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Original Research Article

Prevalence of overweight and obesity, and associations with socio-demographic and etiological factors

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ABSTRACT

Background: Adolescent obesity and overweight (OW) prevalence are rising quickly. The present study was done to assess the prevalence of OW and obesity and its association with demographic and etiological factors.
Methods: An observational study including 386 adolescents aged 10-19 years was conducted using a pre-designed questionnaire. Anthropometric measurements of weight (kg) and height (cm) were taken and body mass index (BMI) calculated by weight (kg)/height^2(m^2). The weight status was classified as underweight (UW) <5th percentile, healthy weight (HW) between the 5th and <85th percentile, OW between >85th and <95th percentile, and obese (OB) equal to or >95th percentile using the CDC percentile ranking for BMI-for-age. Statistical data analysis was done by SPSS software version 20. P<0.05 was considered significant.
Results: The mean age of adolescents in early, mid, and late adolescent age groups were 11.52 (1.13), 15.01 (0.82), and 17.72 (0.77) years respectively. The overall mean age of adolescents was 14.19 (2.63) years. The mean weight, height, and BMI of adolescents were 44.84 (11.35) kg, 1.54 (0.12) meters, and 18.91 (3.89) kg/m^2 respectively. The prevalence of OW and obesity was 11.7%, and 5.4% respectively. A significant association was found between OW and obesity with upper socioeconomic status (p<0.0001), daily junk food intake (p<0.0001), screen time of more than 2 hours per day (p<0.0001), and no or decreased physical activity (p<0.0001).
Conclusions: Adolescent obesity is a prevalent issue that requires early primordial and primary intervention through coordinated policy activities made by policymakers and medical professionals.

Keywords: Adolescent, BMI, Pediatric-obesity, Prevalence, Overweight

INTRODUCTION

One in eight persons worldwide suffered from obesity in 2022. Between 1990 and now, the global rate of adult and adolescent obesity has more than doubled and quadrupled, respectively.[1] In 2022, there were approximately 390 million OW children and adolescents (5-19 years old), and 160 million of them were OB.[1] Obesity is characterized by the accumulation of excess fat deposited in various body parts to the extent that it may compromise one's health.[2]

Adolescence, which spans the age range of 10 to 19 years old and is further subdivided into three groups: Early, mid, and late adolescence, is the transitional stage between childhood and maturity.[3] Significant changes in behaviour, physiology, and physical state occur during this phase.[3] According to the most recent figures, there are 253 million adolescents in India, which makes up

roughly 20% of the country's total population or one-fifth of the population.[4]

Nowadays, one of the biggest global health issues is adolescent obesity.[5] Teens create unique lives and make unique decisions during adolescence, including eating habits, junk food consumption, and inactivity.[5] According to a recent survey conducted by Lobstein and Jackson-Leach, by 2025, there will be approximately 17 million OB youngsters in India.[6] Previously believed to be an issue in the rich world, childhood obesity is now more frequently observed in middle- and low-income nations, particularly in metropolitan areas.[7]

All socioeconomic classes are impacted by teenage obesity globally, regardless of age, sex, or race.[5] Numerous medical ailments, such as fatty liver disease, sleep apnoea, type 2 diabetes, asthma, cardiovascular disease, cholelithiasis (gallstones), skin disorders, irregular menstruation, and orthopaedic issues have all been related to childhood obesity.[5] The etiopathogenesis of teenage obesity is multifaceted, encompassing genetic, neuroendocrine, metabolic, psychological, environmental, and social factors.[5]

A multidisciplinary, multi-phase approach is needed to treat OW and obesity in children and adolescents.[5] This approach includes pharmacotherapy, bariatric surgery, dietary management, physical activity enhancement, restriction of sedentary behaviour.[5] A comprehensive approach that includes community education on obesity prevention, early identification, and management is needed to combat adolescent obesity.[5]

Anthropometry is one of the techniques for diagnosing obesity that is thought to be easy, quick, affordable, and applicable to a large number of people.[8] Many anthropometric indicators have been proposed to diagnose obesity including waist circumference (WC), neck circumference, waist-to-hip ratio, and skinfold thicknesses, but the most widely used is still the BMI.[8]

This study aims to estimate the prevalence of OW and obesity in adolescents and to find its association with demographic and etiological factors among adolescents in the Sitapur district.

