Childhood Overweight in a Rural Tamil Nadu School: Prevalence and Associated Risk Factors

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Abstract: _**Background**: In India, childhood obesity and overweight are becoming major public health issues that impact both urban and rural communities. The prevalence and risk factors for overweight in school-age children in a semi-rural area of Tamil Nadu are examined in this study. **Objective**: To assess the prevalence of overweight among 11-12 year old primary school children at Sri Ramakrishna Matric Higher Secondary School in Krishnagiri, Tamil Nadu, and investigate related variables such eating habits, exercise, and sleep patterns. **Methodology**: A validated sociodemographic questionnaire, Modified Physical Activity Level Questionnaire (MPAQ-C), and Children's Sleep Habits Questionnaire (CSHQ) were administered to 120 school children aged 11–12 years. Body measures (height, weight, waist circumference) were measured. In the enrolled children, age between 11 and 12 years, attending school for at least 5 hours a day and able to speak Tamil or English fluently were included. Children with psychological or mental disabilities or those who had undergone recent surgery were excluded. Data were processed with SPSS (Version 22.0 for Windows). Demographic data were described using descriptive statistics, and the association between BMI and the selected risk factors was tested using Chi-square tests. Values of p < 0.05 were considered to be statistically significant. **Results**: The results showed that 6.78% of the children were overweight and 35.59% were underweight. 14.41% had low levels of physical activity, whilst 64.41% had moderate levels. According to sleep study, 64.41% of people reported symptoms of sleep disorders, and 51.69% slept for shorter periods of time than is advised. Furthermore, a high energy-dense diet was reported by 38.14%. These results were found to be influenced by parental lifestyle choices and educational attainment. **Conclusion**: Even in remote educational settings, the results show that undernutrition and new trends in overweight coexist. To prevent lifestyle-related diseases from an early age, the study emphasizes the necessity of school-based health promotion initiatives that emphasize physical exercise, sleep hygiene, and dietary understanding._

Keywords: BMI, physical activity, sleep patterns, childhood obesity, dietary patterns, and rural India

1. Introduction

Overweight and obesity in children are becoming more widely acknowledged as major global health issues that impact millions of youngsters globally. According to the World Health Organization (WHO), one of the most important public health concerns of the twenty-first century is childhood obesity. Overweight and obesity were once thought to be a condition only found in wealthy and urbanized people, but they are now commonly seen in rural and developing areas, including sections of India. Even in rural areas, there is a nutrition transition because of the fast urbanization, economic shift, and globalization of food markets, which have drastically changed dietary and lifestyle patterns.

Childhood obesity has been on the rise in India over the past few decades. The prevalence of childhood overweight and obesity in India varies between 5% and 20%, depending on socioeconomic and geographic factors, according to a systematic review by Ranjani et al. (2016). The healthcare system faces a special and complicated difficulty when undernutrition and overweight coexist in the same population, a situation known as the twin burden of malnutrition.

Children's overweight and obesity are caused by several risk factors. These include sedentary behaviour, poor sleep patterns, unhealthy eating habits, insufficient physical activity, and parental influence. Eating foods high in energy, spending less time outside, spending more time on screens, and having irregular sleep patterns are all habits that can be changed with early treatments. Furthermore, children's lifestyle choices are greatly influenced by sociocultural factors such parental education, occupation, and health awareness.

This study employs a cross-sectional design and makes use of both anthropometric instruments and validated questionnaires to produce data that can guide future community- and school-based health promotion initiatives. Furthermore, this study supports the inclusion of preventive healthcare in school curricula and adds to the expanding corpus of research on rural health disparities in India. The results could aid in the development of focused interventions that are appropriate for the context and culture, improving the health of kids in semi-rural India.

2. Methodology

Study Design and Setting
A cross-sectional epidemiological study was carried out in schools to determine the prevalence of childhood overweight and the risk factors that are linked to it in school-age children between the ages of 11 and 12. The study was conducted at the private, semi-rural Sri Ramakrishna Matric Higher Secondary School in the Krishnagiri area of Tamil Nadu, India. The semi-urban location of this setting was chosen because it exposes children to both traditional rural customs and new urban lifestyle influences, making it a relevant place for studying changing health trends.

