



The Association of Obesity and Blood Pressure in Children Studying in Schools in a Rural Area

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ABSTRACT

Background: *Childhood obesity and hypertension are major problems worldwide. Obesity is the leading cause of hypertension and hence preventing obesity has a good impact on controlling hypertension. Thus it is important to find any association between obesity and blood pressure in adolescent children which in turn can help in the identification of those at risk.*

Objective: *To study the association of Body Mass Index (BMI) and Waist-Hip Ratio (WHR), with Blood Pressure of children.*

Methodology: *The study covered 187 school children of 13-15 years age from a rural area. Height, weight, waist circumference, hip circumference and two recordings of systolic and diastolic blood pressure of each child were recorded. Body mass index, waist-hip ratio and mean blood pressure were calculated. The data were collated and analyzed using chi-square test.*

Results: *The study population of 187 had a higher proportion of boys (60.4%). 36.4% of children with a higher BMI were found to be hypertensive as compared to 19.4% and 23.6% children with low and normal BMI respectively. Hypertension was found in 27.8% of those children with a waist-hip ratio on the obese side.*

Conclusion: *The study revealed a positive association between obesity and blood pressure in adolescent children. Overweight children, according to both body mass index and waist-hip ratio were found to have a higher blood pressure than the other children.*

Keywords: *Childhood obesity, overweight, hypertension, body mass index, waist hip ratio.*

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. Primary hypertension arises from a complex interplay of genetic, environmental and behavioral factors ^[1]. It is now established that hypertension is now detectable in children and adolescents and is not uncommon ^[2]. Population changes in health-related behaviors, including the childhood obesity epidemic, indicate that the rates of hypertension in the young are increasing ^[3]. The prevalence of prehypertension and hypertension in children is 2.8% and 2.4% ^[4]. High levels of blood pressure in this age are predictors of hypertension in young adults, a phenomenon known as tracking ^[5]. Blood pressure is regulated by activity in the autonomic nervous system ^[2]. Hypertension in children, regardless of etiology results in significant end-organ damage, which in turn may lead to significant cardiovascular morbidity and mortality. So an early diagnosis and proper management of childhood hypertension may therefore prevent hypertension related complications in adulthood ^[6]. The prevalence of childhood obesity has also increased dramatically over the past few years the world over. Both genetic and environmental factors play a role in the development of obesity ^[7]. Obesity is measured by Body Mass Index (BMI). BMI is calculated by dividing weight in kilograms by square of height in meters ^[8]. Obesity is defined as BMI equal to or greater than 95th percentile for age and sex. Children with a

BMI between 85th and 95th are defined as overweight ^[9]. According to WHO, waist-hip ratio can also be used as a tool to measure obesity ^[10]. The International Obesity And Task Force (IOTF); World Health Organization (WHO) estimates the prevalence of overweight (including obesity) aged 5-17 years as 10%. In India, overweight and obesity has been recently on the rise and is present in 20.6% of boys and 18.3% of girls ^[11].

Obesity is associated with sympathetic activation and is the leading risk factor for development of hypertension. Many of the outcomes associated with obesity that was previously thought of as diseases of adults are now affecting children ^[12]. Thus it is important to increase awareness that obesity is related to hypertension in childhood and hence enable children to eat healthy and maintain their body weight. Thus, the question that this study addresses is, "Is there any association between obesity and blood pressure in school-going adolescents from a rural area?"

MATERIALS AND METHODS

The study was a descriptive cross sectional study conducted among 187 children between the ages of 13 to 15 years studying in a high school located in a rural area of South India.

Inclusion Criteria: All school-going children of 13-15 years whose parents gave the informed consent.

