Original Research Article

A cross-sectional study to determine the risk indicators for obesity among adolescents in Mysuru

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ABSTRACT

Background: Childhood obesity is a significant public health concern with long-term health risks. The rising prevalence of obesity among children and adolescents, influenced by biological, behavioural, environmental, and socioeconomic factors, leads to a higher risk of obesity in adulthood and related lifestyle diseases. Early detection is critical as misconceptions by parents and educators delay intervention. Assessing psychological and lifestyle factors comprehensively is crucial for preventing childhood obesity and helping policymakers address its consequences in adulthood. This study was conducted to identify the risk factors that contribute to the development of obesity in children.
Methods: A cross-sectional study was conducted in randomly selected two private schools in the Mysuru district using the lottery method among children aged 10–16 years, including obese and non-obese children studying. Data were collected on socio-demographics, eating habits, physical activity, and psychological factors from 126 students using a semi-structured questionnaire. Descriptive statistics for Socio-demographic characteristics, Chi-square test to find the association between risk factors and childhood obesity using IBM SPSS V.26 (licensed to JSSAHER) was used.
Results: 65.1% were males, and 33.9% were females, constituting the obese/overweight group. The mean age was 13.1±1.7 years and 12.1±1.6 years among overweight/obese and non-obese groups, respectively. A significant association was found between eating habits, including the consumption of pulses, fruits, non-vegetarian food and beverages, decreased physical activity, low mental health, and obesity (p<0.05).
Conclusions: Childhood obesity is linked to diet, physical activity, and psychological well-being. This calls for a multi-pronged approach to preventing it.

Keywords: BMI, Adolescent school children, Childhood obesity, School health

INTRODUCTION

Overweight and obesity are complex conditions that occur when a person's weight exceeds healthy weight for height. These conditions involve excessive fat accumulation that can negatively impact an individual's health. Both children and adults are affected by obesity.

In children, weight fluctuates with height during growth. Body adiposity increases sharply during infancy, reaches its peak around 9 months, and then declines until about 6 years old before increasing again. This second increase is known as adiposity rebound, which continues into adulthood.[1] Obesity is usually measured by Body mass index (BMI) and is defined as a person's weight in kilograms divided by the square of his height in meters

(kg/m^2). For children between 5 and 19 years, overweight is defined as a weight-for-height ratio greater than two standard deviations, and for obesity, it is defined as a weight-for-height ratio greater than three standard deviations.[2] The Global prevalence of obesity is higher amongst women than men. It is predicted that over 1 billion people - 1 in 5 women and 1 in 7 men develop obesity with a BMI $\geq$30 kg/m^2 by 2030[4] and that by 2025, there will be 17 million obese children in India and will have the prevalence of approximately 10.81% childhood obesity among the 5-9 year age group, and around 6.23% prevalence of obesity among teenagers in the age group of 10-19 years.[3] In Karnataka, the percentage of children under the age of five who are overweight, according to NFHS 5, stands at 3.2%, an increase compared to NFHS 4 (2.6%).[4] The prevalence of obesity in Mysuru was 3.86%, and the prevalence of overweight was 12.27%.[5] Early intervention is crucial to prevent childhood obesity and associated adult health risks. Misconceptions by parents and teachers that it is normal for a child's development to be obese and overweight can lead to poor management. Identifying risk factors can aid in the effective prevention and management of health issues. This study was undertaken to determine the associated risk factors of obesity among adolescents of Mysuru.

METHODS

Study design and setting

A school-based cross-sectional study was conducted between August and September 2024 in two randomly selected schools in Mysuru district using a lottery method of simple random sampling.

Sampling technique

A two-stage sampling approach was adopted – stage 1 (school selection) – two schools were selected using the lottery method of simple random sampling from the list of schools in Mysuru district, and stage 2 (participant selection) – all overweight and obese students in the selected schools were purposively included based on BMI classification. For each of these participants, an age- and sex-matched non-obese student was chosen from the same class using simple random sampling, ensuring 1:1 matching criteria.

Study participants

The study included children and adolescents aged 10 to 16 years who provided assent and had institutional consent. Children with chronic illness, endocrine disorders, or long-term medications affecting weight were excluded.

