

Research Article

Prevalence of hypertension and its association with obesity among school children of Pune city, Maharashtra, India: a cross sectional study

Swati Ghonge¹, Hemant S. Patel², Shaileshkumar K. Nagar³, Nilesh Thakor^{4*}

¹Department of Community Medicine, Dr D. Y. Patil Medical College, Pimpri, Pune, Maharashtra, India

²Department of Paediatrics, Mohanlal Dayal Hospital, Killa Pardi, Valsad, Gujarat, India

³Dean, ⁴Department of Community Medicine, GMERS Medical College, Dharpur, Patan, Gujarat 38426, India

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*Correspondence:

Dr. Nilesh Thakor,

E-mail: drnileshthakor@yahoo.co.in

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ABSTRACT

Background: There are numerous psychological, physical and economic consequences of obesity. Conditions such as type 2 diabetes mellitus, hypertension and hypercholesterolemia, which were noted primarily in adults, are becoming more common among children with the increase in the prevalence of obesity. The objective of the study was to find out prevalence of hypertension and its association with obesity among school children.

Methods: The present cross sectional study was undertaken during July 2009 to April 2011 in randomly selected 4 schools of Pune city. Total 1281 children between the age group of 10 to 15 years were examined after taking written informed consent of their parents using pre-designed, pre-tested, semi-structured performa. Anthropometric measurements were taken and BMI were calculated. The prevalence of overweight and obesity were determined based on the IOTF (International Obesity Task Force) criteria. Blood pressure was measured in the left arm to the nearest 1 mmHg using an electronic machine (Omron Corporation Tokyo, Japan), with the participant seated in a relaxed position. Thus collected data was analyzed using Microsoft Excel and Open- Epi Software. (Version 2.3)

Results: Out of 1281 children, 54.09% were males. Overall prevalence of obesity and overweight was 5.62% and 9.99% respectively. Overall, amongst 200 obese and overweight children identified, prevalence of hypertension was 6% and that of pre hypertension was 4.5% as compared to 1.25% and 1.5% ,respectively among the normal weight children. Mean MAC (Mid Upper Arm Circumference) of obese and overweight was 24.8 cm and that of Normal weight children, was 19.1cm with standard deviations of 2.8 and 2.4 cm, respectively. Average Waist-Hip ratio of obese and overweight was 0.87 and that of normal weight children, was 0.80. Mean SBP (Systolic Blood Pressure) of obese and overweight was 111 mm Hg and that of normal weight children was 107 mm of Hg. Mean DBP (Diastolic Blood Pressure) of obese and overweight was 73 mm of Hg and that of normal weight was 69 mm of Hg.

Conclusions: Anthropometric measurements like Waist Hip Ratio, MAC and mean SBP and DBP among obese and overweight group of children were significantly higher as compared to normal weight group of children.

Keywords: Prevalence, Hypertension, Pre Hypertension, Obesity, Overweight, School children

INTRODUCTION

Obesity is associated with an increased risk of morbidity and mortality as well as reduced life expectancy. The last two decade of previous century have witnessed dramatic increase in health care cost

due to obesity and related issues among children and adolescents.¹ Childhood obesity affects both developed and developing countries of all socio-economic groups, irrespective of age, sex or ethnicity. The prevalence of obesity is increasing worldwide in almost every country in all the age groups. The steep increase has prompted this development to be called

an epidemic and because it is worldwide, a pandemic.²

It has been estimated that worldwide over 22 million children under the age of 5 are obese, and one in 10 children is overweight.³ Globally the prevalence of childhood obesity varies from over 30% in USA to less than 2% in Sub-Saharan Africa. Currently the prevalence of obese school children is 20% in UK and Australia, 15.8% in Saudi Arabia, 15.6% in Thailand, 10% in Japan and 7.8% in Iran.⁴ In China, the prevalence of obesity among children aged 7-9 years increased from 1-2 percent in 1985 to 17 percent among girls and 25% among boys in 2000.⁵ In addition, obesity prevalence varies across socio-economic strata. In developed countries, children of low socio-economic status are most affected than their affluent counterparts. The opposite is observed in developing countries: children of upper socio-economic strata are more likely than poor children to be obese.⁶

