PREVALANCE OF ESSENTIAL HYPERTENSION IN SCHOOL GOING EARLY AND MID ADOLESCENT CHILDREN OF KATHMANDU VALLEY

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ABSTRACT

OBJECTIVE: The general objective of the study is to find out prevalence of essential hypertension among early and mid adolescent of school going children of Kathmandu valley. The specific objective of the study is to identify various risk factors (eg diet, family history, obesity) and its correlation with childhood Hypertension and to study the correlation of childhood hypertension with BMI.

METHODS: It is a School based cross sectional study done in schools of kathmandu valley. School going children aged 10yrs to 16 years from four different schools of Kathmandu and lalitpur were taken as study population. Three were private schools and one was government school. All school going children aged 10-16years were included in the study. Children with any chronic illnesses, were excluded from the study.

RESULTS: A total of 613 students were included between the age group of 10 years- 16 years amongst which 326(53.2%) were male and 287(46.8%) were female. Of these 426(69.5%) were in early adolescent age (10-13 yrs) and 187(30.5%) in mid adolescent age(14-16 yrs)..At the end of three screenings 27 cases(4.40%) had abnormal blood pressure. Among these 17 (2.8%) cases had high systolic blood pressure and 21(3.4%) had high diastolic blood pressure of different stages.

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INTRODUCTION

During the last few years, there has been a renewed interest in measuring a blood pressure (BP) in children and adolescents after recognizing that not only secondary hypertension but also essential hypertension can be present in childhood, especially in adolescents.[1] Essential hypertension (Primary Hypertension) is a common disease worldwide and is associated with increased risk of myocardial infarction, stroke and cardiovascular mortality in adults.[2] This essential hypertension is detectable in the young and may track into adulthood.[3] There has been even evidences to prove that even asymptomatic adolescents with mild blood pressure elevation can have target organ damage[3] However, this hypertension goes undetected unless specifically looked for. Therefore, according to the recommendation of the fourth report from the National high B.P education program (NHBPEP) working group all children above 3 years of age, seen in medical care should have their blood pressure (B.P) measured routinely.

Various factors are known to influence onset of this essential hypertension in childhood.Children and adolescents with primary hypertension are frequently overweight.[4] Data on healthy adolescents obtained in school healths screening programs demonstrate that the prevalence of hypertension increases progressively with increasing body mass index (BMI),and hypertension is detectable in approximately 30 percent of overweight children(BMI >95th percentile.[5] A direct relation between weight and blood pressure has been documented as early as five years of age and is more prominent in the second decade. Height is independently related to blood pressure at all ages.[6,7,8] Sex and race do not have the same impact on blood pressure in children as in adults. No significant differences in blood pressure have been found in comparisons of whites, blacks, Hispanics, and Southeast Asians until adolescence. Even then, the differences are small and vary among epidemiologic studies.[9] The reference standards for blood pressure in children do not distinguish between racial or ethnic groups, because the differences are not clinically relevant. Blood pressure is slightly higher in boys than in girls during the first decade of life. This difference begins to widen around the onset of puberty, and blood pressure is significantly higher in young men by the end of the teenage years.[2]

A familial influence on blood pressure can be identified early in life. Children from families with hypertension tend to have higher blood pressures than children from normotensive families.[10] There are significant correlations in blood pressure and cardiovascular risk factors between parents and their children,[11,12] and these have been observed as early as the newborn period.[13] The correlation in blood pressure between parents and adopted children is significantly lower than between parents and their biologic children.[10] Siblings of children with high blood pressure have significantly higher blood pressure than siblings of children with low blood pressure.[14] There is a greater correlation in blood pressures between mothers and their children than between fathers and their children suggesting a direct prenatal influence.[10,14] In a relatively small study, the offspring of mothers who were hypertensive during their pregnancies and had sustained hypertension after giving birth had higher blood pressure during early and late adolescence than the offspring of mothers who were normotensive during pregnancy and afterward.[15] The onset of essential hypertension can be prevented by early detection of these various influencial factors and modifying the known risk factors [16]

The prevalence of hypertension in children ranges from 16.2% to less than l%.[17,18,19,20] This diversity in prevalence of hypertension is due to the varying age groups taken for the study and different criteria adopted for defining hypertension, basic differences between racial sub-groups related to geographic, dietary and cultural factors.[21] At present, precise data on the prevalence of childhood hypertension in Nepal is lacking although there are lots of data available regarding the prevalence of hypertension in adults. Considering this the present study is conducted to evaluate the prevalence of hypertension in apparently healthy school going children in Kathmandu.

