

Prevalence of Overweight and Obesity Among Upper Primary and High School Children in Kollam District, Kerala

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Abstract

Background: India is undergoing a rapid epidemiological transition, from an underweight to an overweight and obese population. Pediatric obesity is a serious public health challenge driven significantly by urbanization, dietary changes, and physical inactivity. The objective is to estimate the prevalence of overweight and obesity among upper primary and high school children in Kollam district, Kerala, and to identify the associated sociodemographic and modifiable lifestyle risk factors. **Material and Methods:** A school-based cross-sectional study was conducted among students from 5th to 10th standard in randomly selected rural and urban schools in Kollam. Data were collected using a semi-structured questionnaire assessing sociodemographic details, physical activity, screen time, dietary habits, and sleep patterns. Anthropometric measurements (Body Mass Index and waist circumference) were recorded. **Results:** Out of 360 participants (mean age 12.36 ± 1.09 years), the prevalence of overweight was 23.1%, and obesity was 21.1%. Urban residence, extreme socioeconomic classes (upper and lower), maternal education, and maternal occupation were significantly associated with higher BMI ($p < 0.05$). Significant modifiable risk factors included a lack of physical activity, prolonged screen time (>2 hours/day), frequent consumption of junk food and carbonated drinks, inadequate sleep (<8 hours), and sleeping immediately after meals. **Conclusion:** There is a high prevalence of overweight and obesity among school-going children in Kollam. Targeted interventions addressing lifestyle factors, particularly dietary habits and physical inactivity, are critically needed to combat this rising epidemic.

Keywords: Pediatric obesity, overweight, childhood nutrition, lifestyle factors, screen time, Kerala.

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INTRODUCTION

Globally, obesity rates are rising alarmingly, impacting children and adults in both industrialized and developing nations. The World Health Organization (WHO) has identified pediatric obesity as one of the most serious public health challenges of the 21st century.^[1] The prevalence of overweight and obesity among children and adolescents aged 5 to 19 years rose dramatically from just 4% in 1975 to over 18% in 2016.^[2,3]

Childhood overweight and obesity have profound impacts on physical and psychological health, often persisting into adulthood.^[4] The condition is linked to a multitude of comorbidities, including metabolic syndrome, early-onset type 2 diabetes, cardiovascular diseases, and non-alcoholic fatty liver disease.^[5,6]

While historically viewed as a problem of high-income countries, obesity is now rapidly increasing in low- and middle-income countries. India faces a dual burden of malnutrition, where undernutrition coexists with an escalating epidemic of obesity.^[7,8] If current trends persist, India will contribute approximately 11% of the global burden of child obesity by 2030, driven largely by rapid urbanization, increasingly sedentary lifestyles, and the widespread availability of high-calorie, nutrient-poor foods.^[9]

Despite growing recognition of this epidemic, there is a

paucity of recent data on the school-going population in the semi-urban and urban landscapes of southern India. Therefore, this study aims to estimate the prevalence of overweight and obesity among upper primary and high school children (5th to 10th standard) in Kollam district, Kerala, and to correlate these findings with sociodemographic factors and modifiable lifestyle risks.

MATERIALS AND METHODS

Study Design and Setting: A school-based cross-sectional study was conducted by the Department of Paediatrics at Travancore Medical College, Kollam, between 2023 and 2024.

Study Population and Sampling: The study population comprised children in the 5th to 10th standards attending selected schools across the Kollam district. A list of all schools in the

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district was compiled and stratified into rural and urban categories. Two schools from each category were selected using a random lot method. Sample sizes from each school were determined using the Probability Proportionate to Size method. Students were ultimately selected via stratified random sampling.

The inclusion criteria mandated that participants must be between 10 and 16 years of age and willing to participate with informed written consent from their parents. Children with severe acute malnutrition (SAM), chronic medical conditions, or those on long-term steroid therapy were excluded. Of the projected sample size, 360 adolescent schoolchildren met the criteria and completed the study.

Data Collection After obtaining Institutional Ethics Committee approval and written parental consent, a pretested, self-designed, semi-structured questionnaire was administered. The proforma captured sociodemographic variables (age, gender, religion, place of residence, parental education/occupation, and family per capita income) and lifestyle variables (modes of transport to school, physical activity duration, daily screen time, dietary preferences, and sleep hygiene).

