ORIGINAL ARTICLES

Body Mass Index and Waist Hip Ratio a Predictor of Hypertension of Adolescent Boys and Girls in a Metropolitan City in Bangladesh

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Summary:

Background: The associations between elevated blood pressure and overweight increasing now a days. Over the last few decades the prevalence of elevated blood pressure also increased in children due to increasing pediatric overweight because of changing dietary habits, changing pattern of life style.

Objective: To see the body mass index and waist hip ratio a predictor of hypertension of adolescent boys and girls in a metropolitan city in Bangladesh.

Methods and Materials: This cross-sectional– descriptive study was conducted in the department of Pediatrics, Sylhet M.A.G. Osmani Medical College Hospital, Sylhet during the period from January 2014 to June 2014. Adolescent boys and girls in Sylhet Metropolitan City were included according to inclusion and exclusion criteria. Inclusion criteria were children aged 12-16 years in Sylhet Metropolitan City. Children aged under 12 or above 16 years and with any systemic disorder were excluded.

Results: This study showed that 56.4% adolescents were male and 43.6% were female with ratio of male: female = 1.3:1 and their average age was 14±2 yrs. Average height of male was 154.82±49.08 cm and female was 148.42±38.09 cm. Average weight of male was 49.12±10.49 kg and that of female was 44.48±12.08 kg .Prevalence of hypertension in adolescent boys and girls of Sylhet city was 0.70% and there was a significant relationship of hypertension with the obesity. Among 7 (seven) hypertensive children, 3(42.8%) were overweight and 3(42.8%) obese (p=0.001). While waist hip ratio among those, 2(28.6%) were excellent and 5(71.4%) were average; was not significant (p=0.745) among the hypertensive adolescents.

Conclusion: Prevalence of hypertension in apparently healthy adolescent child of Sylhet city was 0.70% and had a strong relationship with high body mass index.

Key words: Hypertension, body mass index, essential hypertension

Introduction:

Elevated blood pressure (BP) contributes to the global disease burden worldwide and accounts for 7 million deaths each year.[1] The prevalence of childhood overweight has increased markedly over the last two decades. Evidence suggests that pediatric hypertension may also have become more prevalent than previously reported[2]. This increase reflects an epidemiologic shift from secondary hypertension (most often caused by renal disease) to primary (i.e essential) hypertension as the main cause of hypertension in the pediatric age range .Primary hypertension.

In children has become increasingly common in association with other cardiovascular risk factors that include overweight, insulin resistance, and dyslipidemia .The association between overweight and hypertension in children has been reported in a variety of ethnic and racial groups, with virtually all studies finding higher blood pressures and/or higher prevalence of hypertension in overweight compared with lean children.[3]

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Various factors are known to influence onset of this essential hypertension in childhood. Factors known to affect blood pressure among children include age, sex, body size, race/ethnicity, obesity, familial aggregation and socioeconomic status.[4] Some studies have shown that obesity defined as body mass index(BMI) of e"95 percentile based on gender and age does not correlate well with body fat distribution as compared with waist circumference (WC) which is more accurate in predicting abdominal girth, thus correlating better with hypertension in children. Approximately 20% of American youth are obese, and up to 10% of obese youth have hypertension.[5]

As blood pressure (BP) in children, tends to track from childhood into adulthood, and prevention and control of elevated blood pressure in children might be an important strategy for limiting the global disease burden due to hypertension.[6] The development of such a strategy, however, requires more evidence for the relation between blood pressure and its associated factors in children of different populations, particularly in a context of a changing epidemic of pediatric obesity.[7]

With globalization bringing more lifestyle modifications, adolescents are exposed to multiple risk factors including obesity and also family history of hypertension.8 Research in this area will help policy makers to see if there is a need for addressing this problem effectively in prevention and management of hypertension in children and adolescents. Early diagnosis of hypertension is an important strategy in its control, which was useful in tracking and effective treatment and to prevent further complications. So the objective of this study was to see the body mass index and waist hip ratio a predictor of hypertension of adolescent boys and girls in a metropolitan city in Bangladesh.

Methods

This cross-sectional - descriptive study was conducted in the Department of Paediatrics, Sylhet M.A.G. Osmani Medical College Hospital, Sylhet from January 2014 to June 2014 after approval of Ethical Committee of Sylhet M.A.G. Osmani Medical College Hospital, Sylhet. Children aged 12-16 years in Sylhet Metropolitan City were selected. Children who were suffering from chronic systemic disorder were excluded from the study. Sample size was 1000 calculated using Cochran's formula[$n=z^2pq/d^2$]considering 1% level of significance, 1% precision level (marginal error).

Eight geo-political wards were selected from 27 wards of Sylhet city corporation by lottery. One secondary school was selected from schools in each of the selected wards by lottery. Then 125 children from each school (25 from each class) were selected by purposive sampling method. Authority of the school (principals or head master) was explained about purpose of the study. They had complete freedom to withdraw themselves from the study at any stage. When they were fully convinced only then written informed consent was taken.

