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PREVALENCE AND DETERMINANTS OF OVERWEIGHT AND OBESITY AMONG HIGH SCHOOL STUDENTS: A CROSS-SECTIONAL STUDY FROM SOUTH KERALA

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ABSTRACT

Background: Aim: To determine the prevalence of overweight and obesity and identify the associated sociodemographic, dietary, behavioural, and lifestyle determinants among high school students in South Kerala.

Materials and Methods: A school-based cross-sectional study was conducted among high school students in South Kerala. Information regarding sociodemographic characteristics, dietary habits, physical activity, sedentary behaviour, sleep pattern, family history, and lifestyle factors was collected using a structured questionnaire. Anthropometric measurements including height and weight were obtained using standardized procedures, and Body Mass Index (BMI) was calculated. Nutritional status was classified according to age- and sex-specific BMI criteria. Statistical analyses were performed to estimate the prevalence of overweight and obesity and evaluate their determinants.

Results: The study estimated the prevalence of overweight and obesity among high school students and evaluated the influence of demographic, dietary, behavioural, physical activity, sedentary lifestyle, and familial factors. Unhealthy dietary practices, increased consumption of processed foods and sugar-sweetened beverages, prolonged screen time, inadequate physical activity, insufficient sleep, and positive family history were identified as important determinants associated with excess body weight.

Conclusion: Overweight and obesity among adolescents represent an emerging public health challenge in South Kerala. Identification of modifiable risk factors provides an opportunity for early intervention through school-based health promotion, nutritional education, regular physical activity, and family-centred preventive strategies to reduce future non-communicable disease burden.

Keywords: Adolescent obesity; Overweight; High school students; Body mass index; Dietary habits; Physical activity; Sedentary behaviour; Kerala; Cross-sectional study; Non-communicable diseases.

INTRODUCTION

Overweight and obesity among children and adolescents have emerged as one of the most significant public health challenges of the twenty-first century.[1] The World Health Organization (WHO) recognizes obesity as a chronic, multifactorial, relapsing disease resulting from a complex interaction between genetic susceptibility, environmental influences, dietary practices, physical inactivity, socioeconomic factors, behavioural patterns, and metabolic mechanisms.[2] Once considered a problem confined to high-income countries, overweight and obesity have become increasingly prevalent in low- and middle-income nations, where rapid urbanization, nutritional

transition, and changing lifestyles have accelerated the epidemic.[3] The increasing prevalence of childhood obesity has important implications because excess body weight during adolescence frequently persists into adulthood and substantially increases the risk of type 2 diabetes mellitus, hypertension, dyslipidaemia, cardiovascular diseases, metabolic syndrome, musculoskeletal disorders, psychological problems, and premature mortality.[4]

Recent global estimates indicate that more than one billion people worldwide are living with obesity, including a rapidly increasing proportion of children and adolescents. According to the UNICEF Child Nutrition Report 2025, overweight and obesity have, for the first time, surpassed undernutrition as the most common form of malnutrition among school-aged children and adolescents worldwide.[5] Approximately one in every ten children globally is now living with obesity, reflecting an alarming shift in nutritional patterns driven by increasing consumption of calorie-dense, nutrient-poor foods, reduced physical activity, sedentary behaviour, and aggressive marketing of ultra-processed food products.[6] This transition represents a major challenge for health systems because obesity during childhood predisposes individuals to chronic non-communicable diseases later in life.[7]

India is currently experiencing a rapid epidemiological and nutritional transition characterized by simultaneous persistence of undernutrition and a growing burden of overweight and obesity.[8] Economic development, improved household income, urban expansion, widespread availability of processed foods, increasing dependence on digital technology, and declining physical activity have collectively contributed to the rising prevalence of obesity among children and adolescents.[9] School-going adolescents constitute a particularly vulnerable population because adolescence is a period of rapid physical growth, hormonal changes, psychological development, and establishment of lifelong dietary and lifestyle behaviours.[10] Unhealthy habits acquired during this stage frequently persist into adulthood, increasing the long-term risk of chronic diseases and reducing quality of life.[11]

Kerala presents a unique public health scenario within India. The state has consistently demonstrated excellent health indicators, including high literacy rates, low infant mortality, and increased life expectancy.[12] However, these achievements have been accompanied by an increasing burden of non-communicable diseases. Kerala has undergone an advanced epidemiological transition in which communicable diseases have declined while lifestyle-related disorders have become increasingly prevalent.[13] Diabetes mellitus, hypertension, cardiovascular diseases, and obesity occur at substantially higher rates than the national average. This paradox indicates that improved educational attainment and health awareness alone are insufficient to counteract unhealthy environmental and behavioural influences associated with modernization.[14]

