Section: Community Medicine

Original Research Article

A STUDY OF PREVALENCE AND FACTORS ASSOCIATED WITH OVERWEIGHT AND OBESITY AMONG THE HIGH SCHOOL CHILDREN IN URBAN BALLARI

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ABSTRACT

Background: Childhood obesity is one of the most serious public health challenges of the 21st century. The problem is steadily increasing in low- and middle-income countries. This global pandemic necessitates interventions at a very early age, for which the burden of childhood obesity has to be studied. **Materials and Methods:** There were 1980 children, aged 12 to 18 years, from classes 8th to 10th, in the study. They were selected using the WHO 30-cluster, multistage, proportionate probability sampling technique. The data were collected from individual students by school-to-school visits, using a pre-tested semi-structured questionnaire, followed by anthropometric measurements. **Result:** The prevalence of overweight and obesity was 5.91% and 2.07 % respectively, with a combined prevalence of 7.98%. Socio-demographic characteristics of the study subjects showed that 58 % were boys and 42% were girls. Overweight and obesity were more common among 13 to 16-year-olds (94.4%), students from private schools (53.3%), Hindus (76.3%), children who knew their family income (77.6%), and belonged to class II (36%) of B G Prasad classification. The majority were from a nuclear family (76%), and day scholars (79%). The greater number of overweight and obese students were having a mixed diet (62.4%). **Conclusion:** Obesity and overweight in children was found to be significantly associated with following risk factors: attending private schools, higher socioeconomic class, nuclear family, father's occupation of skilled category, regular Junk food and soft drinks consumers, <1 hour of physical activity, use of motorized vehicle to reach the school, watching Television/Video games for > two hours per day.

INTRODUCTION

A major global concern for children's health is overweight and obesity, which are mostly caused by a diet high in processed and unhealthy foods, sedentary behavior, and a lack of physical activity.[1] Thirty-five million children under five were overweight in 2024. In 2022, more than 390 million kids and teenagers between the ages of 5 and 19 were overweight, with 160 million of them suffering from obesity.[2] Obese people have a lower health-related quality of life. Adolescents and those with extreme obesity are more likely to have comorbidities of obesity, such as depression, fatty liver disease, and type 2 diabetes mellitus.[3] Childhood obesity is also linked to gout, osteoarthritis, gall bladder disease, and sleep apnea.[4] In addition to addressing nutritional, physical activity, sedentary, and sleep behaviors, treatment takes a family-based, compassionate, and stigma-free approach. Furthermore, the fat youngster experiences discrimination and social bias. Preventing childhood obesity must therefore be a top focus.[5] An energy imbalance between calories consumed and calories burned is the primary cause of obesity and overweight. Globally, this energy imbalance is increasing as a result of a decrease in physical activity and an increase in energy-dense, high-fat foods due to a change in lifestyle, a significant shift toward less physically demanding jobs, a rise in automated transportation, and an increase in labor-saving devices at home.[6] The environment in which modern man lives is extremely obesogenic.[7,8]

There is a dearth of information about childhood obesity and overweight in the Ballari region. Data on the prevalence of childhood obesity and its risk

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factors are crucial for the implementation of intervention strategies. Therefore, an effort is made to determine the prevalence of overweight and obesity, along with the risk factors associated with these conditions, among urban Ballari high school students.

Objectives: To estimate the prevalence of overweight and obesity among the High school children of urban Bellary. And to study the factors associated with overweight and obesity.

MATERIALS AND METHODS

Study design and setting: A Cross-sectional study was conducted in the urban regions of Ballari taluk, Karnataka. Ballari taluk is divided into two educational blocks, Ballari East and Ballari West, each having both urban and rural areas. Only the schools from urban areas were listed and included in the study. Students in High Schools (8th to 10th grade) in Ballari, an urban area was studied for one year.

Inclusion Criteria

1) High Schools in Bellary Urban.
2) High School children studying in 8th, 9th and 10th class in the study area.

Exclusion Criteria

1) High Schools with refusal of permission to conduct the study.
2) Refusal by the child to undergo study.
3) Children with history of major illness, which may affect the student's weight, in the past 6 months.

