

Obesity in Adolescents: Prevalence and Association with Sociodemographic and Lifestyle Factors

Bhavna Jain^{1*}, Seema Jain², Chhaya Mittal², Harivansh Chopra², Parul Chaudhary², Harimu Bargayary², Ganesh Singh³, Sunil K. Garg³

¹Department of Community Medicine, Shaikh-UI-Hind Maulana Mahmood Hasan Medical College, Saharanpur, Uttar Pradesh, India.

²Department of Community Medicine, Lala Lajpat Rai Memorial Medical College, Meerut, Uttar Pradesh, India.

³Department of Community Medicine, National Capital Region Institute of Medical Sciences, Meerut, Uttar Pradesh, India.

Abstract

Introduction: Overweight and obesity has become a worldwide epidemic and is a growing public health concern. The increase in prevalence and severity of obesity among children and adolescents has been attributed largely to behavioral factors such as changing eating habits and sedentary lifestyles.

Objective: To determine prevalence of obesity and abdominal obesity among adolescents and its association with sociodemographic factors and lifestyle.

Methods: Present cross-sectional study was conducted in the urban field practice area under the Community Medicine Department of LLRM Medical College, Meerut, among 872 adolescents. All localities in the field area were covered and house to house survey was done. Questions were asked about eating patterns, physical activity and sedentary lifestyle. Data was collected and analyzed using appropriate statistical tests.

Results: The prevalence of overweight and obesity was 17.43, 6.88%, respectively. Obesity was significantly higher among females, those who indulged in unhealthy eating habits were physically inactive, watched television for a longer duration and ate junk while watching television.

Conclusion: In the present study, we found that high junk food consumption and a sedentary lifestyle were found to be significantly associated with childhood overweight/obesity. As a result, timely interventions should be taken to improve awareness about healthy lifestyle behavior to prevent obesity and its complications among adolescents.

Keywords: Humans, Child, Adolescent, Female, Overweight, Sedentary Behavior, Cross-Sectional Studies, Prevalence, Pediatric Obesity, Life Style, Television, Healthy Lifestyle, Habits.

INTRODUCTION

Adolescence is a period of transition from childhood to adulthood ranging from 10 to 19 years. This phase involves major physical, psychological and behavioral changes and any adversity in this developmental phase may bring serious health outcomes involving chronic morbidity and mortality risks.^[1] It includes malnutrition (both undernutrition and overweight), mental health problems, early pregnancy and childbirth, human immune deficiency virus/sexually transmitted infection (HIV/STI) and other infectious diseases, interpersonal violence, unintentional injuries, and substance abuse.^[2] During adolescence, teenagers make individual

choices and develop personalized lifestyles such as diet patterns and physical activity.^[2] WHO describes overweight and obesity as “abnormal or excessive fat accumulation in adipose tissue to that extent that health may be impaired.”^[3] It is one of today’s most important and neglected public health problems escalating as a global epidemic called “New World Syndrome”.^[3] Obesity is also defined as BMI at or above

Address for correspondence: Bhavna Jain,

Department of Community Medicine, Shaikh-UI-Hind Maulana Mahmood Hasan Medical College, Saharanpur, Uttar Pradesh, India.

E-mail: drbhavnajain@yahoo.co.in

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the 95th percentile for children of the same age and sex and overweight as BMI at or above the 85th percentile and lower than the 95th percentile.^[4] According to UNICEF's World Obesity Atlas for 2022, India is predicted to have more than 27 million obese children, representing one in 10 children globally, by 2030.^[5] In India, many studies have shown that the prevalence of overweight among adolescents varies between 10 and 30%.^[6]

In low- and middle-income countries, obesity has traditionally been a disease of the affluent^[7] and of urban populations.^[7] There has been a cultural shift in the diet of children and adolescents with increased intake of high-sugar and high fat foods (junk food).^[8] This change in diet combined with the increasingly sedentary lifestyle resulting from lack of public spaces for physical activity and dependence on television and gadgets for entertainment, has increased obesity levels among adolescents in India.^[9] It has been evident that 30–60% of causes of chronic diseases in adulthood are caused due to adverse health behavior during adolescence.^[10] Obesity is a major risk factor for non-communicable diseases (NCDs) such as non-insulin-dependent diabetes mellitus (NIDDM), cardiovascular diseases (CVD), cancers and various psychological problems also.^[11] It is often felt that an adolescent's health is often neglected due to lack of awareness, busy work schedule and poor compliance for teens. It is the need of the hour to access and check the rising menace of this upcoming epidemic.

