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HYPERTENSION AMONG ADOLESCENT SCHOOL CHILDREN AGED 15-18 YEARS IN AN URBAN GOVERNMENT SCHOOL, KERALA

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ABSTRACT Hypertension among adolescent children is alarming and often tracks to hypertension in adulthood. The present study was conducted to estimate the prevalence and associated factors of hypertension among adolescent school children aged 15-18 years in an urban government scool, Kerala. The blood pressure and anthropometric measurements of 267 students who agreed to participate in the study were examined. The prevalence of hypertension according to the research criteria of the AAP guidelines was found to be 7.98 percent. Elevated blood pressure defined as ≥90th percentile to <95th percentile was present in 8(3.04%) students. Stage 1 hypertension (defined as ≥95th percentile to <95th percentile + 12 mmHg) and stage 2 hypertension (defined as ≥95th percentile + 12 mm Hg) were present in 21(7.98%) of the total students. A statistically significant association was found between BMI and hypertension. The progression of adolescent or childhood hypertension to adulthood is a proven fact. Early detection of hypertension will lead to early intervention and thus there is a need for early identification of hypertension among adolescent children in Kerala.

KEYWORDS : Hypertension, Elevated Blood Pressure, Adolescents, School children

INTRODUCTION

Hypertension is a major long-term health condition and is the leading cause of premature death among adults throughout the world, including both developed and developing countries(Chobanian et al., 2003). Higher Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) are associated with increased risk of Cardio Vascular Disease (CVD) incidence, angina, myocardial infarction, heart failure, stroke, peripheral artery disease and abdominal aortic aneurysm. The hypertension among adolescent children is alarming and is a potential risk factor for hypertension in adulthood. The impact of hypertension in the childhood and adolescent age group is far less appreciated. It is not often perceived as a public health problem(Falkner, 2010). Blood pressure is routinely assessed during physical examination and medical consultation in adults but very seldom in children. Hypertension can have its origin in childhood and can go undetected unless specially looked for during this period. Although the prevalence of hypertension during childhood and adolescents is lower than that seen in adulthood, this condition is not rare in children, thus stressing the importance of evaluating Blood Pressure (BP) (Uddaraju & Ram, 2013).

With globalization bringing more lifestyle changes, adolescents are exposed to multiple risk factors including obesity, unhealthy dietary habits, academic stress, lack of physical activity and unhealthy habits such as smoking and alcoholism, apart from hereditary risk factors(Singh, Maheshwari, Sharma, & Anand, 2006). Early diagnosis of hypertension is an important strategy for the control, effective management and prevention of further complications.

The prevalence of hypertension among children ranges from 5.4% to 19.7% as reported by various studies(Buch et al., 2011; Das, Bhatia, & Sibal, 2017; Falkner, 2010; Urrutia-Rojas et al., 2006). Factors known to affect BP among children include age, sex, family history, race/ethnicity, obesity, and socioeconomic status. Several studies have demonstrated a rise in the mean SBP accompanying increase in age among children. A study reported that children with a SBP > 90th percentile have a tendency to remain in the same percentile over time(Gillman et al., 1993). This tracking phenomenon was highlighted in the systematic review by Chen X et al(Chen & Wang, 2008). Elevated BP in childhood is associated with early markers of cardiovascular abnormalities such as left ventricular hypertrophy (LVH) and atherosclerosis. Hence, there has been an increasing focus on the identification, prevention, and treatment of children and adolescents with sustained hypertension.

Research and generating evidence in this area will help policy makers see if there is a need for addressing this problem effectively in prevention and management of hypertension in children and adolescents. Hence this study was conducted to estimate the prevalence and associated factors of hypertension among adolescent school children studying in the 11th and 12th standard of an urban government school of Thiruvananthapuram city, Kerala.

