Section: Community Medicine

Original Research Article

# CROSS SECTIONAL STUDY ON OBESITY AND OVERWEIGHT AMONG ADOLESCENTS (14-19 YEARS) IN RURAL DISTRICT OF TAMIL NADU

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***Received*** *: 10/08/2025*
***Received in revised form*** *: 18/09/2025*
***Accepted*** *: 04/10/2025*

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**DOI:** 10.70034/ijmedph.2025.4.69

**Source of Support:** Nil,
**Conflict of Interest:** None declared

**Int J Med Pub Health**
2025; 15 (4); 381-386

ABSTRACT

**Background:** Adolescence is a crucial dynamic period for intervention since adolescent behaviours often become a habit in adulthood. Evidence suggests that early detection and lifestyle changes focusing on balanced nutrition, daily physical activity or exercise, and appropriate sleep can avoid adult obesity and its compications. Understanding the incidence and causes of overweight and obesity in varied teenage populations is crucial for school- and community-based solutions. **Objective:** 1.To estimate the prevalence of obesity and overweight among adolescents; 2.To find the determinants associated with obesity and overweight.

**Materials and Methods:** This analytical cross sectional study included 518 adolescents from Government higher secondary schools. The multistage sampling used to recruit participants. The semistructured questionnaire, PQLI scale, DASS 21 scale and anthropometric measurements were used to collect data. The data analyzed using Epi info 7.

**Results:** 54 (10.4%) and 21(4.05%) were overweight and obese in our study. Totally 75 adolescent out of 518 were obese or overweight. Frequent skipping breakfast, frequent intake of fast food, frequent intake of sweetened beverages, increased screen time, less physical activity, stress, anxiety, depression and poor sleep quality were significant risk factors in our study.

**Conclusion:** The higher prevalence of obesity and overweight in our study suggest a earlier prevention and screening to combat this new epidemic of public health problem among adolescents. Also its association with unhealthy dietary practice, increased screen time, less physical activity, stress, anxiety, depression and poor sleep quality recommends the need of multidisciplinary approach to prevent obesity in adolescents.

**Keywords:** Adolescents, obesity, determinants, overweight.

## INTRODUCTION

Low-birth-weight (LBW) infants, defined by the Adolescent overweight and obesity is one of the most common public health concern.[1] Over the past four to five decades, global adolescent overweight and obesity have increased and now the prevalence is 18% and 6% respectively in 2019.[2] The adolescent who are obese are at risk of type 2 diabetes, hypertension, dyslipidaemia, and premature cardiovascular disease.[3,4]

Adolescent and childhood obesity has skyrocketed in middle-income nations like India due to rapid urbanisation, dietary change towards fast food, and reduced physical activity.[5] National estimates show that 12%–19% of Indian adolescents are overweight or obese, with greater percentages in metropolitan areas and higher socioeconomic categories.[6] A meta-analysis of 52 Indian studies indicated 19.3% overweight and 5.3% obesity in teenagers.[7] Recent

school-based studies in southern states, including Tamil Nadu, show 20–25% urban prevalence.[8,9] These trends emphasise the necessity for robust epidemiological data to guide prevention and treatment.

Multiple factors cause adolescent obesity. Screen usage, sedentary lifestyles, and decreasing outdoor play have been linked.[10] Overweight is strongly linked to diet, including eating energy-dense, nutrient-poor foods, skipping breakfast, and drinking sugary beverages and other drinks.[11] Family history of obesity, socioeconomic status and parental education affect risk.[12] Body-image issues and emotional eating may also be crucial.[13] Puberty hormones and sleep disorders complicate this multifactorial illness.[14]

Adolescence is a crucial dynamic period for intervention since adolescent behaviours often become a habit in adulthood. Evidence suggests that early detection and lifestyle changes focusing on balanced nutrition, daily physical activity or exercise, and appropriate sleep can avoid adult obesity and its problems.[15] Understanding the incidence and causes of overweight and obesity in varied teenage populations is crucial for school- and community-based solutions.

This study is conducted to find the overweight and obesity prevalence in adolescents in rural district in Tamil Nadu and examines sociodemographic, dietary, physical activity, and psychological factors.

**Objectives**

1. To estimate the prevalence of obesity and overweight among adolescents
2. To find the determinants associated with obesity and overweight.

## MATERIALS AND METHODS

This cross-sectional study was conducted from June 2022 to May 2023 in Government higher secondary schools in rural district of Tamil nadu.

Sample size and sampling.

The sample size was calculated for a single proportion using the formula-$n=z^2pq/d^2$

where Z was 1.96 for 95% confidence, p is 11.7% as per Singh et al[16], and absolute precision of 3%. With 5% non response rate, the minimum sample size required is 463.