METHODS

Study setting and design

The present observational study was carried out over 18 months among adolescents attending the outpatient department (OPD) of the department of pediatrics, and department of obstetrics and gynaecology at hind institute of medical sciences, Sitapur, Uttar Pradesh, India after obtaining ethical approval from the institutional ethics committee. Informed consent was obtained from the parents of participants before enrolment. Participants' assent/consent was also obtained wherever applicable.

Inclusion criteria

Adolescents aged 10-19 years were included.

Exclusion criteria

Parent or patient refusal, previous health issues such as hereditary disorders (e.g. Down's syndrome or Marfan's syndrome), severe hormonal abnormalities (e.g. Cushing's disease/syndrome); diseases leading to swelling of subcutaneous tissues; diseases leading to muscle wasting; and metabolic bone diseases and drugs causing obesity were excluded.

Sample size

The convenient sampling method was used for enrolment. The sample size was calculated using Cochrane's formula.[9] The sample size was calculated by taking the prevalence (p) of obesity as 20% from the world health organization (WHO) data, a confidence level of 95%, and a margin of error (e) of 5%.[1]

$N = Z^2 (p \times q) / e^2$

Where Z=1.96; p=0.2; q=1-p=0.8; e=0.05

$N=(1.96)^2 \times (0.2\times0.8)/0.025=245.86\approx246$

The calculated minimum sample size was 246 but we enrolled 386 adolescents in the study.

Data collection procedure

For the data collection of the study population; a questionnaire, anthropometric measurements, and physical activity assessment were used. A pre-designed and pretested questionnaire consisting of different components which included personal details, demographics, dietary history, and physical activity history. Demographic characteristics included age, gender, religion, type of family, socioeconomic status using modified Kuppuswamy scale 2023, and livelihood.[10] Dietary history included the type of diet i.e. vegetarian, eggetarian, and non-vegetarian diet, and frequency of junk food intake. Physical activity history included screen time usage, exercise duration, frequency, and type.

All the data were filled in by the investigator himself by interviewing the study subjects individually. Study participants were called to a separate room to do their anthropometric measures after completing the questionnaire. For female study subjects, privacy was maintained and a female nurse/paramedical health worker was present while taking measurements. A digital weighing machine and a stadiometer were used to measure weight in kilograms (kg) and height in centimetres (cm) respectively.

The centre for disease control and prevention (CDC) uses BMI to define OW for children and teens between 2 to 20 years of age as BMI=weight (kg) ÷ height^2 (m^2). After calculating the BMI, it was plotted on the CDC data table of BMI-for-age charts for either boys or girls and was used to categorize percentiles.[11] CDC percentile ranking for BMI-for-age was used to categorize weight status as UW<5th percentile, HW between the 5th percentile to <85th percentile, OW between ≥85th to <95th percentile, and OB equal to or ≥95 percentile.[12]

Statistical analysis

Statistical package for the social sciences (SPSS) software version 20 analyzed the data. Descriptive statistics (frequency and percentage) and mean ± standard deviation was calculated. The chi-square test was used to find the association between two qualitative variables. A $p<0.05$ was considered as the data statistically significant.

RESULTS

The mean age of adolescents in early, mid, and late adolescent age groups were 11.52 (1.13), 15.01 (0.82), and 17.72 (0.77) years respectively. The overall mean age of adolescents was 14.19 (2.63) years. The demographic parameters of adolescents are summarized in Table 1.

Table 1: Demographic parameters of adolescents, (n=386).

Demographic parameter		N	Percentage (%)
Age (in years)	Early adolescents (10-13)	159	41.2
	Mid adolescents (14-16)	139	36
	Late adolescents (17-19)	88	22.8
Gender	Male	196	50.8
	female	190	49.2
Religion	Hindu	243	63
	Muslim	112	29
	Others	31	8
Type of family	Nuclear family	227	58.8
	Joint family	159	41.2
Livelihood	Rural	332	86
	Urban	54	14
Socioeconomic status (SES)	Upper	15	3.9
	Upper middle	43	11.1
	Lower middle	63	16.3
	Upper lower	133	34.5
	Lower	132	34.2

The mean weight, height, and BMI of adolescents were 44.84 (11.35) kg, 1.54 (0.12) meters, and 18.91 (3.89) kg/m^2 respectively. Prevalence of UW, OW, and obesity was 14.8%, 11.7%, and 5.4% respectively (Table 2).

