

Nutritional Status and Obesity Among Adolescents in Relation to Physical Activity

Nenavath Ranjith Kumar¹, Santosh Avinash Boppidi², Uday Kiran Tumma³

¹Associate Professor, Department of Pediatrics, Government Medical College, Wanaparthy, Telangana, India

²Associate Professor, department of Pediatrics, Osmania Medical College, Hyderabad, Telangana, India

³Assistant Professor, Department of Pediatrics, MGM Hospital / Kakatiya Medical College, Hanamkonda, Telangana, India

Received: 18-03-2026 / Revised: 16-04-2026 / Accepted: 17-05-2026

Corresponding Author: Dr. Uday Kiran Tumma

Conflict of interest: Nil

Abstract:

Background: Adolescence is a critical period for growth, during which physical activity plays an important role in maintaining healthy nutritional status and preventing obesity.

Objectives: To assess the nutritional status and prevalence of obesity among adolescents and to determine their relationship with physical activity levels.

Methods: This prospective observational study was conducted in the Department of Pediatrics, Government Medical College, Wanaparthy, from October 2025 to March 2026. A total of 200 adolescents aged 10–19 years were included. Data on sociodemographic profile, anthropometry, and physical activity were collected using a structured proforma. Nutritional status was assessed using BMI-for-age criteria, and participants were categorized as undernourished, normal, overweight, or obese. Statistical analysis was performed using SPSS version 21.0.

Results: Normal nutritional status was observed in 58.0% of participants, while 14.0% were undernourished, 18.0% overweight, and 10.0% obese. Low physical activity was seen in 31.0%, moderate in 44.0%, and high in 25.0%. A significant association was found between nutritional status and physical activity level ($\chi^2 = 29.84$, $p < 0.001$). Mean BMI was highest among adolescents with low physical activity.

Conclusion: Reduced physical activity was significantly associated with overweight and obesity among adolescents, highlighting the need for early lifestyle-based interventions.

Keywords: Adolescents, Nutritional status, Obesity, Physical activity, Body mass index.

DOI: 10.25258/ijpqa.17.5.18

This is an Open Access article that uses a funding model which does not charge readers or their institutions for access and distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>) and the Budapest Open Access Initiative (<http://www.budapestopenaccessinitiative.org/read>), which permit unrestricted use, distribution, and reproduction in any medium, provided original work is properly credited.

Introduction

Adolescence is a critical period for growth and body composition, during which inadequate nutrition, sedentary habits, and declining physical activity can predispose individuals to both undernutrition and excess adiposity. In India, adolescents increasingly face a double burden of malnutrition, where traditional concerns of poor nutritional status coexist with a rising prevalence of overweight and obesity [1]. Recent Indian evidence shows that overweight and obesity among school children and adolescents are becoming important public health concerns, with lifestyle factors such as reduced physical activity, excess screen exposure, and unhealthy dietary behaviors contributing substantially to this trend [2, 3]. Physical inactivity during adolescence not only influences body mass index (BMI) and fat distribution, but may also affect fitness, metabolic risk, and long-term adult health outcomes [3]. Therefore, assessing nutritional status together with physical activity patterns is essential for identifying vulnerable

groups and planning targeted school- and community-based interventions. The present study was taken to assess the nutritional status and prevalence of obesity among adolescents and to determine their relationship with levels of physical activity.

Methods

This prospective observational study was conducted in the department of Pediatrics, Government Medical College, Wanaparthy, from October 2025 to March 2026, after obtaining necessary approvals. Adolescents attending the pediatric outpatient department and adolescent health clinic during the study period were screened for eligibility and enrolled after obtaining written informed consent from parents or guardians and assent from the participants wherever applicable. Adolescents aged 10–19 years of either gender who were willing to participate were included in the study. Those with chronic systemic illness, congenital disorders,

endocrine disease, genetic syndromes associated with obesity, severe acute illness, physical disability limiting routine activity, or those receiving long-term medications known to influence body weight or physical activity were excluded. A predesigned and pretested structured proforma was used to collect data regarding age, gender, residence, socioeconomic background, dietary habits, school attendance, screen time, and routine physical activity. Relevant clinical history was recorded and a general physical examination was performed in all study participants under standardized conditions.

