

Prevalence of Obesity among the Adolescents in the Selected Urban and Rural Areas of Sivasagar District, Assam

Lucky Moni Chutia¹, Dr. Anjali Hazarika², Dr. Ranjita Borah³

¹M.Sc. Nursing, Child Health Nursing Department, Regional College of Nursing, Guwahati-32 Assam, India
Corresponding Author Email: [luckymonind\[at\]gmail.com](mailto:luckymonind[at]gmail.com)

²Retired Associate Professor, Regional College of Nursing, Guwahati-32 Assam, India
Email: [hazarika.anjali\[at\]gmail.com](mailto:hazarika.anjali[at]gmail.com)

³ Assistant Professor, Regional College of Nursing, Guwahati-32 Assam, India
Email: [ranjita.borah\[at\]gmail.com](mailto:ranjita.borah[at]gmail.com)

Abstract: *Background:* Over the past 3 decades, the prevalence of adolescent obesity has increased worldwide, and due to serious public health consequences, it was considered a global epidemic. *Aim:* to assess the prevalence of obesity among the adolescents in the selected Urban and Rural areas of Sivasagar District, Assam. *Materials and methods:* A cross sectional comparative research design was adopted for the study. Total 200 adolescents aged 13-19 years were selected as sample by multistage random sampling technique. WHO reference-2007 for BMI was used to determine the presence of obesity. *Results:* Prevalence of obesity among Urban and Rural adolescents were 6% and 2% respectively. No significant difference between the urban and rural prevalence rate were found at 0.05 level of significance. In Urban setting education of father, occupation of father, frequency of having fast food, type of school, participation in outdoor sports and in Rural setting, occupation of mother, monthly family income, type of school, and mode of transportation to school were significantly associated with prevalence of obesity among adolescents at 0.05 level of significance. *Conclusions:* The study emphasizes the need to develop pragmatic interventions both in individual and community levels to improve adolescents' dietary habits, physical activity and lifestyle to combat this growing public health concern.

Keywords: Prevalence, Obesity, Adolescents, Body Mass Index (BMI), Urban, Rural

1. Introduction

Childhood obesity is one of the most serious global public health challenges of the 21st century, affecting every country in the world. In just 40 years, the number of school-age children and adolescents with obesity has risen more than 10-fold, from 11 million to 124 million. In addition, an estimated 216 million were classified as overweight but not obese (2016).¹ UNICEF reports that India has the largest adolescent population in the world, 253 million and every fifth person is between 10-19 years.² Childhood obesity is now an epidemic in India. With 14.4 million obese children, India has the second-highest number of obese children in the world, next to China.³

Obesity in general is defined as the presence of excess adipose tissue in the body to such a degree that it may lead to health hazards. Obesity can be seen as the first wave of a defined cluster of non-communicable diseases called "new economic syndrome" creating an enormous socio-economic and public health burden in poorer countries (WHO 2000).⁴ The diagnosis of overweight and obesity is made by measuring people's weight and height and by calculating the body mass index (BMI): weight (kg)/height² (m²). The body mass index is a surrogate marker of fatness. For children aged between 5–19 years-BMI for age greater than 2 standard deviations above WHO growth reference median is obese and BMI for age greater than 1 standard deviation above WHO growth reference median is overweight.⁵

A multicounty study showed that the food consumption and eating patterns of many adolescents have deteriorated during the COVID-19 pandemic, including having more snacks, eating out of control, and eating unhealthy food types. School closures and confinement in home have increased children's and adolescents' sedentary time. Globally, the lockdown has also led to less overall physical activity and lower intensity levels among children.⁶

Obese children and adolescents were around five times more likely to be obese in adulthood than those who were not obese. Around 55% of obese children go on to be obese in adolescence, around 80% of obese adolescents will still be obese in adulthood and around 70% will be obese over age 30.⁷ Children with obesity are also at a higher risk of non-communicable disease in adulthood.⁵

Research on obesity has largely concentrated on urban populations with limited focus on rural setting. This study aims to determine and compare the prevalence of obesity among the adolescents in the selected urban and rural areas of Sivasagar District, Assam, India.

