Original Research Article

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Determinants of overweight and obesity among selected school going children in Tumkur (tier 2) city, Karnataka, India

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ABSTRACT

Background: The World Health Organization has described obesity as one of today's most neglected public health problems. Obesity in children appears to increase the risk of subsequent morbidity (like sleep apnea, NIDDM, Gallbladder disease, Dyslipidemia, Insulin resistance etc.), whether or not obesity persists into adulthood.1 In developing countries such as India, especially in urban populations, childhood obesity is emerging as a major health problem nearly 8 to 23 percent children are obese and overweight by various study. Aims and Objectives: To assess the determinants of overweight and obesity in selected government, aided and unaided schools of Tumkur city.

Methods: A cross sectional study was done with 2207 students, aged 10-16 years from 10 schools in Tumkur (tier-2) City. Recommended cut-off points for Indian children (IAP Classification 2012) were utilized to assess overweight and obesity.2 Out of 2207 students 290 were found to be overweight and obese. Twice their number i.e., 580 normal BMI students of same age and gender were selected randomly as controls to study the determinants of overweight and obesity.

Results: Prevalence of childhood overweight was 7.02% and obesity was 6.12% respectively. Children of higher educated family found to be more overweight and obese. High socio-economic group children had higher prevalence of obesity than low socio-economic group. Snacking habit and eating of junk food promoted the obesity. Increased hours of schooling lack of physical activity, tuition classes, more homework, TV watching, use of computers and playing video games contributed to sedentary lifestyle, which triggered the onset of obesity among children.

Conclusions: Overall prevalence of overweight and obesity among school going children was 13.14%. It was more in boys (13.24%) than girls (13.04%), respectively. The higher prevalence of overweight in school children of Tumkur may be attributed to their eating habits, as well as to their lack of awareness on proper eating habits. Education of parents had a direct relationship to childhood obesity. In addition, low involvement in physical activities may also have influenced the rate of overweight and obesity.

Keywords: BMI, Childhood obesity, Physical activity of children, Snacking habit, Sedentary activity

INTRODUCTION

Childhood obesity has more than tripled in the past 30 years. Overweight and obesity during childhood is a

matter of growing concern in India. Social, educational, economic, cultural, psychological and personal factors along with availability of food play a key role in "food behaviour".

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Obesity in children and adolescents is gradually becoming a major public health problem in many developing countries; including India.³ Effective prevention of adult obesity will require the prevention and management of childhood obesity. Healthy lifestyle habits, including healthy eating and physical activity, can lower the risk of becoming obese.⁴ Overall, obesity in childhood appears to increase the risk of subsequent morbidity, whether or not obesity persists into adulthood.⁵ It is believed that 50-80% of obese children will continue to be obese as adults.

METHODS

This cross sectional study was conducted during the period from October 2012 to April 2014 in Tumkur city situated along National Highway-4 nearly 72 Km from Bengaluru, capital of Karnataka. Out of 102 schools in Tumkur city 10% of schools were selected randomly. Among them two Government, two aided and six unaided schools were selected by probability proportionate to size. All students from 10 year completed to 16 years completed by date of birth were selected for the study. After obtaining ethical clearance from ethical committee of Sri Siddhartha Medical College, BEO (block education officer) of Tumkur and school authorities, the class teachers were briefed on the purpose of the study and written consent was obtained from all students under study. The students were then briefed regarding the questionnaire administered to them in local language. BMI was used to assess the obesity based on the BMI charts developed by IAP (Khadilkar, et al).²

BMI was calculated by using the formula:⁷

BMI = weight in kilograms / (height in meter)²

The BMI recorded was compared against Body Mass Index percentile charts as per Indian Academy of Pediatrics (IAP) 2007 Guidelines.² Students who had BMI for age and sex >85th but< 95th percentile of reference population were classified as overweight. Students who had BMI for age and sex >95th percentile of reference population were classified as obese. All the overweight and obese students were selected for the study of determinants of obesity along with twice the number of normal BMI students selected randomly from the same class, gender and similar age as control group for comparison.

Out of 2316 students, 2207 students were selected (109 excluded by exclusion criteria). Out of 2207 students, 290 were found to be overweight and obese. Twice their number i.e., 580 normal BMI students were selected randomly for control group & they were assessed using a predesigned questionnaire by interview technique to elicit information on their family characteristics like socioeconomic status, religion, income, education and occupation of the parents. Information on individual characteristics like age, sex, dietary pattern (type of meal

and snacking habits as it was found difficult to measure the quantity of snack consumption in the pilot study, frequency of snacking was taken into account) and physical activity were also collected. We used standardized weighing machine and stadiometer to measure the weight (nearest to 0.10 kg) and height (nearest to 0.5 cm) of each child by using standard procedures.