Study Population
Both male and female students enrolled in the school between the ages of 11 and 12 made up the study population. These age groups were picked because they mark a crucial period in development and growth when lifestyle choices start to become more personalized and early indicators of undernutrition or overweight may appear.

Inclusion and Exclusion Criteria

Inclusion Criteria:
- Children aged 11–12 years.
- Regular school attendees (minimum of 5 hours/day).
- Children able to understand and communicate in **Tamil or English**.
- Parental consent and child assent obtained for participation.

Exclusion Criteria:
- Children with known psychological or developmental disorders.
- Children who had undergone **recent surgery** or were under medical treatment that might affect weight or activity levels.
- Students who were absent during the data collection period.

Sample Size and Sampling Technique
After gaining approval from the school administration and parents' informed agreement, a total of 120 kids were recruited for the study using a universal sample technique. 118 of these pupils finished the entire test and were incorporated into the final analysis.

Ethical Considerations
Ethical clearance was obtained from the institutional ethical review board. Written informed consent was obtained from the parents or guardians of all participants, and assent was taken from the children. Participation was voluntary, and confidentiality of responses was ensured throughout the study.

Data Collection Tools
1) Sociodemographic Questionnaire
Age, gender, parental education, and family background were among the demographic information gathered using a pre-tested, structured questionnaire.

2) Measurements of Anthropometry

The following were measured using standard anthropometric procedures:
- **Height:** Accurately measured to within 0.1 cm using a stadiometer set up on the wall.
- **Weight:** Accurately measured to the nearest 0.1 kg using a calibrated digital weighing scale.
- **Body Mass Index (BMI):** Determined by dividing height (m2) by weight (kg) and classifying the results based on WHO growth guidelines for gender and age.
- **Waist circumference:** Using a non-elastic measuring tape, this measurement is taken at the halfway between the top of the iliac crest and the bottom edge of the last perceptible rib.

3) Physical Activity Assessment (MPAQ-C)
Indian children's levels of physical activity were measured using the Modified Physical Activity Questionnaire for Children (MPAQ-C), a validated instrument. Activities from the previous week, such as school, sports, commuting, and leisure activities, are covered in the questionnaire. Based on scoring criteria, responses were divided into three categories: low, moderate, and high levels of physical activity.

4) Sleep Pattern Assessment (CSHQ)
The Children's Sleep Habits Questionnaire (CSHQ), which measures things like resistance to going to bed, length of sleep, night awakenings, and daytime sleepiness, was used to evaluate sleep behaviors. Sleep behavior responses were classified as either normal or abnormal.

5) Dietary Pattern Assessment
Participants were interviewed regarding their dietary intake patterns, with an emphasis on the energy density of the foods they ate, as well as the prevalence of junk food, sugary drinks, and snacks. A composite food frequency scoring approach was used to classify the dietary energy density into three categories: Low, Moderate, and High.

Data Analysis
Data were entered into and analyzed using Version 22.0 of the Statistical Package for the Social Sciences (SPSS). The demographic and lifestyle data were compiled using descriptive statistics, such as means, percentages, and frequencies. The relationships between BMI categories and specific variables, including parental education, dietary energy density, sleep patterns, and physical activity, were investigated using the Chi-square (χ^2) test. P-values less than 0.05 were regarded as statistically significant.

3. Results

A total of 118 primary school children participated in the study. The findings based on various parameters are summarized below:

BMI Classification
Most (57.63%) of the study children were under the normal range of BMI. However, 35.59% of underweight patients were malnourished, while 6.78% of them had overweight, suggesting coexistence of malnutrition and the rise of overweight in this group.

Table 1: BMI Classification

BMI Category	Number of Students	Percentage (%)

Normal	68	57.63%
Underweight	42	35.59%
Overweight	8	6.78%

Waist Circumference:
Meanwhile, only 60.17% of the children had normal values in the measurement of waist circumference. In the meantime, 23.73% were below the predicted waist range, 12.71% were overweight and 3.39% belonged to the obese category. This indicates a smaller, but not negligible, proportion of individuals at risk of central obesity.