2. Materials and Methods

Research design:

A quantitative approach with descriptive comparative cross sectional research design.

Study setting:

A multi-stage random sampling method was used. In the first stage, Sivasagar town was randomly selected to represent the urban setting, while the Gaurisagar Development Block was chosen for the rural setting. Then, two urban wards (W. No. 5 and 9) were randomly selected followed by random selection of two localities from each ward. For the rural area, two gram panchayats (Charing and Momai Tamuli) were selected, followed by the random selection of two villages from each panchayat. In the final stage, systematic random sampling technique was used to select the desired sample from the selected areas.

Sample size:

The final sample size was calculated by using the formula $Z^2 p (1 - p) / d^2$ [$p=5.8\%$, $d=0.05$; 95% level of confidence]⁸ and rounded off taking 10% to account for potential nonresponse. The estimated sample was 100. To facilitate comparison between urban and rural prevalence rate 100 adolescents from each setting, i.e. total 200 adolescents were decided for the study.

Sample:

Adolescents aged 13–19 years were selected for the study. The 10–12-year age group was excluded as very young adolescents may not engage meaningfully with self-administered questionnaires which may compromise data reliability.

Study period:

Data were collected in the month of May and June, 2022

Data collection Tool:

‘Structured Self-Administered Questionnaire’ on selected demographic variables and ‘Observation schedule’ to assess BMI was used. Content validity of the tool was done by 9 experts from the field of Pediatric Medicine, Child Health Nursing and Nutrition & Dietetics. To determine the presence of childhood obesity, age- and gender-specific WHO reference for BMI for 5–19-year-old children (z-score) was used. Collected data were analyzed by descriptive and inferential statistics and by using SPSS version 26.

Ethical consideration:

Permission was taken from the concerned authorities. The study was approved by the Institutional Ethics Committee.

3. Result and Discussion**3.1 Findings related to Sample Characteristics**

Among 100 adolescents each from urban and rural areas, the majority were aged 13–15 years (59% urban; 57% rural), and most were female (52% urban; 54% rural). All rural adolescents (100%) and 58% of urban adolescents followed Hinduism. Most were firstborn (66% urban; 57% rural) and from nuclear families (70% urban; 58% rural). In urban areas, 32% of fathers had education up to high school, while in rural areas, 36% were educated up to higher secondary. Mothers were mostly educated up to higher secondary (36%) in urban and high school (37%) in rural areas. Fathers’ occupations were mainly business in urban (69%) and cultivation in rural

areas (38%). The majority of mothers were housewives (73% urban; 76% rural).

Most adolescents were non-vegetarian (88% urban; 97% rural) and have fast food 2–3 times in a week (30% urban; 27% rural). Family income was below Rs. 6,174 for 23% in urban areas, and Rs. 6,175–18,496 for 37% in rural areas. TV screen time was <1 hour/day in 45% of urban adolescents and 1–2 hours/day in 44% of rural adolescents. Mobile screen time was <1 hour/day in 39% urban and 1–2 hours/day in 46% rural adolescents. A majority studied in government schools (62% urban; 92% rural). School transport was mostly by motorized vehicles in urban (58%) and by bicycle in rural areas (78%). Occasional exercise was common (60% urban; 68% rural). Outdoor sports were played occasionally by 33% in urban and 2–3 times/week by 45% in rural adolescents.

3.2 Findings related to assessment of prevalence of obesity among the adolescents in urban and rural areas.

The findings of the present study showed that out of 200 adolescents, 4% were obese and 9% were overweight. In urban setting, out of 100 adolescents, 6% were obese, 14% were overweight, whereas in Rural setting, out of 100 adolescents 2% were obese and 4% were overweight (Table-1). Hence, prevalence of obesity among urban adolescents was 6%, compared to 2% in rural adolescents. It was observed that 20% adolescents in urban area and 6% adolescents in rural area were either obese or overweight.

