



PREVALENCE OF OVERWEIGHT AND OBESITY AMONG URBAN SCHOOL AGE CHILDREN

Medical Education

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ABSTRACT

Aim and objectives: The present study was carried out with the aim to assess the prevalence of overweight and obesity among urban school going children aged 10-15 years. **Materials and method:** Evaluation of overweight and obesity was done using anthropometric measurements. Body weight, waist circumference and height of the children was measured. BMI was calculated. Children having BMI >85th percentile of gender-specific BMI for age value were defined as overweight and those having BMI >95th percentile of gender specific BMI for age value were defined as obese. 3- Prevalence of obesity and overweight was 12.4% in both males and females. Among High school students, proportion of obese was significantly higher as compared to other nutritional status (90.91% vs. 17.93%, 41.44% & 48.67%). **Results:** Prevalence of Overweight and obesity among school going children aged 10-15 years was found to be 11.30% and 1.10% respectively. Frequent visits (once/week) for outside eating was significantly higher in Obese as compared to underweight, normal and overweight. **Conclusion:** We established that energy and fat intake of obese and overweight children was significantly higher as compared to underweight and normal weight children, thus stressing on the need to understand the energy balance context. This finding indicates the need for a lifestyle modification in order to change the situation.

KEYWORDS

Energy balance context, Overweight, Obesity

INTRODUCTION

Childhood obesity is a condition where excess body fat negatively affects a child's health or wellbeing. As methods to determine body fat directly are difficult, the diagnosis of obesity is often based on BMI. Due to the rising prevalence of obesity in children and its many adverse health effects it is being recognized as a serious public health concern. Obesity is categorized using different criteria, however, among adults and adolescents aged >9 years, obesity as defined by World Health Organization (1985) is considered to be most popular. According to WHO definition, a person having a body mass index (BMI) above 25.0 kg/m² is considered to be overweight (i.e. a tendency towards obesity), and a BMI >30.0 kg/m² is defined as obesity. However, this definition is applicable for adults. For children and teenagers, WHO has compiled gender specific BMI for age tables that can be used in place of the BMI criteria for adults.^{2,3}

With the changing lifestyle the tendency to gain weight in childhood itself is increasing, however, obesity is a precursor of many physical and psychological problems that a child has to cope with.

The first problem to occur in obese children are usually emotional or psychological as an obese child is generally bullied or is a target of fun among the peer group. Childhood obesity however can also lead to life-threatening conditions including diabetes, high blood pressure, heart disease, sleep problems, cancer, and other disorders. Some of the other disorders would include liver disease, early puberty or menarche, eating disorders such as anorexia and bulimia, skin infections, and asthma and other respiratory problems. Studies have shown that overweight children are more likely to grow up to be overweight adults. Obesity during adolescence has been found to increase mortality rates during adulthood.⁴

Childhood overweight and obesity are global problems that are on the rise. Nearly 22 million children under the age of five are estimated to be overweight worldwide.⁵

Obesity in children appears to increase the risk of subsequent morbidity, whether or not obesity persists into adulthood.⁴ Outcomes related to childhood obesity include hypertension, type 2 diabetes mellitus, dyslipidaemia, left ventricular hypertrophy, non-alcoholic steatohepatitis, obstructive sleep apnoea, and orthopaedic and psychosocial problems.⁶⁻⁸

Among different morbid outcomes of childhood obesity hypertension, glycemic control and dyslipidemia are known components of a much more morbid condition known as metabolic syndrome. Obesity itself stands as an important constituent of metabolic syndrome components and association of obesity with metabolic syndrome in different age groups has been proven and established widely and is also tipped to be triggering other disorders like chronic kidney disease.^{9,10}

The present study was carried out with the aim to assess the prevalence of overweight and obesity among urban school going children aged 10-15 years.

MATERIALS AND METHOD

The primary data source was collected through a Field Study conducted in Central School, Aliganj, Lucknow. The investigations and further work-up of study was done at Department of Pediatrics, Vivekananda Polyclinic and Institute of Medical Sciences, Lucknow. The study population was school going children aged between 10-15 years attending the Central School, Aliganj, Lucknow city were selected as subjects/ participants of study.

Study Design

The present study was carried out using a cross sectional study design. The nutritional status of urban school going children was evaluated and prevalence of metabolic syndrome components in high risk (overweight/obese) children was assessed.

Sample Size

As in a previous study by Friend *et al.* (2013), the prevalence of metabolic syndrome in obese school children has been reported to be 29.2%. The sample size was estimated to be 1000 school children in the targeted age group. The study was carried out as a stratified sampling design.

Study population

The study population included Children aged between 10-15 years studying in school within the municipal limits of Lucknow city. The study excluded school going children below 10 years or above 15 years of age, Children/parents not willing to participate in the study.

