

## Original Article

# PREVALENCE OF OBESITY AMONG COLLEGE STUDENTS IN RURAL AREA OF BANGALORE

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## ABSTRACT

**Introduction:** Increasing trend of obesity among adolescents is a worldwide phenomenon. There is a scarcity of research on obesity in the later part of adolescence from rural part of India.

**Objective:** To find out the prevalence and factors associated with obesity among college students studying 11<sup>th</sup>& 12<sup>th</sup> standard between 15 - 19 years of age.

**Methods:** A cross sectional study was undertaken by involving all the colleges located within the rural field practice area of Kempegowda Institute of Medical Sciences, Bangalore for a period of 6 months (Apr - Sep 2009). The data was collected from students (n=1170) using pre-tested structured questionnaires. Anthropometric measurements such as height, weight, waist circumference and body fat percentage were taken for all the students. The criteria for overweight/obesity and central obesity were based on proposed WHO Asia-Pacific guidelines and International Diabetes Federation (IDF) guidelines.

**Results:** Overweight/ obesity were found to be 6.1% and 7.2% respectively and central obesity of 1.9%. The overweight/obesity had significant association with age and family history of obesity. The mean BFP was significantly higher among boys in the age group of 15-16 years compared to 17-19 years age group and significant difference in the mean BFP was noted among both boys and girls with family history of obesity. The mean body fat percentage was significantly high in overweight/obesity and central obesity.

**Conclusions:** The present research has found prevalence of overweight/obesity of 13.3% and central obesity of 1.9% respectively in the age group of 15-19 years, which needs to be confirmed in future studies.

**Key words:** Adolescent, body mass index, central obesity, body fat percentage, physical exercise.

## INTRODUCTION

The burden of obesity has increased exponentially, affecting all socio-economical groups of both developed and developing countries, irrespective of age, sex and ethnicity in recent decades. This prompted WHO to describe obesity as an escalating global epidemic.<sup>1</sup>

Obesity in adolescence is a significant risk factor for a range of serious non-communicable diseases in adulthood such as cardiovascular diseases, diabetes mellitus, osteoarthritis, gall bladder diseases, cancers and increased risk of mortality.<sup>2</sup> Increasing trend of obesity among adolescents is a worldwide phenomenon<sup>3</sup> and considered as one of the major public health challenge of the 21<sup>st</sup> century.<sup>4</sup>

Extensive review of literature at that point of time has shown that there is a scarcity of research on comprehensive assessment of obesity in the age group of 15-19 years by using BMI, waist circumference and body fat percentage measurement in rural part of India. In this context, the present research was undertaken to find out the prevalence and factors associated with obesity among college students in rural area of Bangalore, Karnataka, India.

## METHODS AND MATERIALS

**Subjects:** The present cross sectional study was carried out in Kengeri PHC area located within the rural field practice area of Kempegowda Institute of Medical Sciences, Bangalore from April to September 2009. There were two colleges and both were included

in the study. A total of 1205 students, out of which 1170 (97.1%) students aged between 15-19 years studying in 11<sup>th</sup> and 12<sup>th</sup> standard were available for the study. At the beginning, consent of the college authority and students were obtained and the data was collected by an interview method using a pre-tested structured questionnaire from study subjects by trained investigators.

**Anthropometric Measurements:** Trained investigators measured height, weight and waist circumference of the study subjects by following standard procedures and guidelines. The height was measured to the nearest 0.5 cm with stadiometer. Weight was measured to the nearest 0.5 kg with weighing scale.

According to proposed WHO Asia-Pacific guidelines<sup>5</sup>, a subject was considered overweight if the body mass index (BMI) was  $\geq 23$  kg/m<sup>2</sup> and obese if the BMI was  $\geq 25$  kg/m<sup>2</sup>, and according to International Diabetes Federation (IDF) guidelines,<sup>6</sup> cut-offs for waist circumferences to define central obesity was  $\geq 90$  cm for boys and  $\geq 80$  cm for girls.

**Assessment of Body fat percentage (BFP):** Body fat percentage was assessed by Bio-electrical impedance (BIA) method. It is based on the principle that tissues containing water such as muscles, blood vessels and bones are highly conductive with electricity, but fat tissues are not, therefore by using this principle it is possible to determine the ratio of fat tissues to other tissues in the body by measuring the electric resistance of the body tissues by extremely weak electric current application (50-500 micro amp) to the body. In the bio-electrical impedance method, a small alternating current is passed through the body to assess the body fat percentage by feeding details such as age, sex and height of the subject in to the instrument using OMRON body fat monitor (HBF - 306).<sup>7</sup> The repeated measurements were taken on a subsample of study subjects for reliability analysis.

**Statistical Analysis:** In this study, both descriptive (percentage, mean and standard deviation) and inferential statistics were used to analyse the data. The Chi-square test was used to find out the association between overweight/obesity and socio-demographic characteristics, physical exercise and type of diet. The standard error of the mean (SEM) was used for the

analysis of BFP with the socio-demographic characteristics, physical activity, type of diet and anthropometric data (BMI and waist circumference). The Student's t-test was used to find out difference between the mean values of BFP between two groups. All the statistical analysis were performed using Statistical Packages for Social Sciences (Window version 17.0; SPSS Inc, Chicago (IL), US).

