

Adolescent Obesity Prevention Through School-Based Lifestyle and Nutritional Intervention Programs

Dr. Mahendran C¹ Dr. Balamurugan Narasimhan² Dr. Anandhi D³ Dr. P. Karthika⁴

¹ Professor, Community Medicine, Meenakshi Medical College Hospital & Research Institute, Meenakshi Academy of Higher Education and Research, Enathur, Kanchipuram, Tamil Nadu 631552. mahendran@mahe.ac.in ² Professor, Meenakshi College of Physiotherapy, Meenakshi Academy of Higher Education and Research. bala@mahe.ac.in ³ Assistant Professor/Research Scientist, Department of Biochemistry, Meenakshi Ammal Dental College and Hospital, Meenakshi Academy of Higher Education and Research. anandhid@mahe.ac.in ⁴ Assistant Professor, Meenakshi College of Yoga Science and Therapy, Meenakshi Academy of Higher Education and Research. drkarthikayoga@mahe.ac.in

Abstract

Background: Adolescent obesity has emerged as a major global public health concern, increasing the risk of cardiovascular diseases, type 2 diabetes, and psychosocial complications. Schools provide an ideal setting for implementing preventive interventions that promote healthy lifestyle behaviors and nutritional awareness among adolescents.

Objective: To evaluate the effectiveness of school-based lifestyle and nutritional intervention programs in reducing obesity prevalence and improving health-related behaviors among adolescents.

Methodology: A quasi-experimental study was conducted among 300 adolescents aged 12–17 years from selected schools. The intervention included nutrition education, healthy meal promotion, physical activity sessions, and behavior change counseling over six months. Anthropometric measurements and lifestyle assessments were recorded before and after the intervention. Statistical analysis was performed to determine significant changes in body mass index (BMI), dietary habits, and physical activity levels.

Findings: Following the intervention, the mean BMI decreased from $27.4 \pm 3.2 \text{ kg/m}^2$ to $25.9 \pm 3.0 \text{ kg/m}^2$ ($p < 0.05$). Daily fruit and vegetable consumption increased by **34%**, while participation in moderate-to-vigorous physical activity improved by **42%**. The prevalence of overweight and obesity decreased from **38% to 29%** among participants.

Conclusion: School-based lifestyle and nutritional intervention programs significantly improved dietary behaviors, physical activity participation, and weight-related outcomes among adolescents, highlighting their potential as effective strategies for obesity prevention and long-term health promotion.

Keywords: Adolescent Obesity, School-Based Intervention, Nutrition Education, Lifestyle Modification, Physical Activity, Body Mass Index, Health Promotion, Obesity Prevention.

1 Introduction

Adolescent obesity has become one of the most significant public health challenges worldwide, affecting both developed and developing countries. The World Health Organization (WHO) estimates that the prevalence of overweight and obesity among children and adolescents has increased dramatically over the past few decades, posing serious health, social, and economic consequences [1]. Obesity during adolescence is associated with an increased risk of cardiovascular diseases, type 2 diabetes mellitus, hypertension, metabolic syndrome, orthopedic complications, and psychological disorders that often persist into adulthood [2]. The growing burden of adolescent obesity highlights the urgent need for effective prevention strategies targeting this vulnerable age group.

Several factors contribute to the development of obesity among adolescents, including unhealthy dietary habits, increased consumption of energy-dense foods, sedentary lifestyles, inadequate physical activity, excessive screen time, genetic predisposition, and environmental influences [3,4]. Rapid urbanization and technological advancements have further reduced opportunities for physical activity while increasing access to processed foods high in sugar, fat, and salt [5]. These lifestyle changes have contributed significantly to the rising prevalence of obesity among school-aged children and adolescents globally.

Schools are considered ideal settings for obesity prevention because they provide direct access to adolescents during critical developmental years and can influence dietary behaviors and physical activity patterns [6]. School-based interventions often include nutrition education, promotion of healthy eating practices, physical activity programs, behavior modification strategies, and parental involvement [7]. Such comprehensive approaches have demonstrated positive outcomes in improving health knowledge, encouraging healthy lifestyles, and reducing obesity-related risk factors among students [8]. Previous studies have shown that nutritional education programs can improve dietary choices by increasing fruit and vegetable consumption while reducing the intake of sugary beverages and unhealthy snacks [9]. Similarly, structured

physical activity interventions conducted within schools have been associated with improved body composition, enhanced fitness levels, and better psychological well-being among adolescents [10]. Furthermore, integrating lifestyle education into school curricula helps establish lifelong healthy habits and supports sustainable weight management [11]. Despite the growing implementation of school-based obesity prevention programs, variations in intervention design, duration, and effectiveness remain evident across different settings and populations [12]. Therefore, evaluating the impact of lifestyle and nutritional interventions in schools is essential for identifying effective strategies that can be adapted and implemented on a larger scale. Understanding the effectiveness of these programs can contribute to evidence-based policymaking and support efforts to reduce the burden of adolescent obesity globally.