Sample size: 1980

The sample size is determined using the formula $N= (z^2pq)/d^2$

N = Sample size estimate.

z = Standardized normal deviate (1.96).

p = Proportion of the target population with the characteristic being measured.

q= (100-p)

d= Relative precision.

A study conducted in Mangalore city of Karnataka, by Dhole S et al,9 found the prevalence of overweight to be 9.9%; this prevalence was used to find out the sample size. Relative precision was set at 20%.

So, in our study z = 1.96; p= 9.9; q =90.1 and d = 1.98 (20% of 9.9)

Sample size estimate (N) = (1.96×1.96×9.9×90.1)/1.98×1.98 = 3426.67/3.92= 874

We used a multistage, cluster sampling technique to collect the sample. So to overcome the design effect, and make the sample more representative, the sample size, calculated which be 874, was doubled to 1748. Adding the non-response error of 10% and rounding off, the sample required was found to be 1980.

Sampling technique: WHO, 30 clusters; probability proportionate sampling technique was used to select the study subjects. A list of all high schools (8th to 10th class) in Bellary urban was prepared. A total of 68 schools were present in the list, being government schools first, followed by private aided, and private. The total population of students in 8th, 9th, and 10th in each school was collected from the Block Education Office, Ballari East and West. A cumulative population list was created, and samples were selected by systematic sampling from a random start.

The total school population (15,634), was then divided by the number of clusters needed (30), to determine the sampling interval (a=521). Likewise, a random number (n=181) was selected within the size of the sampling interval. The first school selected was the one attended by the nth (181) child, the second school was the one attended by the nth + a (181+521=702) child, the third by the nth +2a (181+1042 =1223) child etc., till 30 clusters have been identified. If the same school was selected twice by this method (school population > sampling interval), the school was divided into two subsamples, and each subsample was taken as a separate cluster.

To achieve the required sample size of 1980 from 30 clusters, the sample required from each cluster was 66. Within each cluster, the children were selected using a simple random technique.

Ethical consideration: This was a cross-sectional study with no interventions; however, the study protocol was approved by VIMS, Ethical Review Committee.

Informed consent: the objectives of the study and procedure were explained to all the students, and verbal and written informed consent was taken.

Study Material: A semi-structured questionnaire to collect data on the required variables was designed based on the previous literature. The questionnaire was translated into Kannada (local language). The questionnaire in both English and Kannada languages was scrutinized by the Faculty of the Department of Community Medicine, VIMS, Ballari, following which it was tested in one English medium and one Kannada medium School, of Ballari, urban, with their respective questionnaire. Necessary changes were made based on the feedback of children and the difficulties encountered. An electronic weighing scale with an error of ± 100 grams was used to record the weight of the study subjects. The weight was measured without shoes and heavy clothing. Using a standard procedure, a portable stadiometer with an error of 0.1cm was used to measure height.

Method of collection of data: Permission to conduct the study was obtained from, Block education officers of Ballari East, Ballari West, and from the principals of the schools selected for the study. Data was collected using a pre-tested semi-structured questionnaire, taking the verbal consent of the students, and explaining each question to them students. Anthropometric measurements, two readings each of height, weight, waist, and hip circumference were taken, and the average calculated. Adiposity varies with age and gender during childhood and adolescence; therefore,

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National Centre for Health Statistics/CDC-2000 growth charts for children and adolescents aged 2-20 years, i.e., BMI for age and sex percentile growth curves (Annexure II, III), will be used to classify the subjects as overweight and obese.

Statistical Analysis: The data were entered into a Microsoft Excel 2007 spreadsheet. Final analysis was done using SPSS for Windows 20.0 version. The prevalence of overweight and obesity was estimated for Bellary, urban, with a 95% confidence interval. Risk factors for overweight and obesity were compared using the odds ratio, and statistical significance was tested using the chi-square test.

RESULTS

Among the 1980 students studied, 41(2.07%) were found to be obese, 117(5.91%) were overweight, 554(27.98%) were undernourished, and 1268(64.04%) were normal (Figure 1). Among the study subjects, 1155 (58.3%) were male 825 (41.7%) were female.