Methodology

All the students who agreed to participate, studying in the 11th and 12th class of an urban government school Thiruvananthapuram, Kerala were examined. Along with the BP assessment, other basic information was collected from the students. The information included in the dataset were age, date of birth, gender, height, weight, SBP, DBP, smoking and passive smoking status and physical examination results. Data was obtained from physical examination and completion of the questionnaire.

Weight and Height

Children were weighed wearing light clothes and no shoes. Body weight was measured to a nearest of 0.1 kg using a bathroom scale, with sensitivity 0.1. Zero error correction was made after each measurement. Height was recorded in centimeters to the nearest 1/16th of an inch using a portable stadiometer. All measurements were recorded between 8:30 a.m. and 11:00 a.m. Weight and height were converted to metric measurements in order to determine the BMI, which is represented as weight (kg) divided by the square of height (m2). BMI was classified based on the Extended International Obesity Task Force (IOTF) measurement(Cole & Lobstein, 2012). Overweight and obese categories were combined in this study and are described as obese in this paper.

Blood pressure (BP)

BP was measured after the child rested for at least 5 minutes in a sitting position. BP was measured by a paediatrician and a registered nurse using a standardized mercury sphygmomanometer using auscultaory method in the right arm. Systolic blood pressure was measured taking into account the starting of Korotkoff I sound and diastolic blood pressure was measured at the disappearance of the sound (Korotkoff V). If the readings indicated that the BP was elevated or in the range for hypertension (90th or 95th percentile or 95+12 mmHg, respectively, based on normative BP tables that take into account height, age and gender), a second and third reading was taken. Due to the time constraints for those with hypertension in the first measurement, the second and third measurement were repeated on another day.

The AAP standard guideline for measurement of blood pressure was

used for the BP measurement. The classification of BP percentiles for this study was determined using normative tables generated from the AAP guidelines for screening and management of hypertension in children and adolescents BP was measured in the right arm by using standard measurement practices. An appropriately sized cuff was used for accurate BP measurement.

Mean SBP or DBP levels between 90th and 95th percentile for gender age and height is defined as pre hypertension. Elevated bold pressure was taken when average SBP or DBP is more than or equal to the 90th percentile and less than 95th percentile. Stage I hypertension was defined as ≥95th percentile to <95th percentile + 12 mmHg and stage II hypertension was defined as ≥95th percentile + 12 mm Hg. (Flynn et al., 2017).

Statistical Methods

Data analysis was performed using the SPSS statistical package (SPSS for Windows Version 21)(IBM SPSS Version 21, 2012). The prevalence of SBP and DBP ≥ 90th percentile in the study population, as well as the prevalence of isolated SBP or DBP ≥ 90th percentile, were computed.

Results

The study included 267 students from an urban government school of Kerala, which included 166 male (66.2%) and 101 female (37.8%) adolescents. Age group of the students varied from 15 – 18 years with a mean age of 17.12. The height and weight of all children were measured and BMI was calculated. According to the extended IOTF cut-off scores for children up to 18 years, 12.4 percent and 4.1 percent of the students were overweight and obese respectively. More than seven percent of the students reported that they are current smokers or that they ever smoked. About 31 percent of the students reported passive smoking, which is defined as exposure to second-hand tobacco smoke (SHS) from close relatives residing at home or in the neighborhood.

A physical examination of the children was conducted by a paediatrician and it was observed that about two percent had pallor and 19.5 percent had dental caries. In 3.7 percent, thyroid swelling was found during the examination. In 11 students (4.1%) cardiac murmur was present.