The increasing prevalence of overweight and obesity among adolescents in Kerala reflects the ongoing nutrition transition characterized by greater consumption of ultra-processed foods, sugar-sweetened beverages, energy-dense snacks, and fast foods, coupled with declining physical activity.[15] Easy accessibility of processed foods, widespread use of digital devices, prolonged screen time, reduced participation in outdoor sports, dependence on motorized transportation, and inadequate sleep have collectively contributed to positive energy balance and excessive weight gain.[16] Furthermore, familial obesity, socioeconomic status, parental education, and household lifestyle practices significantly influence dietary behaviours and physical activity patterns among adolescents, making obesity a multifactorial health problem requiring comprehensive preventive strategies.[17]

Several studies conducted across India have reported considerable regional variation in the prevalence of overweight and obesity among school-going children, reflecting differences in socioeconomic development, urbanization, cultural practices, dietary habits, and levels of physical activity.[18] Although numerous investigations have examined obesity among urban school children, relatively limited evidence is available regarding the determinants of overweight and obesity among adolescents in South Kerala.[19]

Therefore, this study was undertaken to determine the prevalence of overweight and obesity and identify the associated sociodemographic, dietary, behavioural, lifestyle, and familial determinants among high school students in South Kerala, thereby generating evidence that may support the development of targeted school- and community-based preventive strategies.

MATERIALS AND METHODS

Study Design

A school-based cross-sectional study was conducted to determine the prevalence of overweight and obesity and identify their associated determinants among high school students in South Kerala.

Study Setting

The study was conducted in selected government, aided, and private high schools located in Adoor municipality, Kerala. Schools from both urban and rural areas were included to obtain a representative sample of adolescents from different socioeconomic backgrounds.

Study Duration

The study was carried out over a period of **12 months**, from **June 2025 to May 2026**.

Sample Size Calculation

The sample size was calculated using the formula for estimating a single population proportion:

$$n = \frac{Z^2 P(1-P)}{d^2}$$

Where:

- n = Required sample size
- Z = Standard normal deviate at 95% confidence level = 1.96
- P = Expected prevalence of overweight/obesity among adolescents = 25% (based on previous Indian studies)
- d = Absolute precision = 5%

$$n = \frac{(1.96)^2 \times 0.25 \times 0.75}{(0.05)^2}$$

$$n = \frac{3.84 \times 0.1875}{0.0025} = 288$$

Considering a design effect of **1.8** due to multistage cluster sampling:

$$288 \times 1.8 = 518$$

After adding **15%** for possible non-response and incomplete questionnaires:

$$518 \times 1.15 = 595.7$$

The final sample size was rounded to **600 students**.

Eligibility Criteria

Inclusion Criteria

- Students aged 13–17 years.
- Students enrolled in Classes VIII, IX, and X.
- Students present on the day of data collection.
- Students providing assent and whose parents or guardians provided written informed consent.

Exclusion Criteria

- Students with chronic systemic illnesses known to affect growth.
- Students receiving long-term corticosteroids or medications affecting body weight.
- Students with physical disabilities preventing accurate anthropometric measurements.
- Students with incomplete questionnaires or refusal to participate.

Anthropometric Measurements

Height was measured to the nearest 0.1 cm using a calibrated portable stadiometer with participants standing barefoot in the Frankfurt plane.

Weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale with participants wearing light clothing and no footwear.

Body Mass Index (BMI) was calculated using the formula:

$$BMI = \frac{\text{Weight (kg)}}{\text{Height (m)}^2}$$

Nutritional status was classified according to the WHO BMI-for-age reference standards for children and adolescents as:

- Normal weight
- Overweight
- Obesity

RESULTS

A total of 620 high school students were initially approached for participation. Fourteen students did not satisfy the eligibility criteria, while six students either declined participation or submitted incomplete questionnaires. Consequently, 600 students were included in the final analysis, yielding a response rate of 96.8%. The mean age of the participants was 14.8 ± 1.2 years. Males constituted 52.0% (312/600) of the study population, whereas females accounted for 48.0% (288/600). Most participants belonged to urban areas and nuclear families. Based on BMI-for-age classification, 438 (73.0%) students had normal nutritional status, 108 (18.0%) were overweight, and 54 (9.0%) were obese, giving an overall prevalence of overweight and obesity of 27.0%. Subsequent analyses evaluated the influence of sociodemographic characteristics, dietary habits, physical activity, sedentary behaviour, sleep pattern, and family history on overweight and obesity. Significant associations were identified for several modifiable lifestyle factors, and multivariable logistic regression identified independent predictors of excess body weight.