Table 2: Distribution of adolescents based on BMI (n=386).

BMI categories	N	Percentage (%)
UW (BMI<5th percentile)	57	14.8
HW (BMI 5th-<85th percentile)	263	68.1
OW (BMI ≥85th-<95th percentile)	45	11.7
Obesity (BMI ≥95th percentile)	21	5.4

Table 3 summarizes the distribution of adolescents based on etiological factors for OW and obesity. Table 4 summarizes the association of BMI with different demographic parameters. Table 5 summarizes the association of BMI with etiological factors for OW and obesity.

Table 3: Distribution of adolescents based on etiological factors for OW and obesity, (n=386).

Etiological factors		N	Percentage (%)
Type of diet	Vegetarian	199	51.6
	Eggetarians	108	28
	Non-vegetarian	79	20.5
Frequency of junk-food consumption	Nil	32	8.3
	Daily	110	28.5
	2-3 times weekly	112	29
	Once a week	84	21.8
	1-3 times monthly	48	12.4
Screen time per day	< 2 hours	228	59.1
	2-6 hours	127	32.9
	>6 hours	31	8
Exercise duration	None	74	19.2
	<30 minutes	116	30.1
	30-60 minutes	117	30.3
	>60 minutes	79	20.5
Exercise frequency	None	74	19.2
	1-2 times weekly	87	22.5
	≥3 times weekly	119	30.8
	Daily	106	27.5
Type of exercise	None	74	19.2
	Walking	90	23.3
	Running	24	6.2
	Cycling	92	23.8
	Sports	56	14.5
	Gym	14	3.6
	Dance	36	9.3

Table 4: Association of BMI categories with different demographic parameters, (n=386).

Parameters		BMI categories*, number of adolescents				X^2	P value
		UW	HW	OW	OB		
Adolescent age groups	Early	23	114	16	6	3.632	0.726
	Mid	23	88	19	9		
	Late	11	61	10	6		
Gender	Male	24	145	18	9	6.330	0.097
	Female	33	118	27	12		
Religion	Hindu	34	171	26	12	3.050	0.803
	Muslim	17	71	16	8		
	Others	6	21	3	1		
Type of family	Nuclear	37	151	28	11	1.662	0.645
	Joint	20	112	17	10		
SES	Upper	1	9	1	4	119.431	<0.0001
	Upper middle	7	15	11	10		
	Lower middle	7	29	22	5		
	Upper lower	21	101	10	1		
	Lower	21	109	1	1		
Livelihood	Rural	53	220	40	19	4.178	0.243
	Urban	4	43	5	2		

*UW=Underweight=BMI<5th percentile; HW=Healthy weight=BMI between the 5th percentile to<85th percentile; OW=overweight= BMI between ≥85th to <95th percentile; and OB=obese= BMI≥95 percentile.

Table 5: Association of BMI categories with etiological factors, (n=386).

Parameters		BMI categories number of adolescents				X^2	P value
		UW	HW	OW	OB		
Type of diet	Vegetarian	32	142	14	11	10.829	0.094
	Eggetarian	14	68	21	5		
	Non-vegetarian	11	53	10	5		
Frequency of junk food intake	None	32	0	0	0	222.779	<0.0001
	Daily	6	71	24	9		
	2-3 times weekly	9	87	10	6		
	Once a week	3	66	10	5		
	1-3 times monthly	7	39	1	1		
Screen time	< 2 hours	38	174	9	7	57.434	<0.0001
	2-6 hours	15	79	25	8		
	>6 hours	4	10	11	6		
Exercise duration	None	3	29	30	12	121.288	<0.0001
	<30 minutes	14	90	8	4		
	30-60 minutes	15	94	5	3		
	>60 minutes	25	50	2	2		
Exercise frequency	None	0	36	26	12	98.843	<0.0001
	1-2 times weekly	6	65	11	5		
	≥3 times weekly	27	86	5	1		
	Daily	24	76	3	3		
Type of exercise	None	13	40	17	4	38.502	0.003
	Walking	14	57	13	6		
	Running	6	18	0	0		
	Cycling	16	66	8	2		
	Sports	4	42	5	5		
	Gym	0	10	1	3		
	Dance	4	30	1	1		