Indian data regarding current trends in childhood obesity are emerging. Available studies of Delhi and Chennai has shown the prevalence of 7.4% and 6.2% respectively.^{7,8} A study conducted among adolescent school children in South Karnataka has shown the prevalence of overweight and obesity to be 9.9% and 4.8% respectively.⁹ Aetiopathogenesis of childhood obesity is multifactorial. Interactions between genetic, neuroendocrine, metabolic, psychological, environmental and socio-cultural factors are clearly evident in childhood obesity.¹⁰ There are numerous psychological, physical and economic consequences of obesity. Childhood obesity affects self-esteem and has negative consequences on the cognitive and social development. Conditions such as type 2 diabetes mellitus, hypertension and hypercholesterolemia, which were noted primarily in adults, are becoming more common among children with the increase in the prevalence of obesity. Childhood obesity itself is a predictor of adult obesity and of higher than expected adult morbidity and mortality. Due to difficulty in the treatment of obesity in adults and the many long-term adverse effects of childhood obesity, prevention of childhood obesity has now been recognized as a public health priority. With this background in mind, the present study was undertaken to find out prevalence of hypertension and its association with obesity among school children of Pune city.

METHODS

The present study was a cross sectional study undertaken in 4 schools, which were selected randomly from list of all schools in Pune city during July 2009 to April 2011. All children between the age group of 10 to 15 were included after written informed consent of their parents. The sample size was calculated based on

an estimated prevalence of obesity of 8% by pilot study, with 80% power, 95% confidence and 5% level of significance with an allowable error of 20% to obtain an age - and gender-specific representative sample of children. 1150 school going children of age group 10 to 15 years was the calculated sample size of the study but since all the children, studying in class 5th to 10th, of the selected schools, belonging to the 10 to 15 year age group were included in the study population, the final sample size was 1281 children. These children were examined and interviewed using pre-designed, pre-tested, semi-structured performa. Height was measured in centimeters (cm) using a stadiometer. Weight was measured in kilograms (Kg) using a standardized weighing machine. Body mass index (BMI) was calculated using the formula weight (Kg) divided by height in square meters. Waist circumference was measured in centimeters using a non-stretchable fiber measuring tape. The prevalence of overweight and obesity were determined based on the IOTF (International Obesity Task Force) criteria. Blood pressure was measured in the left arm to the nearest 1 mmHg using an electronic machine (Omron Corporation Tokyo, Japan), with the participant seated in a relaxed position. Hypertension was diagnosed if blood pressure was more than 95th percentile for the age. Thus collected data was analyzed using Microsoft Excel and Open- Epi Software (Version 2.3).

RESULTS

Out of 1281 children males were 54.09% and females were 45.9%. Overall, the total number of obese children identified in whole study population was 72 (5.62%) and number of overweight children were 128 (9.99%). Overall prevalence of obesity was more among female population (6.8%) as compared to that in males (4.62%). Though the prevalence of overweight was more among males (10.25%). Different categories of BMI and gender of the children were not significantly associated (Table 1).

Table 1: Gender wise distribution of children according their BMI category.

Sex	Obese		Over weight		Normal		Total	
	No.	%	No.	%	No.	%	No.	%
Male	32	4.62	71	10.25	590	85.14	693	100
Female	40	6.8	57	9.69	491	83.50	588	100
Total	72	5.62	128	9.99	1081	84.38	1281	100

χ^2 value=0.6444, D.F. =1, p=0.4221

Out of 72 obese children, 8(11.11%) had hypertension whereas 3 (4.16%) had pre hypertension. Out of 128 overweight children identified, 4(3.12%) had

hypertension and 6(4.68%) had pre hypertension. Out of 400 normal weight children examined for blood pressure, 5(1.25%) had hypertension and 6(1.5%) had pre hypertension. Overall, amongst 200 obese and overweight children identified, prevalence of hypertension was 6% and that of pre hypertension was 4.5% as compared to 1.25% and 1.5% ,respectively among the normal weight children. Obese and overweight children had significantly higher blood pressure and 4.149 times higher chances of getting elevated blood pressure (Hypertension and Pre hypertension) as compared to normal weight children (Table 2).