Table 1. Participant Flow and Sociodemographic Characteristics of the Study Participants (n = 600)

The baseline sociodemographic profile of the study participants is presented in **Table 1**. The study population included adolescents aged 13–17 years, with a relatively uniform age distribution across the three age categories. Male students marginally outnumbered female students. More than half of the participants resided in urban areas, and approximately two-thirds belonged to nuclear families. Nearly half of the families reported a monthly income exceeding □25,000. Parents generally had secondary or higher educational attainment, reflecting the educational profile of the study population. These baseline characteristics demonstrate a heterogeneous cohort suitable for evaluating determinants of overweight and obesity.

Table 1: Participant Flow and Sociodemographic Characteristics of the Study Participants (n = 600)

Characteristic	Number	Percentage (%)
Participant Flow		
Students approached	620	100
Excluded (did not meet eligibility criteria)	14	2.25
Declined/incomplete questionnaire	6	0.95
Final analysed	600	96.8
Age Group (years)		
13–14	186	31.0
15	204	34.0

16–17	210	35.0
Sex		
Male	312	52.0
Female	288	48.0
Residence		
Urban	352	58.7
Rural	248	41.3
Family Type		
Nuclear	411	68.5
Joint/Extended	189	31.5
Birth Order		
First	252	42.0
Second	228	38.0
Third or later	120	20.0
Father's Education		
Up to secondary	162	27.0
Higher secondary/Diploma	204	34.0
Graduate and above	234	39.0
Mother's Education		
Up to secondary	144	24.0
Higher secondary/Diploma	222	37.0
Graduate and above	234	39.0
Monthly Family Income		
< □10,000	96	16.0
□10,000–25,000	222	37.0
> □25,000	282	47.0
School Type		
Government	180	30.0
Aided	216	36.0
Private/Unaided	204	34.0

Table 1 demonstrates that the study included a balanced representation of adolescents across different age groups, sexes, residential settings, and school types. The majority belonged to nuclear families and nearly half had a monthly family income exceeding □25,000. The distribution of parental education indicates a relatively well-educated study population, supporting comprehensive assessment of socioeconomic determinants.

Table 2. Anthropometric Characteristics of the Study Participants (n = 600)

Anthropometric measurements of the participants are summarized in **Table 2**. The mean BMI of the study population was within the normal range; however, substantial inter-individual variability was observed. Male students demonstrated slightly greater mean height and weight than females, whereas BMI values were comparable between the sexes. These anthropometric findings provide the basis for BMI classification and subsequent analyses of overweight and obesity.

Table 2: Anthropometric Characteristics of the Study Participants (n = 600)

Variable	Mean ± SD	Minimum	Maximum
Age (years)	14.8 ± 1.2	13	17
Height (cm)	156.8 ± 8.4	138.2	178.6
Weight (kg)	51.7 ± 11.4	31.5	89.4
Body Mass Index (kg/m²)	20.8 ± 3.9	14.2	33.8
Sleep duration (hours/night)	7.2 ± 1.1	5.0	10.0

Table 2 indicates that the participants had a mean BMI of **20.8 ± 3.9 kg/m²**, with values ranging from **14.2 to 33.8 kg/m²**, reflecting a broad spectrum of nutritional status. The observed variation supports further subgroup analyses according to BMI classification and associated determinants.

Table 3. Distribution of Nutritional Status among Study Participants (n = 600)

The prevalence and distribution of nutritional status are presented in **Table 3**. Overall, 27.0% of participants were either overweight or obese. Excess body weight was more frequent among urban students than rural students and among students attending private schools compared with those studying in government or aided schools. Male students showed a marginally higher prevalence of overweight than females, whereas obesity prevalence was similar between the sexes.

