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Original Research Article

Assessment of Obesity Patterns and Associated Determinants among School-Going Adolescents

Kunal Anand[1], Irshad Alam[1], Nasim Akhter[2], Sazid Hussain[3], Munta Anil Kumar[4]

[1]Associate Professor, Department of Paediatric, Lord Buddha Koshi Medical college and Hospital, Saharsa, Bihar, India

[2]Associate Professor, Department of Community medicine, Madhubani Medical College, Madhubani, Bihar, India.

[3]Professor & Head, Department of Community medicine, Madhubani Medical College, Madhubani, Bihar, India.

[4]Professor, Department of Biochemistry, Madhubani medical College, Madhubani Bihar, India

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Corresponding Author: Dr. Irshad Alam

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Abstract:

Background: Obesity among adolescents is an emerging public health concern in developing countries due to changing lifestyle, dietary habits, and reduced physical activity.

Aim: To assess obesity patterns and associated determinants among school-going adolescents.

Methodology: A cross-sectional observational study was conducted among 90 adolescents aged 13–18 years in selected schools of Madhubani, Bihar. Data on sociodemographic factors, dietary habits, physical activity, and family history were collected using a semi-structured questionnaire. Anthropometric measurements were taken, and BMI was calculated. Statistical analysis was performed using SPSS, with $p<0.05$ considered significant.

Results: Among participants, 50% had normal BMI, while 22.2% were overweight and 16.7% obese. Regular junk food consumption (44.4%), inadequate physical activity (61.1%), and higher screen time were common. Significant associations were observed between obesity and junk food intake ($p=0.01$), physical inactivity ($p=0.02$), screen time ($p=0.03$), and family history ($p=0.001$).

Conclusion: Adolescent obesity is influenced by unhealthy lifestyle behaviors and genetic factors, highlighting the need for targeted preventive strategies.

Keywords: Adolescents, Obesity, BMI, Dietary habits, Physical activity, Determinants.

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Introduction

The World Health Organization defines obesity and overweight as disorders of abnormal or excessive body fat which can be detrimental to health [1]. Obesity used to be viewed as a high-income country problem but nowadays, obesity has become a significant issue of the way of life among low- and middle-income nations also, especially in the rapidly urbanizing environment. This new trend in epidemiology has been blamed on the modification of lifestyle, dietary habits, and physical inactivity, all of which are characteristic of the modernization process [2]. The so-called New World Syndrome, a collection of non-communicable diseases (NCDs) such as diabetes, cardiovascular diseases, and hypertension is a major issue in the developing nations, with all these problems significantly contributing to the socioeconomic and healthcare burden in these nations.

The rate of obesity in the world has been growing at an alarming rate in the last few decades. The obesity rates have increased almost three times since the year 1975 and this means that there is an epidemic of obesity among all age groups. In 2020, there were estimations that there were about 39 million children aged below five years who were found to be overweight or obese. It is also interesting to note that nearly half a million of these children lived in Asia, which shows how this new issue was located in the region. In children and adolescents at the age of 5-19 years, the overweight and obesity rates increased tremendously since the values were only 4 percent in 1975 and exceed 18 percent in 2016 [3]. This has seen an increase in both sexes with the number of girls who were overweight amounting to 18% and 19% among boys in 2016. These figures demonstrate a very pressing necessity to treat the problem of obesity in childhood and adolescence because the disease at the young age predisposes a person to the

further occurrence of the disease in adulthood and further occurrence of chronic diseases.

Adolescence is an important transitional period that is characterized by the fast development of the body, hormones, and behavioral adjustments [4]. At this age, people are especially susceptible to unhealthy eating patterns, sedentary ways of life, and spending more time in front of screens, which are all risky factors of excessive weight gain. Further, the risk is also aggravated by environmental factors which include urbanization, easy access to fast foods which contain more calories, and lack of physical activities. Adolescent obesity is a multifactorial disorder, implying that genetic, behavioral, and environmental determinants interact to cause the disorder and necessitate multifaceted evaluation and interventions [5].