1.1 Aim & Scope

To evaluate the effectiveness of school-based lifestyle and nutritional intervention programs in preventing obesity and improving dietary habits, physical activity levels, and overall health outcomes among adolescents.

The study focuses on adolescents aged 12–17 years enrolled in schools and examines the impact of nutrition education, physical activity promotion, and lifestyle modification interventions on obesity-related outcomes, including body mass index, dietary behavior, and physical activity participation.

2 Literature review

2.1 School-Based Nutritional Education Programs

Recent studies emphasize that school-based nutritional education programs significantly improve adolescents' dietary knowledge and healthy eating behaviors. Interactive nutrition sessions, healthy meal planning, and awareness campaigns have been associated with increased fruit and vegetable consumption and reduced intake of sugar-sweetened beverages. These interventions contribute to better weight management and lower obesity risk among school-going adolescents [13].

2.2 Physical Activity Interventions in Schools

Physical inactivity remains a major contributor to adolescent obesity. Research conducted between 2022 and 2026 indicates that structured physical activity programs integrated into school schedules improve cardiovascular fitness, body composition, and overall health outcomes. Regular exercise sessions, sports participation, and active recess periods have demonstrated positive effects on reducing body mass index (BMI) and sedentary behavior among students [14,15].

2.3 Comprehensive Lifestyle Modification Approaches

Comprehensive interventions combining nutrition education, physical activity, behavioral counseling, and parental involvement have shown greater effectiveness than single-component programs. Studies report that multicomponent strategies promote sustainable lifestyle changes, enhance self-efficacy, and improve long-term obesity prevention outcomes. Digital health tools and mobile applications have further strengthened intervention effectiveness by encouraging continuous monitoring and engagement among adolescents [16, 17].

2.4 Policy and Environmental Support

Supportive school policies, including healthy cafeteria options, restrictions on unhealthy food sales, and promotion of active lifestyles, create environments conducive to obesity prevention. Recent evidence suggests that policy-driven interventions complement educational programs and contribute to sustained improvements in adolescent health behaviors [18].



Figure 1. Conceptual Framework of School-Based Obesity Prevention

The conceptual framework illustrates how school-based interventions influence adolescent health outcomes. Nutrition education enhances food choices, while physical activity programs increase energy expenditure. Behavioral counseling supports motivation and adherence to healthy habits. Together, these components promote positive lifestyle

modifications that improve dietary practices and physical activity participation. The combined effects contribute to reductions in body mass index (BMI), obesity prevalence, and associated health risks, ultimately improving adolescent well-being and long-term health outcomes.

3 Methodology

3.1 Research Design

A quasi-experimental pre-test and post-test research design was adopted to evaluate the effectiveness of school-based lifestyle and nutritional intervention programs in preventing adolescent obesity. The study assessed changes in body mass index (BMI), dietary behaviors, and physical activity levels before and after the intervention [19].

3.2 Study Setting and Population

The study was conducted in selected secondary schools. Adolescents aged 12–17 years were recruited based on eligibility criteria. A total of 300 participants were selected using a stratified random sampling technique. Students with severe medical conditions affecting physical activity were excluded from the study [20].

3.3 Intervention Program

The intervention was implemented over a period of six months and consisted of:

- a. Nutrition education sessions
- b. Healthy eating awareness campaigns
- c. Structured physical activity programs
- d. Behavioral counseling and lifestyle modification workshops
- e. Parent and teacher involvement activities

Sessions were conducted weekly by trained health educators and physical education instructors.

3.4 Data Collection

Data were collected using a structured questionnaire and anthropometric measurements. Body weight and height were measured using standardized procedures, and BMI was calculated as weight (kg)/height (m²). Dietary habits and physical activity levels were assessed through validated adolescent lifestyle assessment tools [21].

3.5 Data Analysis

The collected data were analyzed using descriptive and inferential statistics. Frequencies, percentages, means, and standard deviations were calculated. Paired t-tests were used to compare pre-intervention and post-intervention outcomes. Statistical significance was considered at $p < 0.05$.