Table 1: Description and physical examination findings of the participants

Characteristics	N(%) 267(100%)
Age	
Range	15-18
Mean(SD)	17.12(0.63)
Gender	
Male	166(62.2%)
Female	101(37.8)
Passive smoking	
Yes	85(32%)
No	182(68%)
Smoking	
Smoker	20(7.5%)
Non smoker	247(92.5)
BMI Categories	
Not overweight	223(83.5)
Overweight	33(12.4)
Obese	11(4.1)
Pallor	
Yes	4(1.5)
No	263(98.8)
Thyroid Swelling	
Yes	10(3.7)
No	257(96.3)
Cardiac Murmur	
Yes	11(4.2)
No	256(95.8)
Dental Caries	
Present	52(19.6)
Absent	215(80.4)

Prevalence of elevated blood pressure and hypertension

Among the 267 students 52 had Blood Pressure more than the 90th percentile during the first examination and these 52 students were re-examined using auscultaory method. BP was reassessed on another day and 48 students reappeared for the evaluation on the next day. Two consecutive Blood Pressure measurements were taken and averaged. The averaged blood pressure of 263 adolescent children was further used for analysis. The diagram showing the examination process is shown in figure 1. Among the 48 students who were examined again, it was found that 29 of them had BP levels more than the 90th percentile. The prevalence of hypertension according to the research criteria of the AAP guideline was found to be 11.02 percentage (N= 263). Elevated blood pressure defined as ≥90th percentile to <95th percentile) was present in 3.04 percent of the students. Stage 1 (defined as ≥95th percentile to <95th percentile + 12 mmHg) and stage 2 hypertension (defined as ≥95th percentile + 12 mm Hg) was present in 7.98 percent of the total students.

Table 2: Elevated blood pressure and hypertension among the participants (N= 263)

Blood pressure above 90th percentile	
Yes	29 (11.02)
No	234 (88.9)
Total	263(100)

Table 3: Classification of Hypertension and staging (N= 263)

Category	**N(%)**
Elevated Blood Pressure	8(3.04)
Hypertension	21(7.98)
Stage 1	8(3.04)
Stage 2	13(4.94)
Total	29(11.02)

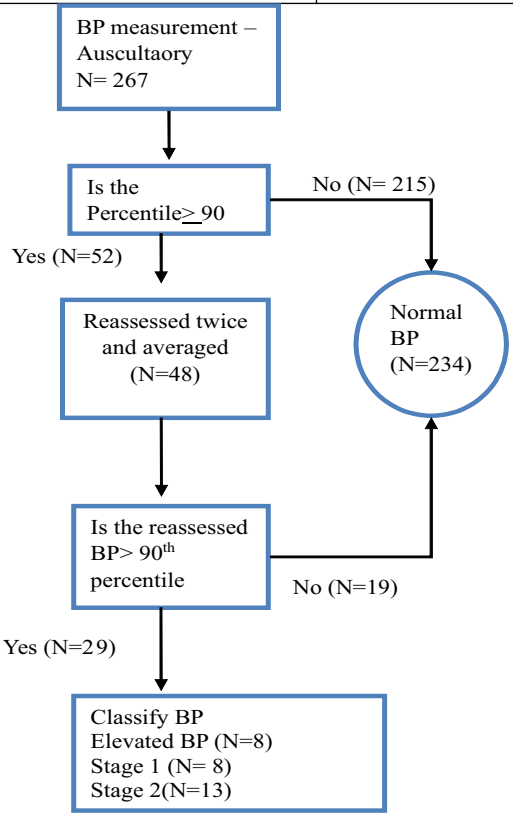

Figure 1 : Flowchart - BP assessment

BMI and Hypertension - For further analysis with hypertension, BMI was classified into two - normal BMI and Overweight. About 22.7 percent of the children with overweight and obesity were having elevated BP/hypertension while only 8.5 percent of the students with normal BMI were having elevated BP/hypertension. This difference was statistically significant with a P value less than 0.05.

Gender – There was no gender difference in the prevalence of elevated BP/Hypertension. About 11 percent of both male and female students had elevated BP/hypertension in the study.

Smoking - About seven percent of the total participants were smokers and 32 percent experienced passive smoking. Smoking and passive smoking were not found to be significantly associated with elevated BP/hypertension in this study.