Anthropometric Measurements: Weight was recorded to the nearest 0.1 kg using a calibrated digital weighing scale. Height was measured to the nearest 0.1 cm using a stadiometer. Body Mass Index (BMI) was calculated as

weight (kg) divided by height squared (m²). BMI was plotted on the extended Indian Academy of Pediatrics (IAP) growth charts (2015), where a BMI >85th percentile indicates overweight and >95th percentile indicates obesity.^[10] Waist circumference (WC) was measured using a stretch-resistant tape; a WC at or above the 70th percentile was interpreted as high risk for metabolic complications.^[10]

Statistical Methods: Data were entered into Microsoft Excel and analyzed using Stata 14.02. Continuous variables were summarized as Mean ± Standard Deviation (SD). Categorical variables were presented as frequencies and proportions. The Chi-square test was used to analyze associations between qualitative variables and BMI categories. A p-value of < 0.05 was considered statistically significant.

RESULTS

Sociodemographic Profile

The sociodemographic characteristics of the 360 adolescent school children included in this study are summarized in Table 1. The cohort had a mean age of 12.36 ± 1.09 years and consisted predominantly of males and urban residents. Based on the Modified B.G. Prasad classification, the vast majority of the participants belonged to the upper and upper-middle socioeconomic classes.

Table 1: Sociodemographic Profile of the Study Participants (N = 360)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	212	58.9
Female	148	41.1
Place of Residence		
Urban	224	62.2
Rural	136	37.8
Socioeconomic Status (Modified B.G. Prasad)		
Upper & Upper-Middle Class	278	77.3
Lower-Middle & Lower Class	82	22.7

Prevalence of Overweight and Obesity: The overall mean BMI of the study population was 20.18 ± 4.11. Table 2 presents the nutritional status of the participants according to the extended IAP growth charts. Over 44% of the cohort fell

into the overweight or obese categories. Additionally, nearly a quarter of the children exhibited central adiposity, placing them at a high risk for future metabolic complications.

Table 2: Prevalence of Overweight, Obesity, and Central Adiposity

Nutritional Parameter	Frequency (n)	Percentage (%)
BMI Classification		
Underweight	2	0.6
Normal Weight	199	55.3
Overweight	83	23.1
Obese	76	21.1
Waist Circumference		
High Risk (>70th percentile)	86	23.9

Sociodemographic Associations with BMI: As presented in Table 3, there was no statistically significant association between a child's age or gender and their weight status. However, urban residence and socioeconomic status demonstrated highly significant correlations with elevated

BMI. The highest prevalence of overweight and obesity was clustered in both the upper socioeconomic classes and the lower socioeconomic classes. Maternal education and occupation also significantly influenced the child's BMI profile, whereas paternal factors did not.