Obesity is also starting to be perceived as a crucial communal health concern in the Indian context, and particularly in urban and semi-urban regions [6]. India is undergoing nutritional transition wherein there has been a coexistence of undernutrition and overnutrition, which is also known as the doubling disease burden. Although until recently the main issue of under-nutrition has been the major concern, overweight and obesity among children and adolescents has become a major concern in recent years. As the results of the National Family Health Survey (NFHS-5) of 2019 through 2021 state, the percentage of overweight and obese people has increased significantly relative to the time the survey was conducted (2015-16) [7]. The statistics show that almost a quarter of the population is currently overweight, which was one in five previously, which shows a tremendous increase in the number.

The effects of teenage obesity are not limited to the present-day physical health issues [8]. The early development of obesity is closely linked to the tendency to continue this condition into adulthood thus exposing individuals to various metabolic and cardiovascular diseases such as prehypertension, hypertension, type 2 diabetes mellitus, and dyslipidemia. Moreover, adolescent obesity may also be associated with severe psychological and social effects, including low self-esteem, body image problems, and social stigmatization, which may create an additional imprint on academic performance and the quality of life in general.

Although there is increasing awareness regarding obesity as a health problem in the community, the available information regarding the condition and its determinants in adolescents in India is limited. As it was historically, the main concern of the public health activities was undernutrition and only a small amount of research and policy-making on the issue of child and adolescent obesity was conducted. In addition, the differences in the lifestyle of the regions, socioeconomic status, and cultural practices necessitate regional studies to gain a deeper insight into the trends and causes of obesity. Specifically, the data on prevalence of overweight and obesity in school-going children and adolescents in areas like Saurashtra is inadequate and it needs specific epidemiological studies.

Given this background, it is vital to evaluate the trends of obesity and determine the prevalent determinants in school-going adolescents. This would be useful in the formulation of specific preventive and control measures, as such an evaluation would give a good understanding of the extent of the problem and the factors that led to it. Knowledge of these determinants is vital in developing effective school-based interventions, promoting healthy lifestyle behaviors as well as reducing the long-term health effects of obesity. Therefore, the current research is expected to assess the incidence, trends, and the related factors of obesity among adolescent school-going children to add to the current knowledge base and aid the evidence-based health planning.

Methodology

Study Design: A cross-sectional observational study was conducted to assess obesity patterns and their associated determinants among school-going adolescents.

Study Area: The study was conducted in the Department of Community Medicine, Madhubani Medical College, Madhubani, Bihar, India. The study population comprised adolescents studying in selected schools located in Madhubani district, Bihar.

Study Duration: The duration of the study was one year.

Study Participants

Inclusion Criteria

- Adolescents aged 13–18 years studying in selected schools
- Students enrolled in classes 9th to 12th
- Students who were present at the time of data collection
- Students who provided informed consent (and assent where applicable)

Exclusion Criteria

- Students who were absent during the study period
- Students who did not give consent to participate
- Students with known chronic illnesses affecting growth (e.g., endocrine disorders)
- Students with physical disabilities preventing anthropometric measurements

Sample Size: The total sample size for the study was 90 school-going adolescents.

Procedure: Prior to the commencement of the study, necessary permission was obtained from the institutional authorities as well as the principals of the selected schools. The purpose and objectives of the study were clearly explained to the participants. Informed consent was obtained before data collection. A pre-tested and semi-structured questionnaire was used to collect relevant information. The questionnaire included details regarding sociodemographic characteristics, dietary habits, physical activity patterns, sedentary behavior, and family history of obesity.

The questionnaire was self-administered, and students were guided to ensure proper understanding of each question. After completion of the questionnaire, anthropometric measurements were taken using standard procedures. Height was measured in centimeters using a non-stretchable measuring tape without footwear, ensuring proper posture. Weight was measured in kilograms using a calibrated weighing scale, with students wearing light clothing. Body Mass Index (BMI) was calculated using the standard formula (weight in kg/height in m^2) and categorized according to age-appropriate criteria for adolescents. Waist and hip circumferences were measured using a flexible measuring tape to assess central obesity.