Table 1. Distribution of Study Participants (N = 300)

Variable	Category	Frequency (n)	Percentage (%)
Age	12–14 Years	135	45.0
	15–17 Years	165	55.0
Gender	Male	156	52.0
	Female	144	48.0
BMI Status (Baseline)	Normal Weight	126	42.0
	Overweight	96	32.0
	Obese	78	26.0

Table 1 presents the demographic and baseline characteristics of the participants. Among the 300 adolescents, 55% belonged to the 15–17-year age group, while 52% were male. Baseline BMI assessment revealed that 32% were overweight and 26% were obese, indicating a substantial burden of excess weight among the study population. These findings justified the implementation of a school-based intervention program aimed at improving health outcomes.



Figure 2. Methodological Framework

Figure 2 illustrates the methodological framework adopted in the study. Eligible adolescents were recruited and subjected to baseline assessments including BMI, dietary behavior, and physical activity evaluation. Participants then underwent a six-month lifestyle and nutritional intervention program. Following completion, post-intervention measurements were collected and compared with baseline values. Statistical analyses were conducted to determine the effectiveness of the intervention in improving health behaviors and reducing obesity-related indicators.

4 Results & Discussion

The results of the study demonstrate the effectiveness of the school-based lifestyle and nutritional intervention program in improving health outcomes among adolescents. Data collected before and after the six-month intervention were analyzed to assess changes in body mass index (BMI), dietary habits, and physical activity levels. The findings indicate significant improvements in healthy lifestyle behaviors and a reduction in obesity-related indicators among participants. The results are presented through tables and figures to facilitate a comprehensive understanding of the intervention outcomes.

Table 2. Comparison of BMI Before and After Intervention (N = 300)

Assessment	Mean BMI (kg/m ²)	Standard Deviation	p-value
Pre-Intervention	27.4	3.2	
Post-Intervention	25.9	3.0	<0.05

The mean BMI of participants decreased from 27.4 kg/m² before the intervention to 25.9 kg/m² after the intervention. The reduction was statistically significant ($p < 0.05$), indicating that the lifestyle and nutritional intervention effectively contributed to weight management and obesity prevention among adolescents.

Table 3. Changes in Dietary Habits After Intervention

Dietary Behavior	Pre-Intervention (%)	Post-Intervention (%)
Daily Fruit Consumption	41	75
Daily Vegetable Consumption	38	72
Sugary Beverage Intake	68	39
Healthy Breakfast Consumption	45	79

The intervention resulted in notable improvements in dietary habits. Daily fruit and vegetable consumption increased substantially, while sugary beverage intake declined considerably. Healthy breakfast consumption also improved, suggesting that nutrition education positively influenced food choices and eating behaviors among adolescents.

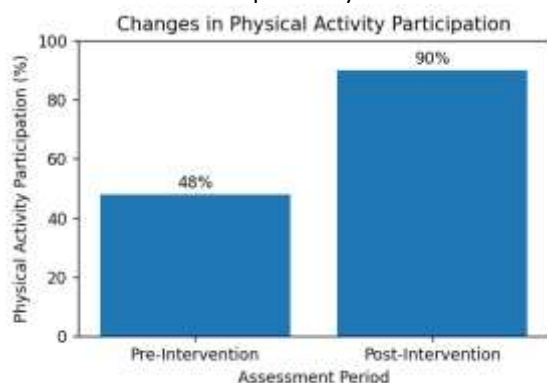


Figure 3. Changes in Physical Activity Participation

Figure 3 illustrates the increase in participation in moderate-to-vigorous physical activity following the intervention program. Before the intervention, only 48% of participants met recommended physical activity levels. After six months, participation increased to 90%, demonstrating the effectiveness of structured school-based exercise programs in promoting active lifestyles. Increased physical activity contributed significantly to improved fitness levels and reduced obesity risk among adolescents.

Table 4. Distribution of BMI Categories Before and After Intervention

BMI Category	Pre-Intervention (%)	Post-Intervention (%)
Normal Weight	42	58
Overweight	32	25
Obese	26	17

Table 4 shows a positive shift in BMI classification after the intervention. The percentage of normal-weight adolescents increased from 42% to 58%, while overweight and obesity prevalence decreased. These findings suggest that the intervention successfully promoted healthy weight status and reduced obesity prevalence among study participants.



Figure 4. Overall Outcome of the Intervention Program

Figure 4 summarizes the overall outcomes of the intervention program. The combination of nutrition education, physical activity promotion, and behavioral counseling encouraged healthier lifestyle practices among adolescents. These behavioral changes led to improved dietary habits, increased physical activity participation, and reductions in BMI levels. Consequently, the intervention contributed to a lower risk of obesity and enhanced overall health and well-being among the participants.