Table 2: Waist Circumference Classification

Waist Category	Number of Students	Percentage (%)
Normal	71	60.17%
Underweight	28	23.73%
Overweight	15	12.71%
Obese	4	3.39%

Modified Physical Activity Questionnaire for Children (MPAQ-C):
Using the MPAQ-C Scoreto assess physical activity, it was shown that 21.19% of children had high activity levels, 14.41% had low physical activity, and 64.41% were moderately active. Although most kids continued to be moderately active, a sizable fraction did not engage in physical activity to their full potential.

Table 3: Modified Physical Activity Level (MPAQ-C Score)

MPAQ-C Score	Number of Students	Percentage (%)
Moderate	76	64.41%
High	25	21.19%
Low	17	14.41%

Sleep Duration:
It was discovered that 31.36% of students reported having regular sleep durations, but 51.69% of students had shorter than advised sleep durations. Notably, 16.95% had the shortest sleep duration, potentially affecting their metabolic health and development.

Table 4: Sleep Duration

Sleep Duration	Number of Students	Percentage (%)
Short	61	51.69%
Normal	37	31.36%
Shortest	20	16.95%

Sleep Disorders:
According to the analysis, just 35.59% of students slept normally, while 64.41% showed indications of irregular sleep patterns or sleep disorders. This highlights a potentially serious issue affecting children's overall well-being.

Table 5: Sleep Disorder Status

Sleep Disorder Status	Number of Students	Percentage (%)
Abnormal	76	64.41%
Normal	42	35.59%

Parental Education:
There was a nearly equal distribution of parents' educational backgrounds, with 49.15% of children having parents with less education and 50.85% of children having parents with more education. This variable is crucial for comprehending how the environment and family affect lifestyle.

Table 5: Parental Education

Education Level	Number of Students	Percentage (%)
Higher	60	50.85%
Lower	58	49.15%

Dietary energy density:
Of the children surveyed, 42.37% had a moderately high energy density diet, 38.14% had high energy density foods, and only 19.49% had a low energy density diet. A diet rich in energy density is linked to a higher risk of being overweight or obese.

Table 6: Energy Density of Diet

Energy Density	Number of Students	Percentage (%)
Moderate	50	42.37%
High	45	38.14%
Low	23	19.49%

4. Discussion

Even in semi-rural Indian settings, the current data show a worrying trend of rising childhood obesity and overweight. Studies conducted in India, including those by Kapil et al. (2002) and Ranjani et al. (2016), identify dietary practices, urbanization, and physical inactivity as major risk factors, which is consistent with findings from Naidu et al. (2013) and Ganasegeran et al. (2012) in Malaysia. It is emphasized how parents, especially those with greater education and work status, can encourage convenient but unhealthy eating habits.

Despite the moderate activity levels suggested by MPAQ-C scores, screen usage and sedentary study habits lower total energy expenditure. These results have been supported by further research, which shows that the prevalence of obesity is still rising after 2020. For instance, Bhat et al. (2025) and Dasgupta et al. (2023) emphasize how socioeconomic status, screen time, and westernized meals are strongly connected with excess weight gain among Indian school students. Similarly, significant prevalence rates were discovered in both urban and semi-rural areas by Mullur et al. (2024) and Rao et al (2022).

5. Conclusion

This study emphasizes the necessity for early intervention in rural and semi-urban India, where the incidence of overweight is 7.5%. Comprehensive school-based health initiatives that emphasize active lives, a healthy food, and family education ought to be put into place. To guarantee that lifestyle diseases are addressed early through school curriculum integration, awareness campaigns, and routine health screening, policymakers and educators must work together.

6. Study Limitations

1) **Limitation on Sample Size:** There might not be enough individuals to fully capture differences among various socioeconomic or cultural categories.

2) **Short Data Collection Period:** Because the data were gathered in a condensed amount of time, they might not accurately represent seasonal changes in diet or activity.

3) **Parental Data Missing:** Little is known regarding the influence of families because information on parents' BMI, lifestyle choices, and awareness of childhood obesity was not collected.

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