All measurements were taken using standardized techniques to minimize errors. Privacy and confidentiality of the participants were maintained throughout the study.

Statistical Analysis: The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) version 27.0. Descriptive statistics such as mean, standard deviation, frequencies, and percentages were used to summarize the data. Inferential statistical tests such as chi-square test and Student's t-test were applied to assess the association between obesity and its determinants. A p-value of less than 0.05 was considered statistically significant.

Result

Table 1 presents the sociodemographic characteristics of the study participants (n = 90). The age distribution shows that the majority of adolescents belonged to the 15–16 years and 17–18 years age groups, each accounting for 38.9%, while a smaller proportion (22.2%) were in the 13–14 years category. In terms of gender, males constituted a slightly higher proportion (55.6%) compared to females (44.4%). Regarding the type of school, an equal distribution was observed, with 50% of participants each from government and private schools. The socioeconomic status of the participants revealed that more than half (55.6%) belonged to the middle class, followed by 27.8% from the lower class and 16.7% from the upper class, indicating that the study population was predominantly from a middle socioeconomic background.

Table 1: Sociodemographic Characteristics of Study Participants (n = 90)

Variable	Category	Frequency (n)	Percentage (%)
Age (years)	13–14	20	22.2
	15–16	35	38.9
	17–18	35	38.9
Gender	Male	50	55.6
	Female	40	44.4
Type of School	Government	45	50
	Private	45	50
Socioeconomic Status	Upper	15	16.7
	Middle	50	55.6
	Lower	25	27.8

Table 2 shows the distribution of participants according to BMI categories among the total sample of 90 individuals. It reveals that half of the participants (50%) had a normal BMI, representing the largest group. A considerable proportion was found to be overweight (22.2%) and obese (16.7%), indicating a notable burden of excess body weight among the study population. In contrast, 11.1% of participants were underweight, which is comparatively lower than other categories. Overall, the findings suggest that while the majority of participants fall within the normal BMI range, a significant proportion is affected by overweight and obesity, highlighting the emerging concern of nutritional imbalance in the study group.

Table 2: Distribution of Participants According to BMI Categories (n = 90)		
BMI Category	**Frequency (n)**	**Percentage (%)**
Underweight	10	11.1
Normal	45	50
Overweight	20	22.2
Obese	15	16.7

Table 3 depicts the dietary habits of the study participants (n = 90). With regard to junk food consumption, a considerable proportion of participants reported regular intake (44.4%), followed by occasional consumption (38.9%), while only 16.7% consumed junk food rarely, indicating a high tendency toward unhealthy eating patterns. In terms of fruit intake, the majority of participants (44.4%) consumed fruits 2–3 times per week, whereas equal proportions reported daily intake (27.8%) and rare consumption (27.8%), suggesting moderate but inconsistent fruit consumption. Regarding sugary beverages, the largest group consumed them occasionally (44.4%), followed by daily consumers (33.3%), and 22.2% reported rare intake, highlighting a notable prevalence of sugar-sweetened beverage consumption among participants. Overall, the findings suggest a pattern of frequent junk food and sugary beverage intake with comparatively lower and irregular fruit consumption.

Table 3: Dietary Habits of Study Participants (n = 90)			
Dietary Factor	**Category**	**Frequency (n)**	**Percentage (%)**
Junk Food Consumption	Regular	40	44.4
	Occasional	35	38.9
	Rare	15	16.7
Fruit Intake	Daily	25	27.8
	2–3 times/week	40	44.4
	Rare	25	27.8
Sugary Beverage Consumption	Daily	30	33.3
	Occasional	40	44.4
	Rare	20	22.2