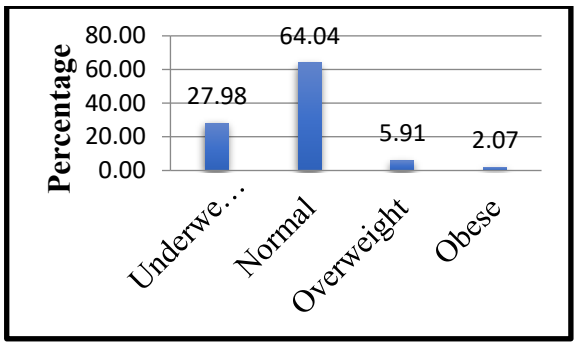

Figure 1: Distribution of study subjects based on BMI category

Various parameters, such as gender, school type, religion, socioeconomic status, family type, residence type, diet type, father's education, mother's education, father's occupation, mother's occupation, number of consumptions of junk food and soft drink in a week, physical activity, mode of transport to the school, number hours spent in watching TV/video games and sleep were studied and categorized according to the BMI categories and reflected in table 1.

Table 1: Distribution of study subjects based on various parameters and BMI categories

Parameter	Under weight		Normal		Over weight		Obese		Total	
	No	%	No	%	No	%	No	%	No	%
Gender										
Male	399	34.6	664	57.5	70	6.1	22	1.9	1155	58.3
Female	155	18.8	604	73.2	47	5.7	19	2.3	825	41.7
School Type										
Govt	133	28.8	304	65.8	22	4.8	3	0.7	462	23.3
Aided	175	37.9	264	57.1	19	4.1	4	0.9	462	23.3
Private	246	23.3	700	66.3	76	7.2	34	3.2	1056	53.3
Religion										
Hindu	418	27.8	969	64.2	95	6.3	28	1.9	1510	76.3
Muslim	116	28.5	262	64.4	18	4.4	11	2.7	407	20.6
Others	20	31.8	37	58.7	4	6.4	2	3.2	63	3.2
BG Prasad Socioeconomic class										
V	22	51.2	19	44.2	2	4.7	0	0.0	43	2.8
IV	85	37.4	129	56.8	11	4.9	2	0.9	227	14.8
III	110	31.1	216	61.0	24	6.8	4	1.1	354	23.0
II	130	23.5	385	69.5	29	5.2	10	1.8	554	36.0
I	90	25.1	217	60.5	33	9.2	19	5.3	359	23.4
Family type										
Nuclear	408	27.1	964	64.1	98	6.5	35	2.3	1505	76
Joint	146	30.7	304	64.0	19	4.0	6	1.3	475	24
Residence type										
Day Scholar	447	28.5	1001	63.8	89	5.7	33	2.1	1570	79.3
Hostel	107	26.1	267	65.1	28	6.8	8	2.0	410	20.7
Diet type										
Mixed	337	27.3	796	64.5	75	6.1	27	2.2	1235	62.4
Vegetarians	217	29.1	472	63.4	42	5.6	14	1.9	745	37.6
Fathers education										
Illiterate	25	33.8	44	59.5	5	6.8	0	0.0	74	3.7
1st to 7th	127	32.9	234	60.6	21	5.4	4	1.0	386	19.5
8th to 10th	193	30.3	399	62.6	32	5.0	13	2.0	637	32.2
Pre-degree	108	25.8	276	65.9	24	5.7	11	2.6	419	21.2
≥ Graduate	101	21.8	315	67.9	35	7.5	13	2.8	464	23.4
Mothers education										
Illiterate	56	40.9	72	52.6	9	6.6	0	0.0	137	6.9
1st to 7th	161	29.1	350	63.3	24	4.3	18	3.3	553	27.9
8th to 10th	186	28.7	410	63.4	41	6.3	10	1.5	647	32.7
Pre-degree	102	28.3	226	62.8	23	6.4	9	2.5	360	18.2
> Graduate	49	17.3	210	74.2	20	7.1	4	1.4	283	14.3
Fathers' occupation										
Unemployed	5	41.7	7	58.3	0	0.0	0	0.0	12	0.6

