



CENTRAL OBESITY IN SCHOOL GOING ADOLESCENTS OF A SMALL BUT GROWING CITY IN NORTH INDIA

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ABSTRACT **INTRODUCTION:** Central obesity, a state of excessive accumulation of central subcutaneous and visceral fat, is an important predictor for cardiovascular and metabolic risks in children and adolescents. Waist circumference (WC) is a simple, yet effective, surrogate measure of abdominal obesity. Central obesity is increasing but not many studies have been done in adolescents in India.

OBJECTIVES: To study the prevalence of central obesity in school going adolescents and to compare median values (50th percentile) of the waist circumference of study group with that of some other adolescent reference populations.

Methodology: A cross-sectional study was done among 660 adolescents in two affluent and two non-affluent schools in Aligarh (north India) using systematic random sampling. Anthropometric measurement of waist circumference was taken. Central obesity was defined as >90th percentile for age and sex, using British children WC Charts. Statistical analysis was done using IBM SPSS 20.0. Chi square test applied.

RESULTS: The mean value of WC was 69.19 ± 11.48 cm. Overall prevalence of central obesity was found to be 28.5% (CI: 25.2-32.0). The prevalence was significantly higher among boys than in girls (24.7% versus 33.6%) and in the affluent schools than in the non-affluent schools (38.8% versus 18.2%). The 50th percentile of waist circumference of the study population was found to be higher than that of the reference UK adolescent population and Hong Kong adolescents, but lesser than that of adolescents of Kuwait, among both boys and girls. It was also found to be similar to adolescents of Turkey among boys, but higher than those of girls.

CONCLUSION & RECOMMENDATIONS: The alarming problem of central obesity in school going adolescents must be addressed urgently. There's dire need to develop Indian national reference standards for waist circumference to gauge the actual magnitude of the problem and guide primary physicians/pediatricians in screening central obesity in adolescents.

KEYWORDS : central obesity, waist circumference, adolescents

INTRODUCTION

Obesity in children and adolescents has acquired epidemic proportion globally⁽¹⁾. Central or abdominal obesity, a state of excessive accumulation of both central subcutaneous and visceral fat, has emerged as an important predictor for metabolic complications and adverse cardiovascular health in children and adolescents^(2,3).

Central obesity is a critical component of the International Diabetes Federation criteria for the definition of metabolic syndrome in adolescents.⁽⁴⁾ Waist circumference (WC) is a simple, yet effective, way of measuring central obesity in adults⁽⁵⁾ and children⁽⁶⁾ and may be better predictor of cardiovascular disease risk than body mass index (BMI) in both adults⁽⁷⁾ and children⁽⁸⁾.

Central obesity is on a rise in children and adolescent^(9,10), but there's a paucity of data on central obesity among adolescents in India. Therefore, the present study was undertaken with the following objectives: 1) To study the prevalence of central obesity in school going adolescents. 2) To compare median values (50th percentile) of the waist circumference of study group with that of other reference populations.

MATERIALS AND METHODS

This study was part of a cross-sectional study, conducted from August 2009 to July 2010, in two affluent (having tuition fees more than Rs 10000 per annum), and two non-affluent schools (having tuition fees less than Rs 10000 per annum), in Aligarh. Type of school has been used as a proxy for socio-economic status (SES). The study design was approved by the institutional ethical committee.

Taking estimated prevalence of overweight as 3.23%⁽¹¹⁾, alpha error of 5 per cent, 2% absolute allowable error and 10 percent non-response rate, sample size calculated was 321 and rounded off to 330. 330 adolescents were covered in both affluent and non-affluent group of school, making the total sample size 660.

Purposive selection of two affluent and two non-affluent schools was done from urban area of Aligarh, allowing for operational feasibility. The total numbers of children from each school were sampled by Probability Proportionate to Size technique and systematic random sampling was done. In case a student was found absent on the date of interview or was found ineligible, student falling on the next roll number was taken.

Apparently healthy school children of Vth to Xth standard, who had completed 10 years of age on the date of examination and were not more than 16 years of age (as per school records) were examined after taking informed consent from the school authorities and the parents. Children in need of medical attention were appropriately referred.

Children having chronic illness, severe malnutrition, endocrinal problems, physical & mental defects, those with apparent obesity induced or associated with any syndrome and those found to be smokers (defined as any amount of smoking or tobacco chewing at any time during past 6 months) and those not cooperating for anthropometric measurements, were excluded.