A structured questionnaire was filled up through face to face interview at the beginning of the study. The exact age of children was verified from school records. The blood pressure, height, and weight of each student was measured by the researcher herself. Children those who had positive family history of hypertension, was confirmed by telephonic interview of parents. Students, those who had systemic illness (such as Acute glomerulonephritis, Nephrotic syndrome) were excluded by details history and thorough physical examination.

It was taken at morning before the starting of school. At a time 10 students was taken to a room and was allowed to sit for 10 minutes. Meanwhile, in order to make them relaxed the purpose and procedure of the study was explained to them. Weight of students was measured sensitive to 0.1 kg after removing shoes but not removing the uniform (due to privacy problem) by bathroom scale and height sensitive to 0.1 cm by height scale. Hip (start at one hip and wrap the tape around the other hip and back to where started) and waist circumference (start at the top of hip bone, then bring the tape measured all the way around body) was measured using flexible measuring tape. Body mass index and waist-hip ratio was calculated.

After that blood pressure was recorded one by one. The resting pulse rate (PR), Systolic blood pressure (SBP) and Diastolic blood pressure (DBP) was measured by mercury sphygmomanometer using the same machine throughout the study. Age appropriate cuff covering 2/3rd of the length of the arm was measured in right arm, in sitting posture with a back rest, with cubital fossae at the level of heart. The bladder

of the cuff was inflated to about 200 mm Hg level, then it was deflated slowly at a rate of 1 mm per second. Systolic blood pressure was measured at the level of first appearance of sound (Korotkoff phase 1) and diastolic blood pressure was measured at the level of muffling of sound (Korotkoff phase V). Readings was taken for three times at an interval of one minutes. All these three readings was recorded and their average was considered as the blood pressure of that child at that time. Children whose blood pressure was found above 95th percentile for age and sex was measured for the second time after two weeks. Children whose blood pressure was again found above 95th centile was measured for the third time after two weeks. Those children having blood pressure above 95th percentile on three occasions was identified to have hypertension. Weight of students was measured sensitive to 0.1 kg after removing shoes and school uniforms by bathroom scale and height sensitive to 0.1 cm by height scale. Hip and waist circumference was measured using measuring tape. Body mass index was measured by weight in kg divided by height in m^2 and waist-hip ratio was calculated.

Those who was identified to have hypertension, was referred to hospital for further evaluation to find out the cause of hypertension, either primary or secondary and risk factors by details history, thorough physical examination and laboratory investigation (Random blood sugar, Lipid profile, Serum creatinine, Chest X-ray, Electrocardiogram, Echocardiogram, Ultraso-nography of whole abdomen and Urine R/M/E).

Relevant data was recorded in predesigned questionnaire. Data was processed manually and analyzed with the help of SPSS (Statistical package for social sciences) Version 21.0. Quantitative data was expressed as mean and standard deviation. Qualitative data was expressed as frequency and percentage.

Results:
During the study period total 1000 adolescents were enrolled in this study. 56.4% respondents were male and 43.6% were female with ratio of male: female = 1.3:1 and their average age was 14±2 yrs. Average height of male was 154.82±49.08 cm and female 148.42±38.09 cm. Average weight of male was 49.12±10.49 kg and that of

female was 44.48± 12.08 kg.(Table-I). Table II shows 32.3% were underweight, 56.9% were normal weight, 8.7% were overweight and 2.1% obese. Among the respondents hip circumference in male was 72.67 cm and in female was 78.70 cm. Average waist circumference of male was 67.70 cm and that of female was 68.86 cm.(Table-III). Table IV shows maximum (59.2%) respondents had average waist hip ratio of 0.90-0.95, among them male female ratio was 1.5:1, followed by 36.8% had <0.85 waist hip ratio and only 4% had >0.95 waist hip ratio.

Table-I

Baseline characteristics of the study populations (N=1000)

Characteristics	Frequency	Percent	Mean± SD
Sex	Male -564		
	Female -436		
Age(years)	Male		14±2
	Female		
Height(cm)	Male		154.82±49.08
	Female		148.42±38.09
Weight(kg)	Male		49.12±10.49
	Female		44.48±12.08
Total	1000	100	

Table-II

Body Mass Index of the study populations (N= 1000)

BMI	Sex	Frequency	Percent
Underweight	Male - 179		
(<18.5)	Female - 144	323	32.3
Normal	Male- 323		
(18.5-24.99)	Female- 246	569	56.9
Overweight	Male- 49		
(25-29.99)	Female- 38	87	8.7
Obese	Male- 13		
(≥30)	Female- 8	21	2.1
Total		1000	100

Table-III

Hip and waist circumference of the study populations (N= 1000)

Parameter	Sex	Frequency	Mean±SD
Hip circumference	Male	564	72.67±14.4078.70±14.20
	Female	436	
Normal(18.5-24.99)	Male	564	67.70±13.4368.86±12.46
	Female	436	
Total		1000	

Table IV

Waist hip ratio of the study populations (N= 1000)

Waist hip ratio	Sex	Frequency	Percent	Mean±SD
<0.85(Excellent)	Male -164 Female-204	368	36.8	
0.85-0.89(Good)	Male-0 Female-0	00	00	0.86±0.06
0.90-0.95(Average)	Male-372 Female-220	592	59.2	
>0.95(At risk)	Male-28 Female-12	40	4.0	
Total		1000	100	

Table V

Prevalence of hypertension (N= 1000)

Hypertension	Frequency	Percent
Yes	7	0.7
No	993	99.3
Total	1000	100.0

This study showed that prevalence of hypertension among the study population 0.7. It was observed that those who were overweight and obese , were at risk of hypertension. The difference was statistically significant (P=0.001). (Table VI). Among the hypertensive adolescents there was no significant association found between hypertension and waist hip ratio (P>0.05)(Table-VII).