MATERIAL AND METHOD

This is a School based cross sectional study done among Schools of Kathmandu valley. School going children aged 10yrs to 16 years from four different schools of Kathmandu and lalitpur were taken as study population.Three were private schools and one was government school.All school going children aged 10-16yrs were included in the study.Children with any chronic illnesses, were excluded from the study. Increasing prevalence of high Blood pressure in children of urban Nepal due to change in lifestyle, food habits and increasing obesity was the main Working hypothesis in this study. Statical analysis was performed using SPSS version 16.Chi-square test,pearson correlation,fisher's exact test were the statistical methods employed in the present study.

Working Definition

The child was considered normotensive if the blood pressure was less than 90th percentile.

If the blood pressure was > 90th percentile or > 120/80mm Hg (even if < 90th percentile), B.P. was rechecked at the same visit after half hour.

If BP was persistently abnormal even in the second screening, BP was rechecked again at one week interval.

At the end of third screening, if BP was >90th and < 95th percentile or >120/80mm Hg (even if < 90th percentile), child was considered as having prehypertension.

If BP at the end of third screening was >95th percentile, child was considered as having hypertension.

Ethical considerations

The aim and the purpose of the study were explained to the children and school staff who were present there during the procedure and verbal consent was taken before the procedure.

Data collection procedure

All children aged 10 to 16 years studying in grades 6 to 10 were enrolled into the study. Systematic sampling was the sampling technique used based on their roll numbers of the class so that each children has the chance of being included in the study. Age was verified from school records and rounded off to completed years. Body mass index were taken in each child as per standard norms. Before recording the blood pressure, the procedure was fully explained to the child and was made to sit quietly for five minutes. Blood pressure was recorded in sitting position in right arm with cubital fossa at heart level, by auscultatory method using standard mercury sphygmomanometer. The appropriate sized cuff was selected with the bladder width about 40% of the arm circumference at a point midway between olecranon and acromion and the bladder length covering at least 80% to 100% of the circumference of the arm. If cuff is too small, the next larger cuff was used. The first and fifth phases of Korotkoff sounds were taken as indicative of the systolic and diastolic blood pressures respectively. Three measurements were taken at intervals of five minutes each and systolic blood pressure and diastolic blood pressure were categorized. If blood pressure was found higher on first reading it was taken again after half hour and again if higher on second reading BP was taken after one week if after third screening found higher high blood pressure was categorized. The percentile charts based on gender, age and height provided by NHBPEP were used for classification of blood pressure.

RESULTS

A total of 613 students were included between the age group of 10 years- 16 years amongst which 326(53.2%) were male and 287(46.8%) were female .Of these 426(69.5%) were in early adolescent age (10-13 yrs) and 187(30.5%) in mid adolescent age(14-16 yrs).

Table 1: Showing age and sex distribution of the study population

		M	F	Total
Age	10-13 years	232	194	426
		71.2%	67.6%	69.5%
	14-16 years	94	93	187
		28.8%	32.4%	30.5%
Total		326	287	613
		100.0%	100.0%	100.0%

Fig 1: Showing diagrammatic distribution of included children according to age

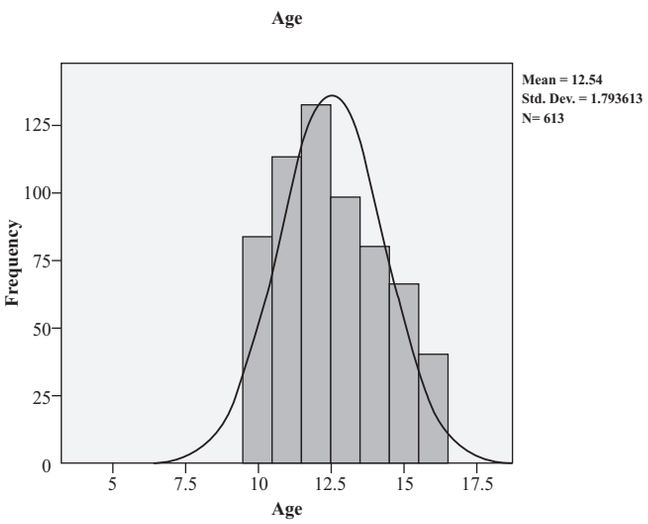

Table 2: Abnormal Blood Pressure Across 3 screenings

	First screening		Second screening		Third screening	
SBP (>90th percentile)	64	10.4%	19	3.1 %	17	2.8 %
DBP (>90th percentile)	27	4.4 %	23	3.8 %	21	3.4 %