Anthropometric measurement of waist circumference was done as advocated by World Health Organization⁽¹²⁾. Waist circumference was measured to the nearest 0.1 cm horizontally at the midpoint point between inferior margin of the last rib and iliac crest using a non-stretchable tape.

Central obesity was defined as $\geq 90^{\text{th}}$ percentile of WC for age and sex⁽⁴⁾. Waist Circumference percentile charts given by McCarthy et al⁽¹³⁾ were used as reference charts.

A comparison among the median values (50th percentile) of WC of the study population was done with that of some other adolescent populations (Hong Kong¹⁴, Kuwait¹⁵, Turkey¹⁶ and the reference UK adolescents¹³ taken in our study) in whom WC was measured at the same site.

The data were entered in Excel Sheet and checked for correctness and missing data, and then were entered into IBM SPSS 20.0 software for analysis. Descriptive statistics and inferential statistics were computed. Proportions of central obesity according to sex and type of school (reflective of social class) are reported with their 95% confidence interval (CI). Chi-square test was applied to test statistical significance. P value <0.05 was considered to be significant.

TABLE 1. Age wise distribution and Waist Circumference characteristics of study group

Age Group (years)	N (%)	WC (Mean \pm Std. Deviation)
10-11	85 (12.9)	62.74 \pm 9.59
>11-12	100 (15.2)	64.05 \pm 10.04
>12-13	139 (21.1)	69.20 \pm 10.17
>13-14	153 (23.2)	70.05 \pm 9.62
>14-15	130 (19.7)	73.72 \pm 12.58
>15-16	53 (8.0)	75.57 \pm 13.32
Total	660 (100)	69.19 \pm 11.48

The prevalence of central obesity has been shown in table 2. A statistically significant difference was found in the prevalence of central obesity among both the sexes and also among the affluent and non-affluent schools.

TABLE 2. Prevalence of central obesity among school going adolescents.

	Central Obesity (Waist circumference >90th percentile)			Test of Significance
	n	%	Confidence Interval (CI)	
Sex				
Male (N=380)	94	24.7	20.7-29.3	$\chi^2 = 6.177, df= 1, p<0.05$
Female (N=280)	94	33.6	28.3-39.3	
Type of School				
Affluent (N=330)	128	38.8	33.7-44.1	$\chi^2 = 34.392, df=1, p< 0.05$
Non-affluent (N=330)	60	18.2	14.4-22.7	
Total (660)	188	28.5	25.2-32.0	

Figure 1 and 2 shows the comparisons of the age- and sex-specific 50th WC percentile of the study population and the children from other countries. Compared with the British and Hong Kong references, the adolescent boys in the present study displayed higher values in all age groups, but had lesser values than adolescent boys of Kuwait. The median WC of boys among the study population and Turkey was found to be almost the same except in the 12-13 years age group. Among the girls, the WC levels in the study population were higher than that of the UK, Hong Kong and Turkey, but lesser than that of Kuwait.

DISCUSSION

Waist Circumference, as a marker of central obesity, has great importance in both the clinical and health preventive settings. It is a simple, inexpensive measurement, correlated with the fat distribution⁽⁶⁾, and metabolic and cardiovascular complications⁽¹⁷⁾; and can be a very cost-effective tool in developing countries like India. Thus the assessment of WC in everyday clinical practice, along with the BMI evaluation may be useful to identify those overweight/obese children at an increased risk of developing obesity related comorbidities^(18,19).

Our study is one of the foremost studies to report the prevalence of central obesity in school going adolescents in Uttar Pradesh, north India. With almost three adolescents out of ten having central obesity, we have found the prevalence to be high. Our finding is similar to that in another study conducted in South Indian children⁽²⁰⁾, where the authors have reported 30% of children were above 90th percentile of waist circumference of British children.

A multicentric study in which WC was measured in 29,244 children aged 8-18 years, prevalence of abdominal obesity in urban Indian schoolchildren was reported to be 4.5%.⁽²¹⁾ Such difference in prevalence can be due to a much larger sample size used, multicentric sampling, and a wider range of age group comprising both children and adolescents in that study.