Data collection tools and techniques

Anthropometric measurements (height and weight) were recorded using standard procedures. The body mass index (BMI) was calculated. The World Health Organization's BMI for age–Z–score classification (5-19) years was used to categorise the participants as Overweight BMI > +1 SD, Obese -> +2 SD, and Non-obese - $\leq$ +1 SD.

Data were collected using a pretested semi-structured questionnaire designed to assess risk factors of obesity consisting of 4 domains:

Socio-demographic profile; eating habits – frequency and quantity of food items consumed (cereals, pulses, vegetables, fruits, milk products, snacks, and beverages). Eating patterns were categorized as – occasional (never or twice/month), moderate (once or twice/week), excessive (daily/ multiple times per day); physical activity and sedentary lifestyle – based on CDC guidelines ($\geq$60 minutes/day or $\geq$3 days/week). Physical activity was categorised as highly active, moderately active, and low active. A sedentary lifestyle is low (<2 hours/day), moderate (2–3 hours/day), and high (>3 hours/day). Psychological assessment – emotional well-being, including feelings of anxiety, bullying, or sadness, was assessed and categorised as rarely experienced, occasionally experienced, and frequently experienced

Data was entered in MS Excel and analysed using SPSS Version 26. Descriptive statistics were used to summarise socio-demographic data. The inferential analysis was done using the Chi-square test to assess the association between risk factors and obesity. A p value <0.05 was considered statistically significant.

RESULTS

In the present study, the mean age of overweight and obese adolescents was significantly higher (13.1±1.7 years) compared to their non-obese counterparts (12.1±1.6 years), with a statistically significant difference (p=0.045). This indicates that the likelihood of being overweight or obese increases with age, possibly due to reduced physical activity, increased screen time, or changing dietary patterns during early adolescence. A significant association was also observed between gender and obesity status (p=0.02). Among the overweight/obese group, a higher proportion were males (65.1%) compared to females (33.9%). In contrast, in the non-obese group, females constituted a higher proportion (55.6%) than males (44.4%), suggesting that male adolescents in the study population were more prone to overweight and obesity.

The analysis of dietary habits revealed several significant associations with overweight and obesity among adolescents. Excessive consumption of pulses was reported by 17.5% of the obese group, while none of the non-obese participants reported such intake, showing a statistically significant association (p=0.002). Fruit consumption patterns also differed significantly (p=0.018), with 7.9% of obese participants reporting excessive intake, while none in the non-obese group did

so. Additionally, a higher proportion of obese adolescents (30.2%) consumed non-vegetarian food moderately compared to non-obese adolescents (12.7%), which was statistically significant (p=0.017). Beverage consumption also showed a significant association with obesity (p=0.01), with 30.2% of obese participants reporting moderate intake, compared to only 9.5% among the non-

obese. However, the frequency of consumption of cereals, vegetables, milk products, and snacks did not show statistically significant differences between the two groups. These findings suggest that specific dietary patterns—particularly increased intake of pulses, fruits, non-vegetarian foods, and beverages—may be linked to a higher risk of overweight and obesity in adolescents.

Table 1: Socio-demographic characteristics of the study participants (n=126).

Variable		Overweight/obese (%)	Non-obese (%)	Total (%)	P value
Mean age (years)		13.1+1.7	12.1+1.6	126(100)	0.045*
Gender	Male	41(65.1)	28 (44.4)	69(55.2)	0.02*
	Female	22(33.9)	35 (55.6)	57(44.8)	

*P value <0.05 is statistically significant.

Table 2: Dietary habits and food consumption pattern (n=126).