Knowledge of Hypertension - Only one student among the 29 adolescents who had elevated BP or hypertension was aware about the hypertension status before and that indexed child was in the category of 'elevated blood pressure' category in the study. For all other 28 students, they had never been told by a health care worker or a doctor that they have elevated BP or hypertension.

Table 4: BP more than 90th percentile and associated factors

		Blood pressure N(%)			P Value
		Normal (N=234)	Elevated BP/HTN (N=29)	Total	
BMI	Normal	200(91.3)	19(8.7)	219(100)	0.01
	Over weight	34(77.3)	10(22.7)	44(100)	
Gender	Male	146(89)	18(11)	164(100)	0.57
	Female	88(89.9)	11(11.1)	99(100)	
Smoking	Yes	18(90.0)	2(10.0)	20(100)	0.62
	No	216(88.9)	27(11.1)	243(100)	
Passive Smoking	Present	75(89.3)	9(10.7)	84(100)	0.54
	Absent	158(88.8)	20(11.2)	178(100)	
Knowledge	Yes	0(0)	1(100)	1(100)	0.11
	No	234(89.3)	28(10.7)	262(100)	

Discussion

We determined the prevalence and risk factors for hypertension among school-going adolescents in an urban higher secondary school in Kerala. Overweight and obesity were found to be significant association for the elevated BP/hypertension. The prevalence of hypertension among higher secondary school children aged 15-18 years was 7.98 percent. The prevalence of elevated BP was 3.04 percent. Screening studies for essential hypertension among school-going children in India show a prevalence distribution of 5.4–19.7%(Buch et al., 2011; Das et al., 2017; Falkner, 2010; Urrutia-Rojas et al., 2006). A study reported by Mohan and Kumar in Ludhiana found a high incidence of hypertension in the urban areas, particularly in obese children(Mohan et al., 2004). Another study showed that childhood obesity showed an increasing trend in a short period, and hypertension, was common in overweight children(Raj, 2011).

More than 45% of young adults with high systolic blood pressure had at least one systolic measurement greater than 90th percentile during childhood; 40% of those with elevated diastolic blood pressure also had a history of elevated blood pressure during childhood(Gillman et al., 1993). According to AHA – AAP guideline for childhood hypertension, children three years of age or older should have their blood pressure measured when seen at a medical facility(Flynn et al., 2017).

No gender difference was found in the prevalence of hypertension. But studies indicate an adolescent male predominance in the prevalence of hypertension(Das et al., 2017). Only one child was already aware about their hypertension status in the study. The behavioral risk factors such as smoking and passive smoking are strongly associated with hypertension among adolescents as reported by other studies, but our study could not find any association(Afraa Edrees, 2016).

Conclusion

The observation that 7.98 percent and 3.04 percent of adolescent children studying in the 11th and 12th standard in a school of Thiruvananthapuram city had hypertension and elevated BP respectively shows the high burden of the condition among the population. Only one child among the 29 previously knew their elevated BP/hypertension status. It was surprising that even in a state like Kerala where the public health scenario is well sound, the adolescent hypertension is left unnoticed.

The progression of childhood - adolescent hypertension to adulthood is a proven fact and because of this tracking phenomenon there is a scope for early intervention. Primary prevention strategies especially in case of children with elevated BP and stage 1 and stage 2 hypertension warrants screening of adolescent children attending clinics, community and school settings.

Recommendations

It is recommended that adolescent children from the age of 10 years onwards should have one BP measurement on a yearly basis. Adolescent health card developed and designed by CDC Kerala may be popularized which has got scope for recording various health parameters.

Limitation

The limitation of the study was that it was conducted only in one school in the Thiruvananthapuram city of south Kerala. Hence, the generalization of results to the whole state is not feasible. Also, only a few risk factors for hypertension were studied and the findings of our study suggest the need for larger population-based studies to accurately estimate the prevalence and risk factors for hypertension among children and adolescents in our state.

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