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Unskilled	110	34.8	190	60.1	15	4.7	1	0.3	316	16.0
Semiskilled	168	33.5	306	61.0	23	4.6	5	1.0	502	25.4
Skilled	271	23.6	765	66.5	79	6.9	35	3.0	1150	58.1
Mothers Occupation										
Home maker	415	26.1	1043	65.6	93	5.9	38	2.4	1589	80.3
Unskilled	32	29.9	63	58.9	11	10.3	1	0.9	107	5.4
Semiskilled	11	44.0	13	52.0	1	4.0	0	0.0	25	1.3
Skilled	96	37.1	149	57.5	12	4.6	2	0.8	259	13.1
Junk food-no/week										
≥3 times	261	24.8	687	65.3	76	7.2	28	2.7	1052	53.1
<3 times	293	31.6	581	62.6	41	4.4	13	1.4	928	46.9
Soft drinks-no/week										
≥3 times	119	26.3	278	61.5	42	9.3	13	2.9	452	22.8
<3 times	435	28.5	990	64.8	75	4.9	28	1.8	1528	77.2
Physical activity										
<1 hour	252	24.8	635	62.6	96	9.5	32	3.2	1015	51.3
≥ 1 hour	302	31.3	633	65.6	21	2.2	9	0.9	965	48.7
Mode of Transport										
Motorized vehicle	147	20.8	486	68.8	53	7.5	20	2.8	706	35.7
Bicycle/walk	407	31.9	782	61.4	64	5.0	21	1.6	1274	64.3
TV/Video games										
> 2 hrs	65	23.6	171	62.0	27	9.8	13	4.7	276	13.9
≤ 2 hrs	489	28.7	1097	64.4	90	5.3	28	1.6	1704	86.1
Hours of sleep										
≤ 6	45	20.4	158	71.5	15	6.8	3	1.4	221	11.2
>6 to <10	434	28.1	984	63.7	91	5.9	36	2.3	1545	78.0
≥ 10	75	35	126	58.9	11	5.1	2	0.9	214	10.8

DISCUSSION

The prevalence of overweight and obesity in our study was 5.91% and 2.07% respectively, with a combined prevalence of 7.98%. Ashtekar S V et al,[10] conducted a study in 2012, in Latur city of Maharashtra, they found the prevalence of overweight and obesity to be 8.44% and 1.54 % respectively. Hence, the prevalence of overweight and obesity of the present study was similar to other studies of India.

In this study, the prevalence of overweight and obesity was highest among 16-year (12.3%), followed by 15-year (8.4%), 14-year (8.1%), 13-year-olds (6.5%), 17 year (6.5%) and 12 year old (4.2%). From 13 years to 16 years there is an increase in prevalence of overweight and obesity with an increase in age; however, the association between age and overweight/obesity was not statistically significant. In a similar study done by S Kumar et al,[11] the prevalence of obesity increased with increase in age. Contrast results were seen in a study done by Warraich et al,[12] where no relationship between the BMI category and age was seen.

In the present study, the prevalence of overweight and obesity was similar in males and females (8%). There was no association between gender and overweight/obesity. Sharada Sindu et al,[13] in their study done in Amritsar, Punjab, found a higher prevalence of overweight and obesity among girls (18.3%) than boys (14.86), but this difference was not statistically significant.

In the present study, we found a significant association between private schools and overweight/obesity. Prevalence of overweight and obesity was highest among Private schools (10.4%), compared to government (5.4%), and aided (5.0%) schools, and this difference was found to be statistically significant (p< 0.001). Similar results were found in a study carried out by Laxmaiha et al,[14] in which, the prevalence of overweight and obesity to be significantly higher among private schools (9.6%), compared to government schools (3.2%).

In this study, prevalence of overweight and obesity was highest among 10th class (9.8%), followed by 9th (7.0%), and 8th class (6.8%), but this difference was not found to be statistically significant (p =0.074). Since the study was limited to High school children, comparing primary school children with high school children was not possible. However, Vohra et al,[15] in their study in Lucknow city of Uttar Pradesh found that prevalence of overweight and obesity was higher among children belonging to class above 8th, compared to those below 8th.