Table 1: Frequency and percentage distribution of adolescents in urban and rural areas on the basis of age and sex specific WHO reference for BMI for 5–19 year-old, $n=n_1+n_2=200$

BMI Category	Cut off BMI-z score	Urban (n ₁ =100)		Rural (n ₂ =100)		Total (n=200)	
		f	%	f	%	f	%
Obese	> +2SD	6	6	2	2	8	4
Overweight	>+1SD	14	14	4	4	18	9
Healthy weight	<+1SD; >-2SD	72	72	78	78	150	75
Thinness	< -2SD	8	8	15	15	23	11.5
Severe thinness	< -3SD	0	0	1	1	1	0.5

Globally, WHO reports that from 1990 to 2022, the percentage of children and adolescents aged 5–19 years living with obesity increased four-fold from 2% to 8%.⁵ In India, Comprehensive National Nutrition Survey (CNNS) 2016–2018, reported prevalence of obesity 1.1% and overweight 4.8% among adolescents aged 10–19 years,⁹ which is notably lower than the findings of the present study. However, a two-decade meta-analysis conducted in India estimated the pooled prevalence of childhood obesity at 8.4% and overweight at 12.4%, suggesting an upward trend in recent years.¹⁰ As per CNNS-Assam preliminary factsheet-2016 obesity prevalence was reported 1.3% in Assam (Urban:1.0%; Rural: 1.4%).¹¹ Whereas, studies conducted in Guwahati city, Assam, have reported obesity rate among school going adolescents 3.41% which aligns with the present study findings.¹²

A similar comparative study conducted by Pathak S, Modi P, Labana U and Khimyani P. (2016) to assess the prevalence of obesity among urban and rural school going adolescents of Vadodara, India reported that out of 188 adolescents 17.6% (33), 20.2% (38) were obese and overweight respectively.

Among urban children 31.3% were obese, 32.3% were overweight while 63.6% were either obese or overweight as compared to only 2.2% obese, 6.7% overweight and 8.9% either obese or overweight among rural children.¹³ The obesity prevalence rate is considerably higher than those observed in the present study. However, the findings from another comparative study carried out by Saraswathi YS, Najafi M, Gangadhar MR and Malini SS. (2009) to assess the prevalence of childhood obesity in school children from rural and urban areas in Mysore, Karnataka, India, reported that out of 2189 school children the prevalence of overweight/obesity was 8.75 % and 0.8 % in urban and rural area respectively.⁴

3.3 Findings related to comparison of prevalence of obesity among the adolescents in urban and rural areas.

Table: 2 shows the comparison of prevalence of obesity among the Urban and Rural adolescents' which was calculated by Clopper Pearson Exact method of confidence interval (CI) at 95% level of confidence and fisher exact test at 0.05 level of significance. The CI for urban subjects was 0.0223-0.1260 while CI for rural subjects was 0.0024-0.0704. There is overlapping of the score of CI at 95% level of confidence (Fig:1) which indicates that the prevalence rate of obesity among the urban and rural adolescents are not significantly different. Again, the statistic value of exact p calculated by fisher exact test was found to be 0.279 ($p > 0.05$) which can be inferred that there is no significant difference between prevalence of obesity among urban and rural adolescents at 0.05 level of significance.

A study conducted by Alok P, Malay P and Divyesh Kumar V. (2009) on prevalence of overweight and obesity in adolescent of urban and rural area of Surat, Gujarat including 176 in rural and 213 in urban adolescents reported that prevalence of obesity increased non-significantly from 12.8% in rural to 14.6% in urban ($p = 0.612$).¹⁴ The findings are contrasted by a study conducted by Hormis N and D'silva F. (2013) on obesity among adolescents of urban and rural schools in Mangalore. The study was conducted among 1200 adolescents which revealed that there is a significant difference in the occurrence of obesity among urban and rural children respectively i.e., 31 (5.2%) and 13 (2.2%), (Z cal value $2.640 > Z$ tab value 1.96).¹⁵