Mean MAC (Mid Upper Arm Circumference) of obese and overweight was 24.8 cm and that of Normal weight

children, was 19.1cm with standard deviations of 2.8 and 2.4 cm, respectively. Average Waist-Hip ratio of Obese and Overweight was 0.87 and that of normal weight children, was 0.80. Mean SBP (Systolic Blood Pressure) of Obese and Overweight was 111 mm Hg and that of normal weight children was 107 mm of Hg. Mean DBP (Diastolic Blood Pressure) of Obese and Overweight was 73 mm of Hg and that of normal weight was 69 mm of Hg. Standard Error of Difference between two means applied between all the measurements of the two groups of children was found to be significant(p=0.0000), indicating that all the measurements were significantly higher in Obese and Overweight children as compared to normal weight children (Table 3).

Table 2: Prevalence of hypertension in obese and overweight children and comparison with normal weight children.

BMI Status	Hypertension		Pre hypertension		Normal Blood Pressure		Total children examined for blood pressure	
	Number	%	Number	%	Number	%	Number	%
Obese	8	11.11	3	4.16	61	84.72	72	100
Overweight	4	3.12	6	4.68	118	92.18	128	100
Normal	5	1.25	6	1.5	389	97.25	400	100
Total	17	2.83	15	2.5	568	94.66	600	100

X²=15.86, D.F.= 1, p=0.0001, Odds Ratio=4.149, CI=1.959-8.788

Table 3: Comparison of anthropometric measurement and blood pressure measurement according to BMI category.

Measurement (Mean± Standard Deviation)	Obese and Overweight	Normal	t	p value
MAC (Mid Arm Circumference)cm	24.8±2.8	19.1±2.4	29.07	.0000
Waist-Hip Ratio	0.87±.05	0.80±.04	21.80	.0000
SBP (Systolic Blood Pressure)mm Hg	111±9.8	107±8.2	5.55	.0000
DBP (Diastolic Blood Pressure)	73±8.5	69.7±8.4	5.69	.0000

DISCUSSION

In our study overall prevalence of obesity and overweight was 5.62% and 9.99% respectively. Similar prevalence of obesity and overweight in school children were found in studies done by Kapil et al,⁷ Kotian et al,⁹ Premnath et al,¹¹ and Kadilkar et al.¹²

In our study, amongst 200 obese and overweight children identified, prevalence of hypertension was

6% and that of pre hypertension was 4.5% ,as compared to 1.25% and 1.5% in normal weight children. The results are comparable to the study done by Rao et al¹³ in 2223 overweight children of 9 to 16 years age group in Pune, which showed that the prevalence of hypertension was 9.7%. The findings are lower as compared to the study done by Chatwal et al¹⁴ in Punjab on 2560 children where prevalence of hypertension among obese children was 13.7%. The lower prevalence rate in present study as compared to above study may be due to small

number of children screened for elevated blood pressure as compared to above studies. The prevalence of HT in children has been reported to vary between 0.41% to 11.7%.¹⁵⁻¹⁸

In our study anthropometric measurements like Waist Hip Ratio, MAC and Mean SBP and DBP among obese and overweight group were significantly higher as compared to normal weight group. The results of anthropometric measurement are comparable to the study done by Kapil et al⁷ which showed significantly higher measurements of W/H Ratio and MAC among obese and overweight group as compared to normal weight group. The findings of SBP and DBP were consistent with the study done by Rao et al¹³ in Pune which showed significant difference between SBP and DBP of overweight group as compared to normal group.

CONCLUSIONS

Anthropometric measurements like Waist Hip Ratio, MAC and Mean SBP and DBP among obese and overweight group of children were significantly higher as compared to normal weight group of children. Childhood obesity is a crucial issue that needs to be addressed urgently. Changing dietary practices and maintenance of regular physical activity starting as early as infancy through parental initiative and social support interventions are the most important strategies to tackle childhood obesity and hypertension. There is definitely a need for well-planned, large-scale studies using standardized methodologies to estimate the prevalence of hypertension and its association with obesity and overweight in school children. When planning these studies it is necessary to ensure that importance is given to accurate evaluation of socio economic status and representation of the different regions of India. A comprehensive study including anthropometric data, biochemical data, clinical signs and dietary intake data among the same group of children will give a better insight into the situation.

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