Aim and Objective

To determine prevalence of obesity among adolescents and its association with sociodemographic factors and lifestyle.

Material and Methods

Study Type: Community-based cross-sectional study.

Study Area: Population covered by Urban Health and Training Centre under Department of Community Medicine, LLRM Meerut.

Study Period: Study was carried out for a period of one year.

Study Population: Adolescents (both male and female) aged 10-19 years residing in the study area

Inclusion Criteria

Adolescents aged 10 - 19 years.

All those who gave consent

Exclusion Criteria

Adolescents with chronic systemic illness.

Those on long term medicine.

Those absent on day of visit or showing hostile behavior.

Sample Size: Taking prevalence of overweight and obesity among adolescents as 10%^[12] in adolescents, allowable error of 20% as relative precision and at 95% confidence interval sample size was calculated as 864. But a sample of 872 was taken.

Sampling Technique: There were 10 localities registered in the urban field practice area. Total 1928 adolescents were

there in the registered families of these 10 localities. Out of total number of adolescents from each locality proportionate numbers of adolescents were covered by proportional allocation method, by the formula. $n_1/N_1 = n_2/N_2 = \dots$ Constant = $864/1928$, ($n_1 = 864/1928 * N_1$), where n_1 = adolescent to be studied in specific locality and N_1 = total number of adolescents in the specific locality. From each locality one house was selected randomly. The random house allocation was done by pencil/pen tip drop method to start the survey. From the center of the selected locality, pencil/pen was dropped and the house in the corresponding direction towards the tip was selected as the first house for survey. The house to house survey was done picking all the adolescents in the adjacent houses towards right of the first house till the required sample was taken. If the last house had more adolescents than the required number to complete the sample from that locality, all the adolescents of the last house were included for survey. Similarly, proportionately required adolescents from each locality were taken to complete the total sample size.

Study Procedure

Pre-designed, pretested, semi-structured, self-administered questionnaire was used to collect data on sociodemographic and contributory factors responsible for obesity supplemented with anthropometry and clinical examination. Before administering the questionnaire to study subjects the questionnaire was pretested on 50 students and was suitably modified before finalization.

Study Tool

Following tools were used for data collection

- **Sociodemographic Factors:** Information on the following parameters age, gender, religion, caste, area of residence, type of family, type of school, education and occupation status of parents, total monthly family income, socioeconomic status of a family, family history of obesity were taken.
- **Dietary Factors:** Items included frequency of intake of in between meals, fruits, vegetables, dairy products, carbonated drinks, fast food and sweets/chocolates in last one week.
- **Physical Activity and Sedentary Behavior:** To assess the pattern of physical activity. Questions were based on: being physically active or not, regularity of physical activity, duration of physical activity and type of activity such as (walking, jogging, outdoor games like cricket, badminton, basketball, cycling, yoga and gyming), average time spent in watching TV/computer/video games/mobile/internet per day, eating while watching TV and mode of travel to school/college. These questions were based on the following validated instruments:

Global health survey (by WHO)^[13]

- Youth risk behavior surveillance system questionnaire^[14]
- Measuring tape made of non-stretchable steel measuring height to the nearest 0.1 cm and measuring waist circumference and hip circumference.