## RESULTS

**Prevalence of obesity:** Out of 1170 study subjects, 569 (48.6%) were underweight, 445 (38.0%) were normal and 156 (13.3%) were considered as overweight/obese, of which 72 (6.1%) were overweight and 84 (7.2%) were obese according to BMI. According to waist circumference 22 (1.9%) were considered to be suffering from central obesity.

**Association between socio-personal characteristics and overweight/obesity:** Eighty seven (15.8%) study subjects in the age group of 17-19 years were overweight/obese as compared to 69 (11.1%) from 15-16 years group and after adjustment with other variables indicate that age was found to be a significant factor in predicting obesity ( $P < 0.005$ ). The odds of having obesity in 17-19 yrs age group was found to be 1.699 times when compared to 15-16 yrs age group (aOR 1.699; 95% CI 1.190-2.425).

Among girls, 92 (14.8%) were overweight/obese compared to 64 (11.7%) among boys. Among overweight/obese, 84 (24.9%) had family history of obesity and after adjustment with other variables indicate that family history of obesity was found to be a significant factor in predicting obesity ( $P < 0.001$ ). The odds of having obesity for a person without family history of obesity is 0.277 times when compared to a person with family history of obesity (aOR 0.277; 95% CI 0.195-0.393).

Overweight/obesity was found in 143 (16.7%) subjects who were not engaged in physical exercise (a minimum of 5 days in a week and 30 min/day) compared to 13 (4.1%) of those engaged physical exercise.

According to the diet, 56 (14.4%) of the subjects on vegetarian diet were considered as overweight/obese as compared to 100 (12.8%) on mixed diet (Table 1).

**Table 1: Association between socio-personal characteristics and overweight/obesity**

Variable	Category	Subjects (n= 1170)	Overweight/obesity (%)	OR	aOR	95%CI	P-value #
Age (years)	15-16	621(53.1)	69(11.1)	1.50	1.699	1.190-2.425	<0.005*
	17-19	549 (46.9)	87(15.8)				
Sex	Boys	548 (46.8)	64(11.7)	1.31	1.442	0.997-2.086	0.052(NS)
	Girls	622(53.2)	92(14.8)				
Type of family	Nuclear	948(81)	132(13.9)	0.75	0.704	0.438-1.134	0.149(NS)
	Non-nuclear	222(19)	24(10.8)				
Family h/o obesity	Present	337(28.8)	84(24.9)	0.29	0.277	0.195-0.393	<0.001*
	Absent	833(71.2)	72(8.2)				
Physical exercise	No	482 (41.2)	61(12.7)	0.90	0.772	0.535-1.115	0.168(NS)
	Yes	688 (58.8)	95(13.8)				
Type of diet	Vegetarian	389 (33.2)	56(14.4)	0.87	0.812	0.563-1.173	0.268(NS)
	Mixed	781(66.8)	100(12.8)				

\* Statistically significant, NS = Not significant; #based on multiple log reg)

Socio-personal characteristics and mean BFP: In the current study, mean BFP was shown to be higher among girls compared to boys in both age groups. The mean BFP was significantly higher among boys in the age group of 15-16 years compared to those in the age group of 17-19 years, but no significant difference among girls. In this study, significant difference in the

mean BFP was noted among both boys and girls with family history of obesity.

The mean BFP was shown to be significant higher among boys who were not engaged in physical exercise but no significant difference among girls. With regard to type of diet, no significant difference in BFP was observed among both boys and girls (Table 2).

**Table 2: Distribution of socio-personal characteristics according to mean body fat percentage**

Variable	Category	Boys			Girls		
		n=548	BFP(Mean±SEM)	p value	n=622	BFP(Mean±SEM)	p Value
Age	15-16	246	16.8±0.34	<0.04*	375	23.7±0.29	0.66(NS)
	17-19	302	15.8±0.35		247	23.9±0.41	
Type of family	Nuclear	453	16.3±0.26	0.68(NS)	495	24.0±0.26	0.16(NS)
	Non nuclear	95	16.1±0.71		127	23.2±0.54	
Family h/o obesity	Present	148	18.3±0.51	<0.0001*	189	24.9±0.47	<0.003*
	Absent	400	15.5±0.27		433	23.3±0.27	
Physical exercise	No	342	16.7±0.35	<0.002*	514	23.8±0.26	0.82(NS)
	Yes	206	15.5±0.31		108	23.9±0.62	
Type of diet	Veg	158	16.6±0.50	0.46(NS)	231	23.7±0.41	0.68(NS)
	Mixed	390	16.2±0.28		391	23.9±0.29	

\* Significant at 0.05 level of confidence, NS = Not significant;  $t_{0.05}$  = 1.980, SEM = Standard Error of Mean