Table 3: Association of Sociodemographic Factors with Overweight and Obesity

Sociodemographic Variable	Total (N=360)	Overweight / Obese n (%)	Normal / Underweight n (%)	p-value
Age				0.37
10 years	10	5 (50.0%)	5 (50.0%)	
11 years	76	26 (34.2%)	50 (65.8%)	
12 years	111	54 (48.6%)	57 (51.4%)	
13 years	99	46 (46.5%)	53 (53.5%)	
14 years	64	28 (43.8%)	36 (56.3%)	
Gender				0.57
Male	212	91 (42.9%)	121 (57.1%)	
Female	148	68 (45.9%)	80 (54.1%)	
Place of Residence				0.01*
Urban	224	128 (57.1%)	96 (42.9%)	
Rural	136	31 (22.8%)	105 (77.2%)	
Socioeconomic Status				< 0.001*
Class I (Upper)	123	66 (53.7%)	57 (46.3%)	
Class II (Upper Middle)	155	71 (45.8%)	84 (54.2%)	
Class III (Middle)	76	16 (21.1%)	60 (78.9%)	
Class IV (Lower Middle)	0	0 (0.0%)	0 (0.0%)	
Class V (Lower)	6	6 (100.0%)	0 (0.0%)	
Mother's Education				< 0.001*
Illiterate	0	0 (0.0%)	0 (0.0%)	
Primary school	6	2 (33.3%)	4 (66.7%)	
Middle school	6	4 (66.7%)	2 (33.3%)	
High school	164	52 (31.7%)	112 (68.3%)	
Intermediate/Diploma	125	66 (52.8%)	59 (47.2%)	
Graduate	55	33 (60.0%)	22 (40.0%)	
Professional degree	4	2 (50.0%)	2 (50.0%)	
Mother's Occupation				0.008*
Unemployed	173	74 (42.8%)	99 (57.2%)	
Unskilled worker	15	11 (73.3%)	4 (26.7%)	
Semiskilled worker	22	15 (68.2%)	7 (31.8%)	
Skilled worker	74	22 (29.7%)	52 (70.3%)	
Clerical/Shop/Farmer	12	6 (50.0%)	6 (50.0%)	
Semiprofessional	42	21 (50.0%)	21 (50.0%)	
Professional	22	10 (45.5%)	12 (54.5%)	
Father's Education				0.30
Illiterate	0	0 (0.0%)	0 (0.0%)	
Primary school	2	2 (100.0%)	0 (0.0%)	
Middle school	8	2 (25.0%)	6 (75.0%)	
High school	82	34 (41.5%)	48 (58.5%)	
Intermediate/Diploma	161	68 (42.2%)	93 (57.8%)	
Graduate	90	46 (51.1%)	44 (48.9%)	
Professional degree	17	7 (41.2%)	10 (58.8%)	
Father's Occupation				0.38
Unemployed	0	0 (0.0%)	0 (0.0%)	
Unskilled worker	12	8 (66.7%)	4 (33.3%)	
Semiskilled worker	22	10 (45.5%)	12 (54.5%)	
Skilled worker	60	29 (48.3%)	31 (51.7%)	
Clerical/Shop/Farmer	137	57 (41.6%)	80 (58.4%)	
Semiprofessional	77	29 (37.7%)	48 (62.3%)	
Professional	52	26 (50.0%)	26 (50.0%)	

Lifestyle and Behavioral Factors: The impact of modifiable behavioral factors on the prevalence of overweight and obesity is outlined in Table 4. Sedentary behaviors—specifically motorized commutes to school, less than 30 minutes of physical activity, and prolonged daily

screen time—were powerful determinants of increased BMI. Furthermore, poor dietary habits (frequent consumption of junk food, snacking, and carbonated drinks) and inadequate sleep hygiene strongly correlated with weight status.

Table 4: Association of Modifiable Lifestyle Factors with Overweight and Obesity

Lifestyle & Behavioral Factor	Total (N=360)	Overweight / Obese n (%)	Normal / Underweight n (%)	p-value
Mode of transport to school				< 0.001*
Walking	80	20 (25.0%)	60 (75.0%)	
Bicycle	123	30 (24.4%)	93 (75.6%)	
Other motorized vehicles	157	109 (69.4%)	48 (30.6%)	
Duration of physical activity per day				< 0.001*
< 30 minutes	88	66 (75.0%)	22 (25.0%)	
30 minutes to 1 hour	98	66 (67.3%)	32 (32.7%)	