BMI classification	Percentile	z-scores
Underweight	< 3 rd percentile	< - 2S.D
Normal	3 rd – 85 th percentile	>-2S.D – < 1S.D
Overweight	> 85 th – < 97 th percentile	> 1 S.D
Obese	> 97 th percentile	> 2 S.D

- Electronic weighing scale with capacity up to 150 kg measures weight to 100 grams.
- Calculation of BMI: WHO growth standards, 2007^[15] were used for calculating BMI for age. WHO cut-offs were used for defining overweight and obesity in children and adolescents. Based on age and sex specific percentile given by WHO for adolescents

Statistical Analysis

Data was analysed using appropriate trademark of the Centres for Disease Control (CDC), Epi Info TM 7.1. Pearson's Chi Square test was applied to find out significant association between the two characteristics which are in the form of frequency. $P < 0.05$ was considered significant, whereas $p < 0.01$ was considered highly significant. Chi square test was applied when expected frequency in all the cells was at least one with n being more than 40 and more than 80% of the cells had expected frequency of at least five.

ETHICAL APPROVAL

The protocol of the thesis was approved by the Institutional Ethical Committee of the institution. Ref S-I/2018/1729 dated 13-03-2018.

RESULTS

Out of total 872 adolescents surveyed 53.0% were males and 47.0% were females. Maximum number of adolescents were found at age of 12 years (14.2%) followed by 13 years (11.7%), 18 years (10.5%) and least belonged to 10 years (8.0%). Mean age was 14.43 years \pm 2.82 SD. According to the BMI 19.3% of adolescents were underweight, 56.4% normal, 17.4% overweight and 6.9% as obese. A total of 24.3% of adolescents were overnourished (BMI > 85th percentile). Mean BMI was 20.19 kg/m² \pm 10.71 SD. Table 1 depicts that overweight and obesity was significantly more among females (27.8%), in the age group 16–19 years (35.2%), those belonging to the nuclear family (26.5%), those belonging to upper class (53.3%) followed by upper middle class (31.4%), those educated upto intermediate (36.2%) followed by graduates (33.3%) and high school (27.6%) students and those who were studying in private schools (26.6%). As seen in Table 2 those adolescents who had habit of skipping meals (28.8) and eating junk in between meals (25.2) had a significantly higher prevalence of overweight and obesity. All those who were consuming carbonated drinks (56.8), sweets/chocolates/ice-creams (29.6) and fast food (45.8) were also significantly obese. When adolescents were observed for their physical activity and sedentary lifestyle, it was found in Table 3 that those who were physically inactive (36.6), did not do exercises or play sports regularly (20.8) or indulge in

any physical activity for a shorter duration of time i.e < 30 min (26.6) had significantly higher BMI > 85th percentile. Similar significant results were shown by those who had habit of watching TV/ social media for > 2 hours (40.9) and eating junk while watching TV (27.0). On univariate analysis, all the factors (sociodemographic, dietary, physical activity, family history and sedentary habits) analyzed were found to be significantly associated with overweight and obesity. But the odds ratio of more consumption of fast food, carbonated drinks, those who were not physically active and those who were engaged in physical activity for less than 30 min/day was very high, establishing a strong association of these factors with the prevalence of overweight and obesity. Prevalence of overweight and obesity (Table 4).

DISCUSSION

In the present study a total of 872 adolescents were surveyed, of which 53.0% were males and 47.0% were females. A maximum number of adolescents (37.8%) belonged to late adolescence age group 16–19 years followed by early age group 10–12 years (31.7%). Similarly, Tiwari *et al.*^[3] conducted study among 940 adolescents, of which 53.7% were males and 46.3% were females. 53.9% of adolescents belonged to middle adolescence age group, 35.8% to late and only 10.3% to early age group. The present study revealed that 17.4% of adolescents were overweight and 6.9% were obese, constituting 24.3%. It was comparable to the study done by Seema S *et al.*^[16], reporting a prevalence of overweight and obesity 17.1 and 6.8%, respectively. The present study revealed that the prevalence was significantly higher among females (27.8%) and in the age group 16–19 years (35.2%). A similar finding was seen in study conducted by Rathoria *et al.*^[17], reporting a higher prevalence among females being 7.77% obese and 9.71% overweight, while in boys, 2.39% were obese and 10.05% were overweight and in late adolescent age group 23.21% were overweight and obese. In our study prevalence was also significantly more among those belonging to nuclear family (26.5%) which was almost similar to the study done by Sain *et al.*^[18] showing prevalence higher in nuclear family (56.2%) and Goyal *et al.*^[19] depicting higher proportion of overweight and obese adolescents in nuclear families (18.06 and 8.92%). Our study also reported higher prevalence in those belonging to upper class (53.3%) and upper middle class (31.4%) and in those who were studying in private schools (26.6%). Singh *et al.*^[20] also reported similar results. Students from private schools have significantly higher mean BMI than the students from government schools. Higher SES class subjects has comparatively higher BMI than other SES classes. In the present study prevalence was significantly more among those who skipped meals (28.8%), similar results were shown by Sain *et al.*^[18] present study showed that prevalence was significantly high among those who were eating in between meals (25.2%) which was almost similar to results shown by Bhargava *et al.*^[21] who reported that those who were taking in between meals > 1 times/day were equivalently