Multistage sampling done. First, list of schools in Kanchipuram is enlisted and from the list around three schools were selected randomly by lottery method. In all schools, each class room roughly had around 45-50 students. In all three schools, all standards were recruited (from 9$^{th}$ to 12$^{th}$ standard) and from each standard one section is selected randomly. And all students in selected section were recruited for the study. Adolescents who were absent on the day of data collection, those with serious acute illness, or those whose parents or guardians did not provide consent were excluded. Overall 518 students participated in our study.

**Operational Definitions**

Body mass index (BMI) was calculated as weight in kilograms divided by height in meters squared. Overweight was defined as BMI-for-age > +1 SD and obesity as BMI-for-age > +2 SD according to the WHO 2007 growth reference for 5–19 years.[1]

**Data Collection**

Data were collected using a structured, pretested questionnaire and standardized anthropometric measurements.

- Anthropometry: Height was measured to the nearest 0.1 cm with a portable stadiometer, and weight to the nearest 0.1 kg with a calibrated digital scale. Two readings were taken and averaged.

**Variables Assessed**

- Sociodemographic: age, sex, socio economic status as per Modified kuppusamy scale
- Dietary: Frequency of breakfast skipping per week , frequency of intake of fast foods and sugar-sweetened beverages per week, daily fruit and vegetable consumption, number of meals per day.[1]
- Inadequate physical activity: moderate-to-vigorous physical activity every <150 mins per week[21]
- Increased screen time-Daily screen time for recreation more than 2 hours[25]
- Sleep: Pittsburgh Sleep Quality Index (PSQI) score <5 indicate good sleep quality
- Psychological determinants: Depression, stress and anxiety as per DASS 21(Depression anxiety and stress scale)
- Family history: Family history of obesity

**Data Analysis**

Descriptive statistics were given in proportion or mean with s.d. Associations between risk factors and overweight/obesity were assessed using chi-square tests. Analyses were performed using Epi info 7

Ethical considerations

The study protocol was approved by the Institutional Ethics Committee. The informed consent was obtained from parents or guardians day before the study by sending consent form with students, and assent was obtained from all participating adolescents on the day of study. Confidentiality was maintained, and adolescents identified with health concerns were referred for further evaluatio.

## RESULTS

The study population consisted of 518 adolescents, with a slightly higher proportion of females (55.8%). Socioeconomic status was predominantly low (63.1%), followed by middle (36.3%) and a very small proportion from the upper class (0.6%). In terms of dietary habits, 46.1% reported skipping breakfast ≥3 times per week, frequent consumption of fast food (43.2%) and sugar-sweetened beverages (50%). Conversely, only 21.2% consumed fruits and vegetables daily. Regarding meal frequency, nearly

24% of adolescents reported having more than four meals per day. Around majority of adolescents (77.2%) engaged in inadequate physical activity. Recreational screen time exceeded 2 hours/day in 51.9%. Sleep quality assessment indicated that 31.3% of adolescents reported poor sleep quality. The prevalence of depression, anxiety, and stress was 9.1%, 11.6%, and 14.3% of adolescents. Family history of obesity was present in 10.4% of adolescents.(Table 1).

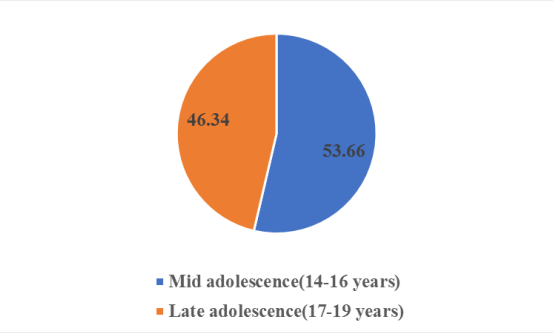


**Figure 1: Distribution as per mid and late adolescence**

278 (53.66%) and 240 children were of mid and late adolescence age group as in Figure 1

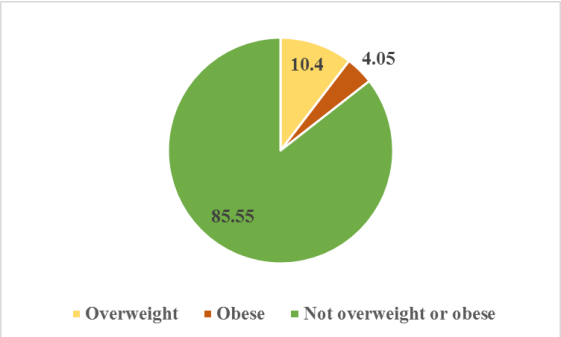


**Figure 2: Prevalence of obesity and overweight**

54 (10.4%) and 21(4.05%) were overweight and obese in our study. Totally 75 adolescent out of 518 were obese or overweight(Figure 2)

