consumption of diets rich in fat, sugar and calories [4]. The all cause mortality has also been shown to be 50% higher in the prehypertensive adults compared to the normotensive counterparts.

There are not many studies done in this part of the country which estimates the prevalence of this epidemic & hence the study was planned. Drug therapy for prehypertension is not recommended for various reasons [4, 5]

Hence the present study was taken up to determine blood pressure levels in apparently healthy, asymptomatic school children in the age range of 11 to 17 years in Puducherry union territory and determine the associated risk factors with hypertension like age, sex, body weight, height and socio-economic status. These statistical values can be used as reference for blood pressure norms for the children residing in Puducherry.

The present study was undertaken in this direction, to estimate the prevalence of Prehypertension and identify the risk factors in among school children [11 – 17 years] in Puducherry.

Aim and Objectives

To find out the incidence of prehypertension amongst school students in Puducherry. To show any possible correlation between high normal BP & increasing BMI**.** To assess any gender variation in the incidence of prehypertension. To estimate the rate of prevalence of prehypertension among the study population.

MATERIALS AND METHODS

This was a descriptive cross sectional study done were 1100 school students from urban and rural schools of Puducherry. Stratified random sampling procedure was used in this study. Puducherry comprises of 110 higher secondary schools which includes both government and private schools. First random of 16 schools will be selected among 110 schools. Secondly from the school register, 68 students from each school were included. In this study, students randomly considering equal representation in classes between 6^{th} to 12th standard. Thus 1100 school students interviewed in the study.

In this present study, age of students from 11 – 17 years of both sexes were included , School children who are suffering from following diseases , Congenital anomaly, Cardiac diseases, Renal diseases and Under chronic drug intake were excluded from the study.

The study was approved by the institutional ethical committee and written consent form, from the subject was obtained for carry out study after explaining to them the protocol of the study and the benefits of the study. Before recording the blood pressure, children in groups of 10 were taken to a separate room away from noise, and they were explained in detail, the procedure of pressure recording and they were reassured that the procedure is not painful. All children were made to void urine before blood pressure recording, as a full bladder is a source of strong sensory stimuli, which may increase the blood pressure.

All efforts were made to eliminate factors which might affect the blood pressure such as anxiety, fear, crying, laughing, recent activities in order to facilitate the blood pressure recording under simulated "basal" or "near basal" conditions. Blood pressure was recorded only when the child had become accustomed to the observer, instrument and surroundings.

Their demographic data was collected which included their height, weight, habits. Blood pressure was recorded using a standard mercury sphygmomanometer and Omron Digital BP apparatus. Cuffs of two different sizes were used in the procedure. In children above 7 years of age standard adult size cuff [12.5cm] was used. A cuff bladder encircling at least 80% of the arm circumference was applied to the non dominant arm. The disappearance of phase V Korotk off sounds was taken as the diastolic reading. The mean of three readings recorded 2 min apart was taken [6]. If these readings differed by more than 5 mm Hg, a further three readings were recorded at 2 min intervals and the mean of all six readings taken. The radial pulse rate was manually recorded over a 1 min period.

Sample Size Calculation

Since prevalence of Prehypertension in school children was not known and not documented in Puducherry, we incorporated the prevalence figure of 2.2% from previously conducted study among school children [6, 7]. Applying the formula $n= [t^2xp [1-p]]/m^2$, where n is required sample size , t is confidence level[standard value of 1.96], p is estimated prevalence and m is the margin of error[standard value 0.05], and adjusting for the design effect of 1.5 , keeping the number of estimate [gender estimate] to be 2 and 10% being the non-response rate, the sample size required was 1100.

Statistical Analysis

The data collected were tabulated according to various epidemiological parameters like age, sex, etc. The mean values and standard deviation of all Anthropometric parameters were calculated. T-test, unpaired, was used to find the difference between the mean values among boys and girls concerned with systolic blood pressure, diastolic blood pressure, height with systolic blood pressure and diastolic blood pressure and weight with systolic blood pressure and diastolic blood pressure.

The Pearson's or product moment correlation coefficients [r] were calculated to assess the correlation between weight and systolic blood pressure, weight and diastolic blood pressure, height and systolic blood pressure, height and diastolic blood pressure both for boys and girls. The strength of the correlation coefficient was determined by using t-test $p > 0.05$ [5% level of significance] was considered as not significant [NS] and $p < 0.01$ was considered as significant [S] for the corresponding degrees of freedom [df].