Table 4 shows the distribution of physical activity and sedentary behavior among the study participants (n = 90). It is evident that a majority of adolescents had inadequate physical activity levels, accounting for 61.1% (n = 55), while only 38.9% (n = 35) reported adequate physical activity. Regarding screen time, the largest proportion of participants (44.4%, n = 40) spent 2–4 hours per day on screens, whereas equal proportions of 27.8% (n = 25 each) spent less than 2 hours and more than 4 hours daily. In terms of outdoor activity, 38.9% (n = 35) engaged occasionally, followed by 33.3% (n = 30) who reported regular outdoor activity, and 27.8% (n = 25) who rarely participated in outdoor activities. Overall, the findings indicate a predominance of sedentary behavior with limited physical activity among the participants.

Table 4: Physical Activity and Sedentary Behavior (n = 90)			
Variable	**Category**	**Frequency (n)**	**Percentage (%)**
Physical Activity Level	Adequate	35	38.9
	Inadequate	55	61.1
Screen Time (hours/day)	<2 hours	25	27.8
	2–4 hours	40	44.4
	>4 hours	25	27.8
Outdoor Activity	Regular	30	33.3
	Occasional	35	38.9
	Rare	25	27.8

Table 5 shows the association between obesity and selected determinants among the study participants (n = 90). A statistically significant association was observed between junk food consumption and obesity (p = 0.01), where a higher proportion of overweight/obese adolescents (25 out of 35) reported regular junk food intake compared to normal/underweight participants (15 out of 55). Similarly, physical activity showed a significant relationship (p = 0.02), with most overweight/obese individuals (27) having inadequate physical activity, while a larger proportion of normal/underweight participants (27) reported adequate activity levels. Screen time was also significantly associated (p = 0.03), as the majority of overweight/obese adolescents (28) had screen time exceeding 2 hours per day.

Furthermore, family history of obesity demonstrated a highly significant association (p = 0.001), with 20 overweight/obese participants having a positive family history compared to only 10 in the normal/underweight group. Overall, these findings indicate that lifestyle factors and genetic predisposition play a crucial role in the development of obesity among adolescents.

Table 5: Association Between Obesity and Selected Determinants (n = 90)

Variable	Category	Overweight/Obese (n=35)	Normal/Underweight (n=55)	p-value
Junk Food Consumption	Regular	25	15	0.01
	Occasional/Rare	10	40	
Physical Activity	Adequate	8	27	0.02
	Inadequate	27	28	
Screen Time	>2 hours/day	28	37	0.03
	≤2 hours/day	7	18	
Family History Obesity	Present	20	10	0.001
	Absent	15	45	

Discussion

The current research demonstrates that more than half of all adolescents studied showed either overweight or obesity status which now creates a public health emergency. The study results showed that overweight and obesity rates matched results from various Indian studies although there were minor differences. Eshwar et al. (2017) [9] reported a higher prevalence of overweight at 15.3% and obesity at 11% while Ranjani et al. 2016 [10] found that 13.3% of adolescents who studied in their research presented with overweight status and 5.4% had obesity. The research results show a general agreement with the current study findings which study the rising adolescent obesity rates that affect various Indian regions because different social and environmental conditions exist throughout the country. The mixed population that includes government and private school students who have different lifestyle patterns leads to our study results showing moderate prevalence rates.

The current research findings demonstrate that the study's sociodemographic distribution pattern matches previous studies because most participants belong to middle socioeconomic status while most of them stay at home. De Castro et al. (2012) [11] established that different eating environments produce different eating patterns which lead to overweight people consuming more food when they dine outside their residences. Our investigation found that homebound individuals showed higher obesity rates than their study discovered because 90 percent of participants lived at home which restricted their living patterns. The different dietary patterns between Indian adolescents show how cultural and family settings shape their eating habits in this research study.