1 – 2 hours	116	24 (20.7%)	92 (79.3%)	
> 2 hours	58	3 (5.2%)	55 (94.8%)	
Days active for ≥60 mins in a week				< 0.001*
None	24	21 (87.5%)	3 (12.5%)	
1 – 3 days	148	109 (73.6%)	39 (26.4%)	
3 – 6 days	100	22 (22.0%)	78 (78.0%)	
Everyday	88	7 (8.0%)	81 (92.0%)	
Screen Time (TV, mobile, computer/day)				< 0.001*
< 30 minutes	71	12 (16.9%)	59 (83.1%)	
30 minutes – 2 hours	197	64 (32.5%)	133 (67.5%)	
> 2 hours	92	83 (90.2%)	9 (9.8%)	
Frequency of junk food consumption/week				< 0.001*
None	32	2 (6.3%)	30 (93.8%)	
1 – 2 days	212	55 (26.0%)	157 (74.0%)	
3 – 6 days	74	61 (82.4%)	13 (17.6%)	
Everyday	42	41 (97.6%)	1 (2.4%)	
Snacking between regular meals				0.001*
No	95	28 (29.5%)	67 (70.5%)	
Yes	265	131 (49.4%)	134 (50.6%)	
Carbonated drinks in past 30 days				< 0.001*
Never	106	16 (15.1%)	90 (84.9%)	
Once	115	32 (27.8%)	83 (72.2%)	
2 times	57	36 (63.2%)	21 (36.8%)	
3 or more times	82	75 (91.5%)	7 (8.5%)	
Hours of sleep in a day				< 0.001*
6 hours	2	0 (0.0%)	2 (100.0%)	
7 hours	43	22 (51.2%)	21 (48.8%)	
8 hours	191	65 (34.0%)	126 (66.0%)	
9 hours	98	68 (69.4%)	30 (30.6%)	
10 hours	22	4 (18.2%)	18 (81.8%)	
11 hours	4	0 (0.0%)	4 (100.0%)	
Timing of sleep after food				< 0.001*
Immediately	88	82 (93.2%)	6 (6.8%)	
After 1 hour	144	60 (41.7%)	84 (58.3%)	
After 2 hours	128	17 (13.3%)	111 (86.7%)	

DISCUSSION

Childhood obesity is a multifaceted public health crisis driven by a complex interplay of genetic, environmental, and behavioral factors. Our study provides updated epidemiological data from the Kollam district of Kerala, revealing a combined prevalence of overweight and obesity of 44.2%. This indicates a highly concerning shift in pediatric nutritional status in the region, aligning with national trends highlighting a surge in childhood adiposity.^[8]

Sociodemographic Determinants: The lack of significant gender disparity in our cohort contrasts with some earlier Indian studies,^[11] but aligns with recent global data suggesting that the gender gap in pediatric obesity is narrowing.^[3] We observed a significantly higher prevalence of obesity among urban children compared to their rural counterparts. This mirrors findings by Kundu et al. (2021) and Pathak et al. (2018), who noted that urban environments often facilitate greater access to high-calorie foods and promote sedentary lifestyles.^[12,13]

Our data indicated a dual burden across socioeconomic strata: overweight and obesity were highly prevalent in the uppermost SES classes (likely due to higher purchasing power) as well as the lowest SES class. This reflects a complex nutritional transition where lower-income families may increasingly rely on cheap, energy-dense dietary options.^[14] Maternal factors, specifically education and employment status, significantly impacted child BMI. Working mothers often face time constraints, leading to

greater reliance on readily prepared, processed foods.^[8]

Behavioral and Lifestyle Risk Factors The energy balance model dictates that weight gain inherently results from an imbalance between caloric intake and expenditure. Physical inactivity was a significant predictor of obesity in our study, corroborating findings that declining outdoor play is a primary driver of the pediatric obesity epidemic in India.^[15]

Dietary habits were profoundly obesogenic, with a vast majority of students regularly consuming bakery items, sweets, and carbonated beverages. Furthermore, our study reinforces the critical link between excessive screen time and obesity. As highlighted by Fang et al. (2019), excessive screen time displaces physical activity and is heavily associated with mindless snacking.^[16] Finally, short sleep duration emerged as a vital modifiable risk factor, likely disrupting the hormonal regulation of hunger and satiety.

Strengths and Limitations: The strength of this study lies in its comprehensive assessment of multiple lifestyle variables. However, the cross-sectional design limits our ability to establish definitive causality, and reliance on self-reported data for diet and screen time may introduce recall bias.

CONCLUSION

The prevalence of overweight and obesity among upper primary and high school children in the Kollam district is alarmingly high. This epidemic is heavily concentrated in urban areas and is driven by modifiable lifestyle factors, predominantly physical inactivity, excessive screen time, poor dietary choices, and

inadequate sleep. Addressing this crisis requires an urgent, multi-sectoral approach involving schools, parents, and pediatric healthcare providers to safeguard the health of future generations.

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Conflicts of interest

There are no conflicts of interest.

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