Anthropometric assessment was carried out using standard techniques. Body weight was measured to the nearest 0.1 kg using a calibrated digital weighing scale with participants in light clothing and without footwear. Height was measured to the nearest 0.1 cm using a stadiometer with the participant standing erect against a vertical surface. BMI was calculated as weight in kilograms divided by height in meters squared (kg/m^2). Nutritional status was assessed using BMI-for-age criteria appropriate for adolescents, and the participants were categorized as undernourished, normal, overweight, or obese based on standard age- and sex-specific reference values. Mid-upper arm circumference was measured where required as an additional anthropometric parameter. Physical activity was assessed using a structured questionnaire based on routine daily activities, outdoor play, sports participation, walking or cycling to school, sedentary behavior, and time spent in screen-based activities. Based on the total duration and intensity of activity, adolescents were classified into low, moderate, and high physical activity groups according to predefined operational criteria. Clinical signs suggestive of nutritional deficiency and obesity-related risk indicators such as central adiposity, where feasible, were also documented. All measurements were taken by trained personnel to minimize inter-observer variation, and instruments were checked periodically for calibration.

The collected data were entered into Microsoft Excel and analyzed using SPSS software version 21.0. Continuous variables such as age, height, weight, and BMI were expressed as mean \pm standard deviation, while categorical variables such as sex, nutritional status categories, and physical activity levels were presented as frequencies and percentages. The prevalence of undernutrition, overweight, and obesity was calculated as proportions of the total study population. The association between nutritional status and levels of physical activity was assessed using the chi-square test or Fisher's exact test wherever appropriate. Mean BMI values across different physical activity categories were compared using independent sample t-test or one-way analysis of variance (ANOVA), depending on the number of groups. The relationship between obesity and selected demographic or lifestyle variables such as screen time and dietary habits were also analyzed. $P < 0.05$ was considered statistically significant.

Results:

A total of 200 adolescents were included in the study. The mean age of the participants was 14.6 ± 2.1 years. Males constituted 54.0% and females 46.0% of the study population. Based on BMI-for-age assessment, 58.0% had normal nutritional status, while 14.0% were undernourished, 18.0% were overweight, and 10.0% were obese. Low physical activity was observed in 31.0%, moderate activity in 44.0%, and high activity in 25.0% of adolescents. A significant association was found between nutritional status and physical activity levels, with overweight and obesity being more frequent among those with low activity compared to those with moderate or high activity ($\chi^2 = 29.84$, $p < 0.001$). Mean BMI was also significantly higher among adolescents with low physical activity than among those with high activity (24.1 ± 4.2 vs. 20.3 ± 3.1 kg/m^2 , $p < 0.001$). Screen time of more than 2 hours per day was significantly associated with overweight/obesity ($\chi^2 = 18.62$, $p < 0.001$).

Table 1: Baseline characteristics of the study participants (n = 200)

Variable	Number	%
Age group (years)		
10–13	68	34
14–16	82	41
17–19	50	25
Gender		
Male	108	54
Female	92	46
Residence		
Urban	116	58
Rural	84	42

Nutritional status	Number	%
Undernourished	28	14
Normal	116	58
Overweight	36	18
Obese	20	10
Total	200	100
Mean BMI = 21.8 ± 4.1 kg/m ² ; Median BMI = 21.2 kg/m ²		

Physical activity level	Number	%	BMI
Low	62	31	24.1 ± 4.2
Moderate	88	44	21.4 ± 3.5
High	50	25	20.3 ± 3.1
Statistical analysis	ANOVA F = 16.74, p < 0.001		

Nutritional status	Low activity (n=62)	Moderate activity (n=88)	High activity (n=50)	Total
Undernourished	6	14	8	28
Normal	24	56	36	116
Overweight	18	14	4	36
Obese	14	4	2	20
Total	62	88	50	200
Statistical analysis	$\chi^2 = 29.84$; df = 6; p < 0.001			

Discussion:

The present study demonstrated that although the majority of adolescents had normal nutritional status, a substantial proportion were either undernourished or affected by overweight and obesity, highlighting the continuing double burden of malnutrition in Indian adolescents. This pattern is increasingly being reported across India, where persistent pockets of thinness and micronutrient inadequacy now coexist with a rising prevalence of excess body weight due to nutrition transition, reduced outdoor activity, and sedentary lifestyles. In the present study, overweight and obesity together accounted for more than one-fourth of the study population, while undernutrition was also notable, suggesting that adolescent health services must address both ends of the nutritional spectrum simultaneously [1]. Recent Indian reviews have shown that childhood and adolescent overweight/obesity are no longer confined to affluent metropolitan populations and are now seen across diverse regions and socioeconomic groups [4]. Indian evidence further suggests that the burden is influenced by urbanization, dietary shifts, screen exposure, and reduced daily energy expenditure [4, 5]. Thus, the findings of the present study are epidemiologically relevant and support the view that adolescence is a vulnerable period for the emergence of both nutritional deficiency and adiposity-related health risk [1, 4, 5].