The prevalence of central obesity in Lebanese adolescents was higher (41.8%) as compared to that in our study.⁽²²⁾ These differences can be attributed not only to varied socio-cultural and behavioural factors but also to different methods of assessing central obesity and different site of WC measurement. The differences and problems in international comparison arising due to different sites of measurement of WC have been highlighted by Wang et al.⁽²³⁾

The adolescents who belong to affluent section of society and the female adolescents appear to be more at risk. Gender-based differences

RESULTS

Among total 660 study subjects, 380 (57.6%) were male. The mean value of waist circumference was found to be 69.19 \pm 11.48 cm. Age wise distribution and WC characteristics of study populations have been shown in table 1.

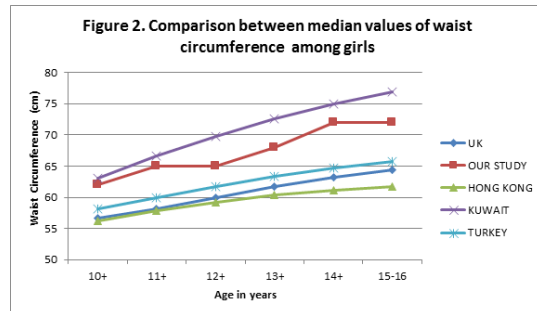
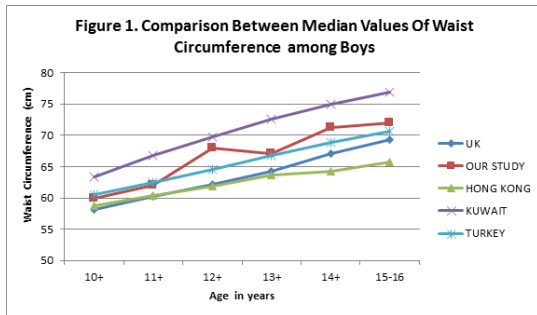
in central obesity have been found in our study and have also been reported by other researchers. The prevalence of central obesity was more among females as compared to male adolescents, a finding reciprocated by others^(9,10,20). But in a study conducted in Lebanese adolescents, rates of central obesity have been reported to be higher in males (50.7% vs 34.1%) than in females⁽²²⁾.

The 50th percentile of waist circumference of the study population was found to be higher than that of the reference UK population, among both boys and girls. Similarly, Kuriyan et al⁽²⁰⁾ have also reported higher values of waist measurements in Indian children as compared to age and gender matched British children. It is suggested that the higher percentile values of WC in the current study can be in part due to ethnic differences in body fat patterning and the genetic tendency of Asians to abdominal obesity⁽²³⁾; in addition current measures are compared with the British data obtained more than 10 years ago, such data might have undergone significant changes⁽¹¹⁾.

The median WC percentile in this study was found to be higher than that of other Asian adolescents of Hong Kong and Turkey but lower than that of adolescents of Kuwait. Thus, among the Asians also waist circumference percentiles of adolescents from various countries are found to vary considerably. There are studies indicating ethnic predisposition among Asians to metabolic syndrome.⁽²⁴⁾ Lower BMI levels have been found to correspond to cardiovascular risks among the Asian population as compared to the Caucasians⁽²⁴⁾. The same may be said about WC also. This emphasizes the necessity of developing population-specific percentiles. Kurien et al⁽²⁰⁾ have developed smoothed waist percentile curves for middle class South Indian children of both sexes, aged 3-16 years. Given the diversity of Indian subcontinent, there is need to develop a nationally representative reference standards for waist circumference percentiles and also specific population based cut-offs for diagnosis. This will not only help to gauge the actual magnitude of the problem but also guide primary physicians/pediatricians in screening central obesity in adolescents. More research, specifically longitudinal studies, are recommended to identify precise cut off points for waist circumference that could equate to different levels of risk for cardiovascular diseases.

Obesity has been shown to track into adulthood.⁽²⁵⁾ The alarming problem of central obesity in school going adolescents must be addressed urgently, not only to decrease burden of metabolic syndrome among adolescents but also for primary prevention of central obesity in adults which is assuming alarming proportions in Indian population.⁽²⁶⁾ Waist circumference measurement should be

included in the School Health Programme to facilitate screening of at risk adolescents and prevent obesity through primary health care approach. Further research on contributing factors for the central obesity can also be helpful in this regard.



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