Methodology

Screening for Overweight and Obesity

Evaluation of overweight and obesity was done using anthropometric measurements. Body weight, waist circumference and height of the children was measured. BMI was calculated. Children having BMI $>85^{\text{th}}$ percentile of gender-specific BMI for age value were defined as overweight and those having BMI $>95^{\text{th}}$ percentile of gender specific BMI for age value were defined as obese. The overweight and obese children thus screened as per WHO criteria were recruited.

The assessment of Socioeconomic Status was done using the following criteria: Annual income $<Rs$ 300,000 (Class I), Annual income Rs $>300,000-600,000$ (Class II) and Annual income $>Rs$ 600,000 (Class III). Habits like fast food consumption, cold drink consumption, street food consumption, habits of bringing packed lunch from home, dietary recall, etc. was also noted. Anthropometric measurements were made with the help of a measuring tape and weighing scale. The data so collected was subjected to statistical analysis. Ethical approval was obtained from the Institutional Ethical Committee of Vivekananda Polyclinic and Institute of Medical Sciences, Lucknow, permission for conducting Part I of the study was obtained from the respective institution/school. Informed consent was obtained from the guardians of the students for Part II of the study.

Statistical analysis

SPSS version 25.0 analyzed the Excel data when it was loaded. Quantitative (numerical variables) data was given as mean and standard deviation, whereas qualitative (categorical variables) data was provided as frequency and percentage. The student t-test was used to compare the two groups' mean values, while the chi-square test analyzed their frequency differences. If $p < 0.05$, it was statistically significant.

RESULTS

Table 1 showing

Age Group	Total (N=1000)	Underweight (n=251)		Normal (n=625)		Overweight (n=113)		Obese (n=11)	
		No.	%	No.	%	No.	%	No.	%
≤ 12 yrs	417	168	66.93	227	36.32	22	19.47	0	0
> 12 yrs	583	83	33.07	398	63.68	91	80.53	11	100
$\chi^2 = 104.013 (df=3); p < 0.001$									
Min-Max (Median)	10-15 (13)	10-15 (12)		10-15 (13)		11-15 (14)		13-15 (14)	
Mean $\pm$ SD	12.73 $\pm$ 1.72	11.87 $\pm$ 1.59		12.90 $\pm$ 1.70		13.53 $\pm$ 1.33		14.26 $\pm$ 0.65	
Female	500	144	57.37	294	47.04	58	51.33	4	36.36
Male	500	107	42.63	331	52.96	55	48.67	7	63.64

Approximately one-fourth students were found to be underweight (25.10%) and 11.30% students were Overweight. Prevalence of Obesity in the present study was 1.10% only. Proportion of students aged ≤ 12 years was higher in Underweight (66.93%) and all the obese students were aged > 12 years.

There were 500 (50.0%) each males and females. Proportion of males in students with nutritional status Obese (63.64%) and Normal (52.96%) was higher as compared to those with Underweight (42.63%) and Overweight (48.67%).

Table 2 showing

		Total (N=1000)	Underweight (n=251)		Normal (n=625)		Overweight (n=113)		Obese (n=11)	
			No.	%	No.	%	No.	%	No.	%
Educational Level	Primary (Class V)	161	73	29.08	85	13.6	3	2.65	0	0
	Middle (Class VI-VIII)	470	133	52.99	281	44.96	55	48.67	1	9.09
	High School (Class IX-X)	369	45	17.93	259	41.44	55	48.67	10	90.91

$\chi^2 = 89.979 (df=6); p < 0.001$										
Socio-economic Status	Class I	266	70	27.89	164	26.24	32	28.32	0	0
	Class II	672	166	66.14	424	67.84	74	65.49	8	72.73
	Class III	62	15	5.98	37	5.92	7	6.19	3	27.27
$\chi^2 = 11.396 (df=6); p < 0.077$										

Proportion of Underweight students was higher among those studying in Primary (Class V) classes while proportion of obese students was higher among students studying in high school (IX-X) classes.

The proportion of Obese was higher as compared to Underweight, Normal & Overweight in SES Class II and Class III though there was no statistical significance.