Exclusion Criteria

1. Children having any acute illness.

2. Present or past history suggestive of cardiovascular, respiratory or any other systemic illness.

3. Children with any disability.

Study Procedure

Demographic data of the children were collected. Height, weight, hip circumference, waist circumference and both systolic and diastolic blood pressure, two recordings each at an interval of 15 minutes, were recorded. Body Mass Index, Waist-Hip Ratio and mean blood pressure were calculated. The percentiles of Body Mass Index and Blood pressure were determined for the age and sex of each child using a CDC growth chart. The study population was divided into three groups: Underweight, Normal and Overweight, according to BMI and into obese and non-obese according to WHR. The data were then entered into Microsoft excel spreadsheet. Pearson 's Chi-square test was performed using statistical program for social sciences (SPSS) software to find any association between BMI, WHR and Blood pressure.

Ethical Considerations

The study was approved by the institutional review board of my institution. Permission to conduct the study was obtained from the school authorities. Informed consent was obtained from the parents.

RESULTS

This study involved 187 school going children of age group between 13-15 years. The study population had a higher proportion of boys.

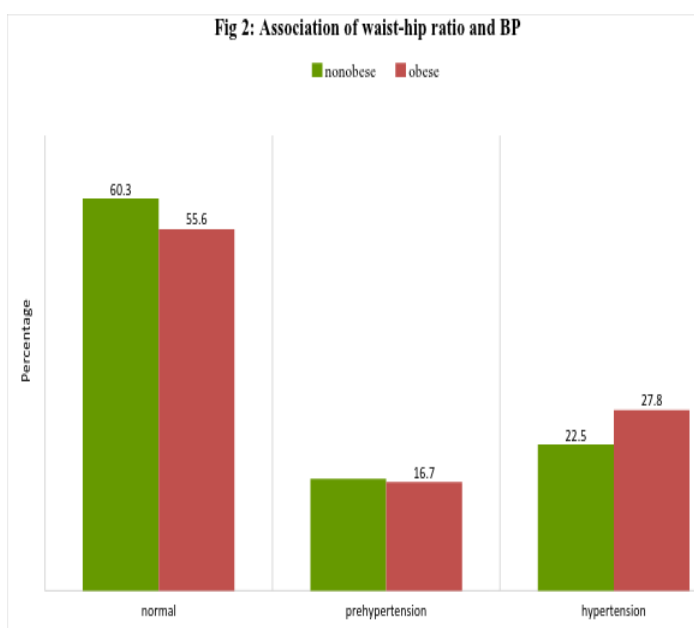
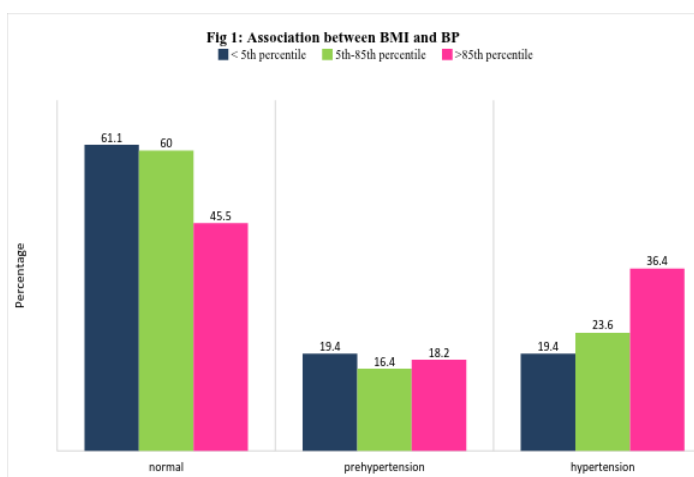
Majority of the children were 13 years old. Table 1 shows the baseline data of the study population.

Table 1: Baseline data of study population

Variables	Number (n)	Percentage (%)
Gender		
Male	113	60.4
Female	74	39.6
Age		
13 years	82	43.9
14 years	64	34.2
15 years	41	21.9
Body Mass Index		
Underweight	36	19.3
Normal	140	74.9
Overweight	11	5.9
Waist- hip ratio		
Non-obese	151	80.7
Obese	36	19.3
Systolic Blood Pressure		
Normal	139	74.3
Prehypertension	24	12.8
Hypertension	24	12.8
Diastolic Blood Pressure		
Normal	135	72.2
Prehypertension	19	10.2
Hypertension	33	17.6

Fig 1 shows that 45.5% children with BMI above 85th percentile had normal BP whereas only 36.4% children with BMI above 85th percentile were hypertensive. Also 19.4% children with BMI <5th centile were hypertensive. The p value of 0.814 obtained from the Chi square test suggests that obesity has no significant relation with BP.