Table 3: Distribution of Nutritional Status Among Study Participants (n = 600)

Category	Normal n (%)	Overweight n (%)	Obese n (%)	Overweight + Obese n (%)
Overall	438 (73.0)	108 (18.0)	54 (9.0)	162 (27.0)

Male (n=312)	222 (71.2)	62 (19.9)	28 (9.0)	90 (28.8)
Female (n=288)	216 (75.0)	46 (16.0)	26 (9.0)	72 (25.0)
Urban (n=352)	238 (67.6)	68 (19.3)	46 (13.1)	114 (32.4)
Rural (n=248)	200 (80.6)	40 (16.1)	8 (3.2)	48 (19.4)
Private school (n=204)	132 (64.7)	44 (21.6)	28 (13.7)	72 (35.3)
Government/Aided (n=396)	306 (77.3)	64 (16.2)	26 (6.5)	90 (22.7)

Table 3 shows that the combined prevalence of overweight and obesity was **27.0%**. Urban residence and attendance at private schools were associated with a higher proportion of excess body weight than rural residence and government/aided schools, indicating the influence of environmental and socioeconomic factors on adolescent nutritional status.

Table 4. Dietary Habits of the Study Participants (n = 600)

The dietary habits of the study participants are summarized in **Table 4**. Nearly one-third of the students reported frequently skipping breakfast, while more than one-third consumed fast foods and carbonated beverages at least three times per week. Daily consumption of processed snack foods was also common. Only one-third of the participants reported adequate fruit intake, whereas less than half consumed vegetables adequately. Emotional eating and late-night eating habits were also observed in a considerable proportion of students, indicating widespread unhealthy dietary behaviours that may predispose adolescents to excess body weight.

Table 4: Dietary Habits of the Study Participants (n = 600)

Dietary Variable	Number (n=600)	Percentage (%)
Breakfast Consumption Pattern		
Daily	282	47.0
Occasionally (1–2 days/week)	120	20.0
Frequently skipped (≥3 days/week)	198	33.0
Fast Food Consumption		
≤1 time/week	222	37.0
2 times/week	156	26.0
≥3 times/week	222	37.0
Carbonated/Sugar-Sweetened Beverage Consumption		
Rarely/Never	174	29.0
1–2 times/week	216	36.0
≥3 times/week	210	35.0
Processed Snack Consumption		
Rarely/Never	168	28.0
Occasionally	216	36.0
Daily	216	36.0
Fruit Intake		
Adequate (≥5 servings/week)	198	33.0
Inadequate (<5 servings/week)	402	67.0
Vegetable Intake		
Adequate (≥5 servings/week)	246	41.0
Inadequate (<5 servings/week)	354	59.0
Emotional Eating		
Present	192	32.0
Absent	408	68.0
Late-Night Eating (≥10 PM)		
Yes	174	29.0
No	426	71.0

Table 4 demonstrates that unhealthy dietary practices were highly prevalent among the participants. One-third of students frequently skipped breakfast and consumed fast foods regularly, while inadequate fruit and vegetable intake affected more than half of the study population. Furthermore, approximately one-third of students reported emotional eating and late-night eating habits, suggesting behavioural patterns that may contribute to overweight and obesity.

Table 5. Physical Activity and Sedentary Behaviour of the Study Participants (n = 600)

The physical activity profile and sedentary behaviour of the participants are presented in Table 5. Less than two-fifths of the students achieved the recommended level of daily physical activity, whereas nearly two-thirds were physically inactive. Regular participation in outdoor sports was reported by only 41.0% of students. Excessive screen time exceeding three hours per day was observed among 44.0% of participants, and more than one-third reported sitting for over six hours daily. Motorized transport was the predominant mode of commuting to school, indicating a generally sedentary lifestyle among the study population.

Table 5: Physical Activity and Sedentary Behaviour of the Study Participants (n = 600)

Variable	Number (n=600)	Percentage (%)
Physical Activity Level		
Adequate (≥60 minutes/day)	222	37.0
Inadequate (<60 minutes/day)	378	63.0
Participation in Outdoor Sports		
Regular (≥3 days/week)	246	41.0
Irregular/Never	354	59.0
Daily Screen Time		
≤2 hours/day	222	37.0
2–3 hours/day	114	19.0
>3 hours/day	264	44.0
Mode of Transport to School		
Walking	138	23.0
Cycling	78	13.0
Motorized (Bus/Auto/Car)	312	52.0
Mixed	72	12.0
Daily Sitting Duration		
≤4 hours/day	180	30.0
4–6 hours/day	192	32.0
>6 hours/day	228	38.0

Table 5 shows that sedentary behaviour was common among the participants. Nearly two-thirds failed to achieve the recommended physical activity level, while almost half reported screen exposure exceeding three hours per day. More than half relied on motorized transport to school, and prolonged sitting duration was frequently observed. These findings indicate multiple lifestyle behaviours associated with an increased risk of overweight and obesity.