A key observation in the present study was the significant association between lower physical activity

and higher BMI. Adolescents with low physical activity had the highest mean BMI, whereas those with high physical activity had the lowest mean BMI, indicating a clear inverse relationship between activity level and adiposity. This is biologically plausible because reduced physical activity lowers energy expenditure, promotes positive energy balance, and contributes to fat accumulation over time [6]. The present findings are consistent with emerging evidence from India and elsewhere showing that inadequate moderate-to-vigorous physical activity is associated with greater odds of overweight, obesity, and related metabolic abnormalities in children and adolescents [7, 8]. A mixed-method study from rural Telangana highlighted that physical activity in Indian adolescents is strongly shaped by school routine, gender norms, domestic responsibilities, and opportunities for recreation, all of which can influence total daily energy expenditure [5]. Recent evidence syntheses have similarly shown that lower physical activity and unfavorable 24-hour movement behavior patterns are associated with greater adiposity in young people. Therefore, the statistically significant association observed in the present study is in line with current evidence and reinforces the importance of regular physical activity as a central determinant of adolescent nutritional status [8, 9].

Another important implication of the present study is the likely contribution of sedentary behavior, especially screen-based leisure, to excess body weight. Although the principal focus of the study was

physical activity, the observed clustering of overweight and obesity among less active adolescents is consistent with the broader literature linking sedentary time, prolonged sitting, and inadequate sleep with obesity risk [3]. Sedentary behavior reduces overall caloric expenditure and is often accompanied by snacking, irregular meal timing, and exposure to unhealthy food marketing. Indian pediatric obesity guidelines strongly recommend daily moderate-to-vigorous physical activity and restriction of recreational screen time as essential preventive measures. Studies from central India have also shown that modifiable behaviors such as junk food intake, reduced exercise, and increased screen exposure are common among children with obesity [10]. Recent reviews further indicate that reducing sedentary behavior and improving integrated 24-hour movement patterns may be as important as increasing exercise alone [11, 12]. Taken together, the present findings suggest that obesity prevention strategies in adolescents should move beyond weight measurement and include systematic assessment of activity behavior, sedentary habits, and lifestyle routines in the home and school environment [3, 10, 12].

The persistence of undernutrition alongside overweight/obesity in the present study deserves particular attention. This dual burden reflects the complex social and nutritional environment of Indian adolescents, where some remain exposed to food insecurity, poor dietary quality, recurrent illness, and limited health awareness, while others experience calorie-dense but nutrient-poor food consumption with inadequate physical activity. Such coexistence has major public health implications because undernourished adolescents may suffer impaired growth, reduced physical capacity, and poor educational performance, whereas overweight and obese adolescents are at increased risk of insulin resistance, hypertension, and future cardiovascular disease [1]. Recent Indian work among adolescent girls has highlighted that malnutrition remains closely linked with education, household conditions, and dietary inadequacy [13]. At the same time, evidence syntheses from India show wide variation in overweight and obesity prevalence across studies, reflecting regional, demographic, and methodological differences. The present study therefore adds to the growing recognition that adolescent nutritional surveillance should not focus exclusively on obesity or undernutrition in isolation but should adopt a more integrated framework that captures both anthropometric deficiency and excess in relation to modifiable behavioral factors such as physical activity [4, 5].

The clinical and public health implications of the present study are considerable. Since adolescence is a formative stage for establishing lifelong habits, early identification of low physical activity and abnormal BMI offers a valuable opportunity for

intervention before obesity becomes entrenched in adulthood [14]. The significant association between physical inactivity and adverse nutritional status in the present study suggests that school- and community-based measures may be especially effective. Recent reviews of obesity prevention programs indicate that multicomponent school-based interventions incorporating nutrition education, structured physical activity, and behavior change support can produce meaningful improvements in BMI and health behaviors. Indian reviews have also emphasized the potential role of school-centered interventions in addressing unhealthy diet and excess body weight in children [6]. In practical terms, pediatric departments and adolescent clinics should incorporate routine BMI-for-age assessment, counseling on daily activity, reduction in screen exposure, and family-centered lifestyle education. Community-level strategies should also create safe play spaces, improve awareness among parents and teachers, and encourage active transport and sports participation [7, 11]. Overall, the present study supports the conclusion that improving physical activity is not merely a fitness goal but a critical strategy for preventing adolescent overweight and obesity while promoting healthier nutritional status in the broader population [2, 6].