S. no.	Eating habits	Frequency of consumption	Non-obese (%)	Obese (%)	P value
1	Cereals	Occasional consumption	6 (9.5)	9 (14.3)	0.409
		Moderate consumption	57 (90.5)	54 (85.7)	
		Excessive consumption	0 (0)	0 (0)	
2	Pulses	Occasional consumption	28 (44.4)	23 (36.5)	0.002*
		Moderate consumption	35 (55.6)	29 (46.0)	
		Excessive consumption	0 (0)	11 (17.5)	
3	Vegetables	Occasional consumption	5 (7.9)	9 (14.3)	0.094
		Moderate consumption	17 (27.0)	25 (39.7)	
		Excessive consumption	41 (65.1)	29 (46.0)	
4	Fruits	Occasional consumption	41 (65.1)	29 (46.0)	0.018*
		Moderate consumption	22 (34.9)	29 (46.0)	
		Excessive consumption	0 (0)	5 (7.9)	
5	Milk products	Occasional consumption	8 (12.7)	11 (17.5)	0.694
		Moderate consumption	50 (79.4)	46 (73.0)	
		Excessive consumption	5 (7.9)	6 (9.5)	
6	Non-vegetarian food	Occasional consumption	55 (87.3)	44 (69.8)	0.017*
		Moderate consumption	8 (12.7)	19 (30.2)	
		Excessive consumption	0 (0)	0 (0)	
7	Snacks	Occasional consumption	37 (58.7)	40 (63.5)	0.584
		Moderate consumption	26 (41.3)	23 (36.5)	
		Excessive consumption	0 (0)	0 (0)	
8	Beverages	Occasional consumption	56 (88.9)	44 (69.8)	0.01*
		Moderate consumption	6 (9.5)	19 (30.2)	
		Excessive consumption	1 (1.6)	0 (0)	

*P value <0.05 is statistically significant.

The study found a strong inverse relationship between physical activity and obesity in adolescents (p=0.000). While 41.3% of obese adolescents were less active, only 11.1% of non-obese adolescents fell into this category. In contrast, 49.2% of non-obese participants were highly active compared to just 6.3% of obese adolescents. Although not statistically significant (p=0.08), 4.8% of obese adolescents exhibited high sedentary behaviour, with none reported among non-obese. These results highlight the protective role of physical activity against adolescent obesity.

Obese adolescents reported significantly more psychological issues compared to non-obese peers

(p=0.000). While 96.8% of non-obese participants rarely experienced psychological distress, only 68.3% of obese adolescents reported the same. Notably, 28.6% of the obese group occasionally and 3.2% frequently experienced psychological problems, indicating a clear link between obesity and poor psychological health.

Statistically significant associations with p<0.05 were found between obesity and its risk factors. Dietary habits showed an association with excessive consumption of pulses, fruits, non-vegetarian foods, and beverages among the overweight and obese. Lower physical activity and increased psychological distress were also associated with overweight/obese individuals.

Table 3: Physical activity and Sedentary behaviour (n=126).

S. no.	Risk factors	Frequency of physical activity	Non-obese (%)	Obese (%)	P value
1	Physical activity	Less active	7 (11.1)	26 (41.3)	0.00*
		Moderately active	25 (39.7)	33 (52.4)	
		Highly active	31 (49.2)	4 (6.3)	
2	Sedentary activity	Low sedentary	0 (0)	0 (0)	0.08
		Moderately sedentary	63 (100.0)	60 (95.2)	
		High sedentary	0 (0)	3 (4.8)	

*P value <0.05 is statistically significant.

Table 4: Psychological distress among participants (n=126).

S. no.	Risk factors	Psychological issues	Non-obese (%)	Obese (%)	P value
1	Psychological Health	Rarely experienced	61 (96.8)	43 (68.3)	0.00*
		Occasionally experienced	2 (3.2)	18 (28.6)	
		Frequently experienced	0 (0)	2 (3.2)	

*P value <0.05 is statistically significant.

DISCUSSION

Childhood and adolescent obesity are one of the leading causes of non-communicable diseases in adults. The study investigated risk factors by assessing Eating habits, Physical activity, and psychological assessments of children and adolescents, including detailed dietary evaluations to identify specific food groups and eating patterns associated with obesity among obese and non-obese individuals. The study also concentrated on analysing physical activity, its intensity, and duration among obese/overweight and non-obese children and examined sedentary patterns in different settings like screen time, transportation, and school breaks, etc.; the present study also focused on the psychological assessment in terms of stress, anxiety, and depression leading to unhealthy eating behaviours and weight gain of the children. A study conducted by Barua et al at Kolkata states that reduced knowledge and awareness, lifestyle factors, family history, environmental and work-related stress, poor time management, socio-cultural and behavioural characteristics, and increased urbanisation leading to excess body weight in terms of overweight and obesity.[5] The study participants in our study were aged between 10-16 years, among whom the majority were male, showing a similar trend to that of a study conducted by Bekhwani et al in Pakistan.[6] Our study reported a significant association between eating habits and obesity, which is similar to the study conducted by Nathani et al in Varanasi.[7] In this study, a significant association was found between physical activity and obesity, contrary to the study by Karki et al, conducted in 2019 to investigate the associated factors of childhood obesity in Nepal, and the study by Desalew et al, conducted in Ethiopia.[8,9]