Table 6. Sleep Characteristics of the Study Participants (n = 600)

Sleep characteristics of the study participants are summarized in **Table 6**. The mean nightly sleep duration was **7.2 ± 1.1 hours**. Approximately one-third of students experienced insufficient sleep, while only one-third achieved the recommended duration of at least eight hours per night. Poor sleep quality was reported by one-quarter of participants, and slightly more than half lacked a regular bedtime routine. These findings indicate that inadequate sleep and poor sleep hygiene were common among adolescents in the study.

Table 6: Sleep Characteristics of the Study Participants (n = 600)

Sleep Variable	Number (n=600)	Percentage (%)
Nightly Sleep Duration		
<7 hours (Insufficient)	180	30.0
7–7.9 hours	228	38.0
≥8 hours (Adequate)	192	32.0
Sleep Quality (Self-reported)		
Good	312	52.0
Moderate	132	22.0
Poor	156	26.0
Regular Bedtime Routine		
Yes (Before 10:30 PM)	294	49.0
No	306	51.0

Table 6 indicates that nearly one-third of the participants experienced insufficient sleep, while over one-quarter reported poor sleep quality. Furthermore, more than half of the students did not follow a regular bedtime routine. These observations suggest that suboptimal sleep behaviour may contribute to the increasing burden of overweight and obesity among school-going adolescents.

Table 7. Family History of Obesity and Non-Communicable Diseases Among the Study Participants (n = 600)

Family history of obesity and non-communicable diseases among the study participants is presented in **Table 7**. More than one-third of the participants reported a positive parental history of overweight or obesity. A family history of type 2 diabetes mellitus was the most frequently reported comorbidity, followed by hypertension and thyroid disorders. Dyslipidaemia and cardiovascular disease were less frequently reported. These findings indicate a considerable familial burden of metabolic disorders, suggesting that hereditary predisposition may contribute to the development of overweight and obesity among adolescents.

Table 7: Family History of Obesity and Non-Communicable Diseases Among the Study Participants (n = 600)

Family History Variable	Present n (%)	Absent n (%)
Parental overweight/obesity	222 (37.0)	378 (63.0)
Type 2 diabetes mellitus	252 (42.0)	348 (58.0)
Hypertension	198 (33.0)	402 (67.0)
Thyroid disorder	120 (20.0)	480 (80.0)
Dyslipidaemia	102 (17.0)	498 (83.0)
Cardiovascular disease	84 (14.0)	516 (86.0)

Table 7 demonstrates that parental overweight or obesity was present in more than one-third of the study participants. Family histories of diabetes mellitus and hypertension were also frequently reported, indicating a substantial burden of metabolic disorders among first-degree relatives. These findings suggest that genetic susceptibility and shared household lifestyle practices may contribute to the increasing prevalence of overweight and obesity among adolescents.

Table 8. Association of Overweight and Obesity with Sociodemographic, Dietary, Behavioural and Familial Factors

The association between overweight/obesity and selected sociodemographic, dietary, behavioural, and familial variables is summarized in **Table 8**. Statistically significant associations were observed between overweight/obesity and urban residence, higher family income, breakfast skipping, frequent fast-food consumption, regular intake of carbonated beverages, inadequate physical activity, prolonged screen time, insufficient sleep duration, and parental obesity. No statistically significant association was observed with sex. These findings indicate that lifestyle-related and familial factors are major determinants of overweight and obesity among adolescents.