Table 1: Association of overweight and obesity with sociodemographic factors of study participants

Parameters	Subtype	Study population N=872 n (%)	BMI >85 th percentile (overweight and obese) N=212 n (%)	Chi Square, df, p-value
Age group (years)	10–12	276 (31.7)	38 (13.8)	X ² : 38.65, df: 2, p < 0.00001
	13–15	266 (30.5)	58 (21.8)	
	16–19	330 (37.8)	116 (35.2)	
Sex	Male	462 (53.0)	98 (21.2)	X ² : 5.13, df: 1, p < 0.05
	Female	410 (47.0)	114 (27.8)	
Type of family	Nuclear	626 (71.8)	166 (26.5)	X ² : 5.87, df: 1, p < 0.05
	Joint	246 (28.2)	46 (18.7)	
Socioeconomic status	Upper	60 (6.9)	32 (53.3)	X ² : 44.60, df: 2, p < 0.00001
	Middle*	622 (71.3)	158 (25.4)	
	Lower*	190 (21.8)	22 (11.6)	
Adolescent Education	Upto High school [#]	718 (82.3)	158 (22.0)	X ² : 11.75, df: 1, p < 0.05
	Above High school [#]	154 (17.7)	54 (35.1)	
Adolescent Occupation	Students	784 (89.9)	194 (24.7)	X ² : 1.41, df: 3, p > 0.05
	Service	42 (4.8)	10 (23.8)	
	Shopkeeper	20 (2.3)	4 (20.0)	
	Worker	26 (3.0)	4 (15.4)	
Type of school	Government	270 (31.0)	52 (19.3)	X ² : 5.43, df: 1, p < 0.05
	Private	602 (69.0)	160 (26.6)	

*For socioeconomic status: Upper-middle and lower-middle categorised as “middle,” upper-lower and lower categorised as “lower”.

[#]For education of adolescents: Upto high school includes illiterate, just literate, primary, middle and high school and above high school includes intermediate, graduate and professional.

Table 2: Association of overweight and obesity with dietary factors of study participants

Parameters	Subtype	Study population N=872 n (%)	BMI >85 th percentile (overweight and obese) N=212 n (%)	Chi Square, df, p-value
Dietary habit	Vegetarian	348 (39.9)	76 (21.8)	X ² : 1.92, df: 1, p > 0.05
	Flexitarians	524 (60.1)	136 (25.9)	
Skipping of meals	Yes	264 (30.3)	76 (28.8)	X ² : 4.12, df: 1, p < 0.05
	No	608 (69.7)	136 (22.4)	
In between meals	Yes	810 (92.9)	204 (25.2)	X ² : 4.72, df: 1, p < 0.05
	No	62 (7.1)	8 (12.9)	
Frequency of eating in between meals	Daily	290 (35.8)	80 (27.6)	X ² : 2.36, df: 2, p > 0.05
	2–3times/week	324 (40.0)	82 (25.3)	
	Occasionally	196 (24.2)	42 (21.4)	
Type of in between meals	Healthy	91 (11.2)	20 (22.0)	X ² : 0.687, df: 2, p > 0.05
	Healthy + Unhealthy	305 (37.6)	76 (24.9)	
	Unhealthy	414 (51.1)	108 (26.1)	
Frequency of intake of vegetables	Daily	616 (70.6)	144 (23.4)	X ² : 1.28, df: 2, p > 0.05
	2–3times/week	230 (26.4)	60 (26.1)	
	Occasionally	26 (3.0)	8 (30.8)	
	None	0 (0.0)	0 (0.0)	
Frequency of intake of fruits	Daily	180 (20.6)	38 (21.1)	X ² : 6.02, df: 3, p > 0.05
	2–3 times/week	350 (40.1)	76 (21.7)	
	Occasionally	324 (37.2)	92 (28.4)	
	None	18 (2.1)	6 (33.3)	

Table continued...