**Table 1: Descriptive data of study variables**

| Domain | Variable | Category | n | % |
|---|---|---|---|---|
| Socio-demographic | Standard of study | 9th | 121 | 23.4 |
| | | 10th | 137 | 26.4 |
| | | 11th | 135 | 26.1 |
| | | 12th | 125 | 24.1 |
| | Gender | Male | 229 | 44.2 |
| | | Female | 289 | 55.8 |
| | Socioeconomic status | Upper | 3 | 0.6 |
| | | Middle | 188 | 36.3 |
| | | Low | 327 | 63.1 |
| Dietary | Breakfast skipping ≥3 times/week | Yes | 239 | 46.1 |
| | | No | 279 | 53.9 |
| | Fast-food intake ≥3 times/week | Yes | 224 | 43.2 |
| | | No | 294 | 56.8 |
| | Sugar-sweetened beverages ≥3/week | Yes | 259 | 50 |
| | | No | 259 | 50 |
| | Daily fruit & vegetable consumption | Yes | 110 | 21.2 |
| | | No | 408 | 78.8 |
| | Number of meals >4/day | Yes | 124 | 23.9 |
| | | No | 394 | 76.1 |
| Physical activity | Adequate | Adequate | 118 | 22.8 |
| | | Inadequate | 400 | 77.2 |
| Screen time | Recreational >2 hours/day | Yes | 269 | 51.9 |
| | | No | 249 | 48.1 |
| Sleep | Poor sleep quality | Yes | 162 | 31.3 |
| | | No | 356 | 68.7 |
| Psychological | Depression present | Yes | 47 | 9.1 |
| | | No | 471 | 90.9 |
| | Anxiety present | Yes | 60 | 11.6 |
| | | No | 458 | 88.4 |
| | Stress present | Yes | 74 | 14.3 |
| | | No | 444 | 85.7 |
| Family history | Obesity in family | Yes | 54 | 10.4 |
| | | No | 464 | 89.6 |

**Table 2: Risk factors of obesity and overweight- Bivariate analysis**

| Domain | Variable | Category | Overweight and obesity present n (%) | Overweight and obesity absent n (%) | p-value |
|---|---|---|---|---|---|
| Socio-demographic | Standard of study | 9th | 9 (7.4%) | 112 (92.6%) | 0.125 |
| | | 10th | 16 (11.7%) | 121 (88.3%) | |
| | | 11th | 31 (22.2%) | 109 (77.8%) | |
| | | 12th | 24 (19.2%) | 101 (80.8%) | |
| | Gender | Male | 31 (13.5%) | 198 (86.5%) | 0.607 |
| | | Female | 44 (15.2%) | 245 (84.8%) | |
| | Socioeconomic status | Upper | 0 (0%) | 3 (100%) | 0.133 |
| | | Middle | 29 (15.5%) | 159 (84.5%) | |
| | | Low | 46 (14.1%) | 281 (85.9%) | |
| Dietary | Breakfast skipping ≥3/wk | Yes | 53 (22.0%) | 186 (78.0%) | 0.004 |
| | | No | 22 (7.8%) | 257 (92.2%) | |
| | Fast-food intake ≥3/wk | Yes | 57 (25.4%) | 167 (74.6%) | <0.001 |
| | | No | 18 (6.1%) | 276 (93.9%) | |
| | Sugar-sweetened beverages ≥3/wk | Yes | 48 (18.4%) | 211 (81.6%) | 0.015 |
| | | No | 27 (10.4%) | 232 (89.6%) | |
| | Fruit & vegetable daily consumption | Yes | 8 (7.3%) | 102 (92.7%) | <0.001 |
| | | No | 67 (16.5%) | 341 (83.5%) | |
| | Meals intake >4/day | Yes | 51 (41.1%) | 73 (58.9%) | <0.001 |
| | | No | 24 (6.1%) | 370 (93.9%) | |
| Physical activity | Adequate | Yes | 11 (9.3%) | 107 (90.7%) | <0.001 |
| | | No | 64 (16.0%) | 336 (84.0%) | |
| Screen time | For recreational >2 hr/day | Yes | 70 (26.0%) | 199 (74.0%) | <0.001 |
| | | No | 5 (2.0%) | 244 (98.0%) | |
| Sleep | Poor sleep quality | Yes | 65 (40.0%) | 97 (60.0%) | <0.001 |
| | | No | 20 (5.5%) | 346 (94.5%) | |
| Psychological | Depression | Yes | 26 (55.3%) | 21 (44.7%) | <0.001 |
| | | No | 49 (10.4%) | 422 (89.6%) | |
| | Anxiety | Yes | 32 (53.3%) | 28 (46.7%) | <0.001 |
| | | No | 43 (9.4%) | 415 (90.6%) | |
| | Stress | Yes | 35 (47.3%) | 39 (52.7%) | <0.001 |
| | | No | 40 (9.0%) | 404 (91.0%) | |
| Family history | Obesity in family | Yes | 23 (18.3%) | 103 (91.7%) | 0.112 |
| | | No | 52 (13.2%) | 340 (86.8%) | |