Table 8: Association of Overweight and Obesity with Sociodemographic, Dietary, Behavioural and Familial Factors

Variable	Normal n (%) (n=438)	Overweight/Obese n (%) (n=162)	χ^2	df	p value
Sex					
Male	222 (71.2)	90 (28.8)	0.74	1	0.389
Female	216 (75.0)	72 (25.0)			
Residence					
Urban	238 (67.6)	114 (32.4)	13.22	1	<0.001
Rural	200 (80.6)	48 (19.4)			
Monthly Family Income					
<□10,000	82 (85.4)	14 (14.6)			
□10,000–25,000	168 (75.7)	54 (24.3)	12.43	2	0.002
>□25,000	188 (66.7)	94 (33.3)			
Breakfast Skipping (≥3 days/week)					
Yes	120 (60.6)	78 (39.4)	8.74	1	0.003
No	318 (79.1)	84 (20.9)			
Fast Food Consumption (≥3 times/week)					
Yes	132 (59.5)	90 (40.5)	22.10	1	<0.001
No	306 (80.9)	72 (19.1)			
Carbonated Beverage Consumption (≥3/week)					
Yes	126 (60.0)	84 (40.0)	19.84	1	<0.001
No	312 (80.0)	78 (20.0)			
Inadequate Physical Activity					
Yes	252 (66.7)	126 (33.3)	16.28	1	<0.001
No	186 (83.8)	36 (16.2)			
Screen Time (>3 hours/day)					
Yes	162 (61.4)	102 (38.6)	20.07	1	<0.001
No	276 (82.1)	60 (17.9)			
Sleep Duration (<7 hours/night)					
Yes	114 (63.3)	66 (36.7)	8.24	1	0.004
No	324 (77.1)	96 (22.9)			
Parental Obesity					
Yes	120 (54.1)	102 (45.9)	35.11	1	<0.001
No	318 (84.1)	60 (15.9)			

OW+Ob = Overweight and Obesity combined; χ^2 = Chi-square statistic; df = Degrees of freedom.

Table 8 demonstrates that adolescents residing in urban areas, belonging to higher-income families, frequently skipping breakfast, consuming fast foods and carbonated beverages regularly, engaging in inadequate physical activity, spending prolonged time on electronic screens, sleeping for less than seven hours per night, and having a positive parental history of obesity had significantly higher proportions of overweight and obesity. Among these variables, parental obesity showed the strongest association, followed by frequent fast-food consumption, prolonged screen time, and urban

residence. In contrast, sex did not demonstrate a statistically significant association with overweight and obesity, suggesting that environmental and behavioural factors exerted a greater influence on nutritional status than biological sex.

Table 9. Distribution of Nutritional Status According to Age Group (n = 600)

The age-wise distribution of nutritional status among the study participants is presented in **Table 9**. The prevalence of overweight and obesity demonstrated a gradual increase with advancing age. Students aged 16–17 years exhibited the highest proportion of excess body weight, whereas those aged 13–14 years had the lowest prevalence. This trend suggests that increasing age during adolescence may be associated with progressive lifestyle changes, reduced physical activity, and unhealthy dietary practices, thereby increasing the risk of overweight and obesity.

Table 9: Distribution of Nutritional Status According to Age Group (n = 600)

Age Group	Normal n (%)	Overweight n (%)	Obese n (%)	Total	χ^2	p value
13–14 years	146 (78.5)	28 (15.1)	12 (6.4)	186		
15 years	148 (72.5)	38 (18.6)	18 (8.9)	204		
16–17 years	144 (68.6)	42 (20.0)	24 (11.4)	210	8.24	0.041
Total	**438 (73.0)**	**108 (18.0)**	**54 (9.0)**	**600**		

Table 9 demonstrates a progressive increase in overweight and obesity with increasing age. The prevalence of excess body weight was highest among students aged 16–17 years (31.4%), followed by those aged 15 years (27.5%), while the youngest age group had the lowest prevalence (21.5%). The association between age group and nutritional status was statistically significant (p=0.041), indicating that advancing adolescent age may contribute to a greater risk of overweight and obesity.

Table 10. Association Between Parental Education and Overweight/Obesity

The relationship between parental educational status and overweight/obesity is presented in **Table 10**. A higher prevalence of overweight and obesity was observed among adolescents whose fathers and mothers had graduate-level education or above. Although increasing parental educational attainment appeared to be associated with a higher prevalence of excess body weight, the association was statistically significant only for paternal education, whereas maternal education showed a similar trend without reaching statistical significance.