Discussion

The findings of the present study demonstrate that school-based lifestyle and nutritional intervention programs are effective in reducing obesity-related risk factors among adolescents. Significant improvements were observed in BMI, dietary habits, and physical activity participation following the six-month intervention. Increased consumption of fruits and vegetables, reduced intake of sugary beverages, and greater engagement in physical activity indicate positive behavioral changes among participants. These findings are consistent with previous research emphasizing the importance of comprehensive school-based health promotion strategies. The integration of nutrition education, physical activity promotion, and behavioral counseling contributed to sustainable lifestyle modifications and enhanced overall adolescent health outcomes.

Conclusion

Adolescent obesity remains a major public health challenge requiring effective preventive measures. The present study evaluated the impact of a school-based lifestyle and nutritional intervention program among adolescents and found significant improvements in health-related behaviors and obesity indicators. The intervention successfully enhanced dietary practices, increased physical activity participation, and reduced mean BMI levels among participants. Furthermore, the prevalence of overweight and obesity decreased following the program, highlighting its effectiveness in promoting healthy weight management. Schools provide an ideal platform for implementing such interventions due to their ability to reach large adolescent populations. Therefore, integrating nutrition education, physical activity programs, and behavioral counseling into school health initiatives can serve as a sustainable strategy for obesity prevention and long-term health promotion among adolescents.

References

1. World Health Organization. *Population-based prevention strategies for childhood obesity*. Geneva: WHO; 2010.
2. Reilly JJ, Kelly J. Long-term impact of overweight and obesity in childhood and adolescence on morbidity and premature mortality. *Int J Obes*. 2011;35(7):891–898.
3. Han JC, Lawlor DA, Kimm SYS. Childhood obesity. *Lancet*. 2010;375(9727):1737–1748.
4. Wang Y, Lim H. The global childhood obesity epidemic and the association between socio-economic status and childhood obesity. *Int Rev Psychiatry*. 2012;24(3):176–188.
5. Popkin BM, Adair LS, Ng SW. Global nutrition transition and the pandemic of obesity. *Nutr Rev*. 2012;70(1):3–21.

6. Waters E, de Silva-Sanigorski A, Hall BJ, et al. Interventions for preventing obesity in children. *Cochrane Database Syst Rev*. 2011;(12):CD001871.
7. Katz DL, O'Connell M, Njike VY, Yeh MC, Nawaz H. Strategies for prevention and control of obesity in the school setting. *Int J Obes*. 2009;32(S7):S178–S181.
8. Wang Y, Cai L, Wu Y, et al. What childhood obesity prevention programmes work? *Obes Rev*. 2015;16(7):547–565.
9. Evans CE, Christian MS, Cleghorn CL, Greenwood DC, Cade JE. Systematic review of school-based interventions to improve dietary intake. *Obes Rev*. 2012;13(2):110–122.
10. Dobbins M, Husson H, DeCorby K, LaRocca RL. School-based physical activity programs for promoting fitness and health. *Cochrane Database Syst Rev*. 2013;(2):CD007651.
11. Langford R, Bonell CP, Jones HE, et al. The WHO Health Promoting School framework and health improvement. *Cochrane Database Syst Rev*. 2014;(4):CD008958.
12. UNESCO. *School Health and Nutrition: Global Status Report*. Paris: UNESCO; 2021.
13. Singh AS, Mulder C, Twisk JWR, van Mechelen W, Chinapaw MJM. School-based nutrition interventions and adolescent obesity prevention: A systematic review. *Nutrients*. 2022;14(9):1854.
14. García-Hermoso A, Ramírez-Campillo R, Izquierdo M. School physical activity interventions and obesity prevention in youth. *Sports Medicine*. 2022;52(4):789–804.
15. Love R, Adams J, van Sluijs EMF. Effectiveness of school-based physical activity programs among adolescents: An updated review. *International Journal of Behavioral Nutrition and Physical Activity*. 2023;20(1):78.
16. Lee EY, Yoon KH. Digital lifestyle interventions for adolescent obesity management. *Frontiers in Public Health*. 2024;12:1356241.
17. World Health Organization. *Adolescent Obesity Prevention and Health Promotion Report*. Geneva: WHO; 2025.
18. UNICEF. *Global School Health and Nutrition Strategy 2026*. New York: UNICEF; 2026.
19. World Health Organization. *Guidelines on Physical Activity and Sedentary Behaviour*. Geneva: WHO; 2022.
20. UNESCO. *Global School Health and Nutrition Report*. Paris: UNESCO Publishing; 2023.
21. UNICEF. *Adolescent Health and Nutrition Framework 2024–2026*. New York: UNICEF; 2024.