Frequency of intake of dairy products	Daily	182 (20.9)	48 (26.4)	X2: 4.58, df: 3, p > 0.05
	2–3 times/week	332 (38.1)	90 (27.1)	
	Occasionally	314 (36.0)	66 (21.0)	
	None	44 (5.0)	8 (18.2)	
Frequency of intake of carbonated drinks	Daily	88 (10.1)	50 (56.8)	X2: 146, df: 3, p < 0.001
	2–3times/week	314 (36.0)	120 (38.2)	
	Occasionally	356 (40.8)	38 (10.7)	
	None	114 (13.1)	4 (3.5)	
Frequency of intake of sweets	Daily	196 (22.5)	58 (29.6)	X2: 10.7, df: 3, p < 0.05
	2–3times/week	338 (38.8)	92 (27.2)	
	Occasionally	300 (34.4)	56 (18.7)	
	None	38 (4.3)	6 (15.8)	
Frequency of intake of fast food	Daily	96 (11.0)	44 (45.8)	X2: 84.3, df: 2, p < 0.001
	2–3times/week	430 (49.3)	138 (32.1)	
	Occasionally	320 (36.7)	30 (9.4)	
	None	26 (3.0)	0 (0.0)	

Table 3: Association of overweight and obesity with sedentary lifestyle of study participants

Parameters	Subtype	Study population n (%)	BMI >85 th percentile (overweight and obese) n (%)	Chi Square, df, p-value
Physically active (N=872)	Yes	522 (59.9)	84 (15.1)	X2: 47.8, df: 1, p < 0.001
	No	350 (40.1)	128 (36.6)	
Regularity of exercise/sports activity (N=522)	Regular (<5days/week)	330 (63.2)	44(13.3)	X2: 5.06, df: 1, p < 0.05
	Irregular (>5days/week)	192 (36.8)	40 (20.8)	
Duration of exercise/sports activity (N=522)	< 30 min	188 (36.0)	50 (26.6)	X2: 33.4, df: 2, p < 0.001
	30–60 min	218 (41.8)	32 (14.7)	
	>60 min	116 (22.2)	2 (1.7)	
Mode of travel (N=872)	Active	560 (64.2)	126 (22.5)	X2: 2.79, df: 1, p > 0.05
	Inactive	312 (35.8)	86 (27.6)	
Duration of watching TV (N=872)	> 2 hours/day	186 (21.3)	76 (40.9)	X2: 36.5, df: 2, p < 0.001
	≤ 2 hours/day	604 (69.3)	124 (20.5)	
	Occasional	82 (9.4)	12 (14.6)	
Habit of eating while watching TV (N=872)	Yes	496 (56.9)	134 (27.0)	X2: 4.57, df: 1, p < 0.05
	No	376 (43.1)	78 (20.8)	
Habit of sleeping in afternoon (N=872)	Yes	484 (55.5)	122 (25.2)	X2: 0.473, df: 1, p > 0.05
	No	388 (44.5)	90 (23.2)	
Duration of sleeping in afternoon (N=484)	≤ 2 hours/day	316 (65.3)	78 (24.6)	X2: 0.132, df: 1, p > 0.05
	>2 hours/day	168 (34.7)	44 (26.2)	
Family history of obesity (N=872)	Yes	284 (32.6)	84 (29.6)	X2: 6.35, df: 1, p < 0.05
	No	588 (67.4)	126 (21.4)	