Table 3 showing

		Total (N=1000)	Underweight (n=251)		Normal (n=625)		Overweight (n=113)		Obese (n=11)	
			No.	%	No.	%	No.	%	No.	%
Frequency of eating outside	$< \text{Once a month/ Never}$	150	59	23.51	78	12.48	13	11.5	0	0
	Once a month	540	119	47.41	345	55.2	72	63.72	4	36.36
	Once a fortnight	283	71	28.29	183	29.28	26	23.01	3	27.27
	Once a week	27	2	0.8	19	3.04	2	1.77	4	36.36
	$> \text{Twice/ week}$	0	0	0	0	0	0	0	0	0
$\chi^2 = 73.618 (df=6); p < 0.001$										
Frequency of fast food intake	$< \text{Once a month/ Never}$	0	0	0	0	0	0	0	0	0
	Once a month	67	15	5.98	46	7.36	6	5.31	0	0
	Once a fortnight	337	89	35.46	211	33.76	36	31.86	1	9.09
	Once a week	474	120	47.81	285	45.6	60	53.1	9	81.82
	$> \text{Twice/ week}$	122	27	10.76	83	13.28	11	9.73	1	9.09
$\chi^2 = 9.622 (df=9); p < 0.382$										
Frequency of Softdrinks/ Icecream	$< \text{Once a month/ Never}$	0	0	0	0	0	0	0	0	0
	Once a month	70	23	9.16	35	5.6	12	10.62	0	0
	Once a fortnight	334	65	25.9	220	35.2	42	37.17	4	36.36
	Once a week	473	117	46.61	303	48.48	49	43.36	7	63.64
	$> \text{Twice/ week}$	123	46	18.33	67	10.72	10	8.85	0	0
$\chi^2 = 23.982 (df=6); p < 0.004$										
Frequency of Bakery/ Confectionery product consumption	$< \text{Once a month/ Never}$	0	0	0	0	0	0	0	0	0
	Once a month	66	14	5.58	48	7.68	4	3.54	0	0
	Once a fortnight	330	85	33.86	209	33.44	35	30.97	1	9.09
	Once a week	471	123	49	276	44.16	62	54.87	10	90.91
	$> \text{Twice/ week}$	133	29	11.55	92	14.72	12	10.62	0	0
$\chi^2 = 16.837 (df=9); p < 0.051$										
Frequency of Green Leafy vegetable consumption	$< \text{Once a month/ Never}$	0	0	0	0	0	0	0	0	0

	Once a month	0	0	0	0	0	0	0	0	0
	Once a fortnight	0	0	0	0	0	0	0	0	0
	Once a week	311	74	29.4	180	28.8	48	42.9	81.8	2
	>Twice/week	689	177	70.5	445	71.2	65	57.2	18.1	8
	$\chi^2=21.882(6\text{df}=3); p<0.001$									
Frequency of Fruit/Juices consumption	<Once a month/ Never	0	0	0	0	0	0	0	0	0
	Once a month	0	0	0	0	0	0	0	0	0
	Once a fortnight	0	0	0	0	0	0	0	0	0
	Once a week	139	39	15.5	83	13.4	17	15.0	0	0
	>Twice a week	861	212	84.4	542	86.6	96	84.96	11	100
	$\chi^2=2.663(6\text{df}=3); p<0.447$									

Proportion of Underweight students was higher as compared to normal, overweight and obese who visited outside never/once a month while proportion of obese students was higher as compared to underweight, normal & overweight students who visit outside Once a week.

Though proportion of Obese was higher than that of Underweight, normal and overweight students having frequency of fast food intake Once a week.

Proportion of obese students was higher as compared to underweight, normal & overweight students having frequency of consumption of Softdrink/ice cream Once a week.

Proportion of obese students was higher as compared to underweight, normal & overweight students having frequency of consumption of Bakery/Confectionary products Once a week.

Majority of the students consumed green leafy vegetables >twice/week (68.9%) and rest consumed the same Once a week (31.1%). Proportion of obese students was higher as compared to underweight, normal & overweight consuming green leafy vegetables/once a week.

Though Proportion of obese students was higher as compared to underweight, normal & overweight consuming fruit/fruit juices >Twice a week.

DISCUSSION

Childhood obesity is a serious medical condition with nutritional origin that affects children and adolescents. It occurs when a child is well above the normal weight for his or her age and height. Obese children are often jeered upon and bullied by their peers. Childhood obesity can also lead to poor self-esteem and depression.¹⁰

In present study, the prevalence of overweight and obesity was 12.40% (11.30% overweight and 1.10% obese). *Kapil et al.*¹¹ using international cut-off points for BMI reported the prevalence of obesity to be 7.4%. *Braunschweig et al.*¹² using BMI for age criteria as used in present study, found the prevalence of children with BMI >85th percentile to be 44%. *Raj et al.*¹³ reported the prevalence of overweight and obesity to be showing an incremental trend with passage of time.

The prevalence of overweight to range from 3.0% by *Kumar M et al.*¹⁴ to 16.8% by *Raxton et al.*¹⁵ and prevalence of obesity from 0.73% by *Vohra et al.*¹⁶ to 9.3% by *Raxton et al.*¹⁵ The extreme discrepancy among different studies might be attributable to a number of factors including geographical variability, gender, age and sociodemographic profile of population being studied and criteria for classification being used.

In present study, the overweight to obese ratio was 10.27. Although, in different studies, the ratio of overweight to obese children has always been above 1 yet this ratio has ranged widely. *Vohra et al.*¹⁵ found that this ratio was 5.71, *Eshwar et al.*¹⁷ as 3 for ITOF criteria and *Cherian et al.*¹⁸ as the ratio of 4.0 among boys.