Fig 2 demonstrates the relation between waist-hip ratio and blood pressure. 55.6% obese children had normal BP whereas only 27.8% obese children were hypertensive. Also 22.5% of non-obese children were hypertensive. The p value 0.796 again suggests that obesity has no significant association with BP.



DISCUSSION

Our study to assess the association of obesity and blood pressure in school going children of a rural area was conducted on 187 children of age group between 13-15 years. Most of the similar studies conducted earlier were on a larger population. Verma et.al 1994 evaluated the prevalence of hypertension on 2560 healthy school going children between 5-15 years of age [13]. However Robinson et.al, studied the body mass index in primary and secondary hypertension in 314 children [14].

Of the 187 children in our study, 60% were boys and 40% were girls. Similarly Lu et.al, 2013 studied on 78114 children, of which 40,105 were boys and 38,009 were girls [15]. But Tu et.al, 2011 studied the intensified effect of adiposity on blood pressure in overweight and obese children on 9102 children of which 50% were boys and 50% girls [16].

Most of the children in our study had BMI between 5th-85th centile. Only 5.3% and 0.6% children were overweight and obese respectively. But according to waist-hip ratio, 19% children were obese and 81% were non-obese. In the study conducted by Ashleigh et.al, 2012, 66% children had normal BMI and 16% were obese [17]. But in the study conducted by Lu et.al, 2013 to assess the prevalence of hypertension in overweight and obese children in Shanghai, only 9.4% children were obese [15]. The prevalence of overweight and obesity was 5.5% and 3% respectively in the study by Rahman et.al, 2013 to study the prevalence of hypertension in healthy school children in Pakistan [18].

17.6% and 12.8% children in our study had diastolic and systolic BP >95th centile respectively. Similarly, Steinhorsdottir et.al, 2011 in a study to find the prevalence of hypertension in 9-10 year old Icelandic school children showed the prevalence of hypertension to be 13.1% [19]. But in the study conducted by Baradol et.al, 2014 to study the prevalence of overweight, obesity and hypertension amongst school children and adolescent in Northern Karnataka, the prevalence of hypertension was 1.2% [20].

As per our study the association between obesity and hypertension is statistically insignificant. 45.5% children with BMI above 85th centile had normal BP whereas only 36.4% children with BMI above 85th centile were hypertensive. 27.8% with a waist-hip ratio on obese side were also found to be hypertensive. Rahman et.al, 2013 also in his study showed that most (14%) of the pre-hypertensive children had normal BMI and among children with obesity, 37.5% children were pre-hypertensive and 12.5% were hypertensive. But other studies have found the association between obesity and hypertension to be statistically significant ^[18]. Lu et.al, 2013 found overweight and obesity to be associated with hypertension in his study on the prevalence of hypertension in overweight and obese children from a large school based population in Shanghai ^[15].

Another important finding in our study was that a large number of children with normal BMI also had high values of BP. This is similar to the results observed by Rahman AJ et.al ^[18]. These findings suggest that obesity may not be the sole cause of hypertension in children. Hence other factors that may contribute to the problem should be investigated to ensure an effective prevention of hypertension in children.

The limitation of this study is that measurements of BP was performed on a single occasion. Ideally, the BP should be recorded on three separate occasions; this could have a deviation from real estimation of the true prevalence.

CONCLUSION

The present study to find an association between obesity and blood pressure in school going children aged 13-15 years showed that blood pressure was higher in overweight children, according to both BMI and WHR, than others. But this was not found to be statistically significant. This suggests that children should be advised about healthy eating practices and the importance of maintaining an ideal body weight.