The distribution of systolic and diastolic hypertension across three screenings is shown in table 2 .At the end of three screenings 27 cases(4.40%) had abnormal blood pressure. Among these 17 (2.8%) cases had high systolic blood pressure and 21(3.4%) had high diastolic blood pressure of different stages.

Table 3: Different Grades Of High Blood pressure Documented After Third Screenings:

	Frequency	Percent
PSHBP (90-95th percentile)	14	2.3
stage1 HSBP (95-99th percentile)	3	0.5
PDHBP (90-95th percentile)	15	2.4
stage1 HDBP (95-99th percentile)	6	1.0

After third screening taking systolic and diastolic BP separately in the present study population 2.3% had Presystolic High blood pressure (PSHBP), 0.5% had High Systolic Blood Pressure HSBP-(stage1) , 2.4% had Pre Diastolic High Blood Pressure (PDHBP) ,1.0% had High Diastolic Blood Pressure HDBP- (stage1) (table 12)

Taking into account the high systolic and diastolic blood pressure together after third screening 2(0.3%) children had HSBP and HDBP,1(0.2%) had HSBP and PDHBP , 2(0.3%) had PSHBP and PDHBP together and 6 (1.0%) had PSHBP and PDHBP .

Table 4: Blood Pressure after third screening

	Frequency	Percent
HDBP	2	0.3
HSBP and HDBP	2	0.3
HSBP and PDHBP	1	0.2
Normal Pressure	3	0.5
PDHBP	8	1.3
PSHBP	6	1.0
PSHBP and HDBP	2	0.3
PSHBP and PDHBP	6	1.0
Normal	583	95.1
Total	613	100.0

DISCUSSION

A cross sectional prospective study on the prevalence of hypertension of school going childrens of Kathmandu valley aged 10-16 years(early and mid adolescents) was carried out. The study was done in four schools of Kathmandu valley.

Out of 613 students enrolled in our study there were 426(69.5%) children aged 10-13 yrs(early adolescence),and 187(30.5%) childrens aged 14-16 yrs with a male to female ratio of 1.13:1.

Prevalence of Hypertension

The prevalence of hypertension in our study was 4.4%. The prevalence in various other Indian studies ranges from 0.46% to 11.9.Also the prevalence of hypertension in childrens is reported to range from (1-16.2%) taking into consideration various studies across world . This wide difference may be due to different standards used for diagnosis of hypertension. Some studies have adopted fourth phase of Korotkoff sound to define diastolic blood pressure while others have taken fifth korotkoff sound to define diastolic blood pressure. some studies have not taken the height of the children into consideration while grading the BP.Higher prevalence has been reported in some specific parts of the world and country like in Southern India

The distribution of hypertension across three screenings, showed significant reduction in systolic hypertension from 10.4 % in first screening to 2.8% in the third screening and that of diastolic hypertension from 4.4% to 3.4%. Other studies also showed a substantial decrease of BP in children when measures were repeated on different occasions. In a study done in 1979, among 10 641 US children in Dallas, 8.9% children were found to have elevated BP at the first visit. At third visit some days later, only 1.2% had systolic hypertension and 0.4% had diastolic hypertension. In the Muscatine Study, out of 6662 children, 13% had elevated BP at the initial screening visit while less than 1% had persistent elevated BP based on repeated measurements taken on separate occasions. Though diastolic blood pressure is not given much significance in pediatric age group, 3.4% of our school children had diastolic hypertension compared to systolic hypertension of 2.8% after third screening. Diastolic hypertension is also documented in some other studies as well. In one study in USA Blood pressure (BP) data obtained during a BP screening program were analyzed by Sinako AR et al to determine the prevalence of "significant" hypertension among 14,686 black and white children aged 10 to 15 years. They found diastolic hypertension in 3.5% .This study also has

adopted fifth Korotkoff phase to define diastolic blood pressure as our study.