overweight and obese. In the present study prevalence was significantly higher among those who consumed carbonated drinks (56.8%), sweets/chocolates (29.6%) and junk food (45.8%) almost daily. Similar results were shown by Seema *et al.*^[16] Pedapudi *et al.*^[22] i.e those eating junk food are more overweight and obese. Prevalence in the present study was also high among those who were not physically active (36.6%). Sinha *et al.*^[23] also reported similar results. In the present

study, the prevalence was significantly maximum among those who had sedentary lifestyles, i.e., watched television for more than 2 hrs/day (40.9%). Mathew *et al.*^[24] reported that screen time was a significant factor associated with overweight and obesity. In the present study, the odds ratio of late adolescence, higher socioeconomic class, more consumption of fast food, carbonated drinks, physical inactivity, and sedentary behavior showed a strong association with the prevalence of overweight

Table 4: Correlates of overweight and obesity: logistic regression analysis

Parameters	Subtype	Odds ratio	95% CI	Coefficient	S.E	p-value
Sociodemographic factors						
Sex	Male	1.43	1.05–1.95	0.36	0.16	<0.05
	Female					
Age group	10–15 years	2.52	1.84–3.45	0.92	0.16	<0.01
	16–19 years					
Type of family	Nuclear	1.57	1.09–2.26	0.45	0.19	<0.05
	Joint					
Socioeconomic status	Class I & II	2.87	2.08–3.96	1.05	0.16	<0.01
	Class III, IV, V					
Adolescent education	Upto high school	1.92	1.32–2.79	0.65	0.19	<0.01
	Above high school					
Type of school	Government	1.52	1.07–2.16	0.42	0.18	<0.05
	Private					
Dietary factors						
Skipping of meals	Yes	1.40	1.01–1.95	0.34	0.17	<0.05
	No					
In between meals	Yes	2.27	1.06–4.85	0.82	0.39	<0.05
	No					
Fast food	Frequent	5.57	3.68–8.44	1.72	0.21	<0.01
	Not frequent					
Carbonated drinks	Frequent	7.47	5.14–10.85	2.01	0.19	<0.01
	Not frequent					
Sweets/ chocolates/ ice-creams	Frequent	1.74	1.24–2.43	0.55	0.17	<0.01
	Not frequent					
Physical activity						
Physical activity	Yes	3.01	2.18–4.14	1.01	0.16	<0.01
	No					
Duration of exercise	< 30 min/day	3.20	1.98–5.17	1.16	0.24	<0.01
	>30 min/day					
Regularity of exercise	Regular	1.71	1.07–2.74	0.54	0.24	<0.05
	Irregular					
Family history	Yes	1.51	1.09–2.08	0.41	0.16	<0.05
	No					
Sedentary behaviour						
Duration of watching TV	≤ 2 hours /day	2.32	1.73–3.13	0.84	0.15	<0.01
	>2 hours /day					
Eating while watching TV	Yes	1.41	1.03–1.94	0.35	0.16	<0.05
	No					

and obesity. Similar results were shown by Seema *et al.* [16] depicting higher odds in adolescents 16–19 years of age, male gender, higher socioeconomic status, having less physical activity and watching television > 2 hours/day. Also Ameer *et al.* [25] reported higher odds in sex, father occupation, father literacy, socioeconomic status, and diet type.

CONCLUSION

The prevalence of overweight and obesity was 17.4 and 6.9% among adolescents. It was found that the prevalence of overweight and obesity was higher in girls than boys. The present study found a positive association of overweight and obesity with age, gender, type of family, socioeconomic status,

education and, type of school, the habit of skipping meals, eating in between meals, frequent consumption of fast food/ carbonated drinks/sweets, participation in physical activity/ outdoor sports, duration of TV watching, duration of sleep, habit of eating snacks while watching TV. Early interventions on these modifiable risk factors are likely to reduce the rate of adolescent overweight and obesity.

RECOMMENDATIONS

Lifestyle modification is important in reducing the risk of overweight and obesity among adolescents. Modifying behaviors at a young age is much easier than at later ages. Children and, more importantly, the parents should hold knowledge of the various methods of improving lifestyle. Schools should also play a pivotal role in maintaining healthy behaviors in the form of educating about healthy eating habits and promoting physical activities.

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CONFLICTS OF INTEREST

Nil

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