This study also reveals that there is no significant association between sedentary activity and obesity, consistent with the survey conducted by Verduci et al in the UK.[10] This study also reported no significant association between psychological factors and obesity. In contrast, a significant association was found between the sleep quality of the study participants and obesity, yielding results similar to those of a study conducted by Abedelmalek et al in Saudi Arabia and Watharkar et al, in Uttar Pradesh.[11,12]

Limitations

The data were self-reported for some variables, such as dietary habits, physical activity, and psychological health, which may be subject to recall and social desirability bias. The study was conducted in a limited geographic area, which may affect the generalizability of the findings to other populations. Additionally, certain potential confounding factors, such as parental obesity, genetic predisposition, and detailed socioeconomic indicators, were not assessed, which could influence the observed associations.

CONCLUSION

Childhood and adolescent obesity are a growing concern due to lifestyle-associated and modifiable risk factors. These factors include regularly eating high-calorie foods, lack of exercise, too much time spent in sedentary activities, and psychological factors such as stress, anxiety, and depression. In this study, a significant association was found between the risk factors of eating habits, childhood physical activity, and adolescent obesity. Therefore, it is essential to promote healthy eating habits, regular exercise, and maintain good psychological health in children to prevent childhood and adolescent obesity, which can lead to further consequences in adulthood.

REFERENCES

1. Kansra AR, Lakkunarajah S, Jay MS. Childhood and Adolescent Obesity: A Review. Front Pediatr. 2021;8:581461.
2. World Health Organization. Obesity: Preventing and Managing the Global Epidemic: Report of a WHO Consultation. Geneva, World Health Organization, 2000. Available at: https://iris.who.int/handle/10665/42330. Accessed on 3 April 2025.
3. Fleming, Mary Louise. Introduction to Public Health. Elsevier Health Sciences, 2023.
4. National Family Health Survey (NFHS-5), India. International Institute for Population Sciences, Mumbai; 2021.
5. Chanchala H, Madhu B, Nagaraja M, Shanbhog R. Secular trends in prevalence of overweight and obesity over a decade in urban and rural South Indian children integrated with geographic information system. Indian J Dent Res. 2022;33(3):235-40.
6. Bekhwani AR, Khan M. Various Risk Factors of Overweight and Obesity among Children Aged 5-16 Years. J Coll Physicians Surg Pak. 2022;32(6):763-7.
7. Mamta T. Malnutrition: prevalence and risk factors - a cross-sectional study among school going children in Varanasi, the ancient city of India. AYUHOM. 2022;9(2):77-83.
8. Karki A, Shrestha A, Subedi N. Prevalence and associated factors of childhood overweight/obesity among primary school children in urban Nepal. BMC Public Health. 2019;19(1):1055.
9. Desalew A, Mandesh A, Semahegn A. Childhood overweight, obesity and associated factors among primary school children in dire dawa, eastern Ethiopia; a cross-sectional study. BMC Obes. 2017;4:20.
10. Verduci E, Bronsky J, Embleton N, Gerasimidis K, Indrio F, Köglmeier J, et al. Role of Dietary Factors, Food Habits, and Lifestyle in Childhood Obesity Development: A Position Paper From the European Society for Paediatric Gastroenterology, Hepatology and Nutrition Committee on Nutrition. J Pediatr Gastroenterol Nutr. 2021;72(5):769-83.
11. Abedelmalek S, Adam H, Alardan S, Yassin S, Chtourou H, Souissi N. Physical Activity, Sleep Patterns and Diet Habits as Well as the Prevalence of Obesity among Adolescents: A Cross-Sectional Study from Ha'il City in Saudi Arabia. Int J Environ Res Public Health. 2022;19(23):16174.
12. Watharkar A, Nigam S, Martolia DS, Varma P, Barman SK, Sharma RP. Assessment of risk factors for overweight and obesity among school-going children in Kanpur, Uttar Pradesh. Indian J Comm Health. 2015;27:216-22.