OBSERVATIONS AND RESULTS

The sample of 1100 students was analysed by applying ANOVA logistic regression analysis. Out of a total of 1100 students, there were 31 [4.97%] boys & 14 [3.09 %] girls. boys and girls both systolic and diastolic blood pressure increases with weight and it is found to be statistically significant. As seen in the weight distribution,

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though persons with more height seen to have risk of getting elevated blood pressure it is not linear, however these difference between the height of both sexes is statistically significant. In boys, positive correlation was found between the weight and blood pressure though low but found to be significant, whereas correlation between height and blood pressure was found to be very low.

Table 1: Mean SBP and DBP in both sexes

Sexes	SBP [mmHg] Mean±STD	DBP [mmHg] Mean±STD
Boys	106.39±12.1	67.65±8.4
Girls	109.2±10.4	68.48±7.9
	t = -3.90 df = 10.98	p <0.000

Table 2: Correlation of Blood pressure with Weight and Height in Boys [n = 647]

Correlation coefficient [r] of Weight with		Correlation coefficient [r] of Height with	
SBP	DBP	SBP	DBP
0.414	0.428	0.179	0.062
p<0.000	p < 0.000	p < 0.000	p < 0.000

Table 3: Correlation of Blood pressure with Weight and Height in Girls [n = 453]

Correlation coefficient [r] of Weight with		Correlation coefficient [r] of Height with	
SBP	DBP	SBP	DBP
0.402	0.297	0.179	0.062
p < 0.000	p < 0.000	p < 0.000	p < 0.190

Correlation of weight, height with blood pressure were found to be low among girls compared to boys [Table 1,2&3] Family history of hypertension has influenced diastolic blood pressure among the study population which is found to be statistically significant but it is not so with systolic blood pressure. There was significant correlation between prehypertension with height and weight relationship with a P value less than 0.05 in boys but on the contrary, there was no significant correlation between the two in the girls [P value more than 0.05]. SPSS 2 verison was used for data analysis, Student t-test was used to calculate the Karl Pearson's correlation coefficient.

Table 4: Distribution of Blood Pressure according to Family history of Hypertension

Family History	No. of Children	SBP [mmHg]	DBP[mmHg]
Present	147	107.97±11.4	70.07±7.22
Absent	953	107.44±11.53	67.67±8.34
	p – value	t=0.520	t=3.294
	Inference	P=0.603	P=0.001

Table 5: Situation of hypertension according to sex

Sex	No. of children [n]	No. of children found to be Prehypertensive	Percentage [%]
Boys	647	31	4.79
Girls	453	14	3.09
Total	1100	45	4.09

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DISCUSSION

The findings of the present study regarding mean systolic and mean diastolic pressure are comparable with findings of the study conducted by N.K. Anand and Lalit Tandon. Their findings [systolic blood pressure] of 118 mm Hg at 11 years and 126 mm Hg at 17 years for boys and 116 mm Hg 11 years and 124 mm Hg at 17 years for girls are close to the findings of the present study. Similarly mean diastolic pressures for both boys and girls in the present study and study conducted by N.K. Anand and Lalit Tandon are comparable [8].

In the present study it has been seen that the mean systolic and mean diastolic blood pressures increase steadily and proportionately with weight. This finding is in agreement with that of Agarwal VK, Rajiv Sharan, AK Shrivastava, Premkumar and CM Pandey who found that both systolic and diastolic blood pressures increased with increase in weight. Faber ,Robinson, Brucher, Hahn also found similar relation between blood pressure and weight [quoted from Agarwal VK, Rajiv Sharan, K Shrivastava, Premkumar and CM Pandey, 1983]. Rakesh Agarwal, SL Mandowara, B. Bhandari and Garg OP observed that blood pressure is directly proportional to the ratio of weight/height [kg/cm]. Weiss also made similar observation [quoted from Rakesh Agarwal, SL Mandowara, B. Bhandari and Garg OP 1982]. Chahar CK, Shekhawat V, Miglani N and Gupta BD also observed a gradual rise in systolic blood pressure with weight [9,10] Sachdev found direct correlation between blood pressure and body weight and weight/height ratio. Londe found that systolic pressure is related to weight, but not diastolic pressure in either sex [10]. In the Bogalusa heart study, a close relationship [linear relationship] was found between the log of the body weight and blood pressure [9,10]. The mean systolic and mean diastolic blood pressures observed in the present study are lower than that of V.K. Agarwal, Rajiv Sharan, A.K.Shrivatsava, Premkumar and CM Pandey in the comparable weight group [11]. The difference suggests that factors other than body weight, such as height, dietary habits, physical activities, geographical locality may be playing a role in the determination of blood pressures.