It was also found that there are a large number of children within the normal BMI who are hypertensive. This suggests that children can be hypertensive even though their body weight is normal. Hence, BP measurement should not be restricted to overweight and obese children.

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REFERENCES

1. Chobanian AV, Bakris GL, Black HR, Cushman WC, Green LA, Izzo JL Jr. The seventh report of the joint national committee on prevention, detection, evaluation, and treatment of high blood

- pressure, JNC 7 Report: JAMA 2003; 289:2560–2572.
2. National High Blood Pressure Education Program. Working Group on High Blood Pressure in Children and Adolescents. The fourth report on the diagnosis, evaluation, and treatment of high blood pressure in children and adolescents; Indian Pediatrics.2004;114; 555-576.
 3. Munter P, He J, Cutler JA, Wildman RP, Whelton PK. Trends in blood pressure among children and adolescents, JAMA 2009; 291;2107–2113.
 4. Narayanappa D, Rajani HS, Mahendrappa KB, Ravikumar VG. Prevalence of prehypertension and hypertension in urban and rural school going children;Indian Pediatrics 2012; 49: 755-756.
 5. Maria GBDS, Ivan RR, Maria AMDA, Antonio CCC. Relationship of obesity with high blood pressure in children and adolescent; Arq.Bras.Cardiol 2010;94: 110-113.
 6. Feber J, Ahmed M. Hypertension in children: new trends and challenges;Clinical Science 2010: 119; 151-161.
 7. Lifshitz F. Obesity in children; J Clin Res Pediatr Endocrinol 2008; 1(2):53-60.
 8. W. Philip T.James et al ; Overweight and obesity (high body mass index) ; In:Comparative quantification of health risks; 498-596.
 9. National obesity observatory. A simple guide to classifying body mass index in children, June 2011 ;1-9.
 10. World health organization. Waist circumference and waist–hip ratio: Report of a WHO expert consultation Geneva, 8–11 December 2008; pg 1-34.
 11. Gedam DS. Childhood obesity - challenges in the indian scenario 2013a
 12. Gundongdu Z.; Relationship between BMI and blood pressure in boys and girls; Public Health Nutrition 2008: 11(10); 1085-1088.
 13. Verma M, Chhatwal J, George SM. Obesity and hypertension in children. Indian Pediatrics 1994; 31: 1065-1069.
 14. Robinson RF, Batsky DL, Hayes JR, Nahata MC, Mahan JD. Body mass index in primary and secondary pediatric hypertension. Pediatric Nephrology 2004; 19(12): 1379-1384.
 15. Lu X, Shi P, Luo CY, Zhou YF, Yu HT, Guo CY. Prevalence of hypertension in overweight and obese children from a large school based population in Shanghai. China. BMC Public Health 2013; 13:24.
 16. Tu W, Eckert GJ, Dimeglio LA, Yu Z, Jung J, Pratt JH. Intensified effect of adiposity on blood pressure in overweight and obese children. Hypertension 2011; 58(5): 818-824.
 17. Ashleigh L, Kuklina EV, Yoon PW. Prevalence of cardiovascular risk factors among US adolescents , 1998-2008. Pediatrics 2011

18. Rahman AJ, Qamar FN, Ashraf S, Khowaja ZA, Tariq SB, Naeem H. Prevalence of hypertension in healthy school children in Pakistan and its relationship with body mass index, proteinuria and hematuria. Saudi Journal Of Kidney Diseases And Transplantation 2013; 24(2): 408-412.
19. Steinhorsdottir SD, Eliasdottir SB, Indridason OS, Agustsdottir IM, Palsson R, Edvardsson VO. Prevalence of hypertension in 9-10 year old Icelandic school children. J Clin Hypertens (Greenwich) 2011; 13(10): 774-779.
20. Baradol RV, Patil SV, Ranagol A. Prevalence of overweight, obesity and hypertension amongst school children and adolescents in North Karnataka: A cross sectional study. Int J Med Public Health 2014;4:260-264.