In present study, 80.53% of total overweight and all (100%) obese

children were aged >12 years. Thus, the prevalence of obesity and overweight was significantly higher in >12 years age group (17.5%) compared to <12 years (5.3%). Similar to findings of our study, *Eshwar et al.*¹⁷ also observed the rate of overweight and obesity to be higher in 13-15 years age group as compared to 15-18 years age group in both boys (34% vs 37.8%) as well as girls (14% vs 20%). *Kumar M et al.*¹⁴ also showed prevalence of overweight and obesity to be lower in 12 & 13 years old children (3% and 4%) as compared to that in 14 & 15 years old (4% and 9%). With increase age a tendency to gain BMI was also shown by *Rexlin et al.*¹⁵

The findings in general support that during the transition from childhood to adolescence, the pattern of growth changes and results in overweight and obesity. Generally, this is the time when physical activity profile of the children also gets a change. The activities like running, jumping, playing in the boundaries of home becomes difficult and children are often under the burden of studies and hence they do not have enough time for sports and play.

In present study, the prevalence of overweight and obesity was minimal in primary school children (1.9%), however, it increased in middle school students (11.9%) and reached to peak in high school students (17.6%). These differences were significant statistically too. The change in prevalence of overweight and obesity with increasing class is in consonance with the age related changes as observed in our study itself as well as in different studies conducted throughout India.^{14,15,18,19,20}

In present study, prevalence of obesity and overweight was higher in Socioeconomic class III (16.1%) as compared to class II (12.2%) and Class I (12.0%) yet this association was not significant statistically. Although in some previous studies impact of socioeconomic status was assessed in terms of socioeconomic status itself as well as in terms of comparison between type of school (government vs private, English medium vs Vernacular medium)^{14,15,18,19,20} and has resulted in significant differences.

This might be primarily due to the fact that in present study we selected a relatively more homogeneous study population. One of the limitation of the study was that it was conducted in a single school and hence comparisons such as government-private schools, Hindi-English medium schools could not be done as an alternative to socioeconomic strata.

In our study we evaluated the role of dietary preference (vegetarian, non-vegetarian, eggarian), frequency of eating outside home, frequency of fast food intake, frequency of soft drinks/ice cream intake, frequency of bakery/ confectionary products consumption, frequency of green leafy vegetable consumption and frequency of fruit/fruit juice intake as the factors reflecting the dietary pattern.

In present study, we could not find a significant association between dietary preference (vegetarian/ non-vegetarian/ eggarian diet), frequency of fast food intake, bakery/confectionary product intake and fruit/fruit juice intake with nutritional status of the children, however, habit of eating out, soft-drink/ice cream consumption, intake of green leafy vegetables, mode of transport to school, duration of participation in outdoor games and time spent in activities like television watching/video games showed a significant association with the nutritional status of the children.

In present study, majority of children were either vegetarians or eggarians with very few were non-vegetarians. Although, non-vegetarian diet is considered to be a good source of protein, however, in Indian cuisine it is often prepared in a sumptuous gravy full of oil and fat, thus making it equally unhealthy. Moreover, most of the children who reported to be non-vegetarian, did not have a non-vegetarian food item regularly on their plate.

*Kumar M et al.*¹⁴ found that consumption of fried foods, energy drinks and bakery products had a positive correlation with overweight and obesity while regular physical activity was inversely associated with overweight and obesity. It is in agreement with *Babitha Rexton et al.*¹⁵ the consumption of fruits and vegetables was significantly associated with lower odds of overweight and obesity. They also showed that longer duration of participation in outdoor games, avoiding eating out and adequate sleep were significantly associated with lower odds of overweight and obesity.

Tapniker *et al.*²¹ also found fast food and binge eating to be significantly and positively associated with overweight and obesity. Bhardwaj *et al.*²² also held high fat, energy-dense fast foods to be responsible for childhood obesity. Vohra *et al.*¹⁶ in their study from Lucknow also found that shorter duration of outdoor games and consumption of fast food were the important correlates of overweight/obesity among children. Goyal *et al.*²³ reported that habits like junk food, chocolate, eating outside at weekend and physical activity like exercise, sports, sleeping habit in afternoon had a remarkable effect on prevalence on overweight and obesity. Thus, the findings of present study are in agreement with the observations made in literature and emphasize upon the need to understand the energy balance scenario in terms of energy intake and its consumption in view of the activity profile of children.

CONCLUSION

In present study, we established that energy and fat intake of obese and overweight children was significantly higher as compared to underweight and normal weight children, thus stressing on the need to understand the energy balance context. This finding indicates the need for a lifestyle modification in order to change the situation.

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