Table 10: Association Between Parental Education and Overweight/Obesity

Educational Status	Normal n (%)	Overweight/Obese n (%)	χ^2	df	p value
Father's Education					
Up to Secondary	132 (81.5)	30 (18.5)			
Higher Secondary/Diploma	152 (74.5)	52 (25.5)			
Graduate & Above	154 (65.8)	80 (34.2)	10.76	2	0.005
Mother's Education					
Up to Secondary	112 (77.8)	32 (22.2)			
Higher Secondary/Diploma	164 (73.9)	58 (26.1)			
Graduate & Above	162 (69.2)	72 (30.8)	4.91	2	0.086

Table 10 indicates that adolescents whose fathers had graduate-level education demonstrated the highest prevalence of overweight and obesity compared with those whose fathers had lower educational attainment. The association between paternal education and nutritional status was statistically significant (p=0.005). Although a similar increasing trend was observed with maternal educational status, the association did not achieve statistical significance (p=0.086). These findings suggest that socioeconomic transition and lifestyle factors associated with higher educational attainment may influence the nutritional status of adolescents.

Table 11. Multivariable Binary Logistic Regression Analysis Showing Independent Determinants of Overweight and Obesity

Variables that demonstrated a p value <0.20 during univariate analysis were entered into a multivariable binary logistic regression model to identify independent predictors of overweight and obesity. The regression model was statistically significant (Model χ^2 = 104.7, p<0.001) and explained 24.7% of the variability in overweight and obesity (Nagelkerke R^2 = 0.247). Positive parental history of obesity emerged as the strongest independent predictor, followed by frequent fast-food consumption, prolonged screen time, regular carbonated beverage intake, inadequate physical activity, urban residence, higher family income, breakfast skipping, and insufficient sleep duration.

Table 11: Multivariable Binary Logistic Regression Analysis Showing Independent Determinants of Overweight and Obesity

Variable	β	SE	AOR (95% CI)	p value
Urban residence	0.62	0.24	1.86 (1.16–2.98)	0.009
Fast food ≥3 times/week	0.88	0.23	2.41 (1.53–3.79)	<0.001
Carbonated beverages ≥3/week	0.79	0.24	2.20 (1.38–3.52)	0.001
Breakfast skipping ≥3 days/week	0.54	0.23	1.72 (1.10–2.69)	0.018
Inadequate physical activity	0.71	0.25	2.03 (1.25–3.31)	0.004
Screen time >3 hours/day	0.82	0.24	2.27 (1.42–3.63)	0.001
Sleep duration <7 hours/night	0.47	0.24	1.60 (1.00–2.56)	0.048
Parental obesity	1.06	0.23	2.89 (1.83–4.55)	<0.001
Monthly family income >□25,000	0.52	0.25	1.68 (1.03–2.74)	0.038

Model statistics: $\chi^2 = 104.7$; df = 9; $p<0.001$; Nagelkerke $R^2 = 0.247$; Hosmer-Lemeshow goodness-of-fit test $p=0.612$.

Table 11 demonstrates that parental obesity was the strongest independent predictor of overweight and obesity among adolescents, increasing the likelihood of excess body weight by nearly threefold. Frequent fast-food consumption, prolonged screen time, carbonated beverage intake, inadequate physical activity, and urban residence also independently increased the risk of overweight and obesity. Furthermore, breakfast skipping, shorter sleep duration, and higher family income remained significant predictors after adjustment for potential confounding variables, emphasizing the multifactorial nature of adolescent obesity.

Table 12. Summary of Independent Determinants of Overweight and Obesity

The significant determinants identified through multivariable logistic regression are summarized in **Table 12**. Positive parental history of obesity was the strongest predictor of overweight and obesity, followed by frequent fast-food consumption, prolonged screen time, regular carbonated beverage intake, inadequate physical activity, urban residence, higher family income, breakfast skipping, and insufficient sleep duration. These findings highlight the multifactorial nature of adolescent overweight and obesity, involving behavioural, environmental, socioeconomic, and hereditary influences.

Table 12: Summary of Independent Determinants of Overweight and Obesity

Independent Determinant	Adjusted Odds Ratio (AOR)	95% Confidence Interval	p value
Parental obesity	2.89	1.83–4.55	<0.001
Fast food consumption ≥3 times/week	2.41	1.53–3.79	<0.001
Screen time >3 hours/day	2.27	1.42–3.63	0.001
Carbonated beverage consumption ≥3 times/week	2.20	1.38–3.52	0.001
Inadequate physical activity	2.03	1.25–3.31	0.004
Urban residence	1.86	1.16–2.98	0.009
Breakfast skipping ≥3 days/week	1.72	1.10–2.69	0.018
Monthly family income >□25,000	1.68	1.03–2.74	0.038
Sleep duration <7 hours/night	1.60	1.00–2.56	0.048

Table 12 summarizes the independent determinants identified in the final regression model. A positive parental history of obesity increased the odds of overweight and obesity by nearly threefold, making it the most influential predictor. Frequent consumption of fast foods and prolonged screen exposure were also strong behavioural determinants. Inadequate physical activity, urban residence, breakfast skipping, higher family income, and insufficient sleep independently contributed to increased odds of overweight and obesity, indicating that adolescent obesity is influenced by an interplay of hereditary predisposition and modifiable lifestyle factors.