In the present study, prevalence of overweight and obesity was highest among others (9.5%), followed by Hindu's (8.1%), and Muslim's (7.1%), but this difference was not found to be statistically significant. Several studies showed similar results. Subash Thakre et al,[16] in their study in Nagpur city of Maharashtra found prevalence of overweight and obesity to be high among others(19.63%), compared to Hindus(14.2%), again this difference was statistically not significant.

In the current study, even though few study subjects failed to give data on their family income, among those who gave data regarding family income, we found a significant (p <0.001) association of overweight /obesity with high socioeconomic class I (14.5%) followed by class III (7.9%), class II (7.0%), class IV (5.7%) and class V (4.7%). Y Kaneria et al,[17] conducted a comparative cross-sectional study and results showed a significant increase in overweight (3.25%) and obesity (3.73%) in the affluent group as compared to the non-affluent group.

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They concluded that comparative data clearly delineate that obesity is an increasing malady of affluent populations.

In this study, the prevalence of overweight and obesity was higher among nuclear (8.8%), compared to joint family (5.4%), and this was statistically significant (p=0.012). The odds of a student in a nuclear family getting overweight and obesity were 1.745 (1.123 to 2.710; 95% CI) times the student in a joint family. However, Vohra et al,[15] in their study among School children of Lucknow city, Maharashtra, found the prevalence of overweight/obesity to be 2.89% and 7% in nuclear and joint families, respectively, but this difference was statistically not significant (p = 0.06).

In the present study, the prevalence of overweight and obesity was highest among hostilities (8.8%), compared to day scholars (7.8%), but this difference was not statistically significant (p =0.502).

In the present study, even though the prevalence of overweight and obesity was higher among mixed diet (8.2%), compared to vegetarians (5.5%), we didn't find any significant association between type of diet and overweight/obesity (p =0.555). However, several studies, show significant higher prevalence among mixed diet. Ashtekar S V et al,[10] conducted a study among 1182 school children, aged 9 to 14 years, in Latur city of Maharashtra, and found the prevalence of overweight and obesity to be higher among children consuming mixed type of diet (17.54%), compared to vegetarian type of diet (2.89%), which was statistically significant (p< 0.001; Odds ratio= 3.54).

In our study we didn't find any association between parent's education and overweight/obesity. Prevalence of overweight and obesity was highest among children with father's education above graduate (10.3%), followed by pre- degree (8.4%), 8th to 10th (7.1%), illiterate (6.8%) and 1st to 7th (6.5%), but this difference was not statistically significant. Prevalence of overweight and obesity was highest among students with mother's education as pre-degree (8.9%), followed by graduate (8.5%), 8th to 10th (7.9%), 1st to 7th (7.6%) and illiterate (6.6%) but this difference was not statistically significant. Vohra et al,[15] conducted a study, among high school children of Lucknow, Uttarpradesh. They found the prevalence of overweight and obesity to be 3.3%, in mother's education below 6th standard, compared to 5.59%, in more than 6th standard, but it was not statistically significant (p =0.46).

In the present study, we found significant association of father's occupation under skilled category, with overweight/obesity. Prevalence of overweight and obesity was highest among students with father's occupation as skilled (9.9%), followed by semiskilled (5.6%), and unskilled (5.1%), and this difference was found to be statistically significant (p = 0.002). Prevalence of overweight/obesity was highest among students with mothers occupation as unskilled (11.2%), followed by home maker (8.2%), skilled (5.4 %) and semiskilled (4.0%), but this difference was not found to be statistically significant at 95% confidence level. (Chi square = 4.553; d f = 3; p = 0.208). Similar results were found in the following study. Laxmaiha et al,[14] conducted a study among 1208 children, aged 12 to 17 years, in urban adolescents of Hyderabad, India, in the year 2003, found the prevalence of overweight and obesity to be higher among those with parents occupation as service (9.1%) or business (7.4%) compared to others (3.1%).