Conclusion

The present study showed that adolescents had a mixed nutritional profile, with normal nutritional status predominating but with a considerable burden of both undernutrition and overweight/obesity. Lower physical activity was significantly associated with higher BMI and a greater prevalence of overweight and obesity. These findings emphasize that physical inactivity is an important modifiable determinant of adolescent nutritional health. Routine assessment of BMI and physical activity in pediatric and school health settings can help identify at-risk adolescents early. Strengthening school-based exercise, health education, and lifestyle counseling may play a crucial role in improving nutritional status and preventing obesity-related health consequences in this age group.

References

1. Sharma N, Sanjeevi RR, Balasubramanian K, Chahal A, Sharma A, Sidiq M. A Systematic Review on Prevalence of Overweight and Obesity among School Children and Adolescents in Indian Population. *Indian J Endocrinol Metab.* 2024; 28(2): 104 – 16.
2. Kaul A, Bansal N, Sharma P, Aneja S, Mahato MP. Association of Screen Time Usage and Physical Activity With Overweight and Obesity Among School-Going Children in Uttar Pradesh. *Cureus.* 2023; 15(10): e47690.
3. Khadilkar V, Shah N, Harish R, Ayyavoo A, et al. *Indian Academy of Pediatrics Revised*

- Guidelines on Evaluation, Prevention and Management of Childhood Obesity. *Indian Pediatr.* 2023; 60(12): 1013 – 31.
4. Das S, Shukla AK, Galhotra A. Determinants of malnutrition among adolescent females of age 15-19 years in an urban slum of Raipur city. *J Family Med Prim Care.* 2024; 13(11): 5231 – 9.
 5. Singh S, Awasthi S, Kapoor V, et al. Childhood obesity in India: A two-decade meta-analysis of prevalence and socioeconomic correlates. *Clinical Epidemiology and Global Health.* 2023; 23: 101390
 6. Bhattacharya M, Picchioni F, Zanello G, Srinivasan CS. Quantity and quality of physical activity during adolescence: Evidence from a mixed-method study in rural Telangana, India. *J Biosoc Sci.* 2024; 56(2): 314 – 37.
 7. Georgoulis M, Grapsa I, Arnaoutis G, Bountziouka V, et al. Association Between Physical Activity and Indicators of Overweight/Obesity and Metabolically Unhealthy Obesity Risk in Children and Adolescents: A Systematic Review of Prospective Epidemiological Studies and Randomized Controlled Trials in Western Countries. *Obes Rev.* 2026; 27(1): 1 – 28.
 8. Bourke M, Harrison Z, Fortnum K, Thomas G, et al. Association between 24-hour movement behaviors and adiposity in children and adolescents: A compositional data meta-analysis. *Obes Rev.* 2025; 26(5): e13884.
 9. Hossian M, Mielke GI, Nisar M, Tremblay MS, Khan A. Global research on 24-hour movement behaviours guidelines in children and adolescents: a systematic review. *Int J Behav Nutr Phys Act.* 2025; 22(1): 108.
 10. Mathew PJ, Jagzape TB, Goel AK, Kumar A, Singh TH. Social and Demographic Factors Associated With Obese Children in the Age Group of 6-12 Years Attending a Tertiary Care Institute in Central India and the Prevalence of Depression in These Children: An Observational Study. *Cureus.* 2023; 15(7): e41749.
 11. Wong JP, Bachman J, Griggs S, Hartz J. Decreasing Sedentary Behaviors in Youth to Prevent and Manage Childhood Obesity: Is It Realistic? *Curr Atheroscler Rep.* 2023; 25(8): 479 – 85.
 12. Meneses-Echavez JF, Iglesias-Gonzalez LE, Loaiza-Betancur AF, Guapo NC. Sedentary behavior and sleep for children and adolescents with obesity: A systematic review. *Ann N Y Acad Sci.* 2025; 1545(1): 66 – 75.
 13. Panda A, Parida J, Jena S, Behera SS, Pradhan A, et al. Prevalence and associated risk factors of overweight and obesity among adolescent population of India: a scoping review. *BMC Nutr.* 2025; 11(1): 110.
 14. Hassan MA, McDonough DJ, Ryu S, Zhou W, Oginni J, Gao Z. Comparative effectiveness of school-based obesity prevention programs for children and adolescents: a systematic review and network meta-analysis. *Front Public Health.* 2024; 12: 1504279.