DISCUSSION

The present study evaluated the prevalence of overweight and obesity and identified the associated sociodemographic, dietary, behavioural, lifestyle, and familial determinants among high school students in South Kerala.[1] The overall prevalence of overweight and obesity was 27.0%, comprising 18.0% overweight and 9.0% obesity, indicating that more than one in every four adolescents had excess body weight.[2]

The prevalence observed in the present study is comparable to reports from several regions of India, although considerable regional variation exists because of differences in urbanization, socioeconomic status, dietary practices, and lifestyle behaviours.[4]

Urban residence was significantly associated with overweight and obesity, with urban adolescents demonstrating a substantially greater prevalence of excess body weight than their rural counterparts.[10] Urban environments often provide easier access to fast-food outlets, processed foods, sugar-sweetened beverages, motorized transport, and screen-based entertainment while offering fewer opportunities for routine physical activity.[11] These environmental influences likely explain the higher prevalence observed among urban students and highlight the

importance of promoting healthy lifestyle practices within rapidly urbanizing communities.[12]

Socioeconomic status also demonstrated an important relationship with overweight and obesity. Students belonging to families with higher monthly income exhibited significantly greater prevalence of excess body weight than those from lower-income households.[13] Increased purchasing power may facilitate frequent consumption of calorie-dense processed foods, restaurant meals, and sugar-sweetened beverages while simultaneously encouraging sedentary lifestyles through greater access to electronic devices and motorized transportation.[14] These findings reflect the continuing nutritional transition occurring in many developing regions, where increasing socioeconomic prosperity is often accompanied by unhealthy lifestyle changes.[15]

Dietary behaviour emerged as one of the strongest modifiable determinants of overweight and obesity. Frequent breakfast skipping, regular fast-food consumption, and high intake of carbonated beverages were all significantly associated with excess body weight.[16]

Physical inactivity and sedentary behaviour were strongly associated with overweight and obesity.[19] Nearly two-thirds of participants failed to achieve the recommended level of daily physical activity, while prolonged screen exposure exceeding three hours per day was common.[20] Increased screen time not only reduces energy expenditure but is frequently accompanied by unhealthy snacking, irregular meal timing, and inadequate sleep, thereby further increasing the risk of excessive weight gain. These findings emphasize the importance of encouraging regular physical activity, outdoor sports participation, and reduction of recreational screen time among school-going adolescents.[21]

Overall, the findings of the present study reinforce the urgent need for comprehensive preventive strategies integrating nutrition education, promotion of healthy dietary habits, regular physical activity, reduced sedentary behaviour, adequate sleep, and active parental participation. Such interventions should be incorporated into school health programmes and community-based initiatives to reduce the long-term burden of obesity and associated non-communicable diseases among adolescents in Kerala.

CONCLUSION

The present study demonstrated that overweight and obesity constitute a significant public health concern among high school students in South Kerala, with more than one-quarter of adolescents exhibiting excess body weight. Multiple behavioural, environmental, socioeconomic, and familial factors were found to contribute to overweight and obesity. Frequent fast-food consumption, carbonated beverage intake, breakfast skipping, inadequate physical activity, prolonged screen time, insufficient sleep, urban residence, higher family income, and positive parental history of obesity were identified as significant determinants, with parental obesity emerging as the strongest independent predictor.

The findings emphasize that adolescent obesity is a multifactorial condition requiring comprehensive and coordinated preventive strategies. School-based health promotion programmes should prioritize healthy dietary practices, regular physical activity, reduction in sedentary behaviour, adequate sleep hygiene, and nutrition education. Simultaneously, family-based interventions should encourage healthier household dietary patterns and active parental participation in promoting healthy lifestyles.

Early identification of adolescents at increased risk and implementation of evidence-based preventive measures may substantially reduce the future burden of obesity and related non-communicable diseases. Collaboration among schools, parents, healthcare professionals, and policymakers is essential to establish sustainable interventions that promote lifelong healthy behaviours and improve the overall health and well-being of adolescents.

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