3.4 Findings related to association between obesity among the adolescents of Urban and Rural areas and selected demographic variables

In Urban setting demographic variables such as Education of father (exact $p = 0.026$), Occupation of father (exact $p = 0.044$), Frequency of having fast food (exact $p = 0.046$), Type of school (exact $p = 0.028$), Frequency of participation in outdoor sports (exact $p = 0.041$) were significantly ($p < 0.05$) associated with prevalence of obesity among Urban adolescents at 0.05 level of significance which was calculated by fisher's exact test of statistics. In rural setting demographic variables like occupation of mother (exact $p = 0.032$), monthly family income (exact $p = 0.004$), type of school (exact $p = 0.006$), and mode of transportation to school (exact $p = 0.004$) were found significantly associated with prevalence of obesity among adolescents at 0.05 level of significance. Other variables, age, gender, religion, birth order, type of family, education of

mother, type of diet, television screen time, mobile screen time and frequency of exercise were found statistically non-significant with prevalence of obesity among adolescents in Urban and Rural areas at 0.05 level of significance (Table-3). A similar comparative study conducted by Pathak S, Modi P, Labana U and Khimyani P. (2016) on prevalence of obesity among urban and rural school going adolescents of Vadodara, India. reported that parental income was significantly associated with higher BMI (obese and overweight) while other variables like fast-food frequency, time spent in television watching were not found significant.¹³

Table 2: Comparison of prevalence of obesity among the adolescents in urban and rural areas

Place of residence	Prevalence of obesity	95% Confidence Interval		Exact p value
		Lower limit	Upper limit	
Urban	6% (0.06)	0.0223	0.1260	0.279 ^{NS}
Rural	2% (0.02)	0.0024	0.0704	

A cross- sectional study revealed that there was a significant association between obesity and variables like type of family (χ^2 cal=3.994, $p < 0.05$), family income (χ^2 cal=4.123, $p < 0.05$) in rural adolescents and family income ($p = 0.042$, $p < 0.05$) in urban adolescents.¹⁵

Another similar study conducted by Gautam S and Jeong HS (2019) in Udupi, Karnataka reported that religion, education of both the father and mother, occupation of both the father and mother and frequency of junk food consumption, type of school were significantly associated with elevated BMI ($p < 0.05$) while other variables like gender and type of diet were not significantly associated.¹⁶



Figure 1: Confidence interval plot for prevalence of obesity among adolescents in urban and rural areas
NS: Not significant at 0.05 level of significance

Similar findings were reported in a study conducted by Boruah C (2018) in Guwahati city, Assam shows that the prevalence of overweight and obesity was significantly more among students who were non-vegetarian, consume junk food daily, don't play outdoor games, use vehicles as mode of transport to school, watch TV for more than 3 hours.¹²

Jagadesan S, Harish R, Miranda P, Unnikrishnan R, Anjana RM and Mohan V. (2014) conducted a study on the prevalence of overweight and obesity among children and adolescents in Chennai, India among 18,955 children and

adolescents across 31 private and 20 government schools. It was found that the prevalence of overweight/obesity was significantly higher in private compared to government schools ($P < 0.001$). The study concludes higher prevalence of overweight and obesity among private schools in Chennai.¹⁷

Another study conducted by Mohan J, Chitharaj RR and Ganesan DK (2018) in Tamil Nadu, India shows that the prevalence of both overweight and obesity were more in those who did not participate in any of the outdoor sports which were found to be statistically highly significant.⁸

Another study conducted by Baruah KK and Baruah M. (2017) in Guwahati city Assam also revealed similar findings that obesity is significantly associated with physical activity, intake of fast food.¹⁸

Pedapudi AD, Davis RA, Rosenberg P, Koilpillai P, Balasubramanya B, Johnson AR et al. (2020) conducted study on overweight and obesity among 734 students aged 10 years and older in Bengaluru city, India reported that age, gender, religion, education level of parents, mother working outside the home, participation in vigorous physical activities, vegetarian diet, and consumption of junk foods as snacks were not found to be significantly associated with overweight/obesity and adolescents from the higher income families, were more likely to be overweight or obese.¹⁹