In the current study, the prevalence of overweight and obesity was more among those who consumed any junk food 3 or more times per week (9.9%), compared to those who consumed it less than 3 times a week (5.8%), and this difference was statistically significant (p =0.001). The odds of those who consume junk food 3 or more times a week developing overweight and obesity was 1.776 (1.262 to 2.498; 95% C.I) times than those, who consumed it less than 3 times a week. The prevalence of overweight and obesity was more among those who consumed soft drinks 3 or more times per week (12.2%), as compared to those who consumed it less than 3 times (6.7%), and this difference was found to be statistically significant (p< 0.001). The odds of those consuming soft drinks 3 or more times per week developing overweight and obesity is 1.971 (1.356 to 2.708 95% C.I) times, compared to those who consume less than 3 times per week. Similar results were found in the following study.

Goyle et al,[18] conducted a cross sectional study among 1159 school students, aged 12 to 15 years, in Surat, Gujarat and found those consuming outside home servings more than twice a week, had 11.35 times the risk of developing overweight and obesity compared to those who had 2 or less servings per week. Those who consumed fast food 3 or more times per week had 1.44 times the risk of developing overweight and obesity compared to those consumed less than 3 times per week. They also found consumption of carbonated drinks as an independent significant risk factor for overweight ad obesity. (P value <0.001; OR = 6.95 4.41 to 10.94)

In the present study, we found a significant association of overweight and obesity with lack of physical activity. Prevalence of overweight and obesity was highest among those with less than 1 hour of physical activity (12.6%), compared to those with 1 or more hours of physical activity (3.1%), and this difference was statistically significant (p< 0.001). The odds of those with less than 1 hour of physical activity developing overweight and obesity was 4.498 times that of those with more than 1 hour of physical activity. Several studies showed similar results. A study was conducted by M Shashidhar Kotian et al,[19] among 12 to 15 year old adolescents, from January to April 2007, in the city of Mangalore. They found that the prevalence of overweight and obesity was 21 times higher among those participating < two hour/week, in any type of physical activity.

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In the present study, we found significant association of, use of motorized vehicle to reach school, with overweight/obesity. Several studies showed similar results. Sanghamitra Pati et al,[20] conducted a cross sectional study among school children of Cuttack City, Odisha, found that the children who travelled to school by motorized vehicle, had 10 times higher risk of overweight and obesity compared to those who came to school by walking.

In the present study, the prevalence of overweight and obesity was highest among those who had more than 6 to less than 10 hours (8.2%) of sleep, followed by 6 and less (8.1%), and 10 or more (6.1%), but this difference was not statistically significant ($p > 0.552$). However, several studies have shown some association duration of sleep with overweight and obesity. Rebecca Kurian et al,[21] conducted a study among 598 children, aged 6 to 16 years, and they found that decreased duration of sleep was significantly associated with overweight and obesity.

Limitations of the study: The cross-sectional nature of the study may not be of help in establishing temporality. The study was limited to high school children so the association between age group could not be established. The study was limited only to the schools in urban area. Recall bias among the children especially about the diet, family income may have confounded some findings. Alternative methods of measuring overweight /obesity were not used because of resource and time constraints.

CONCLUSION

The prevalence of overweight and obesity was 5.91% and 2.07 % respectively, with a combined prevalence of 7.98%. Obesity and overweight was found to be significantly associated with following risk factors: attending private schools, higher socioeconomic class, nuclear family, father's occupation of skilled category, regular Junk food and soft drinks consumers, less than 1 hour of physical activity, usage of motorized vehicle to reach the school, watching Television/Video games for more than two hours per day. School policies and programs should support the adoption of healthy diets and physical activity. Schools are the ideal means of intervention, as they are central to children's lives and information can be effectively imparted to children by this means. This can be done by training teachers in lifestyle education, and on nutrition and physical activity.

Author Contribution

Study concept and design, literature search, data acquisition, analysis, interpretation of results, manuscript preparation, and manuscript editing.

Study concept and design, data acquisition, manuscript editing, and review.

Data analysis, interpretation of results, manuscript preparation, and editing.

Manuscript preparation, editing, and review.

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