*UW=Underweight=BMI<5th percentile; HW=Healthy weight=BMI between the 5th percentile to<85th percentile; OW=Overweight=BMI between >85th to<95th percentile; and OB=Obese=BMI >95 percentile

DISCUSSION

Adolescent overnutrition is becoming a global public health problem as it increases at a rapid pace in developing countries. The present study not only explores the prevalence of OW and obesity in Sitapur district in India but also gives insight into the associated demographic and etiological factors for OW and obesity.

In the present study, the mean age of adolescents was 14.19 (2.63) years and the prevalence of OW, and obesity was 11.7%, and 5.4% respectively. Our findings were comparable to a study by Seema et al from Rohtak, Haryana, India which reported a mean age of 13.9 years, a prevalence of OW and obesity of 17.1% and 6.8% respectively.[13] Similarly, Belay et al study from Ethiopia reported a mean age of 15.4 (1.9) years with 26.1% overall prevalence of overnutrition with 23.7% OW, and 2.4% obesity.[14]

Among the demographic parameters, there was no significant association reported between different BMI categories with adolescent age groups (p=0.726), gender (p=0.097), religion (p=0.803), type of family (0.645)), and livelihood (0.2.43) in our study (Table 4). In contrast to our study, Seema et al reported a higher prevalence of obesity among males and Otitoola et al reported a higher prevalence of obesity among female adolescents.[13,15] In accordance with our study, Gorantla et al found a higher prevalence of OW in Hindus (9%) as compared to Muslims (5.9%) in their study.[16] In a research that was similar to ours, Bhattacharya et al discovered that patients from nuclear families had a greater prevalence of obesity as compared to joint families (13.9% vs. 5.5%), although this difference was not statistically significant.[17] Pathak et al reported more prevalence of OW and obesity in urban adolescents in comparison to our study where most adolescents belong to rural livelihood.[18]

There was a significant association (p<0.0001) found between BMI categories and socioeconomic status indicating a higher prevalence of OW and obesity in upper and middle socioeconomic classes in our study (Table 4). Akin to our study, Thomas et al reported higher socioeconomic class adolescents with high OW and obesity prevalence (p=0.01).[19] Goyal et al study also had similar findings.[20]

Among the etiological factors, there was no significant association reported between different BMI categories with the type of diet i.e. vegetarian, eggetarian, and non-vegetarian (p=0.094) (Table 5) which was in contrast to a study by Seema et al that reported non-vegetarian dietary habits had a significant association with adolescent obesity.[13]

Daily junk food intake was significantly associated with OW and obesity in our study (p<0.0001) (Table 5) which was akin to studies by Overcash et al and Liang et al.[21,22] Screen time use of more than 2 hours per day was significantly associated with OW and obesity in the present study (p<0.0001) (Table 5) that was comparable to studies by Seema et al and Haghjoo et al.[13,23] In the present study, decreased exercise duration, frequency, and type was significantly associated with OW and obesity (p<0.05) indicating that adolescents who did no exercise were OW and OB and as the duration and frequency of exercise increased the prevalence of OW and obesity decreases (Table 5). Our findings were similar to studies by Seema et al and Pathak et al.[13,18]

CONCLUSION

The findings from our study conclude a significant association between OW and obesity with upper socioeconomic status, daily junk food intake, screen time of more than 2 hours per day, and no or decreased physical activity. Obesity among adolescents is a prevalent issue, and policymakers and healthcare professionals need to be aware of this. Obesity prevention calls for coordinated policy actions across government agencies and a whole-system approach. The development and execution of treatments aimed at preventing childhood obesity should concentrate on those that are feasible, efficient, and likely to close gaps in health disparities.

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