A study conducted by Qiu Y, Xie YJ, Chen L, Wang SL, Yang H, Huang Z et al. (2021) on electronic media device usage and its associations with BMI and obesity in a rapidly developing City in South China showed that, no significant associations were found between the length of TV program viewing and mobile phone usage and BMI ($p > 0.05$).²⁰

4. Conclusion

The present study results revealed that the prevalence of obesity among adolescents were 6% in urban and 2% rural setting, with no significant difference between two settings. In light of the globally increasing trends in adolescent obesity, the CNNS data, and recent studies conducted in Assam, including the findings of the present study, it is evident that the prevalence of obesity among adolescents is on the rise. This emerging public health issue calls for urgent and targeted interventions. Policy measures should prioritize preventive strategies such as school-based health education, promotion of physical activity, public awareness campaigns on balanced nutrition, healthy lifestyle and routine screening programs aimed at early detection and management of obesity among adolescents. Immediate action at both individual and community levels, along with educating adolescents and their parents on lifestyle modification techniques is essential to combat this growing global public health challenge.

5. Future Scope

Table-3: Association between prevalence of obesity among the adolescents in Urban and Rural areas with selected demographic variables

Socio Demographic variables	Urban				Rural			
	χ^2 value	df	p value	Exact P value	χ^2 value	df	p value	Exact P value
Age of the child	0.155	1	0.694	1	0.041	1	0.840	1
Gender	0.891	1	0.345	0.423	0.013	1	0.909	1
Religion	0.281	2	0.869	1	-	-	-	-
Birth order	0.730	2	0.694	0.522	1.540	2	0.463	0.608
Type of family	0.203	2	0.904	1	1.478	2	0.478	0.613
Education of father	15.279	5	0.009*	0.026*	9.297	5	0.098	0.082
Education of mother	7.945	5	0.159	0.149	2.778	5	0.596	0.357
Occupation of father	9.716	4	0.045*	0.044*	6.832	4	0.145	0.166
Occupation of mother	10.310	4	0.728	0.096	15.452	4	0.004*	0.032*
Monthly Family Income	9.645	6	0.140	0.075	33.673	6	0.000*	0.004*
Type of diet	0.132	1	0.717	0.547	0.063	1	0.802	1
Frequency of having fast food	11.939	5	0.036*	0.046*	5.518	5	0.356	0.364
Television screen time	0.212	3	0.976	1	2.597	3	0.458	0.547
Mobile screen time	1.932	3	0.587	0.413	13.658	2	0.198	0.227
Type of school	5.568	1	0.018*	0.028*	23.469	1	0.000*	0.006*
Mode of transportation	2.245	2	0.326	0.432	27.114	2	0.000*	0.004*
Frequency of Exercises	2.517	2	0.284	0.340	0.960	2	0.619	1
Frequency of participation in outdoor sports	11.55	5	0.041*	0.041*	4.435	5	0.489	0.336

Longitudinal studies to track changes in obesity prevalence and associated risk factors and health outcomes may be done to get insights into the progression and persistence of obesity from adolescence into adulthood. A similar comparative study can be replicated on larger sample covering more diverse geographical areas to generalize the findings.

6. Limitation

The study was limited by time constraints allowing only one-time measurements which restricted the ability to determine the chronological progression of overweight and obesity.

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Author Profile



Ms. Lucky moni Chutia, M.Sc. Nursing, Child Health Nursing Department, Regional College of Nursing, Guwahati-32 Assam.



Dr. Anjali Hazarika, Retired Associate Professor, Child Health Nursing Department, Regional College of Nursing, Guwahati-32 Assam.



Dr. Ranjita Borah, Assistant professor, Child Health Nursing Department, Regional College of Nursing, Guwahati-32 Assam.