Inclusion criteria

All school going children (10-16 yrs of age group) from selected schools from both genders were included for study.

Exclusion criteria

- Children who/whose parents did not give consent for the study.
- Children who were absent on the day of interview even on second visit.
- Children who were less than 10 years of age or more than 16 years of age.
- Children who had chronic illness, endocrine problems, physical and mental defects were excluded by history, physical examination and appropriate laboratory investigations.
- Children hailing from outside Karnataka.

A predesigned questionnaire was used to interview the study participants (including both normal and obese students) to elicit information on their family characteristics like socio-economic status, religion, income, education and occupation of the parents. Information on individual characteristics like age, sex and dietary pattern were also collected. A written informed consent in the local language was taken from all 870 students and their class teacher before their participation.

${\it Question naire}$

The questionnaire was prepared to assess the eating habits of the students participating in the study. Questions were divided into different sets like,

- Socioeconomic status
- Education of parents, parental obesity.
- Snacking habits
- Daily activities (Physical and Sedentary)

Statistical analyses

Data collected was entered in MS Excel spread sheet (version 2007). Descriptive statistical analysis was done. Further analysis was done using inferential statistical tests by using Epi InfoTM 7.1.1.14. For all the statistical tests, p value of <0.05 was considered as statistically significant. The results for continuous variable were given as mean \pm standard deviation and as proportions

and percentages wherever relevant. Interpretations were drawn after appropriate statistical analysis.

RESULTS

Out of 2207 students, prevalence of overweight was 7.02% (155) and obesity was 6.12% (135) respectively. Prevalence of underweight was 11.96% (264) and normal nutritional status was 74.9% (1653) respectively. Overall prevalence of overweight and obesity was 13.14% (Figure 1). In figure 1 underweight also included because to show total sample size and its distribution=2207.

From the Table 1 it was observed that, in the age group of 14-15 years prevalence of overweight being 8.20% was highest and prevalence of obesity (8.6%) was at its peak in the age group of 11-12 years.

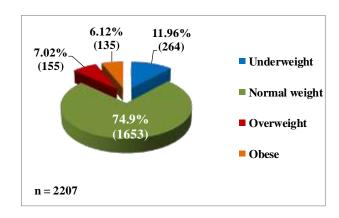


Figure 1: Prevalence of underweight, normal weight, overweight and obese (n=2207).

Table 1: Prevalence of overweight and obesity in different age groups.

Age Group (years)	No. of students in each group	Overweight	Obese	Total
10-11	343	25 (7.29%)	17 (4.96%)	42 (12.30%)
11-12	407	27 (6.63%)	35 (8.60%)	62 (15.30%)
12-13	423	29 (6.86%)	29 (6.86%)	58 (13.70%)
13-14	394	26 (6.60%)	17 (4.31%)	43 (10.90%)
14-15	366	30 (8.20%)	23 (6.28%)	53 (14.60%)
15-16	274	18 (6.57%)	14 (5.11%)	32 (11.80%)
Total	2207	155 (7.02%)	135(6.12%)	290 (13.10%)

Chi-square = 14.5391; df=5, P=0.0246, Association= Significant.

The mean BMI of Boys were 17.42 (SD ± 3.12) and for girls were 18.17 (SD ± 3.34) respectively. The mean BMI

from age 10 years to 16 years in Table 2 illustrate how increasing age increases mean BMI in both boys and girls.

Table 2: Distribution of students according to their mean BMI and SD.

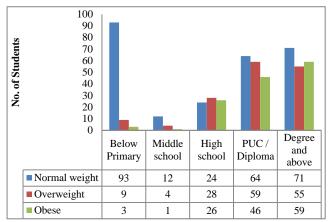
Age in	Boys			Girls		
years	No. of observation	Mean BMI	SD	No. of observation	Mean BMI	SD
10	169	16.17	±2.38	174	16.54	±2.58
11	213	16.72	±2.92	194	17.42	±3.27
12	228	17.25	±3.22	195	17.65	±3.47
13	202	17.56	±3.30	192	18.23	±3.26
14	192	17.93	±3.25	174	19.43	±3.62
15	137	18.91	±3.77	137	19.76	±3.85
Total	1141	17.42	±3.12	1066	18.17	±3.34

As per Modified Kuppuswamy's socio economic classification (Note: By using All India Consumer Price Index (AICPI) for the year 2014 Jan), Among over nutritious children 61% belonged to class II & only 9.5% to class I. None of them were from class V. Where in

normal weight students 47% belong to Class II and 14.5% were from class I.