Socio-demographic Risk Factors

There was no age or sex predilection in our study. Some of the studies have found increased prevalence of hypertension in girls, which they attributed to hormonal changes around puberty. However, some studies have found no sex differences in the prevalence of hypertension.

In our study we didn't find any correlation of BP with age. As per Second Task Force report that blood pressure increases with age during the pre-adult years in all study populations. Several others studies have also reported that blood pressure increased with age . Hwang B et al in Department of Pediatrics, Veterans General Hospital-Taipei, Taiwan performed a Triple measurements of blood pressure obtained from infants younger than one year of age at supine position and in a quiet situation and at a sitting position from children older than one year. They found the average blood pressure values (systolic/diastolic/mean) increases with age. This study had sample size of 3937, aged 1 day to 6 yrs, and had used oscillometric electronic device to measure blood pressure. Our study has a smaller sample size, age yrs was limited to 10 to 16 yrs and mercury sphygmomanometer was used as measuring tool for blood pressure. However, some Japanese studies have only found correlations between diastolic blood pressure and age. Like in one study by Nishiyama s et al in Japan found that the strongest correlation for systolic BP (SBP) was weight and for diastolic BP (DBP) it was age. This study included children aged 12 to 17 years had used electronic device for measuring blood pressure, and were followed up for one year of time duration to define high blood pressure.

Anthropometric Risk Factors

This study has shown significant association of height, weight and increased body mass index with hypertension . Obesity in childhood is a well established risk factor for hypertension. Gupta and Ahmad have also reported that prevalence of sustained hypertension in obese children was 20 times more as compared to controls. Andriska *et al.* found that 41% of their hypertensive children were obese. Court *et al.* have concluded that hypertension has significant correlation with severe childhood obesity. Schachter *et al.* evaluated the blood pressure during first five years of life and found only modest association between body size and blood pressure. Schall *et al.* studied black adolescents and reported that high BP among females was associated with greater fatness while in males highest BP correlated with increased muscle mass and decreased fatness. Hypertension in obese children may be due to increased cardiac output, increased blood volume, excessive sodium intake, increased steroid production and alteration in receptors for various pressor substances. Considering the influence of height on BP, various recent BP standards are based on height and age.

In the developed countries like United States and Canada, the rising risk of HTN is in part due to the increasing prevalence of obesity as demonstrated by the following observations in school-aged children

In the previously mentioned report based upon the United States National Health Survey data, the risk of high BP (defined as greater than the 95^{th} percentile) doubled for every one unit of increase in the BMI z-score unit.

A longitudinal adolescent Canadian cohort study among children of grade 7, 9 and 11 demonstrated that the risk of high SBP (defined as greater than the 90^{th} percentile) was more than a two-fold increase in overweight children (defined as a BMI $>85^{th}$ percentile) compared to non-overweight children.

In a 2002 school-based study of 5102 children (mean age 13.5 years), the prevalence of HTN rose with increasing BMI (2 versus 11 percent among those with BMI $\leq 5^{th}$ and $\geq 95^{th}$ percentile, respectively).

Similarly, in a study of predominantly minority 8^{th} grade adolescents, the risk of hypertension increased with rising BMI (6.9 versus 24.6 percent among those with BMI $<85^{th}$ and $\geq 95^{th}$ percentile, respectively).

Relation of HTN with increasing BMI was observed in all age groups including children between two and five years of age.

An increase in the weight-for-length in the first six months of life was associated with higher systolic blood pressure at three years of life, particularly among infants who were thin at birth.

Diet and Life Style Risk Factors

In our study there was no positive correlation between hypertensive children and their dietary habits. It is generally accepted that hypertensive individuals benefit from a dietary increase in fresh vegetables, fresh fruits, fiber and reduction of sodium.[4] Also lower BP has been associated in children and adolescents with an increased intake of potassium, magnesium, folic acid, fiber which are rich in vegetables and fruits.[4]

In one of the study done in Iranian children and adolescents dietary habits had correlations with BP. In their study the frequency of the intake of sweets correlated with both SBP and

DBP, adding salt to food had a direct correlation, and the frequency of the consumption of dairy products had an inverse correlation with SBP. The frequency of vegetable consumption and the use of whole-grain bread had an inverse correlation with DBP. Furthermore, the use of hydrogenated solid fat and the frequency of fast food consumption had raised the probability of high BP in their study.

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