In the present study the mean systolic blood pressure and mean diastolic blood pressure were found to increase with increase in the body height in both sexes but not a linear relationship. D. Laroia, M. Sharma, V. Dwivedi, KM Belapurkar and P.S. Mathur noted similar correlation between height and systolic and diastolic blood pressures in both sexes in the study conducted in 1989[9]. Sachdev, V.K. Agarwal, Faber and Master did not find any correlation between systolic and diastolic blood pressure with height [12].

Correlation of blood pressure with weight and height by means of correlating correlation coefficients [r] in the present study shows that both systolic and diastolic blood pressure are significantly related to both, body weight and height, in both sexes in all age groups
Londe after similar analysis came to conclusion that systolic pressure is probably related to weight, but not to the height in both sexes and the diastolic pressure is not related to either weight or height [13].

Berenson comments that in youth, blood pressure levels vary considerably with height and weight and when children are grouped by body weight and height the usual positive correlation with age is lacking. In the Bogalusa heart study a linear relationship has been demonstrated between height and blood pressure and hence Berenson recommends that the blood pressure levels in the growing child be related to height and blood pressure for height is to be used as a standard reference[14].

Voors et al. observed that after adjusting for effects of height and weight on blood pressure levels, age appears to have no relationship to levels. He also comments that approximately 40% of variability of blood pressure level seems to be explained by a combination of factors such as height, weight, triceps skin fold thickness, or arm circumference [15].

The findings of the present study are in agreement with the statement that height and weight are the strongest determinants of blood pressure. There is also a significant correlation between blood pressure and weight/ height ratio [known as Ponderal index] which is an indicator of body mass.

Family history of hypertension was significant risk factor for hypertension as evident in many studies like

Zambian study which showed that parental history before age of 60 was related to offspring hypertension. Studies from India like Verma et al, Soundarssanance et al and Gupta and Ahmed have also reported similar observations. But in our study we couldn't observe such relationship which might be due to inadequate screening of parents as hypertension is iceberg disease and is largely asymptomatic.

In the present study, there was no significant association between parental hypertension and blood pressure in their children. Similar observation was made by Sachdev, who actually recorded blood pressure of both the parents and their children and compared them [12].

However, it is an established fact that familial aggregation of blood pressure occurs among adults and it extends through childhood down to the age of one year and in some cases the resemblance seems to start as early as first month of life [16,17]

Among the prehypertensives, we found a favourable outcome for girls [4.79 % among boys and 3.09 % among girls] probably due to the protective action of estrogen. The role of estrogen in hypertension is not clear as some data suggests otherwise [HRT in women]. More data & deeper insight into this possibility needs to be assessed. In our present study group boys were categorized as overweight with a positive correlation with high blood pressure. Influence of gender in hypertension prevalence has been observed among men who showed higher prevalence of both systolic and diastolic hypertension in young age [18]. In the present study analysis we have identified a previously underestimated subgroup of prehypertensives in concordance with the JNC-VII criteria, which needs special attention to avoid progression to hypertension and possible cardiovascular disease.

In our study group 147 students [13.3%] had a family history of hypertension . This obviously implies that a strong family history is an independent risk factor & those students are prone to develop prehypertension prematurely. Thus tackling them should be our prime priority to prevent or delay future comorbidities.

The public health implication of this increased burden of at-risk people in our population requires serious consideration. It has been estimated that a 5 mmHg reduction in systolic blood pressure in the population will produce a 14% reduction in the risk of stroke and a 9% reduction in the risk of coronary heart disease [19-21]

The present study stresses the need to target this subgroup of prehypertensives more aggressively to prevent the epidemic of hypertension and its sequelae like coronary artery disease and chronic kidney disease. It has been shown that overweight status and increasing age are potential risks for future development of hypertension thus obesity management and lifestyle modifications are potential factors in the prevention of hypertension and we stress the need to inculcate this in the early training period among the medical students to keep the health care fraternity in better shape. Prehypertension & hypertension are also significant risk factors for the development of insulin resistance & hence metabolic syndrome which is reported frequently in India. Presently pharmacological therapy has not been recommended to treat prehypertension except for those with other comorbid risk factors [22-26]

Strength of this study was a large group of school students from a different age and socioeconomic background. There is limited data among Indian literature in this population.

CONCLUSION

In our study, we have concluded that we have an alarming number of prehypertensive subgroup in the student community which needs to be identified and informed of the future complications. Prehypertension is potentially modifiable with simple lifestyle modifications. The prevalence is higher among the school students than previously expected.

LIMITATION

Limitation of this study was absence of follow-up and comparative study with private schools.

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