Obesity in children, whose father's education was degree and above (includes graduate & post-graduates), was

definitely higher than in children, whose father was less educated (Figure 2).



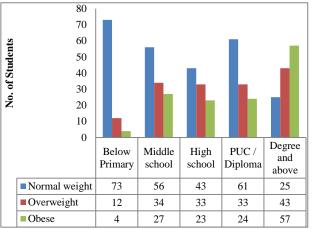
Chi-square=34.25, df=12; P=0.001, Association= Highly significant.

Figure 2: Association between father's education and nutritional status of children.

Obesity in children whose mother's education was college and above was higher than in children whose mother education status was lower (Figure 3).

There was not much difference between Veg and mixed diet consumer and obesity. Snacking habit shows increase in prevalence of obesity in this study. Among normal weight 14 (2.4%) children and in overweight and obese group 69 (23.7%) children consumed bakery items more

than 100 grams and more than two times per week, statistically it was observed that there is significant difference in consumption of bakery items between them. (P<0.001) 8.9% of normal weight children and 11.3% of overweight and obese consumed ice creams more than two times. 49.8% among normal weight and 53.4% among overweight and obese consumed chocolate more than two times. 8.9% normal weight and 11.3% of overweight and obese consumed potato chips more than 50 grams and more than two times/week; difference was not statistically significant. (P>0.05) (Table 3).



Chi-square=34.844, df=12; P=0.001, Association= Highly significant.

Figure 3: Association between mother's education and nutritional status of children.

Table 3: Frequency of consuming fastfoods and obesity.

Frequency of	Bakery ite	ems	Ice Cream	1	Chocolate	!	Potato chi	ips
consumption / Week	Normal	Ow/Ob	Normal	Ow/Ob	Normal	Ow/Ob	Normal	Ow/Ob
< 2 Times	566 (97.6%)	221 (76.2%)	528 (91.0%)	257 (88.6%)	291 (50.2%)	135 (46.6%)	573 (98.8%)	286 (98.6%)
> 2 Times	14 (2.4%)	69 (23.8%)	52 (9.0%)	33 (11.4%)	289 (49.8%)	155 (53.4%)	7 (1.2%)	4 (1.4%)
Total	580 (100%)	290 100%)	580 (100%)	290 (100%)	580 (100%)	290 (100%)	580 (100%)	290 (100%)
Chi-square	19.932		1.018		0.874		0.011	
df	1		1		1		1	
P	0.001		0.312		0.074		0.914	
Association	Highly Sig	nificant	Not signifi	cant	Not signifi	cant	Not signifi	icant

Ow/Ob = overweight and obese.

It was observed that 5.6% non-obese children and 15.5% of obese children consumed fast food more than two times per week, which was statistically highly significant. (P<0.001) (Figure 4). Fast food is energy dense and high in fat, low in complex carbohydrates. Furthermore beverages containing substantial amounts of sugar or

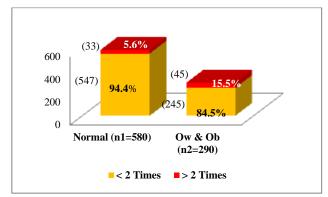
alcohol are often consumed as a part of fast food meal. Examples of fast foods are samosa, Chips, Burgers, Biscuits, Soft drinks like coca cola, Pepsi chocolates and Ice creams. Frequency of more than 5 times per week was included as high frequency in our study.

It was observed that increased frequency (>5 times per week) of eating fruits seen in normal as compared to overweight and obese students, however it was statistically not significant (P>0.05). We observed that among normal weight students 56.7% (329) and 24.15% (120) and among overweight and obese 146 (50.3%) and 63 (21.7%) children consumed vegetables two to five times and more than five times per week respectively. There was significant difference between two groups in consumption of vegetables. (P<0.05) (Table 4).

Physical activity assessed in this study showed that increase in frequency of physical activity in normal weight group than obese group.

We assessed sedentary life style by time spent on television watching, playing video games, time spent in tuition classes, time spent doing homework and time spent for sleep per day. It was observed that 81.38%

(236) obese and 14.14% (82) non-obese students spent more than one hour in watching TV. (p=0.001) (Table 5).



Ow & O b = overweight and obese; Chi-square=21.689, df=12; P=0.001, Association= Highly significant.