**Table 3: Association between body mass index and central obesity with body fat percentage**

Variable	Category	Boys (n=548)			Girls (n=622)		
		N	BFP(Mean±SEM)	p value	n	BFP(Mean±SEM)	p value
BMI	Obese	64	25.8±0.56	<0.0001*	92	31.9±0.52	<0.0001*
	Non obese	484	15.0±0.21		530	22.4±0.21	
Central obesity	Present	8	30.5±2.06	<0.0001*	14	29.9±2.13	<0.0001*
	Absent	540	16.1±0.23		608	23.7±0.24	

\* Significant at 0.05 level of confidence;  $t_{0.05}$  = 1.980, SEM = Standard Error of Mean

Obesity (BMI), central obesity and mean BFP: In the current study, mean BFP was significantly higher among obese compared to non obese among both boys and girls. Similarly, mean BFP was significantly higher among the subjects having central obesity as compared to those without central obesity (Table 3).

## DISCUSSION

In the present study, the prevalence of overweight and obesity in the age group of 15-19 years according to BMI (proposed WHO Asia-Pacific guidelines) was 6.1% and 7.2% respectively, together constitute 13.3%. It is an interesting finding that prevalence of obesity was higher compared to overweight. Most of the studies on obesity in the later part of adolescence in Indian soil adopted WHO or IOTF classifications.<sup>8,9</sup> these classifications underestimate the prevalence of obesity among Indian adolescents because of higher cut-off adopted in these classifications.

The prevalence of overweight/obesity was higher in the age group of 17-19 years compared to the subjects in 15-16 years. This could be due to the fact that, in the later part of adolescence, the chance of obesity increases due to high burden of college work and academic competitiveness, which decreases the participation in sports and other forms of physical activi-

ties.<sup>10</sup>This trend shows that obesity in later part of adolescence may pass on to adulthood and can cause serious metabolic derangement and cardiovascular diseases leading to premature death.<sup>11</sup>

In this study overweight/obesity was higher among girls compared to boys. This may be due to increased restriction on outdoor sports and other activities in the society. In a study conducted by Seema Choudhary<sup>12</sup> in rural Varanasi by involving girls in the age group of 10-19 years found that overweight and obesity was 2.2% and 0.7% respectively, together constituting 3%, which is lower compared to the prevalence among the girls observed in the current study.

The prevalence of central obesity was 1.9%, and it was higher among girls (2.1%) compared to boys (1.6%). In study conducted in Iran using IDF guidelines show that prevalence of central obesity among girls was 1.2%,<sup>13</sup> which is lower compare to present study. Central obesity is considered as a significant causative factor in the development of metabolic syndrome and cardiovascular diseases. The study on Korean adolescents also shown that prevalence of central obesity was high among girls and this could be due to gender related genetic predisposition to the accumulation of visceral fat.<sup>14</sup>

Overweight/obesity and BFP was higher in subjects having family history of obesity. In a study conducted by Goyal RK observed that family history of obesity was significantly associated with obesity among adolescents and this could be due to dominant genes involved in the development of obesity.<sup>15</sup> In this context, family is a critical window of opportunity to tackle obesity in adolescence which should start from early childhood by involving the family, school/college and local community in long term behavioural modification strategies and family history of obesity should be used as a screening tool for the identification of high risk adolescents for obesity.

In this study, among boys, BFP was significantly higher in the age group of 15-16 years compared to those in the age group of 17-19 years, which is similar to the findings from a study conducted among Korean adolescents.<sup>16</sup> Surprisingly overweight/obesity was significantly higher among 17-19 years in both the groups, but BFP was significantly higher in 15-16 years among boys. These difference needs to be investigated further.

Among boys, BFP was higher among those who are not engaged in physical exercise and among girls, this difference was not observed, which needs to be probed further.

Mean BFP was significantly higher among obese compared to non-obese according to BMI and central obesity. In a study conducted on Chinese adolescents from rural area shown that BFP highly correlated with BMI and central obesity.<sup>17</sup> These evidence strengthen that BMI, waist circumference and BFP are useful and reliable indicators in measuring obesity in later part of adolescence.

This study is cross-sectional in nature; hence it is difficult to make causal inference of the observations. The BIA (Bioelectrical Impedance Analysis) is attractive in terms of cost, equipment portability and minimal need for personnel training but considered as doubly indirect method in the measurement of BFP.

The current research has shown higher prevalence of obesity and in this regards, there is a need to confirm these observations by undertaking large sample multi-centric studies by using BMI, waist circumference and BFP and The future research should also focus on bring out appropriate cut-off values for BMI, waist circumference and BFP for the classification of obesity among Indian adolescents, there by preventing them from becoming victims of chronic diseases and premature death in the near future.

## CONCLUSION

The present research has found prevalence of overweight/obesity of 13.3% and central obesity of 1.9% respectively and associated with age and family history of obesity. The mean BFP was significantly higher

in overweight/obesity and central obesity. Further studies are needed to confirm these results.

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