The prevalence of overweight and obesity slightly increased with higher classes, from 7.4% in 9th grade to 22.2% in 11th grade, but this association was not statistically significant (p=0.125). Gender also did not show a significant difference, Socioeconomic status results was not statistically significant (p=0.133).(Table 2)

Adolescents who skipped breakfast ≥3 times per week had a higher prevalence (22.0%) compared to those who did not skip. Frequent fast-food consumption ≥3 times/week, higher intake of sugar-sweetened beverages ≥3 times/week and low fruit and vegetable consumption was associated with higher prevalence of obesity and overweight. Interestingly, adolescents consuming more than four meals per day had the highest prevalence of obesity and overweight (Table 2)

Inadequate physical activity was significantly associated with overweight/obesity.Adolescents with recreational screen time >2 hours/day showed 26.0% prevalence of overweight/obesity. Poor sleep quality, Adolescents with depression (55.3%), anxiety (53.3%), and stress (47.3%) had significantly higher prevalence of overweight and obesity. A positive family history of obesity association was not statistically significant. (Table 2).

## DISCUSSION

In our study, 14.5% were classified as overweight or obese, with 10.4% overweight and 4.05% obese. This prevalence is similar with previous national and regional studies reporting rates around 12–18% among Indian adolescents,[17-19] highlighting a rising public health epidemic of obesity. Punjab study reported 14.2% prevalence while a study in Lucknow found 15.6% among children.[17,18] These findings highlight the obesity epidemic among adolescents.

We found no significant association between overweight/obesity and sociodemographic factors such as grade level, gender, or socioeconomic status. These findings are consistent Kerala study which reported obesity prevalence of 3.6–11.7% without any association with sociodemographic factors19. However some studies shown association but this difference may be attributed to difference in sample size and study group.[20]

Unhealthy dietary practices were determinants of overweight and obesity. Students skipping breakfast ≥3 times /week were risk factor of obesity consistent with studies showing that breakfast skipping relation to increased fat accumulation in current study.[18,21] Fast-food intake ≥3 times/week was another determinant found. This is similar to Delhi study result where fast-food intake contributed to adolescent obesity.[21] Sugar-sweetened beverages

(≥3/week) and low fruit and vegetable intake were also significantly associated with overweight/obesity in current study.[22,23] Interestingly, adolescents taking > four meals per day had the highest prevalence of obesity (41.1%), dissimilar with some studies suggesting that multiple meals may prevent overeating.[23] This may be due to increased fast food intake as meal in our study.

Inadequate physical activity was significantly associated with overweight/obesity in our study. This is similar to a study in Mumbai which associated low physical activity, excess screen time with high BMI.[24] Student with recreational screen time >2 hours/day was risk factor of obesity in our study which is similar to meta-analysis that stated excessive screen time increases obesity in children.[25] Poor sleep quality was risk factor of overweight/obesity. Sleep deprivation disrupts appetite-regulating hormones such as leptin and ghrelin, contributing to increased caloric intake.[19]

Adolescents with depression, anxiety and stress showed significantly higher prevalence of overweight and obesity Psychological problem might lead to emotional eating, reduce physical activity, and alter metabolic activity in body increasing obesity risk.[20,21]

Family History of obesity was not risk factor in our study. However, prior studies suggest that genetic predisposition and shared familial lifestyle behaviors contribute to adolescent obesity.[26]

**Mechanisms Linking Risk Factors to Obesity**

Overweight and obesity in adolescents is due to interplay of behavioral, dietary, psychological, and environmental factors. Skipping breakfast and consuming fast foods or sugar-sweetened beverages lead to increased calorie intake. The low fruit and vegetable intake disrupts satiety and metabolism. Inadequate physical activity reduces calorie expenditure while excessive screen time encourages sedentary life style and exposure to food craving. Poor sleep quality disrupts hormonal regulation and psychological health affects the dietary practice. Collectively, these interrelated factors create an energy imbalance, favoring fat accumulation.

## CONCLUSION

The higher prevalence of obesity and overweight in our study suggest a earlier prevention and screening to combat this new epidemic of public health problem among adolescents. Also its association with unhealthy dietary practice, increased screen time, less physical activity, stress, anxiety, depression and poor sleep quality recommends the need of multidisciplinary approach to prevent obesity in adolescents

**Limitations:**

This study included only school going adolescents and Government school going students were included. So our study cant be generalized to all adolescents but can be limited to Government school going children.

**Competing interest:**

Authors declare no conflict of interest

**Acknowledgement:**

Authors thank all the students and school faculties for active participation in the study

**Contribution:**

All authors equally contributed to study data collection and analysis.

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