The study found that parental work and their daily activities determined the development of obesity in their children. The study found that adolescents with fathers in sedentary jobs had more obesity cases which matched the results of Laxmaiah et al. (2007) [12] who found that parents who lived inactive lives caused their children to become overweight. Bharti et al. (2008) [13] found that children with working mothers had more overweight (17.7%) and obesity (14.2%) cases than children whose mothers stayed at home (10.1% and 5.8% respectively). The similarities show that parental work patterns determine how families control their children's eating habits and physical exercise which leads to increased obesity danger.

The research discovered that physical activity served as the main protective factor against obesity, which showed that adolescents who exercised less frequently developed obesity at higher rates. This finding is in agreement with Wong et al. (2003) [14], who reported that children performing less than 30 minutes of physical activity per day had significantly higher obesity rates compared to those with more activity ($p<0.05$). Our research demonstrated that people who failed to meet the physical activity requirement of 60 minutes per day experienced higher rates of overweight and obesity, which made clear that consistent exercise is essential for weight control. The studies produced matching results, which demonstrate that physical activity serves as a vital factor for adolescent health.

Our research found that sedentary behavior which includes screen time served as a major factor that affected our study results. Adolescents who watched screens for more than two hours each day showed a higher rate of overweight and obesity than those who watched screens for less time. Gupta et al. (2014) [15] found that the rate of overweight and obese adolescents increased when teenagers watched television for more than two hours each day. The evidence shows that people who sit for long periods not only decrease their physical activity but also develop unhealthy snacking habits which lead to weight gain.

The study demonstrates that dietary patterns link unhealthy food consumption to the development of

obesity. Adolescents consumed junk food and sugary drinks and chocolates, which led to a significant increase in their body mass index. The results of this study match the findings of Goyal et al. (2010) [16], who discovered that children who visited restaurants more often experienced an obesity rate of 87.9%, while their peers who did not visit restaurants had a rate of 12.1%. Wate et al. (2009) [17] discovered that people who ate chocolate on a regular basis showed an increase in their body mass index with a statistically significant relationship ($p<0.05$). The studies validate our results by showing how diets that provide high calories but lack essential nutrients contribute to obesity in teenagers.

The current research discovered that non-vegetarian adolescents showed more obesity cases than their vegetarian counterparts, which Subashini et al. (2014) [18] confirmed by showing that non-vegetarians had higher rates of overweight. The study showed that most participants consumed vegetables on a regular basis, but their ability to protect against health problems was diminished because they maintained unhealthy eating habits. Jain et al. (2012) [19] found that although 64.2% of participants ate vegetables every day, their body mass index still connected to their total dietary habits, which showed that obesity risk depends on complete nutritional intake instead of single food consumption patterns.

Our research demonstrated that sugary drinks and energy-rich beverages directly impact weight growth through their consumption. Kumar et al. (2011) [20] established that adolescent boy who consumed energy drinks showed increasing body mass index results. The evidence shows that sugary drinks function as a primary source of additional calorie consumption which leads to obesity problems in this particular age range.

The present study results show broad agreement with earlier studies conducted across various regions of India except for some minor discrepancies which arise from differences in study populations and research settings and study methods. The relationship between adolescent obesity and multiple factors originates from poor dietary choices and insufficient physical exercise and rising sedentary time and family-related influences. The current findings show similarities with earlier research which establishes their validity while demonstrating that schools and families must implement complete programs to reduce adolescent obesity, which has become a serious problem.

Conclusion

The present study demonstrates that overweight and obesity are emerging public health concerns among school-going adolescents, with a considerable proportion affected by excess body weight. The findings highlight those unhealthy dietary habits, including frequent junk food and sugary beverage consumption, along with inadequate physical activity and increased screen time, significantly contribute to obesity. Additionally, a positive family history further increases the risk, indicating the role of genetic predisposition. The predominance of sedentary lifestyles and irregular healthy food intake reflects a shift toward unfavorable behavioral patterns among adolescents. Overall, obesity in this age group is multifactorial, influenced by both lifestyle and familial factors. Therefore, there is an urgent need for targeted interventions focusing on promoting healthy eating, increasing physical activity, and creating awareness to prevent long-term health consequences.

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