Table VI

Association between hypertension and Body Mass Index (N=7)

BMI	Hypertension				P value
	Yes		No		
	Frequency	Percent	Frequency	Percent	
Underweight	0	0	323	32.5	
Normal	1	14.4	566	57.0	
Overweight	3	42.8	84	8.5	0.001
Obese	3	42.8	20	2.0	
Total	7	100	993	100	

Table VII

Association between hypertension and waist hip ratio (N=7)

Waist hip ratio	Hypertension				P value
	Yes		No		
	Frequency	Percent	Frequency	Percent	
<0.85(Excellent)	2	28.6	366	36.9	
0.85-0.89(Good)	0	00	0	00	
0.90-0.95 (Average)	5	71.4	587	59	0.745
>0.95(At risks)	0	00	40	4.0	
Total	7	100	993	100	

Discussion

Hypertension is a disease with a high morbidity and mortality. A silent threat to the health of people all over the world is hypertension. It is suggested that hypertension has its origin in childhood but goes undetected unless not followed up carefully during this period. Early identification of children at risk for hypertension, proper evaluation and appropriate management are important to prevent the serious and long term complications associated with the condition. The present study was undertaken to see the predictability of BMI and west hip ratio of hypertension.

Prevalence of hypertension in this study population was 0.7%.[9] Kumar CK found that prevalence of hypertension is 2% to 5%.[9] There was no age or sex predilection in this study. In a similar study, Suphi et al.[10] found no sex differences in the prevalence of hypertension but average blood pressure values (systolic/diastolic/mean) increases with age.

There was an overwhelming evidence in this study that the prevalence of hypertension was high among obese individuals (p=0.001), which is highly significant. Jonathan et al.[11] also found obesity and overweight a major risk factors for hypertension. Hall JE [12] also showed similar finding that chronic obesity also causes marked structural changes in the kidneys that eventually leads to a loss of nephron function, further increasing the arterial pressure.

This study results also coincides with an Indian study done by Goel R et al.[13] in Delhi among school children, published in 2010. Anand et al.[14] also found that compared to their normal counterparts, prevalence of hypertension was 15 times more in obese children. Sorof et al.[15] also showed more prevalence of hypertension in obese children as compared to non-obese (33% vs11%).In this study, among 1000 respondents, 32.3% were underweight, 56.9% were normal weight, 8.7% were overweight and 2.1% obese .Prevalence of hypertension was high among obese individuals (p=0.001), which is highly significant. This also confirms results of done by Jonathan et al.[11] Sorof et al.[15] also showed more prevalence of hypertension in obese children as compared to non-obese (33% vs 11%).

This study found average hip circumference was 78.70 cm and average waist circumference was 67.70 cm. Waist hip ratio of maximum respondents (59.2%) were 0.90-0.95, 36.8% were <0.85 and only 4% were at risk that means, >0.95. So, statistically this study could not find any significant association between waist hip ratio and hypertension though there is strong evidence in this study that obesity and overweight among males with waist-hip ratio more than normal is highly significant for higher prevalence of adolescent hypertension. This results agrees with similar finding of Goel R et al.13done in Delhi.

This study shows all positive hypertension respondents had normal ultrasonography, chest x-ray and echocardiogram. Electrocardiogram has shown 85.7% were normal and 14.3% were found left ventricular hyperplasia. Urine R/M/E of all respondents were normal. Regarding lipid profile, cholesterol mean±SD was 171.00±38.78, TG mean±SD was 92.28±30.72, HDL mean±SD was 52.71±22.05 and LDL mean±SD was 86.00±13.84. Serum creatinine level was 0.83±0.15 and

random blood sugar level was 8.43±2.05. Thus, investigations of these hypertensive children failed to document any underlying cause. Similar opinion is experienced by Londe S et al[16]. This study indicated that association between abnormal lipid profile and hypertension in children were not statistically significant.

Conclusion:

A group of adolescence aging 12-16 years in metropolitan city was studied to see prevalence of hypertension. Their waist hip ratio and body mass index (BMI) was determined and correlated with the prevalence of Hypertension. Prevalence of hypertension in apparently healthy adolescent child of Sylhet city was 0.70% and had a strong relationship with high body mass index.

Limitations of the study

• This study was conducted in only Sylhet city and may not reflect exact situation of rural area of Sylhet.

• This was a cross-sectional and descriptive study with small sample size.

• All measurements were made by single observer.

Recommendations

These asymptomatic children with essential hypertension may become adult symptomatic patients. So, blood pressure should be measured for all children during routine school health checkup.

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