Figure 4: Frequency of eating fast foods and obesity.

Table 4: Frequency of eating vegetables and obesity.

Vegetable per week	Normal (n ₁ =580)	Overweight and Obese (n ₂ =290)	Total
<2times	111 (19.13%)	81 (27.93%)	192 (22%)
2-5times	329 (56.72%)	146 (50.34%)	475 (55%)
>5times	140 (24.14%)	63 (21.72%)	203 (23%)
Total	580 (100%)	290 (100%)	870 (100%)

Chi-square=8.697, df = 2, P=0.012, Association= Significant.

Table 5: Obesity in relation to TV viewing.

Time spend watching television per day	Normal (n ₁ =580)	Overweight and obese (n ₂ =290)	Total
< 1 Hour/Day	82	236	318
> 1 Hour/Day	498	54	552
Total	580	290	870

Chi-square=14.028, df=1, P=0.001; Association= Highly significant.

DISCUSSION

Prevalence of overweight and obesity was 13.14% in school going children, 11.96% (264) children were underweight and 74.9% (1653) were normal weight. In a similar study conducted by Kapil U on 10-16 years old affluent school children in Delhi, prevalence of obesity was 7.4%. In this present study prevalence of overweight and obesity in government school children was 3.8% (13) & in aided schools children was 9.4% (47) and in unaided school children was 16.8% (230). Gradual rise in prevalence of obesity among both boys and girls was observed in government, aided and lastly in unaided schools children.

Socio-economic background of students seemed to play a role in risk of obesity. In our study, higher prevalence of obesity was seen in class II and above socioeconomic status (as per modified Kuppuswamy's socioeconomic scale), compared with class III & IV. Similarly study by Ramachandran showed higher prevalence of obesity in the higher socio-economic groups. ¹⁰ In our study it was found that parents' education was having a strong positive association with prevalence of overweight and obesity, and it was observed that as parents' education level increased, prevalence of overweight and obesity tended to increase.

In this study history of parental obesity was positively associated with overweight and obesity in children. In another study done in Punjab school children, it was observed that positive family history of obesity contributed significantly for childhood obesity. ¹¹

We found that 21% of overweight and obese children were consuming a mixed diet, however, association of mixed diet consumption and overweight/obesity was not found to be statistically significant. Studies have shown association between high energy, high fat and junk foods as one of the influencing factors of obesity in childhood. Moreover diets high in fats are likely to be energy dense and highly palatable. This combination leads to increased energy intake and to increased body mass index. ¹²

In our study children consuming high calorie foods like fast food, biscuits, bakery items, ice-creams, chocolates and potato chips were observed to have an increased prevalence of obesity. Between 7 to 15 years of age an excess of approximately 165 Kcal/day could lead to a theoretical 3kg excess weight gain, largely as fat per year. Worldwide, eating foods away from home has been implicated as a cause for increased energy intake. ¹³

Television watching was observed to increase obesity risk, however their sedentary activity like playing on computers, video-games and going for tuition classes were not of much significant between both groups. Studies have shown that an increase in physical activity was associated with decrease in BMI among girls and boys, who were overweight; conversely, an increase in inactivity was associated with increasing BMI in girls, which was similar to our study.¹⁴

Limitations

Quantification and qualification of snacking and activity of children was framed for convenience of practicability & was not measured.

CONCLUSION

Overall prevalence of overweight and obesity among school going children was 13.14%. It was more in boys (13.24%) than girls (13.04%), respectively. The higher prevalence of overweight in school children of Tumkur may be attributed to their eating habits, as well as to their lack of awareness on proper eating habits. Education of parents had a direct relationship to childhood obesity. In addition, low involvement in physical activities may also have influenced the rate of overweight and obesity.

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Ethical approval: The study was approved by the

Institutional Ethics Committee

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Annexure

Sl. No.	What is Already Known?	What this Study Adds
1.	Overweight & Obesity is public health problems in developed countries.	This study shows even in India overweight and obesity is a up-coming threat to India. As prevalence in increasing in India too.
2.	Higher the parents Education decrease the prevalence of most of the nutritional disorder in their children.	As the parents are higher educated their children tend to increase the weight, due to both parents will be working and have increased frequency of fast food and going to restaurants.
3.	Eating mixed diet frequently tend to increase weight in childhood.	We found no differences in those who use mixed diet and pure vegetarian diet children.
4.	Most of the studies conducted using WHO age and gender specific BMI classification.	In this study we use Khadilkar classification, which is approved by Indian Academy of Pediatrics, as this classification is suitable to use in Indian community.